



01 BP 4861 OUAGADOUGOU 01 Burkina Faso
Tel: 226 50 36 13 57

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
FOR THE YARAMOKO GOLD PROJECT
Rural Commune of Bagassi
Province of Balé
Boucle du Mouhoun Region**

VOLUME 2 – APPENDIXES

Presented by



01 BP 931 Ouagadougou 01
Tel: (+226) 50 37 77 20
Website: www.begeconsult.com

JULY 2014

APPENDIX 1: ToR OF THE ESIA FOR THE YARAMOKO GOLD PROJECT

APPENDIX 2: ROXGOLD LOCAL RECRUITMENT AND CONTENT POLICY

APPENDIX 3: GEOCHEMICAL ASSESSMENT

APPENDIX 4: RESULTS OF SOIL BASELINE LEVEL ANALYSES (CHEMICAL ANALYSIS AND PROFILES OF SOIL STUDIED)

APPENDIX 5: AIR QUALITY REPORT

APPENDIX 6: NOISE MONITORING STUDY

APPENDIX 7: CALCULATION OF HYDROGEOLOGICAL CHARACTERISTICS

APPENDIX 8: WATER MONITORING REPORT AND RESULTS OF WATER RESOURCE BASELINE LEVEL ANALYSES

ANNEXE 9: LISTS OF NON GOVERNMENTAL ORGANIZATIONS AND COMMUNITY-BASED ORGANIZATIONS

APPENDIX 10: ARTISANAL MINING ACTION PLAN

APPENDIX 11: BOUNDARY POINTS OF THE LAND OF VILLAGES WITHIN THE PROJECT AREA

APPENDIX 12: COORDINATES OF THE PLOTS

APPENDIX 13: STAKEHOLDER ENGAGEMENT PLAN

**APPENDIX 14: ROXGOLD ENVIRONMENTAL AND SOCIAL MONITORING
PLAN**

**APPENDIX 15: TECHNICAL SPECIFICATION OF ENVIRONMENTAL
CLAUSES**

APPENDIX 16: REHABILITATION AND CLOSURE PLAN

**APPENDIX 17: SUMMARY AND LISTS OF ATTENDANCE AND RESOURCE
PERSONS MET AS PART OF THE ESIA**

**APPENDIX 18: MEMO OF MEETINGS WITH COMMUNITIES LIVING
WITHIN THE PROJECT AREA**

**APPENDIX 19: COMPREHENSIVE LIST OF LAND USERS WITHIN THE
MINING PERMIT**

APPENDIX 1

ToR OF THE ESIA FOR THE YARAMOKO GOLD PROJECT



01 BP 4861 OUAGADOUGOU 01 Burkina Faso
Tel: 226 50 36 13 57

**TERMS OF REFERENCE FOR AN ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT OF THE YARAMOKO GOLD PROJECT**

**Rural Commune of Bagassi
Province of Balé
Boucle du Mouhoun Region**

Prepared by



**01 BP 931 Ouagadougou 01
Phone : (+226) 50 37 77 20**

website: www.begeconsult.com

October 2013

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS	iii
LISTS OF TABLES	iii
LIST OF FIGURES	iii
LISTS OF APPENDICES	iii
INTRODUCTION	5
I. BACKGROUND AND CONTEXT	6
1.1. COMPANY INTRODUCTION & BACKGROUND.....	6
1.2. ROXGOLD SUSTAINABILITY AND ENVIRONMENT POLICY	6
1.3. CONTEXT AND JUSTIFICATION	7
II. LOCATION OF THE YARAMOKO PROJECT	8
III. DESCRIPTION OF THE YARAMOKO GOLD MINING PROJECT	12
3.1. MINING OPERATIONS.....	14
3.2. ORE PROCESSING	16
3.3. RELATED INFRASTRUCTURE.....	17
3.3.1. WATER SUPPLY	17
3.3.2 TAILINGS STORAGE FACILITY	20
3.3.3 ELECTRICITY SUPPLY	23
3.3.4. CAMP ACCOMMODATION.....	23
3.3.5. OTHER INFRASTRUCTURES	23
3.3.6 DESCRIPTION OF PROJECT ECONOMICS	23
3.3.7 POTENTIAL PROJECT IMPACTS	24
IV. EXPECTED SERVICES FROM THE CONSULTANT	24
4.1. METHODOLOGICAL APPROACH.....	24
4.2. CONTENT OF THE ESIA REPORT	25
4.2.1. LEGISLATION, LEGAL, POLITICAL AND INSTITUTIONAL ASPECTS.....	25
4.2.2. PRESENTATION OF THE PROJECT PROMOTER	26
4.2.3. RATIONALE OF THE PROJECT.....	26
4.2.4. DESCRIPTION OF THE PROJECT	26
4.2.5. DEFINITION OF THE PERIMETER OR THE STUDY AREA	27
4.2.6. DESCRIPTION OF THE INITIAL STATE AND ITS ENVIRONMENT	27
4.2.7. IDENTIFICATION AND ANALYSIS OF POTENTIAL IMPACTS OF THE PROJECT.	30
4.2.8. MEASURES FOR MITIGATION, COMPENSATION AND ENHANCEMENT OF THE IMPACTS ON THE ENVIRONMENT	31
4.2.9. SITE REHABILITATION AND CLOSURE PLAN.....	32
4.2.10. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN.....	32
4.2.11. COMMUNICATION AND PUBLIC INFORMATION, PUBLIC INQUIRY.....	34
V. PREPARATION OF DOCUMENTS AND REPORTS	35
5.1. THEMATIC MAPS.....	35

5.2. DOCUMENTS AND REPORTS	35
5.2.1. REFERENCES.....	35
5.2.2. APPENDICES	35
VI. COMPOSITION OF THE CONSULTANT’S TEAM AND DURATION OF THE MISSION	35
6.1. CONSULTANT’S TEAM.....	36
6.2. DURATION OF THE MISSION	36
VII. EQUIPMENT TO PROVIDE FOR THE MONITORING	36

ABBREVIATIONS AND ACRONYMS

BEGE: Geosciences and Environment Consultancy
BUNEE: National Bureau for Environmental Assessments
CIL: Carbon in Leach
ESIA: Environmental and Social Impact Assessment
ICMC: International Cyanide Management Code
MEE: Ministry of Environment and Water
NGO: Non Governmental Organization
PED: Process Flow Diagram
ESMP: Environmental & Social Management Plan
PM: Particulate Monitor
IFC: International Finance Corporation
ToR: Terms of Reference
WAD: Weak Acid Dissociable

LISTS OF TABLES

Table 1: UTM Coordinates of the area concerned by the Yaramoko Gold Project
Table 2: Analysis of the Monitoring program
Table 3: Environmental Oversight Program

LIST OF FIGURES

Figure 1: Location map of the project area
Figure 2: Materialization of the vertices of the area concerned by the project
Figure 3: Simplified Ground Plan of the Project's Infrastructure
Figure 4: Schematic Diagram of Underground Mining Operations
Figure 5: Raw Water Reservoir Implementation Plan
Figure 6: Implementation Plan of the Water Reservoir and tailings storage dam
Figure 7: Implementation Plan of the embankment of the tailings storage dam

LISTS OF APPENDICES

Appendix 1: Process flow diagram

INTRODUCTION

The terms of reference (ToR) for the Roxgold gold mining project located in south western Burkina Faso is required in accordance with Article 9 in Decree no 2001-342/PRES/PM/MEE on the scope, content and procedure of the Environment Impact Study and Statement.

Roxgold Inc. is a Canadian mineral exploration and development company listed on the Toronto Stock Exchange where it has its headquarters. Its branch in Burkina Faso, ROXGOLD SARL is located in Ouagadougou.

Currently, it focuses on its Yaramoko permit, particularly the area known as Zone 55, on which it has a significant gold deposit. Implementation of the mine will contribute among others to increase state revenue, to create jobs in the region and to improve the provision of basic social infrastructure for the benefit of neighboring communities

Pursuant to Decree No. 2001-342/PRES/PM/MEE of 17 July 2001 on the scope, content and procedure of the environmental impact study and statement, the Roxgold Yaramoko mining project is subject to an Environmental and Social Impact Assessment. The implementation of the project needs to consider key potential risks and impacts on the biophysical and human environment; this requires implementation of an Environmental and Social Impact Assessment in accordance with national regulations on the environment.

The ToR needs to be submitted to the Ministry in charge of the Environment and the Ministry in charge of Mines in order to obtain official approval to commence the Environmental and Social Impact Assessment (ESIA). The ESIA is required to:

- (i) Complete the feasibility study of The Project so as to obtain a mining permit,
- (ii) Raise funds on the international capital market for financing the project.
- (iii) Assess the social acceptability of the project;
- (iv) Comply with the national regulations.

ROXGOLD SARL has hired the Geosciences, Energy and Environment Consultancy (BEGE) to conduct this Environmental and Social Impact Assessment (ESIA).

According to the above mentioned legislation, these Terms of Reference include;

- Project Description
- Description of the baseline environment
- Establish the limits of what is included in or excluded from the ESIA
- Identification of potential impacts
- Public Consultation plan

I. BACKGROUND AND CONTEXT

1.1. COMPANY INTRODUCTION & BACKGROUND

Roxgold Inc. is a Canadian mineral exploration and development company listed on the Toronto Stock Exchange, where it has its headquarters. Roxgold operates its branch in Burkina Faso, ROXGOLD SARL that was established in 2011 with its offices located in Ouagadougou.

Roxgold is committed to operating its exploration and development activities in Burkina Faso with very high degree of integrity and responsibility to our host communities and environments. Roxgold is committed to working closely with the regulatory bodies and government of Burkina Faso to ensure we operate our business in accordance with the laws of the country.

Roxgold takes its corporate, social and environmental obligations seriously. Appended to these Terms of Reference is Roxgold's Environmental and Sustainability Policy.

The Company is developing a number of exploration concessions in Burkina Faso, where it holds five permits: Yaramoko, Solna (03) and Bouboulou. Currently the main focus is on its Yaramoko permit on which the company intends to develop its project in an area known as Zone 55, which has a deposit containing nearly 2.4 million tons of ore with about 1 million ounces of gold. The company has a drilling program underway to further develop and define this deposit and increase reserves and therefore the life of the mine.

Prior to its inception in 2011, most of Roxgold's concessions were held by Riverstone before being sold to Roxgold. Historically Roxgold has performed exploration activities on the properties utilizing the skills of its geological team. In late 2012, activities have shifted to include defining a development project at the 55 Zone.

Roxgold has hired a group of high level Executives, with various skills in the field of mining projects implementation in sub-Saharan Africa. Indeed, these Executives have experience in the design, permitting and implementation of several similar mining projects (in Senegal, Ghana, Côte d'Ivoire, Mali and Tanzania). They will apply their skills and expertise for the implementation and management of the Yaramoko gold project in Burkina Faso.

Similarly, Roxgold is continuing to develop its employee base and group, growing its size and capacity in preparation for the development and operational phases. Roxgold executives and management have experience in developing personnel from similar regions and will bring high level trainers and mentors to the business to facilitate the growth of the local working group.

Roxgold Inc. is considering underground mining of the Yaramoko gold deposit. Among facilities and equipment necessary for the proper operation of the production unit, there will be a processing plant, a tailings storage facility, a camp and a set of related infrastructure.

1.2. ROXGOLD SUSTAINABILITY AND ENVIRONMENT POLICY

Roxgold is committed to keeping our environmental impact as low as possible and maintaining a balance between environmental and socio-economic priorities of all aspects of the business, as well as of the communities affected by company activities. We advocate a strong sense of environmental stewardship, taking a sustainable approach to activities whilst contributing to the economic development of the regions in which we operate. To this end, the company strives to:

- Identify environmental impacts in all business planning exercises and ensure appropriate mitigation measures and controls;
- Comply with and where possible exceed the requirements of relevant legislation, international best practice standards and other legal obligations for which we are accountable;
- Make sufficient resources available to meet our environmental objectives, including effective and sustainable closure upon completion of activities;
- Develop, implement and continually improve environmental management systems to ensure that environmental processes are integrated into all aspects of the business;
- Ensure all employees and contractors understand their individual environmental management responsibilities;
- Maintain a high degree of emergency preparedness to effectively respond and recover from any environmental incident;
- Ensure suitable waste management practices are achieved through established reduction, re-use, recycling and correct waste disposal strategies;
- Implement effective systems to address the environmental risks of transporting, storing, handling and disposal of hazardous materials;
- Monitor environmental performance through audits, workplace inspections and environmental sample analysis to identify issues and opportunities for continual improvement;
- Build and promote environmental protection within the community by providing training and support;
- Communicate with honesty and consult openly on our activities with all relevant stakeholders to ensure transparency with respect to socio-environmental performance;
- Maximize local employment and support initiatives to enhance capacity building of our host communities;
- Be respectful of local cultures, values and traditions and have an overall positive impact on the communities in which we operate.

1.3. CONTEXT AND JUSTIFICATION

The Environmental and Social Impact Assessment is a crucial component of the sustainable development policy of Burkina Faso. As such, it is protected by several provisions in national law as well as in international law.

At the national level, we can mention the adoption of numerous laws including the Agrarian and Land Reform (1996), the Environment Code (1997), the Forest Code (2011), the Water Code (2001), the Mining Code (2003) and regulations including Decree No. 342-2001 of 17 July 2001 on the scope, content and procedure of the Environmental Impact Study and Statement.

At the international level, Burkina Faso endorsed declarations and ratified many conventions that recognize the central role of environmental assessment in the promotion of sustainable development.

Burkina Faso is very active in terms of gold production with six new mines that started operations the last four years. It should be noted that since 2009 gold has become the first export product in Burkina Faso.

In addition, in February 2013 Burkina Faso was declared “fully compliant” by the Board of Directors of Extractive Industries Transparency Initiative (EITI), which indicates its good governance in the mining sector (regular publication of payments as income and others; availability of a multi-stakeholder monitoring mechanism).

II. LOCATION OF THE YARAMOKO PROJECT

ROXGOLD holds the Yaramoko mining exploration permit on which it has identified a significant gold resource estimated at 2.4 million tons of ore containing approximately one million ounces of gold. This geological model suggests the existence of a considerable potential for greater resource.

The Yaramoko exploration permit is located in the rural commune of Bagassi, Province of Balé, in the Boucle du Mouhoun region (see Figure 1).

The exploration permit covers an area of 168 km² while the influence zone covers 16 km². The site is located at approximately 225 km from Ouagadougou and 100 km from Dédougou. On National Highway No.1 (RN1) Ouagadougou-Bobo, it is accessible from the village of Ouahabou where you take the regional road No. 26 (R26) which leads to Bagassi. Access from Dédougou is also possible via the National Highway No. 10 (RN10) to the junction with the regional road R26. Within the framework of the mine development, farms within Bagassi will be directly impacted.

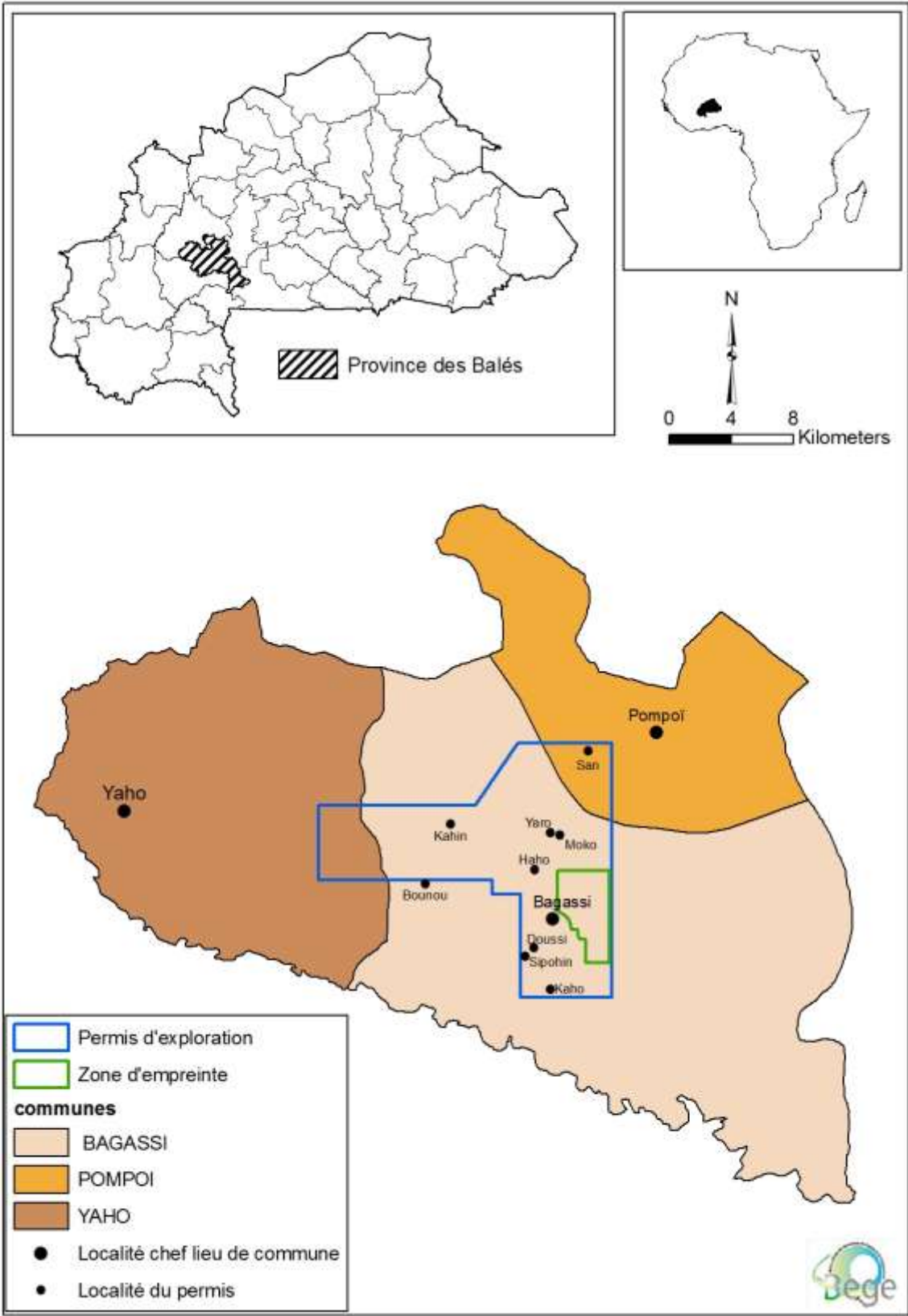


Figure 1: Location map of the project area

The coordinates of the influence area of the mining project (see dotted line on figure 2) are listed in the table below.

Table 1: UTM Coordinates of the area concerned by the Yaramoko Gold Project (ADINDAN system, zone 30)

N°	Points	Coordinates X	Coordinates Y
0	D	470,163	1,295,883
1	E	470,108	1,297,377
2	F	469,952	1,297,368
3	G	469,769	1,297,396
4	H	469,650	1,297,570
5	I	469,652	1,298,008
6	J	469,222	1,298,005
7	K	469,021	1,298,653
8	L	468,859	1,298,870
9	M	468,323	1,299,200
10	A	468,327	1,301,832
11	B	471,689	1,301,823
12	C	471,682	1,295,870

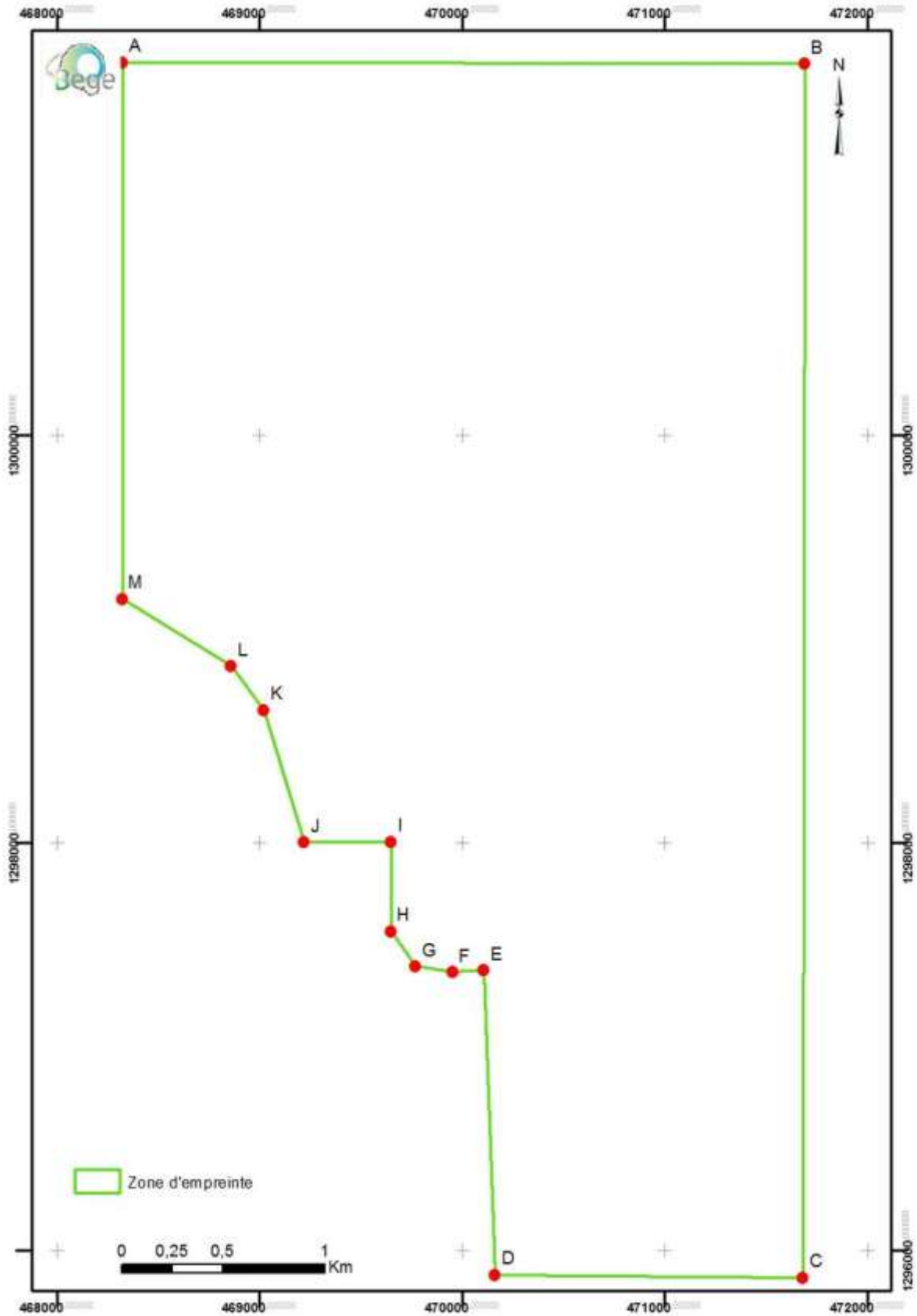


Figure 2: Materialization of the vertices of the area concerned by the project

The project area has been demarcated in a restricted, expanded and regional area.

III. DESCRIPTION OF THE YARAMOKO GOLD MINING PROJECT

The Yaramoko deposit will be operated as an underground mine using the technique of inclined long-hole blast drilling, long hole open stoping extraction, with backfilling if necessary. (See figure 3).

The amount of extracted ore will be approximately 270,000 tons per year for a production of approximately 100,000 ounces of gold per year. The plant will operate 24 hours a day and 365 days per year; it will process about 740 tons of ore per day from the gold deposit of the area known as Zone 55.

The mine whose construction will take two years, will employ 400 workers, including an estimated 50 expatriates at steady state. It will have a life estimated at 10 years with possibility of extension, if new resources are identified.

Where equal competences exist in the local community, Roxgold will look to prioritize local youth in its recruitment policy to ensure the local communities benefit from capacity building and skills development from the project.

A small quarry will be operated above the underground mine with the primary aim to rehabilitate the artisanal mining sites, produce materials essential for the construction of different structures as well as for underground backfilling.

The various buildings and facilities will be located within a secure fence. The ore processing plant will be supplied with water from a dam built in the northeast of the deposit, with a capacity of 3.2 million m³ (See Figure 3). Electricity supply to the mine will be through the use of an oil-fired power plant.

The project includes three main components:

- Mining operations;
- Ore processing;
- Related infrastructure

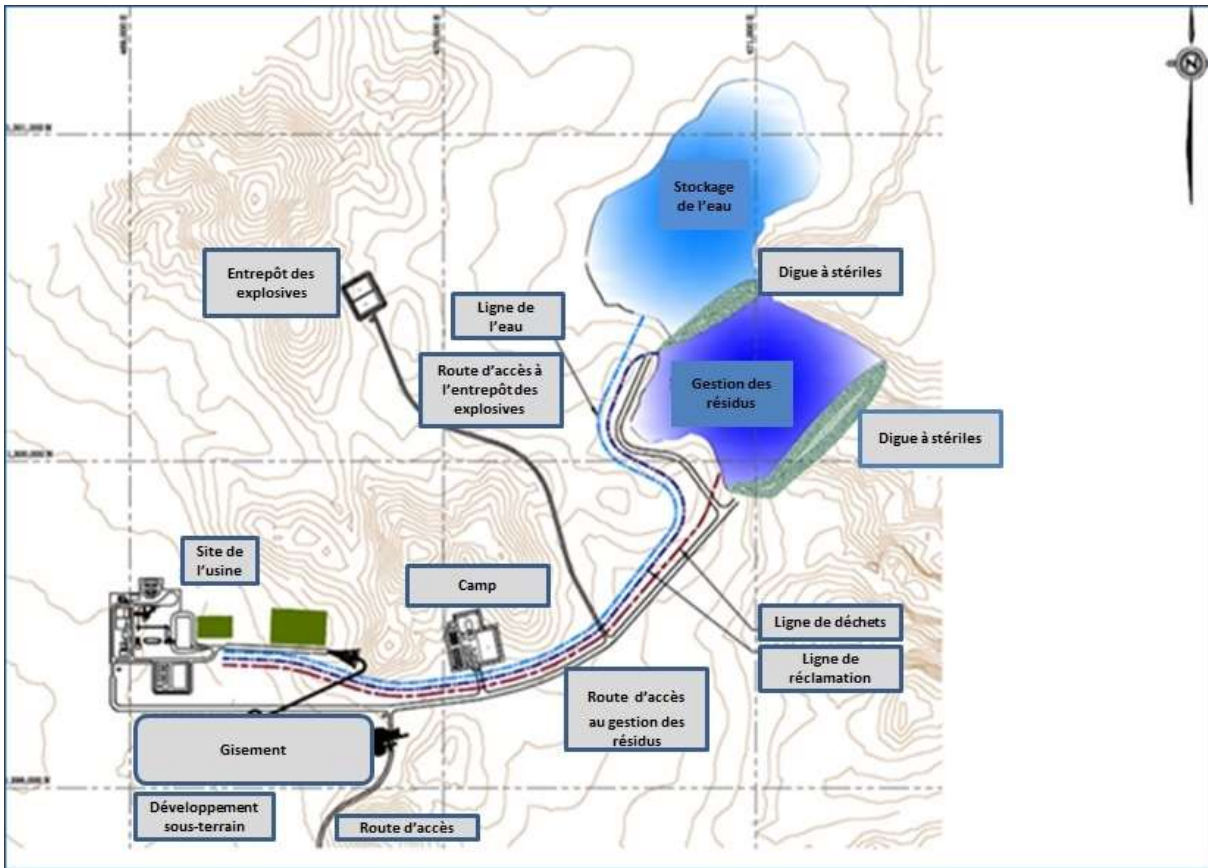


Figure 3: Simplified Ground Plan of the Project's Infrastructure

3.1. MINING OPERATIONS

Roxgold is planning an underground mining operation to a depth of 700 m, through blast-hole open stoping method and long-hole drilling using jumbos. The drill holes will be exploded with explosives.

The deposit will be accessible at the north side from a ramp inclined at 12 ° (See figure 4)

The ramp will facilitate access to and from underground production activities depending on the configuration of the deposit. It will be used to set up networks of electricity and water supply services, ventilation services for the galleries of the mine, transportation of personnel and materials in the mine.

Production drives will be carried out next to the ore body, piercing galleries in the ore.

The broken ore is collected by small bucket loaders, to the underground and intermediary disposal site and transported by larger chargers and carriers and brought on the surface storage area.

You ensure that a minimum of 3 months supply of ore for the processing plant is available on this of the raw ore storage area in case of performance problems of the mine.

Implementation of these operations requires equipment such as drilling jumbos, scoop trams, loaders, auxiliary service equipment; light vehicles.

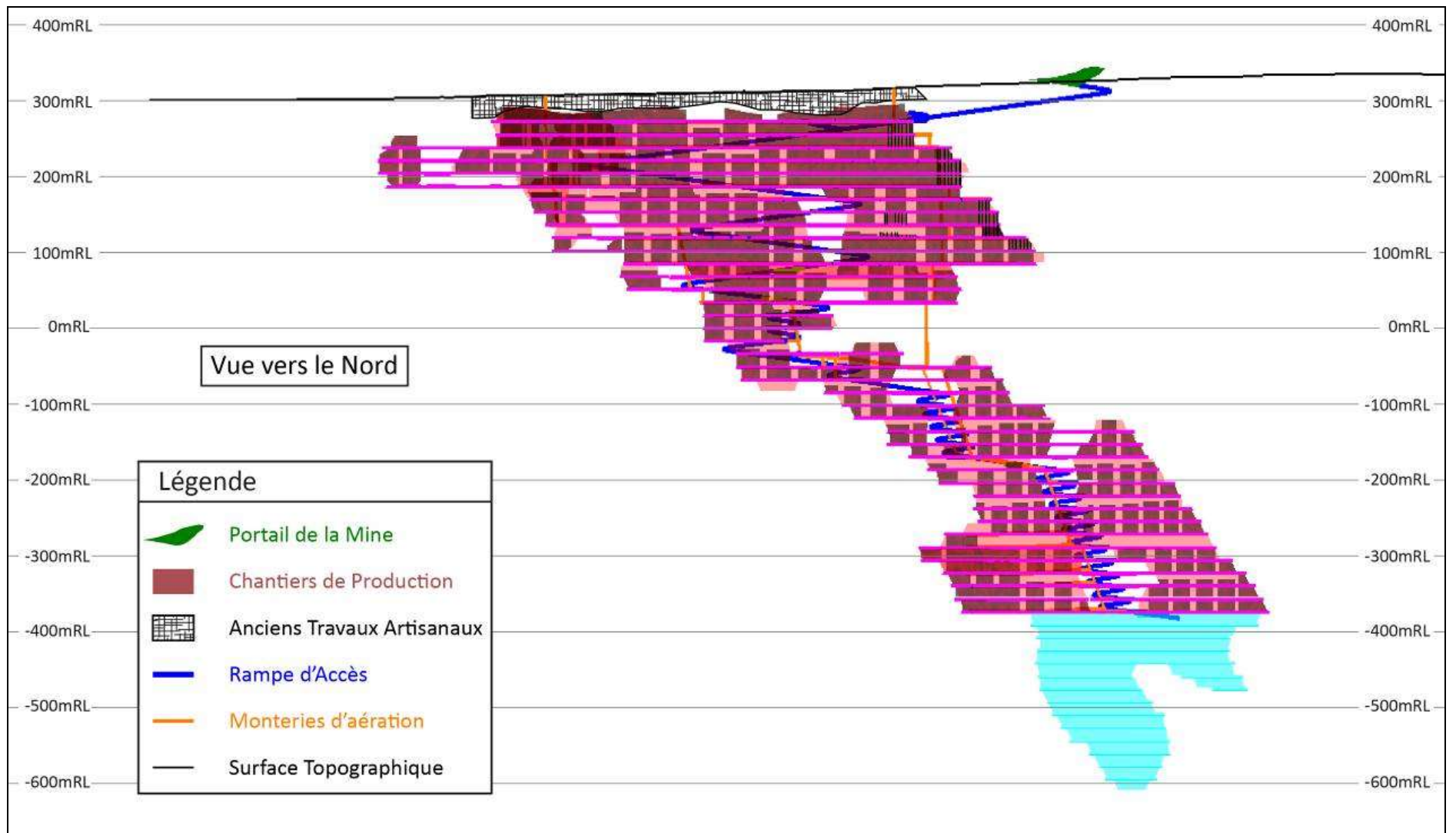


Figure 4: Schematic Diagram of Underground Mining Operations

3.2. ORE PROCESSING

Metallurgical testing to date illustrates gold recovery of about 60 to 85% by gravitational concentration; the overall recovery can reach + 95% through leaching.

In addition, more advanced additional tests to confirm these results and document the engineering and design work will be carried out, which will help refine the final ore processing process.

At this stage, the design of the processing plant includes the following major activities:

- Primary and secondary crushing;
- Recycle Crushing, grinding and classification;
- Recovery of coarse gold through gravitational concentration and leaching of residues;
- CIL and gold recovery through carbon elution;
- Tailings storage and Water Storage Facilities

A detailed Process Flow Diagram (PFD) is appended to this document for readers' reference.

Ore from the mine will be put on the storage area located near the feed silo of the crushing plant.

A feeder with tray located under the silo will be supplied from a screen that will provide the oversized ore to the primary crusher with jaws set at 150 mm.

The crushed ore is transported to the sizing screen through the product release conveyor. The screen will help to separate the two sizes of materials: the oversized material (over 35 mm) will be transported to the secondary crusher. The material of smaller size (less than 35 mm) will be transported by conveyor to the storage silo of the fine ore.

The material transported dry from the screen by conveyor will be directed to the secondary crusher set at 35 mm.

The crushed secondary ore will end in a conveyor and it will be transported dry to the sizing screen for a new screening.

Here, the dust control in the crushing plant will be performed using the high-pressure air produced by a compressor together with water.

A conveyor under the fine ore silo will supply the ball mill which grinds the ore to a fine particle size.

A coarse portion of the ball mill product is subject to gravity concentration whereby coarse gold is collected from the stream and removed via centrifugal concentrators. A leaching process using cyanide and caustic soda to the reactor temperature will help to extract gold from the coarse concentrate to produce supersaturated liquor that will be pumped to a storage tank for its extraction in an electro-winning cell.

The fine pulp sorted from refusal of cyclones is directed to leaching tanks (CIL). Each CIL tank will have screens of carbon sequestration mechanically cleaned.

Activated carbon will be maintained in all tanks except for the first, while cyanide is added to the first tank to leach gold from ore.

Carbon has excellent adsorption properties and once gold is "leached out" in the solution by cyanide, it is adsorbed preferentially on the activated carbon.

In the CIL circuit, the main concept is that gold is leached from the ore and then adsorbed on carbon.

Once gold is adsorbed onto carbon, the barren pulp can pass to the tailings.

Pumps mounted on the hopper of the tailings will transfer the tailings sludge to the Tailings Storage Facility. Roxgold is investigating the use of a compacted clay lining in the basin of the Tailings Storage Facility to minimize any potential seepage.

Carbon containing the adsorbed gold is then subject to an elution process. The pickling solution will be injected with caustic soda and sodium cyanide and then preheated to a temperature of 125 °C. This hot pickling solution is then introduced into the bottom of the elution column to extract gold from carbon and release it into the solution.

The supersaturated solution is then pumped into the electro-winning cells to put down gold on the cathode gridded in stainless steel, where it will be washed in the cell prior to its transfer into the electric calcining furnace. The dry product from the furnace will undergo direct fusion using fluxing agents in a LPG bars furnace to produce ingots.

The following reagents will be used in the gold processing and concentration process: calcium hydroxide, sodium cyanide, caustic soda, hydrochloric acid, activated carbon, diesel and steel grinding media.

3.3. RELATED INFRASTRUCTURE

Among others, the following facilities are planned for the proper operation of the mine development project:

- A reservoir providing water for a processing plant
- A sewage system for plant and camp sites
- A power production and supply plant;
- A tailings storage facility;
- A camp for staff

3.3.1. Water supply

During the four months of rainy season, rainwater will be captured and stored in the water storage facility located at the east of the processing plant site in an adjacent valley. Water will be pumped from the facility and transported to the plant site.

The amount of water collected during this period will be sufficient to ensure water supply for the project throughout the year.

The Water Storage Facility is located approximately 2.5km North East of the processing plant. It is located in an adjacent valley, utilizing favourable natural topography for storage of water. The material

required to build the storage dam will be recovered from within the basement so as to reduce the footprint of impact on the project area. A pumping system at the Water Storage Facility is used to transfer water back to the Processing Plant. The pipe runs alongside the access road between the water storage facility and the processing plant.

Roxgold understands the sensitivity around water and its value in the community. In the event, later in the mines life when the project possibly exhibits a positive water balance, Roxgold would look to make available to the local community, some of this excess water. This would need to be done in a very controlled and considered way in consultation with the community to ensure that expectations are met and safety of the community is maintained.

Indeed, this facility should have a capacity of about 3.2 million cubic meters at full height to meet the operational requirements of the mine while taking into account the high rate of evaporation during dry season.

To achieve this storage capacity, the final embankment to build will be approximately 500 m long, its height shall be at the highest point of 14 m and this will require 120,000 m³ of backfill material. (See Figure 5) The material needed to create this backfilling would come from the basin of the installation as well as the quarry for restoration of artisanal activities.

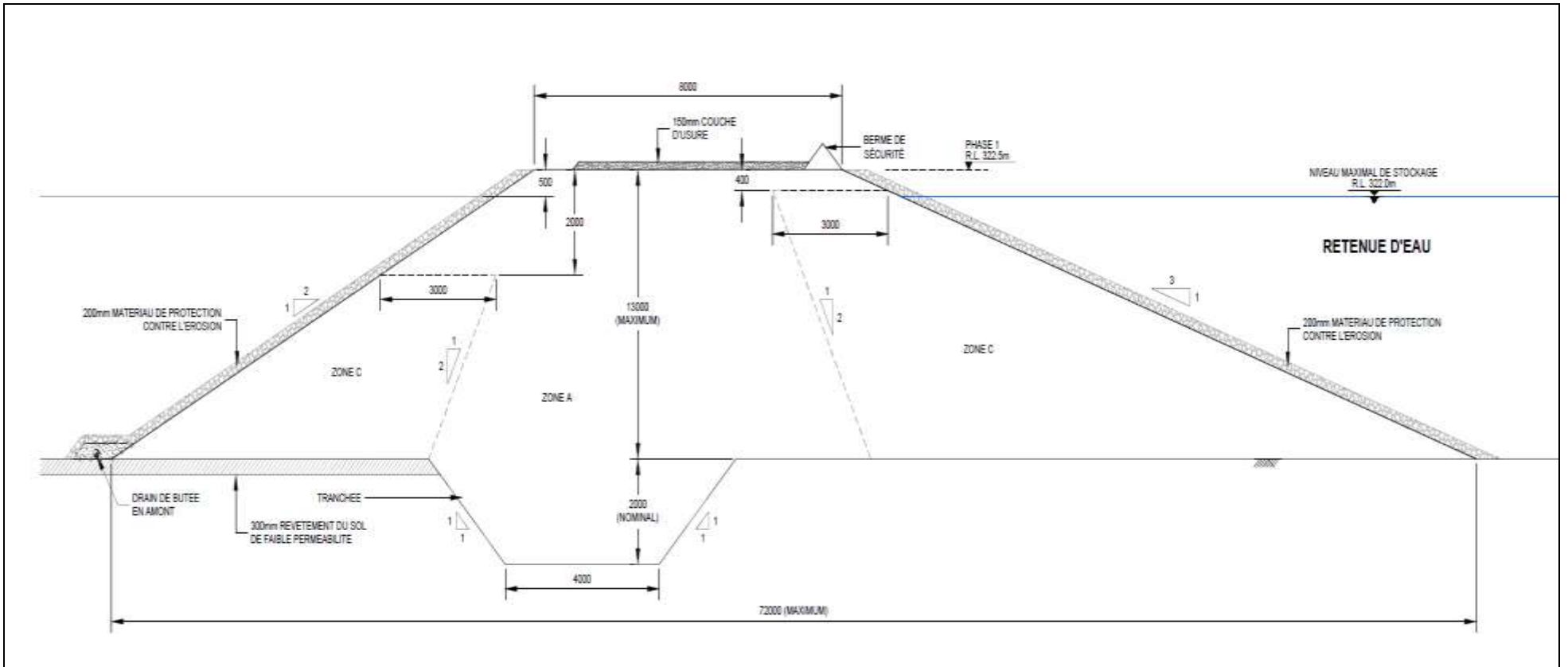


Figure 5: Raw Water Reservoir Implementation Plan

It is planned that the community has controlled access to this system where practical and possible for watering the animals and certain controlled agricultural applications.

Water from the reservoir will be treated by a station of “reverse osmosis” type and stored in a tank to obtain and provide drinking water to the camp and the general use on the site.

The return water from clarification from the tailings storage facility will be pumped to the process water pond in the plant site, so that the values of the residual reactants are retained in the process. Precautions will be taken so that there is no mixing or dilution of the liquid flows with the Water Storage Facility.

A drainage system will be constructed to serve the plant buildings and the camp. All wastewater will be treated before the treated effluent is pumped to the tailings storage facility.

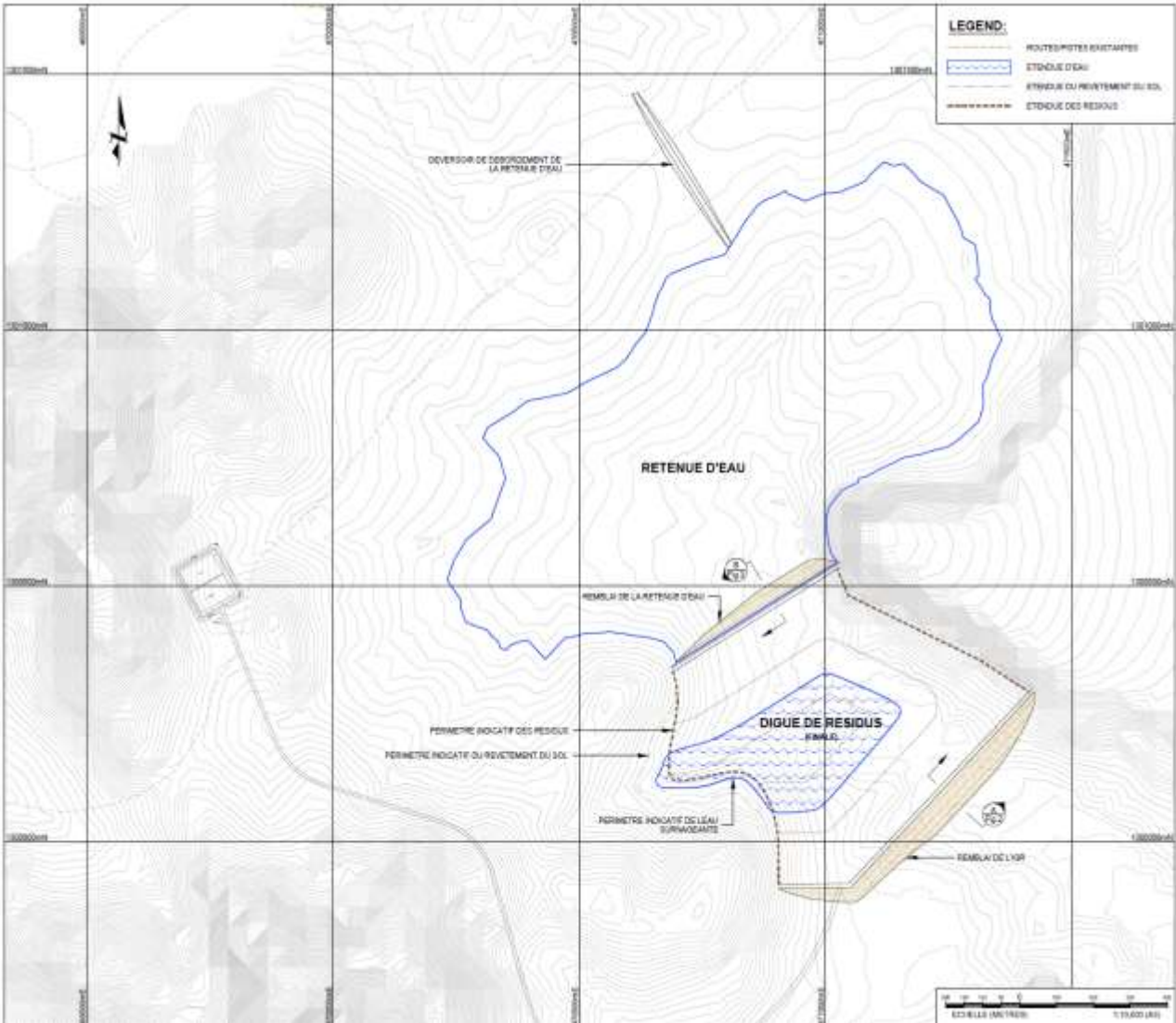


Figure 6 : Plan d’implantation de la Retenue d’eau et de la Digue de résidus

3.3.2 Tailings Storage Facility

The tailings storage facility will be located in an adjacent valley, south-east of the processing plant. This facility should have a capacity of about 3 million cubic meters; which will provide for the operational needs of the mine and take into account the heavy rain falls during the rainy season. The

facility will be fenced to prevent livestock from entering the site and it will be designed and constructed in accordance with ANCOLD standards.

To achieve this storage capacity, the final embankment to be built will have an approximate length of 800 m, a height of 18 m and it shall require 230,000 m³ of backfill material (see Figure 6).

Levels of contaminants from discharged sludge shall comply with the laws of Burkina Faso for levels of Weak Acid Dissociable (WAD) and levels of free cyanide in tailings ponds.

The material needed for its backfilling will come from the basin of the facility and the artisanal activities restoration quarry.

Roxgold intends to develop the base of the Tailings Storage Facility with a compacted clay liner. However, in the case of both the Water Storage facility and the Tailings Storage Facility, there will be further engineering and impact studies performed as part of the ESIA, beyond what is presented here in this Terms of Reference document.

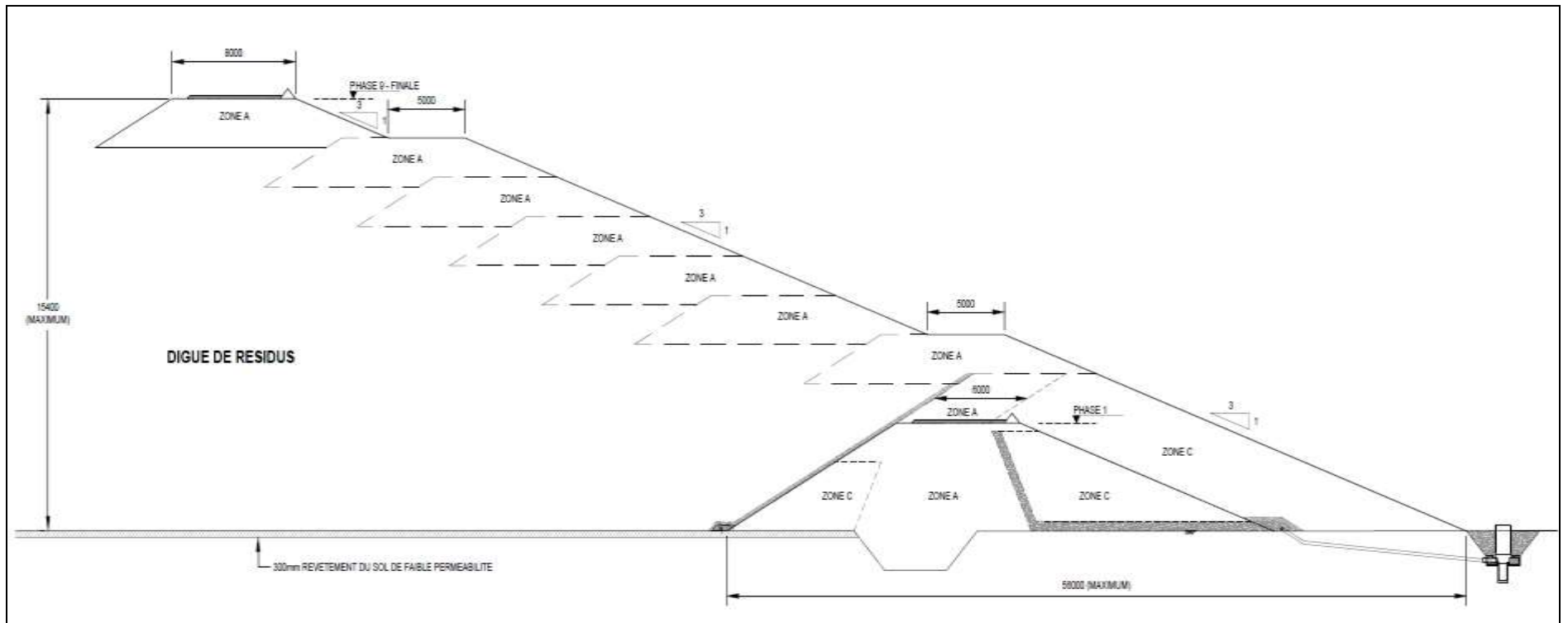


Figure 7: Plan d'implantation du remblai de la digue de résidus

3.3.3 Electricity supply

The Yaramoko mining project (mine, plant and camp facilities) will be powered by a diesel plant on the site of the processing plant. The total charge under normal condition is estimated at 3.0 MW distributed as follows: 1.50 MW for the processing plant and the other surface facilities, and 1.50 MW for underground mining operations.

To meet different requirements, especially for servicing and maintenance and taking into account possible failures, it has been estimated that the power station should be equipped with 6 diesel engines of 835 kW each, of which four will operate continuously while two will be a reserve supply. This gives an installed capacity of 5 MW, with an annual electricity production estimated at 24,000 MW.

Fuel storage facilities contributing to ensure three months of operation will be implemented on site. Similarly, it is expected that about 6.0 million liters of diesel fuel would be required per year for the operation of the power plant.

In the case of the Fuel Storage facility, there will be further engineering and impact studies performed as part of the ESIA, beyond what is presented here in this Terms of Reference document.

3.3.4. Camp Accommodation

Roxgold plans to accommodate about 300 people to maintain and manage the project. The accommodation facilities to meet the needs of these employees include the following main components: kitchen with dining area and dining room for 300 people; separate bedrooms; dormitories for men; two laundry rooms (laundries); recreation center / sports hall; sports field; secure building.

3.3.5. Other infrastructures

With regards the national road network nomenclature, the extended project area is squared by national roads, regional roads, county roads and more or less developed rural tracks. Most of these tracks are non-inventoried.

Apart from the above mentioned infrastructure, the project will require the construction of roads and access pathways, and a heliport, etc.

Overall, the implementation of the above-mentioned infrastructure will affect the biophysical and human environment elements, namely, vegetation, wildlife habitat, agricultural farms, soil and landscape.

To reduce the negative impacts associated with the construction of infrastructure, the Promoter shall ensure the optimization of different parameters. Indeed, it will consist to avoid as far as possible, the most sensitive environmental locations among which there are sacred places, cultural sites, etc.

The main buildings and infrastructure of the mine will be located within a secure fence adjacent to the high security fence of the treatment plant. A security company will be locally hired for this purpose; this company will cope with the management of security and access to the pithead of the mine will be conditioned by the wearing of a badge issued by the Administration of the mine.

3.3.6 Description of Project Economics

Given the high gold grade of the deposit, the Yaramoko project is therefore very small in physical size and impact on the ground. Roxgold are very pleased by this not only due to the reduced impact on our environment, but the effect these factors have on the project economics. Because of the small footprint and size of the facilities, the project will be built with a very modest and manageable Capital cost.

Also, given the high grade and simplicity of operations, Yaramoko is likely to be a profitable mine producing surpluses at a variety of gold prices. These economics will be finalized in a study and included in the ESIA for consideration in context of the broader project. Aspects such as capital cost, operating cost, profit margin, NPV, IRR as well as an estimate of expenditures in Burkina Faso will be included in the report.

3.3.7 Potential Project Impacts

Though not exhaustive, the following list of potential impacts that are likely to be associated with this project:

- Impact on air quality (dust, fumes, various gases, etc.);
- Impact on the quality of groundwater and surface water;
- Impact on aquatic ecosystems ;
- Impact on soil and landscape (turbidity and changes in the landscape);
- Impact on people (loss of arable land, loss of income, loss of timber and property, cultural impacts, population growth, pressure on real estate and the basic social infrastructure, conflicts between communities and so on, etc);
- Economic impacts (job creation , provision of community infrastructure, economic growth in the project area, benefits for the state, improving the status of women etc);
- Various Risks (traffic accidents, collision, industrial hazards, hazardous spills, pollution of all kinds).

Within the ESIA Report, the Promoter details measures of mitigation, compensation, benefit enhancement and risk management to address these potential impacts.

Roxgold acknowledges that the issue of compensation for loss of arable land is an important and sensitive one. Roxgold therefore intends to address this particular impact in the ESIA in accordance with international best practice as well as taking guidance from successfully executed compensation exercises in the region.

IV. EXPECTED SERVICES FROM THE CONSULTANT

These terms of reference are required by legislation, in order to obtain environmental approval to conduct an Environmental and Social Impact Assessment (ESIA) of the Yaramoko gold mining Project, according to the regulations in force in Burkina Faso while taking into account the standards of the International Finance Corporation (IFC), the Equator Principles, the UN Global Compact, Principles of International Council on Mining and Metals.

4.1. METHODOLOGICAL APPROACH

The ESIA implemented is intended to be comprehensive, complete and in accordance with national regulations and international standards. The methodology focused mainly on the following aspects:

- Literature review and mapping

This task will be done based on the information available (previous studies and reports on the project area, base maps, etc.). It helped to understand the administrative and customary organization, to better know potential problems related to the use and/or management of natural resources in the project area, etc. This also applies to all the biophysical and social baseline studies which will have a literature review component whereas this only seems to apply to the community/social aspect.

- Informing administrative and customary authorities of the project

Contacts have been established with the main administrative and customary authorities in the departments concerned by the project in order to:

- Present the project so as to have their eventual adherence during its implementation. Their issues and concerns need to be gathered to ensure that they are addressed by the project;
- Collect *in situ* data available on the environment physical state and the socio-economic situation of villages in the project area, as well as any other relevant information necessary for the conduct of the study.

- On-site Data Collection

This has been done through exchanges during village meetings, semi-structured interviews, and individual interviews with resource persons (heads of concessions, Councilors, Chiefs of land...) of the area and through observations and/or direct measurements.

The information collected and measurements *in situ* in the framework of the study must have a quantitative and qualitative character and their collection have been done by adopting the key measurement tools and devices adapted and tested in relation to the mining sector.

This aspect also applies to biophysical data collection (e.g. water, soils, biodiversity etc.)

- Preparation of various reports and graphics

The Consultant will produce at the end of their investigation the essential graphic documents as well as a report according to the standard plan specified in Decree 2001-342PRES/PM/MEE on the scope, content and procedure of the environmental impact study and statement (physical and electronic versions on CD)

4.2. CONTENT OF THE ESIA REPORT

The preparation of the ESIA report has been made according to the instructions contained in the Standard Plan for writing (see Decree No. 2001-342 of 17 July 2001 and particularly article 7) taking into account the major innovations occurred in the meantime as well as new paradigms in the area. Without being exhaustive, the constituent parts of the ESIA report include:

- Non-technical summary
- Legislation, legal and institutional framework including permitting requirements;
- Description of the project;
- Baseline description of the physical, biological and human environment;
- Analysis of project impacts on different areas of the environment (physical, biological and human environment);
- Analysis of project alternatives;
- Mitigation and impact reduction measures;
- Environmental and social management Plan(s);
- Procedures for public consultation;
- Conclusion.

4.2.1. Legislation, legal, political and institutional aspects

This section addressed in detail the national reference political, legal, regulatory and institutional framework of the study (including international conventions to which Burkina Faso is a party) as well as the performance standards of the International Finance Corporation (IFC) regarding management

of the project's environmental impact, the principles of social and environmental performance of international donors.

4.2.2. Presentation of the project Promoter

In this section the consultant has briefly described the context in which the project will be implemented, making a presentation of the project promoter along with experiences accumulated in the mining sector:

- General information on the promoter;
- Experience of the promoter in the mining sector;
- Availability of the promoter's investment plan;
- Availability of an environmental policy
- Identification of the promoter;
- Brief presentation of the Consultancy responsible for the implementation of ESIA's.

4.2.3. Rationale of the project

In this section, the Consultant highlighted information on the following key points:

- Objectives of the project;
- Background of the project
- Variants ;

Through this section, the Consultant highlighted:

- The problems and/or needs that motivate the implementation of the project;
- The choice of the site;
- Constraints and/or requirements related to mining;
- Major issues and concerns compared to other similar projects.

This section helped to identify the project's environmental, socioeconomic and technical stakes at different scales: local, regional, national or international eventually.

4.2.4. Description of the project

On the basis of maps and other graphic documents available, the Consultant provided information on the following points:

- Location of the site;
- Overall plan of the project (mining waste basin, retention basin, etc.);
- Size and capacity of the project;
- Staff needed for the implementation of the project;
- Facilities, infrastructure and services;
- Mining, servicing and/or maintenance activities; offsite Investment (access roads, reservoirs or water pipes, supply in electricity, telephone, airport, etc.).
- Lifespan of the project;
- Types of production, existence of by-products;
- Description of production factors: raw materials used, energy, etc.;
- Indication of the progress of the work program (expected date of commencement and completion of work, duration of the different phases, etc.

- Description of techniques and/or methods for ore extraction and processing;
- Hydraulic balance and water supply;
- Types of non-mining waste produced;
- Manpower and related training program;
- Total cost of the project.

In sum, the description facilitated the identification and analysis of impacts. In other words, it has been done in relation to the activities that are likely to interact with the human and biophysical components at different stages of the project. The Consultant made the information collected understandable.

4.2.5. Definition of the perimeter or the study area

The Consultant determined the boundaries of the study area and indicated whether the EIA should consider adjacent or distant areas. The study highlighted the different parts of the territory that may be affected by project-related activities (roads, supply of consumables and other borrow materials, etc.).

Besides, the Consultant found it necessary to describe several areas of study, which can facilitate the study and description of environmental components using the appropriate level of perception as appropriate.

The study area provided accurate information with respect to: (i) management of water resources, borrow material, health and safety, (ii) identification and involvement of relevant departments concerned by the problem, (iii) the accurate location of resources likely to be a cause of conflict.

4.2.6. Description of the initial state and its environment

4.2.6.1. Identification of components of the environment

Here, the Consultant conducted an analysis of the initial state of the environment (physical, biological and socio-economic environment) in the specific area of work; in order to have a thorough understanding of the components of the environment before implementing the project.

The map data have been supplemented by field trips to supplement and/or update information previously collected. To do so, various collection and inventory techniques have been used. The baseline state will concern the following aspects and parameters:

- Climate/atmosphere: rainfall, wind direction, humidity, temperature, weather conditions, regeneration, microclimate, evapotranspiration, etc. The study of the air quality is based on a series of measurements of dust and pollutants. Measurements are made on a daily basis during the rainy season and dry season in different places deemed relevant by the Consultant. The sampling site is located in order to be able to monitor air quality between the mine infrastructure and potential sensitive receptors and changes to the baseline conditions. The results of this campaign helped to establish charts on the daily evolution of dust concentration and monthly averages for different seasons and conduct comparisons with national and international standards of air quality.
- Noise: the Consultant found it necessary to conduct a series of measurements of noise over a period of at least four to six months to determine noise levels in the project area. Different measurement points are chosen in a way to cover all sensitive areas (and potentially sensitive receptors) likely to be affected by the project development activities. The Consultant proposed a

protocol to measure the ambient noise (measurement time, measurement area, and measurement periods) that have been discussed with the client.

- Water: Groundwater (quantity, quality, etc.); piezometry, speed and direction of flow; surface water (watercourses and water bodies existing in the project area (quality, natural state, floodplain, infiltration, etc.)). To this end, the Consultant found it necessary to:
 - Conduct a campaign for monitoring surface water (flow, physical and chemical characteristics of the various streams in the project area.) This campaign has been conducted in the rainy season and dry season
 - Conduct a campaign for monitoring groundwater (flow and chemical characteristics of the aquifers in the project area.) This campaign has been conducted in the rainy season and dry season. Several bores have been developed on the project site for this purpose;
 - Develop a map of the current state of surface water resources centered on the project area and its surroundings;
 - Propose relevant sites for the implementation of piezometers (site of the processing unit, park for residues, waste rock piles, etc.) that have been the object of monitoring for the follow-up of characteristics (level and quality) of groundwater ;
 - Ensure monitoring of hydraulic structures (boreholes, traditional wells, large diameter wells) in the villages of the project area;
 - Develop a map of the sampling points of surface water and groundwater;
 - Identify and characterize existing current users of water (surface water and groundwater) in and around the study area to determine their respective vulnerability to changes in the availability of quality and quantity of water, including health risks;
 - Identify and describe ecosystems dependent on water in the study area, in collaboration with the ecology and biodiversity component.
 - A permit for the construction of the raw water reservoir should be obtained from the Ministry of Water as part of the ESIA.

The following tasks have been conducted for the study of soils and land use:

- Soils: description of different types of soils with their features and properties; land use (crops and land tenure, etc.).
 - A study of the morphological characteristics of soils with a morphological map of soils centered on the project area with recommendations on whether topsoil needs to be stockpiled separately for future rehabilitation purposes;
 - A study of the chemical characteristics of soils;
 - An assessment of land particularly the soil suitability for cultivation accompanied by a map showing their crop suitability;
 - Recoding of geographical coordinates of soil pits made;
 - A study of land use.
- Fauna and flora: description of the present vegetation and flora; description of wildlife and their habitat, this section will be supplemented by the following aspects:
 - A more detailed description of the various features of vegetation to establish the environmental value of the various configurations;
 - Identification of resource persons in the project area and its surroundings (traditional healers and female traditional health practitioners, pastoralists, herbalists, local farmers) to conduct an ethno-botanical study that helps to establish the social value (medicinal, food, artisanal use, etc. by local communities) of different plant and animal species. In this register, the Consultant developed a list of economic activities that could be affected by the project;
 - A study of aquatic ecosystems;

- A description of any sensitive areas, species, and ecosystems has been done including protected areas and communal forests etc.
- Development of a vegetation map and sensitivity map indicating the location of sensitive sites (species, natural features, ecosystems) centered on the project area
- Analyze the current state of natural resources in the project area (management, degradation).
- Landscape: landscape description indicating the morphology, dominant elements, guidelines, visual conditions, ecological specificities importance of the area, etc.
- Man and habitat:
The Social Baseline Study provided national, regional and local contextual information on the social setting of the Project. Data collected includes:
 - Demography;
 - Local history;
 - Administrative divisions and local government;
 - Land tenure;
 - Livelihoods;
 - Natural resource use - agriculture and forestry, aquaculture, fish farming, soil extraction, sliding, town-planning, industry and services, leisure, recreation, tourism, other forms of use;
 - Artisanal mining :
 - Local skills;
 - In-country supply chains of goods and services potentially required for the project;
 - Public and social services;
 - Education;
 - Development programs in the area;
 - Local community initiatives ;
 - Local perception of current and future livelihoods;
 - Local cultural practices and ;
 - Local perceptions of the project.
- Health: the implementation of the project will be a potential source of difficulties related to safety, public health, including HIV/AIDS. A specific and more detailed study on health has been conducted. It helped to:
 - Examine comprehensively the current health issues (diseases, infrastructure, personnel, availability of medicines in the project area);
 - Investigate specific health problems on gold panning sites in the project area;
 - Identify potential public health and safety risks to which neighboring communities will likely be exposed with the project implementation;
 - Identify the major language (s) of communication of riparian communities in order to better develop the communication strategy for awareness campaigns;
 - Consider if the means is best suited for the awareness campaign and propose a preliminary plan for community health.
- Socio-cultural heritage:

- Elements or groups and species to be preserved
 - Historical forms of land use;
 - Map of sensitive sites discovered in the vicinity of the project including an inventory of cultural heritage: archaeological, ethnographic riches, etc. ;
 - An understanding of any permits required for their potential disturbance
- Local and regional infrastructure: health, water, education, transport and communication facilities, etc. ;
- Other stakeholders in the project area: NGOs, development projects, etc.

Linkages between the different sector-based/specialist studies have been established by the Consultant.

4.2.6.2. Definition and analysis of alternatives

The aim here was to analyze reasonable alternatives (including the no project option) for the proposed project site, technology, design and the processing process in terms of potential impacts on the environment and their relevance to local conditions.

4.2.6.2.1. Description of alternatives

The Consultant presented the different solutions and options including location on map and appropriate technology.

Brief description of each variant helped to identify processes and activities likely to affect the environment.

4.2.6.2.2. Comparative Analysis of variants

The Consultant primarily defined technical, economic, and environmental criteria. Subsequently, these criteria formed the basis for discrimination of variants. At the environmental level, the major advantages and disadvantages as well as the most worrying temporary disadvantages served as points of comparison. Ultimately, the Consultant established the comparative balance of variants, which helped to retain the most optimal.

4.2.6.3. Justification for the choice of the variant selected

The comparative analysis indicated the basic differences between variants in terms of environmental impacts, technical difficulties, cost and financing. The variant selected was not only the one that meets the project objectives but it is also acceptable at the environmental, technical, economic and social levels.

4.2.7. Identification and analysis of potential impacts of the project

The ESIA helped to further the identification and assessment of impacts at different phases of project implementation in order to provide detailed, reliable and objective data and information on the potential impacts of the project on physical, biological and human environments : Evaluation of potential positive and negative impacts of the project in quantitative terms if possible, proposals for mitigation, compensation and enhancement measures and the identification of any residual negative impacts that cannot be mitigated. This part may, if appropriate, consider cumulative impacts.

4.2.7.1. Identification of impacts

Identification of all environmental impacts has been conducted. The project's potential environmental effects have been highlighted; a suitable scale map indicated clearly: the limits of the excavations; buildings and roads; location of mining production units, etc.

This analysis covered the different phases of project implementation: exploration, mining and closure. It focused on the components of the environment and the following non-exhaustive significant impacts:

- Climate/atmosphere ;
- Natural landscape ;
- Fauna and flora ;
- Soils ;
- Water Resources and Hydrology;
- Man and their housing;
- Social, cultural and socio-economic conditions
- Cultural heritage and other monuments;
- Safety and technology accident risk;
- Waste production;
- Residual impacts after closure;
- Development induced (for example, traffic)

In summary, the Consultant gave an indication of the potential impacts induced by the project, as well as the method of compensation for the affected farms (farmers and landowners).

The context and approach adopted by BEGE and ROXGOLD made it possible to gain the support of local traditional land owners to move on from the critical project areas peacefully and in a timely manner.

4.2.7.2. Impacts Analysis

The Consultant identified the impacts that have been classified according to the environmental elements affected and analyzed taking into account their nature (positive, negative), their duration (short, medium or long-term; temporary, lasting or permanent) their character (direct or indirect) their intensity (negligible, low, medium and high) their scale (local, regional).

The identification and assessment of impacts have been conducted at different phases of the project. For this purpose, the tools and methodology used by the Consultant have been described.

In total, implementation of the ESIA helped to make available to stakeholders in the project, a set of data sufficiently reliable and objective on the positive and negative impacts caused by the project on different environments.

4.2.8. Measures for mitigation, compensation and enhancement of the impacts on the environment

The measures are divided into two major groups: general and specific measures.

General measures apply to components of the gold mining project as well as to all activities.

Specific measures relate only to certain aspects of the activities or components, such as destruction of vegetation, expropriation of landowners, efficient management of waste generated by the mine, etc.

Here, the Consultant proposed concrete measures for mitigation, compensation and enhancement/capacity building.

4.2.9. Site rehabilitation and closure plan

The Consultant proposed a preliminary/conceptual plan for operational restoration and rehabilitation for the rehabilitation of the mine site. This plan must be applied before the actual extraction and it covers the period of mine closure. In addition, it describes the main activities of rehabilitation and closure and the various components of the mine, and estimates the costs of rehabilitation and closure.

4.2.10. Environmental and social management plan

In this section, the Consultant describes the process for controlling the environmental protection measures recommended. To this end, the Consultant developed a detailed plan for monitoring the effective implementation of the above-mentioned measures and effects of the project during its lifetime. This plan includes two distinct components: mitigation measures and their costs; monitoring and oversight program.

Elements included within that Environment and Social Management plan (ESMP) are elements of the following sub-plans:

- Social management plan ;
- Stakeholders' Engagement Plan
- Community development Plan

4.2.10.1. Mitigation measures and their costs

The aim here consisted to further consider all the measures recommended in the study by assigning them a cost and indicating those responsible for their implementation (Ministry of the Environment and Sustainable Development, Ministries in charge of mines, health, agriculture and water, territorial administration; promoters, NGOs, associations, etc.).

Thus, the following elements have been considered in detail:

- Atmosphere/Emissions: noise, dust and gas emissions;
- Water management: surface and ground water supply (hydraulic structures) water quality;
- Soil management: project site preparation activities, erosion/sedimentation;
- Management of ecosystems: terrestrial, aquatic, ecological sustainability.

4.2.10.2. Environmental Monitoring and Oversight Program

This program includes environmental monitoring and environmental oversight and related indicators.

4.2.10.2.1. Environmental Monitoring

Environmental monitoring will consist of observing the evolution of the relevant components of different environments (biological, physical, and human) affected by the project implementation.

The monitoring program should take into account at least the following aspects:

- Identification of actions and components to be subject to monitoring;

- Description of activities and resources provided for monitoring;
- Means provided to control negative impacts identified ;
- The timing chart for the implementation of the monitoring (period, frequency, those responsible).

The Consultant provided an estimate of the cost of the monitoring and oversight program implementation (see Table 2 below).

Table 2: Analysis of the monitoring program

Activities	Measures	Costs of measures	People responsible	Implementation periods
Station for monitoring climate parameters				
Monitoring of air quality				
Monitoring of surface water quality				
Monitoring of groundwater quality				
Communication and social monitoring				
Monitoring the mine rehabilitation plan				
Monitoring of resettlement measures if appropriate				
Capacity building for communities				

4.2.10.2.2. Environmental Oversight

The environmental oversight describes the means and mechanisms used to ensure compliance with legal and environmental requirements in force. The oversight program includes at least:

- The list of legal and regulatory obligations and requirements related to consideration of the environment in the project implementation;
- Description of the means provided for the proper functioning of equipment and facilities and measures in case of occurrence of problems;
- The timing for the implementation of mitigation measures;
- Mechanisms and frequency of submission of periodic reports on the results of oversight programs to the competent authorities.

The oversight program is accompanied by the cost of the measures (see Table 3 below)

Table 3: Environmental Oversight Program

Activities	Measures	Costs of measures	People Responsible	Implementation periods
-------------------	-----------------	--------------------------	---------------------------	-------------------------------

Environmental inspection				
Routine monitoring				
Environmental audit				

4.2.10.2 3. Indicators of environmental monitoring and oversight

The Consultant has taken into account the following key elements in the environmental monitoring and oversight:

- Water quality ;
- Air quality ;
- Level of noise ;
- Soil and vegetation; their degradation levels;
- Status of evolution: plant cover, wildlife habitats, landscape, respiratory diseases and STI/AIDS;
- Conditions and livelihoods of communities.

In summary, the ESMP includes the following key points:

- A reminder of the EIA conclusions;
- Summary tables of impacts and their evaluation;
- A reminder of mitigation, compensation, enhancement and support measures;
- Summary tables of measures;
- Public inquiries on the implementation of the ESIA;
- Non-mining waste management;
- Aspects related to safety and hygiene at work;
- Emergency response plan;
- The environmental monitoring and oversight program specifying the levels of responsibility and monitoring indicators and their frequency;
- Responsibilities and institutional arrangements for implementation;
- The costs of measures and monitoring and oversight program.

4.2.11. Communication and public information, public inquiry

4.2.11.1. Communication and public information

The Consultant has taken the necessary measures for the broadest possible information to reach and inform project stakeholders so that they can objectively give their opinion and concerns related to the project and the technical choices made.

4.2.11.2. Public Inquiry

A public inquiry shall be conducted as part of the ESIA. It is initiated by the Ministry in charge of environment in order to gather favorable opinions and counter-proposals from the different stakeholders of the project. The support of the Consultant will be needed during the inquiry. The Sponsor will contribute to the practical organization of this inquiry.

V. PREPARATION OF DOCUMENTS AND REPORTS

At the end of the study, the following documents must be prepared and submitted by the Consultant: Thematic maps, ESIA Report accompanied by the Executive Summary;

5.1. THEMATIC MAPS

Without limitation, the graphic documents (plans and maps) listed below have been prepared and attached to the report at the end of the study:

- Map of soils;
- Map of the vegetation and sensitive areas (location of species, habitats and ecosystems) ;
- Map of the hydrographic network;
- Map of the socio-economic infrastructure;
- Map of localities, land patterns and location of sacred places and archaeological and cultural heritage sites;
- Plan of the mine site mass: including location plan of the various buildings and facilities: administrative, production, sanitation and hygiene, servicing and maintenance, support facilities for production, lines of communication, power lines and water pipes, etc.
- Location map of the mining pits;
- Etc.

5.2. DOCUMENTS AND REPORTS

The Consultant shall provide draft reports in one (1) copy on paper form and one (1) copy in electronic format; and then final reports in one (1) copy in paper form and one copy in electronic format, which take into account the comments and observations from relevant departments of the Ministry of Environment and Sustainable Development as well as those from the sponsor.

5.2.1. References

The references of all written, published or unpublished documents, used in the study have been given at the end of the report.

5.2.2. APPENDICES

They include, among others:

- Minutes of public consultation meetings (administration, communities, resource persons, institutions) including the attendance list. This register shall specify any other means of consultations (e.g. surveys) that were used to obtain the views of affected persons or groups;
- Tables presenting the relevant data referred to or summarized in the main text;
- Plan of stakeholder engagement/public inquiry and publication plan;
- The action plan that (i) describes the activities required for the implementation of the various mitigation/compensation measures or corrective actions to be undertaken, (ii) prioritizes these actions, (iii) includes the time for their implementation work, and (iv) describes the communication schedules with affected communities where a publication or consultation is planned;
- Any other document deemed relevant.

VI. COMPOSITION OF THE CONSULTANT'S TEAM AND DURATION OF THE MISSION

6.1. CONSULTANT'S TEAM

For the conduct of this mission, the consultant's team consisted of the following personnel:

- One (01) Environmentalist-Head of Mission;
- One (01) Agronomist-soil specialist;
- One (01) hydro-climatologist;
- One (01) hydro-geologist;
- One (01) forester;
- One (01) GIS Specialist;
- One (01) Specialist in sanitary engineering;
- One (01) Specialist in industrial and environmental risks;
- One (01) Socio-anthropologist/Archaeologist;
- One (01) Sociologist ;
- One (01) Specialist in road traffic;
- One (01) Lawyer/Jurist;
- One (01) Specialist in rural land tenure;
- Six (06) Surveyors

Each of these experts have a cumulative minimum of 15 years' experience in their fields of expertise.

6.2. DURATION OF THE MISSION

The duration of the mission is estimated at six months, including the filing of the draft report (two months) and implementation of the monitoring (measurements to be made).

VII. EQUIPMENT TO PROVIDE FOR THE MONITORING

The Consultant shall document the following elements:

1)E-samplers (PM₁₀ and PM_{2.5} monitors) and solar panels



The E-SAMPLER is a light-scatter aerosol monitor. The E-sampler provides accurate, dependable and relevant data for ambient air monitoring. There are two E-samplers installed at Roxgold mine camp, one monitoring PM₁₀ and the other PM_{2.5}.

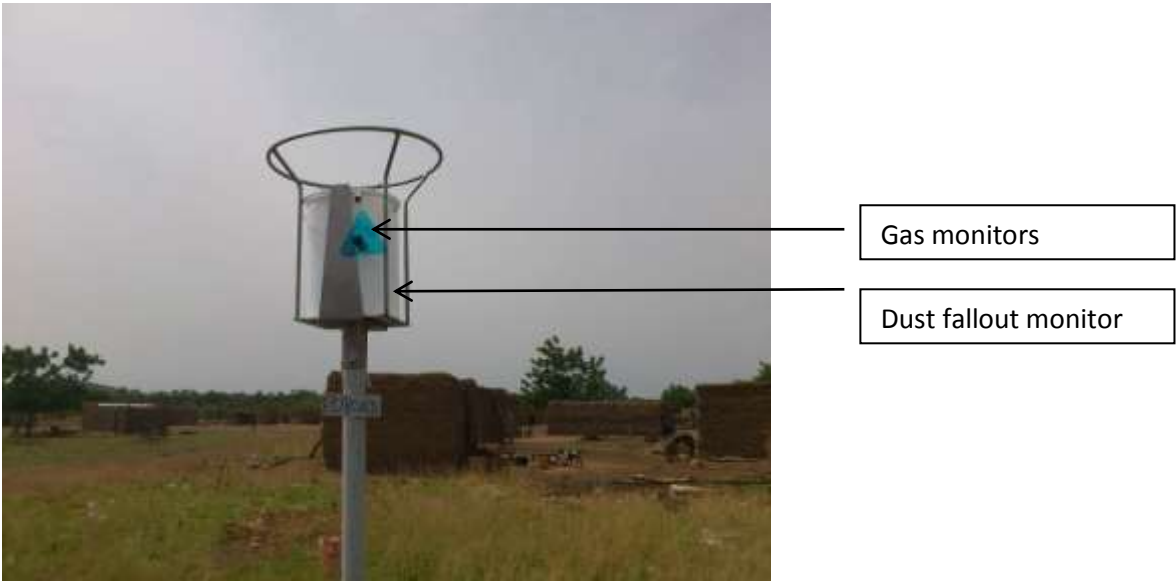
Data is recorded on an hourly basis and downloaded once a month. Each E-sampler has two solar panels and one battery installed to provide a continuous supply of power to the E-sampler.

2) Weather Station



The weather station installed at the Roxgold mine camp is the Vantage Pro2 weather station series. The weather station measures barometric pressure, temperature, humidity, rainfall, wind speed and direction, UV/solar. The weather has been calibrated and records data on an hourly basis. The weather station has been set up on top on the mine office and the console has been installed in the mine so that continuous readings can be recorded. Data will be downloaded once a month by a trained technician from Roxgold

3) Dust fallout and gas monitors



Gas monitors
Dust fallout monitor

There are eight dust monitors installed within the Roxgold mine concession consist of a stand, bucket holder, clamp, pin, lock and bucket. The bucket is filled with water and sodium hypochlorite is added as an algacide. The bucket is changed every month and sent to the lab for analysis.

The Radiello passive sampling method does not involve the pumping of any air, as gases adsorb onto material contained in a collection cartridge which is located behind a diffusive barrier. Gas sampling will be done on a monthly basis at 6 sites for the first four months, and thereafter on a quarterly basis at four sites.

Noise

It is also planned to undertake noise measurements for the period under review to determine noise levels in the project area. Once on the ground, three measurement points will be carefully chosen to cover all sensitive areas likely to be affected by the implementation activities of the project. The proposed equipment is as follows: **SL4022 – High Accuracy Sound level Meter | Class 1**



Water Resources

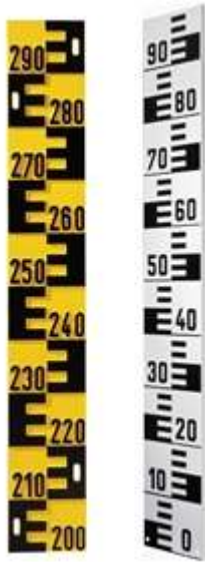
For water resources, the mission will:

- Measure the flow and water levels on the main river and two of its tributaries over the period under review.
- Follow the groundwater piezometric level by installing piezometers.

The mission proposes the installation of 10 piezometers distributed in strategic areas and taking into account the type of aquifer.

- 1) Staff gauges: REF: OTT: 3 staff gauges are desired for this mission. For the Yaramoko 2x1m that is a total of 4 staff gauges of 1 m

Staff gauges in enameled steel sheet



The mission envisages two readings per arm and per day: 6:00 am and 6:00 pm and improvised readings in case of floods/decline.

2) Universal Reel : REF : C31 OTT : Desired number 1



The mission envisages a reading per day and per arm. While waiting to assess the real depths on the ground, we maintain suspension on the pole.

3) Dip Meter



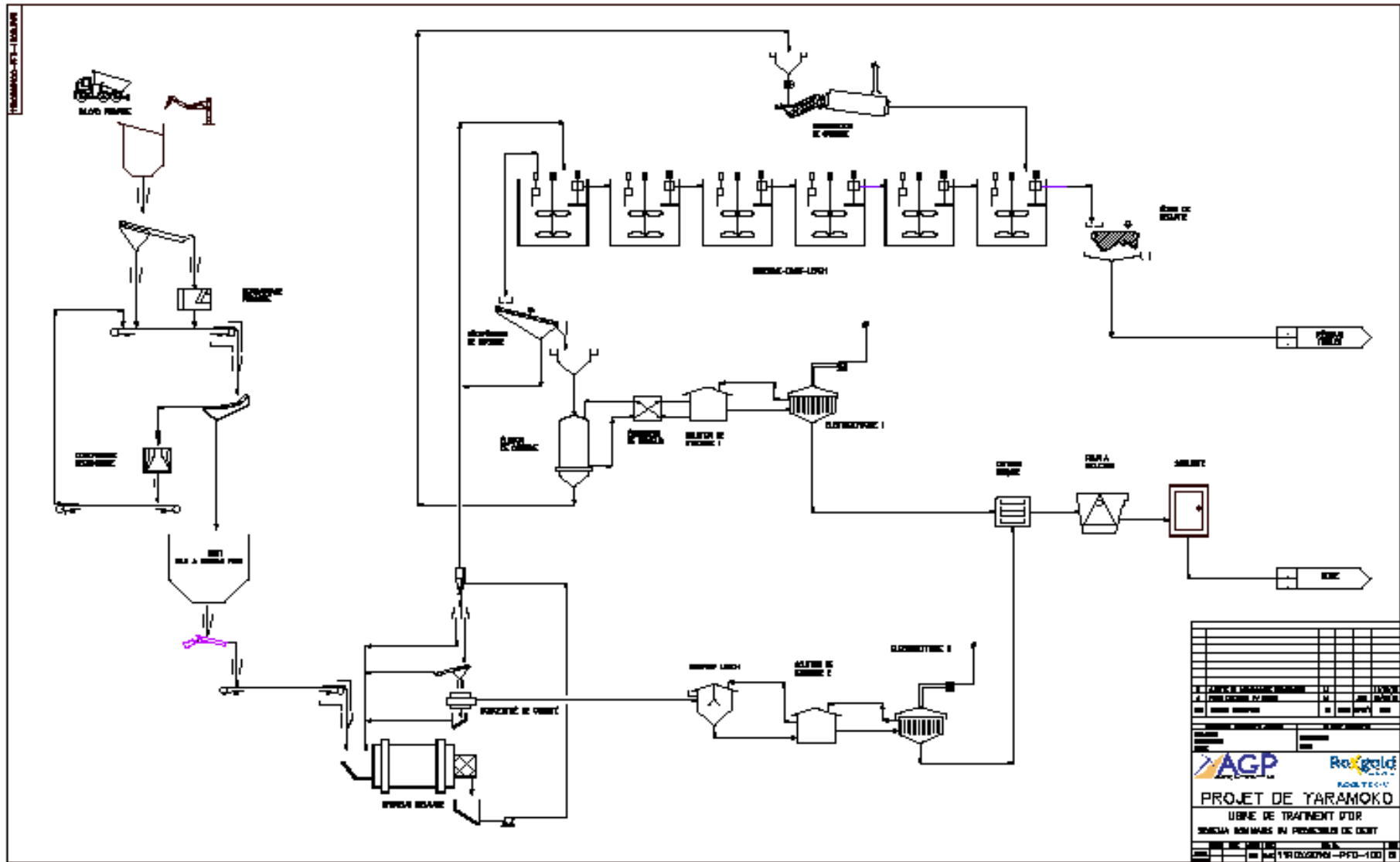
The standard dip meter is a lightweight water level measuring instrument, designed for routine groundwater monitoring. The dip meter is 100m in length with a light indicator and polyethylene tape.

4) Bailers



Disposable bailers are a type of grab sampler used in ground water monitoring wells to retrieve a water samples from below the ground surface. Disposable bailers consist of a hollow tube with a check valve at the bottom and a handle at the top. To retrieve a water sample from a well, a tether cord is attached to the handle at the top of the disposable bailer and the bailer is lowered into the well where it contacts the groundwater. The weight of the disposable bailers causes them to sink into the fluid. Hydrostatic pressure of the fluid pushes up on the check valve (usually a ball check) causing the valve to open and water to flow into the tube. Water entering a disposable bailer will seek its own level so that a partially submerged bailer will be partially full and a fully submerged bailer will be full. When the disposable bailer has filled to its submerged level the valve closes, preventing water from escaping. There are 24 disposable polyethylene bailers on-site.

APPENDIX 1: PROCESS FLOW DIAGRAM



APPENDIX 2

ROXGOLD LOCAL RECRUITMENT AND CONTENT POLICY

Roxgold's local recruitment and content policy forms part of the company's overall human resources policy, adhering to Burkina Faso national labour laws and ILO core standards. Roxgold believes that respecting and working collaboratively with our host communities is key to our success as a company and as good neighbours. In striving for a legacy of long-lasting social and economic growth for the communities in which we operate, the company recognizes that the utilization of local labour and materials has great potential to bring mutual benefits. Roxgold supports local recruitment as a means to directly boost the local economy and to provide capacity building to enhance long-term sustainable development of social and human capital for Burkina Faso, and more particularly for the local area around the Yaramoko Gold Project. Further, we see this is a foundational principle in fostering community involvement and relationship-building.

Roxgold is determined to encourage the development of a motivated, competent and productive workforce with a strong proportion of Burkinabe citizens, especially those hailing from the Yaramoko Gold Project zone of influence. To this end, the following principles will guide Roxgold's recruitment during the development and operations of the Yaramoko Gold Project in Burkina Faso:

- Roxgold will ensure equal employment opportunities are offered to *all Burkinabe nationals*, without discrimination based on gender, ethnicity or age, and will seek to involve locally identified vulnerable people/groups;
- Roxgold will favour locally-hired unskilled labour over those outside the region, as well as seeking to emphasize locally available materials and equipment that meet company needs, holding its consultants and contractors to the same standard whenever possible;
- For all unskilled labour, Roxgold's local hiring targets are as follows:
 - 80% immediate vicinity of the mine
 - 10% regional
 - 10% national
- Through a Local Hiring Committee, coordinated by the host communities, we will work closely with local authorities and other local stakeholders to pinpoint locally available personnel (either skilled or unskilled, depending on company needs vis-à-vis available local skills) and strive to spread the benefits of direct and indirect employment as broadly as possible in the local area;
- In collaboration with staff and contractors, the company will seek to provide relevant training and education programs to local employees to develop capacities, delivered by a mixture of action learning (on-the-job structured training) and formal training courses, held both on site and externally;

This recruiting policy will be reviewed and evolve accordingly with time through development and operational phases.

APPENDIX 3:
GEOCHEMICAL ASSESSMENT

Geochemical Assessment of Waste Rock from the Yaramoko Gold Project, Burkina Faso

Report Prepared for

Roxgold Inc.



Report Prepared by

 **srk** consulting

SRK Consulting (Canada) Inc. #3CR016.002

SRK Consulting (UK) Limited #U5629

10 janvier 2014

Roxgold Inc.

360 Bay Street
Toronto, Ontario, Canada
M5H 2V6
E-mail: info@roxgold.com
Website: <http://www.roxgold.com/>
Tel: 416-203-6401
Fax: 416-203-0341

SRK Consulting (UK) Inc.

5th Floor Churchill House
17 Churchill Way
Cardiff, UK, CF10 2HH
Email: enquiries@srk.co.uk
Web: www.srk.co.uk
Tel: +44 29 2034 8150
Fax: +44 29 2034 8199

SRK UK Project Number: U5629
SRK Canada Project Number: 3CR016.002
Date: January 10, 2014

Authored by:

Julien Declercq, Ph.D, FGS
Consultant Geochemist

Andrew Barnes, Ph.D, Eur.Geol, CGeol
Senior Consultant, Geochemist

Peer Reviewed by:

Robert Bowell, Ph.D, Eur.Geol, CChem, CGeol,
Corporate Consultant Geochemistry

Cover: View of hills overlooking the proposed site

Executive Summary

Introduction

SRK Consulting (UK) Limited (SRK) on behalf of Roxgold Incorporated (Roxgold) has undertaken a geochemical assessment of the Acid Rock Drainage and Metal Leaching potential (ARDML) of waste material from the Yaramoko project, Burkina Faso. The study was undertaken as part of a feasibility study examining the economic viability of a future underground mine and onsite concentrator. This report presents the approach taken, the main findings and draws conclusions on the potential for ARDML generation from waste rock.

Methods

In order to assess the potential for ARDML associated with the Yaramoko project SRK carried on a characterization program of the potential waste rock from the mine site. In order to complete this assessment a review of the site geology was undertaken and the primary material types likely to be encountered on site delineated. Then potential waste rock samples representative of the wall rock were collected and static laboratory testing was performed in Maxxam Laboratories (Canada) on those samples.

Mine waste is typically classified and tested according to material type and the number of samples selected for geochemical testing is based on the relative percentage of each material type predicted to be mined from the geologic model. The term 'material type' typically denotes a unique combination of rock type, alteration type and oxidation state, referring to the basic lithological description of the rock. Based on the observed variations in primary lithology, alteration and oxidation, a total of three material types were identified for the Yaramoko site, Granitoid (GD), Mafic Volcanic (MV) and Quartz Vein Zone (QV).

To characterize the potential waste rock samples a series of short term ('static') geochemical tests were undertaken to allow the preliminary assessment of the acid rock drainage and metal leaching (ARDML) characteristics. While wastes were expected to have low acid rock drainage (ARD) potential an appropriate assessment was undertaken to confirm this.

For the purposes of the geochemical assessment, 28 samples representative of the different lithologies were collected (14 from GD, 12 from MV and 2 from QV) representing the wall rock. The following tests were undertaken on the samples:

- Mineralogical Assessment – assessment of the potential mineralogical controls on acid generation and metal(loid) release using optical microscopy and X-Ray spectroscopy;
- Acid Base Accounting (ABA) – with siderite correction, analysis of potentially acid generating sulphur species and acid neutralizing carbonate species. Simple mass balance provides an estimate of the sample acidity generation potential;

- Strong acid (Aqua regia) extraction of solids – strong acid dissolution of the sample and elemental analysis by ICP-OES/ICP-MS to determine the available elemental quotient of metals and metalloids within the sample;
- Deionized water leach – using the MEND SFE protocol at a liquid to solid ration of 3:1. In the test the sample is with deionized water and the resulting leachate analyzed for dissolved constituents. This gives an indication of the elements immediately available for release from the sample; and
- Static Net Acid Generation (NAG) test with NAG leachate analysis – all the sulphide present in the sample are oxidized by reaction with hydrogen peroxide. Gives an indication of the high end estimate of the acidity potentially released by the sample through oxidative weathering.

Waste Rock Mineralogy

All the samples were analyzed by X-Ray diffraction (XRD) and amongst the collected potential waste rock samples ten were selected for optical and secondary electron (SEM) microscopy. The results of these observations indicate that the samples consist mostly of silicates (quartz, albite and clinocllore). Sulphides were found in traces amount in all samples (0.1 to 0.2 wt%) mainly in the form of medium grained pyrite with chalcopyrite, pyrrhotite and molybdenite present as ultra-trace. Acid neutralising minerals are present in most samples, as both carbonates in the form of calcite and dolomite and (in the case of the MVOL lithology) mafic and ultramafic silicates in the form of phlogopite and actinolite.

Acid Generation Potential

The results of the ABA and NAG testwork shows that the majority of waste rock samples collected can be classified as non-acid forming (NAF) material. Six samples are categorized as uncertain but only one of the 28 samples collected was considered to be Potentially Acid Forming (PAF) as determined through Acid Base Accounting (ABA) and confirmed through NAG testing with the sample generating acidic pH leachate (pH 3). The remainder of the samples generating near-neutral (pH 7 to 7.5) to alkaline (pH 8 to 10) leachates. The NAG pH behaviour can be attributed to a generally low content of acid generating sulphide minerals (consistently less than 0.8%) combined with high concentration of acid neutralising carbonate minerals within the waste rock material. It should be noted that in a number of uncertain sample cases, complete oxidation of sulphide within the NAG tests was not realized and therefore the tests are not thought to be fully confirmatory of ARD potential. Although these samples are not thought likely to generate acidic leachates, it is recommended that further testing is undertaken to fully quantify the ARD potential

In summary, the Yaramoko wall rock material potential for acid generation is considered to be low. However, it is possible that localized generation of acid may occur in small pockets characterized by higher sulphide material.

Metal Leaching Potential

The results of aqua regia digestion found arsenic, sulphur, selenium and gold to be enriched in all material types with respect to the Geochemical Abundance Index (GAI)

values and silver, phosphorus, lanthanum and barium in three samples. Despite being enriched all the values with the exception of gold were close to the analytical method detection limit and represent the generally low content of these elements in the rock

During the deionized water leach test (carried out at a liquid to solid ratio of 3:1), no metal(loid)s were found to be released at concentrations in excess of relevant water quality guidelines. It can therefore be deduced that the potential for immediate (short term) release of problematic solutes from the waste rock disposal (WRD) facility should be minimal.

During the NAG leach extraction in which the sulphide minerals are oxidized with hydrogen peroxide, no element were found to exceed the International Finance Corporation (IFC) and Burkina Faso effluent discharge to surface water guidelines. Only aluminium was found to exceed the Burkina Faso drinking water guidelines in all lithologies. This observation is likely a reflection of the alkaline pH of the final leach solution and the elevated solubility of aluminium under elevated pH conditions.

In the case of the Granitoid lithology, copper (0.009mg/L) and manganese (0.07 mg/L) were found to be higher than the CCME and the Burkina Faso Drinking Water guidelines respectively. While in the Mafic Volcanic lithology Selenium (0.0019 mg/L) and Iron (0.14 mg/L) were found higher than the Drinking water and CCME guidelines. It must be noted that the aqueous concentrations measured are generally low and concern the solutions generated by the waste material prior to any geochemical effect e.g. laboratory to field up-scaling, precipitation of secondary minerals, surface speciation, and dilution.

Potential for Water Quality Impacts

The findings of this report demonstrate that the waste rock samples from the Yaramoko project tested by SRK have a low acid generation potential and are unlikely to release significantly elevated concentrations of problematic elements under normal weathering conditions. However, a low potential for leaching of elements arsenic, selenium, antimony, copper and manganese has been indicated.

Three potential seepage sources have been identified on the Yaramoko project as follows:

- Temporary waste rock dump;
- Underground workings, backfilled waste and wall rock; and
- Leaching of waste rock used for construction within the mine facilities.

Potential water quality impacts resulting from these sources are given in Table i.

Table i: Summary of Potential Water Quality Impacts at the Yaramoko Project

Source	Cause	Impact	Receptor
Temporary waste rock dump	Atmospheric weathering / oxidation of waste rock followed by subsequent leaching by rainwater	Potential for low level leaching of sulphate, selenium, antimony, arsenic, copper and manganese.	Surface water and groundwater receptors in receiving catchment
Underground workings, backfilled waste and wall rock	Atmospheric weathering / oxidation of backfill and wall rock during mine life followed by mobilisation during mine void flooding	Potential for low level leaching of sulphate, selenium, antimony, arsenic, copper and manganese.	Groundwater in vicinity of the 55 zone once groundwater has fully recovered
Waste rock used as construction material	Atmospheric weathering / oxidation of waste rock followed by subsequent leaching by rainwater	Potential for low level leaching of sulphate, selenium, antimony, arsenic, copper and manganese.	Surface water and groundwater receptors in receiving catchment

Recommendations

Prior to operation:

- It is recommended that sequential NAG tests are carried out on samples with a net neutralisation potential less than 20 kg CaCO₃ eq/t. This will give a better indication of the total leachable component and potential final leach pH of the samples;
- It is recommended that conservative geochemical modelling of the source term is performed to quantify fully the leaching potential of the waste and wall rock; and
- Humidity cell testing should also be considered if conservative geochemical modelling indicates the potential for water quality impacts downstream of the mine waste facility.

Mine operation and closure mitigation requirements:

- It is recommended to locate the temporary waste rock storage facility on a low permeability layer and collect and monitor seepage water quality prior to reuse or discharge to the environment. This will ensure that suitable mitigation control measures are in place in the event that low quality water is realized;
- The backfilling of all waste rock to a level below the recovered water table should be undertaken prior to, or at point of mine closure to limit the potential weathering of solutes from these materials;
- Monitoring dewatering water quality prior to discharge. Ensure that suitable mitigation control measures are in place in the event that non-compliant water quality is realized; and
- Monitoring of surface and ground water quality downstream from the mine site during operation and following closure. Assessment of the water quality against a set of site specific water quality objectives based water usage and key receptors to be agreed with the relevant regulating authority.

Table of Contents

1	Introduction and Terms of Reference.....	5
1.1	Purpose and Scope	5
1.2	Theory of Acid Rock Drainage and Metal Leaching (ARDML)	6
2	Background	9
2.1	Location	10
2.2	Climate.....	12
2.3	Geology and Mineralization	14
2.3.1	Regional Geology	12
2.4	Local Geology	15
2.4.1	Mineralization	17
2.5	Water	16
2.5.1	Hydrogeology	18
2.5.2	Hydrology	18
2.6	Mine Plan	22
2.7	Previous Geochemical Testing	21
2.7.1	Waste Rock Geochemistry	21
3	Methodology.....	25
3.1	Introduction	25
3.2	Sampling	22
3.2.1	Delineation of Material Types	22
3.2.2	Summary of Site Visit and Sampling	26
3.3	Sample Preparation	25
3.4	Geochemical Testing	30
3.5	Mineralogical Assessment.....	27
3.6	Static Testwork	31
3.6.1	Acid Base Accounting	31
3.6.2	Net Acid Generation Testing.....	29
3.6.3	Paste Tests	33
3.6.4	Multi Element Analysis of Solids	34
3.6.5	Deionized Water Leach.....	35
3.6.6	Hydrogen Peroxide Leach (NAG test leachate).....	31
3.6.7	Guidelines Used For Assessment	32
3.7	Quality Control / Quality Assurance.....	37
4	Résultats	431

4.1	Mineralogical Assessment	431
4.2	Acid Generating Potential	47
4.2.1	Paste pH and EC Measurements	49
4.2.2	Assessment of Acid Potential and Neutralisation Potential	50
4.2.3	Acid Base Accounting	51
4.2.4	Net Acid Generation Testing	52
4.2.5	Acid Generating Capacity Summary.....	54
4.3	Solute Leaching Potential	56
4.3.1	Multi-Element Analysis.....	58
4.3.2	Deionized Water Leach.....	59
4.3.3	NAG Leachate	61
5	Conclusions.....	62
5.1	Acid Generation	62
5.2	Metal Leaching Potential	63
5.3	Metal Leaching Potential	63
6	Recommendations	64
6.1	Prior to Operation	64
6.2	Mine Operation and Closure Mitigation Requirement	65
7	References.....	67
	APPENDIX A.....	68
	APPENDIX B.....	71

List of Tables

Table 1:	Mineral Groups According to Neutralization Potential (Sverdrup, 1990).....	8
Table 2:	Core Intervals Selected for Analysis	28
Table 3:	ABA Data Interpretation.....	32
Table 4:	Interpretation of GAI Values for Multi-Elemental Assay Data	34
Table 5:	Table of Water Guidelines Used Within this Study.....	36
Table 6:	Percentage of Acceptable RPDs for Duplicate Samples.....	37
Table 7:	Phases Found and Their Relative Percentages in the Yaramoko Field Duplicates.....	41
Table 8:	Mineralogy of Waste Rock Lithology	45
Table 9:	Mineralogy of Waste Rock Samples.....	48
Table 10:	Summary of Waste Rock ABA Testwork Results	47
Table 11:	Summary of Waste Rock NAG Testwork Results	49
Table 12:	Summary of Multi-Element Assay Showing GAI Values for Key Parameters Relating to ARDML ..	52
Table 13:	Deionized Leach Elemental Concentrations (in mg/L) Compared to WHO, IFC, CCME and Burkina Faso MAC Guidelines.....	53
Table 14:	Hydrogen Peroxide Leach Elemental Concentrations (in mg/L) Compared to Guidelines	55

Table 15: Hydrogen Peroxide Leach Elemental Release (in mg/kg) Compared to the Whole Rock Concentrations58

Table 16: Summary of Potential Water Quality Impacts at the Yaramoko Project60

List of Figures

Figure 1: Yaramoko Project Location Map 11

Figure 2: Yaramoko Concession (red circle) in Relation to Local Towns and Villages. Grid Squares Represent 5km12

Figure 3: Burkina Faso Climatic Zones (EIES Yaramoko Report, 2013) 13

Figure 4: Average Monthly Rainfall in Boromo (1971 to 2011) 14

Figure 5: Geology of Greenstone Belts in SW Burkina Faso (Metalka et al., 2011).....15

Figure 6: Generalized Vertical Section through the Weathering Granitic Rock 16

Figure 7: Generalized Vertical Section through the Weathering Granitic Rock17

Figure 8: Catchment Area Relevant to the Yaramoko Project 20

Figure 9: Groundwater Contours and Flow at Yaramoko with Proposed Site Layout Overlain 21

Figure 10: Site Layout Overview 23

Figure 11: Conceptual Underground Mine Plan Considered for the Preliminary Economic Assessment (AGP, 2013).....23

Figure 12: View Looking West (Leapfrog simulation) 27

Figure 13: View Looking North (Leapfrog simulation) 28

Figure 14: Scatter Plot Comparing the Field Duplicates for the NAG Solution Chemistry.....39

Figure 15: Scatter Plot Comparing the Field Duplicates for the Deionized Water Leach Test39

Figure 16: Ion Balance Plot for the NAG Extract and Deionized Water Leach Showing the Sum of Anions Plotted Against the Sum of Cations (meq/L).....40

Figure 17: XRD Patterns: Sample SRK 2863 and its Duplicate SRK 2865 (top), Sample SRK 2846 and its Duplicate SRK 2866 (middle); and Sample SRK 2853 and its Duplicate SRK 2867 (bottom).. 43

Figure 18: XRD Data for All Samples, Classified by Lithology 43

Figure 19: Box and Whisker Plot Describing the Distribution of Total Sulphur (wt%) in All the Samples and in the Samples Analyzed by Optical Microscopy46

Figure 20: Box and Whisker Plot of Paste EC and pH Measurements for the Waste Rock47

Figure 21: Comparison of Neutralization Potential Calculated from Carbonates and with Siderite Correction48

Figure 22: Scatter Plot Comparing: NPR* and NNP* (top), Total Sulphur and NPR (middle); and Acid Generating Potential and Neutralizing Potential of the Waste Rock Material (bot.....49

Figure 23: Scatter Plot comparing the Total Sulphur to the Sulphide Sulphur (wt%) in the ABA Testwork.....5

Figure 24: Box and Whisker Plot of the Acid (top) and Neutralization (bottom) Potential of Each Lithological Type54

Figure 25: Scatter Plot Comparing Measured NAG pH with Neutralization Potential Ratio55

Figure 26: Scatter Plot Comparing NAG pH Measured After Heating the Sample and Sulphide Sulphur Content of the Waste Rock56

Figure 27: Scatter Plot of the Ficklin Metals (mg/kg) Release as a Function of NAG pH57

Figure 28: Scatter Plot of Antimony Release (mg/kg) as a Function of NAG pH58

Figure 29: Scatter Plot of the Arsenic Release (mg/kg) as a Function of NAG pH59

Figure 30: Scatter Plot of the Selenium Release (mg/kg) as a Function of NAG pH60

1 Introduction and Terms of Reference

SRK Consulting (UK) Limited (SRK) has been requested by Roxgold Inc. (Roxgold, hereinafter also referred to as the Company or the Client) to conduct a geochemical assessment of the Acid Rock Drainage and Metal Leaching (ARDML) potential of waste material from the Yaramoko project, Burkina Faso. The study was undertaken as part of a feasibility study examining the economic viability of a future underground mine and onsite concentrator. This report details the approach taken, presents the main findings of the work and draws conclusions on the potential for ARDML generation from waste rock at the Yaramoko project, Burkina Faso.

1.1 Purpose and Scope

The data and analysis presented herein are results from static geochemical characterization testing carried out on twenty eight samples representative of potential waste rock from the Yaramoko project.

The main objectives of the geochemical characterization study are as follows:

- To characterize the geochemistry of potential waste material according to lithology, weathering, alteration and sulphide content;
- To quantify the acid forming characteristics of potential waste material and to assess its potential to generate acid drainage upon weathering; and
- To determine the potential for solute release and to assess the metal mobility from the Yaramoko waste material

Typically a geochemical characterization programme would initially apply a number of static testwork methods (e.g. Acid Base Accounting, Net Acid Generation testing, leach testing and a multi element assay) to characterize the ARDML potential in absolute terms. The term static testing is used to describe absolute analytical methods applied to determine the acid generation and metal leaching characteristics of a given material type at the time of testing. They do not account for temporal changes that may occur in the material as chemical weathering proceeds. Static tests provide a balance of acid generating and acid consuming reactions at an end point and also may be used to determine the potential magnitude of leaching metals from a given material. By contrast kinetic testing evaluates the rate of sulphide oxidation and metal release over time. Static testing is typically carried out as an initial screening evaluation method in order to determine where more comprehensive kinetic testing is warranted. The geochemical characterization study presented herein utilized only static testwork methods to assess ARDML potential of waste rock from the Yaramoko project.

The following activities were completed as part of the geochemical characterization program:

- Review of site geology and identification of the primary material types;
- Collection of core samples representative of potential waste rock available from the exploration programmes; and
- Static laboratory testing of representative waste rock material to assess ARDML potential.

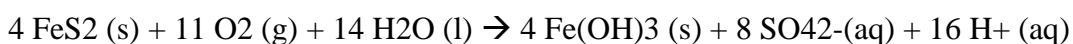
This report has been prepared by SRK to provide Roxgold with a description of the objectives, approach, test methods and findings of the geochemical characterization study. It should be stated that SRK's opinion are based on laboratory analysis of samples undertaken by third party laboratories and subsequently supplied to SRK.

Unless otherwise stated, SRK has used suitably qualified and accredited laboratories for the analysis of all environmental samples. SRK has accepted such results in good faith and has exercised reasonable care in auditing and reviewing the supplied information; however, SRK is not otherwise responsible or liable for the conduct or accuracy of any of the samples or the results. The laboratory results are provided in full in Appendix A and B should independent verification be required.

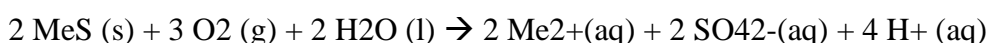
1.2 Theory of Acid Rock Drainage and Metal Leaching (ARDML)

The term 'Acid Rock Drainage and Metal Leaching' (ARDML) refers to the generation of acidic, metal- and sulphate-rich waters that result from the weathering of sulphide minerals (particularly pyrite – FeS₂) under oxidizing conditions. The process may occur naturally in sulphide-bearing rock strata, but is commonly accelerated by mining activity, such as excavation, which increases the likelihood of exposure of sulphide minerals to air and water, effectively accelerating natural weathering processes.

The general equation for pyrite oxidation is summarized below:



However, the equation can also be written for general metal sulphides as:



Metal sulphide + Air + Water → Mobilized metal + Salts + Acidity

Pyrite and other sulphides are not abundant minerals at Yaramoko, though acid generation may occur if there is not sufficient neutralising capacity within the host rocks. However, even in the absence of acid generation the release of potentially problematic concentrations of metals can still occur at near-neutral leaching conditions.

The ability of a mineral to react with water will depend on its solubility under specific hydrogeochemical conditions. In arid environments such as in Burkina Faso, these minerals can represent an important source of potential acidity and metal release in partially oxidized material. Hence these minerals are important as both potential sinks and sources of acidity in the rocks, sulphate and possibly metal ions on precipitation and rapid release on exposure to moisture (Nordstrom, 1982; Cravotta, 1994; Bowell et al., 1996).

Acid-neutralization reactions result from water-mineral reactions and buffering of acidity (H⁺ ions) in drainage. This buffering is frequently accompanied by the precipitation of secondary minerals (Kwong and Ferguson, 1997; Lawrence and Wang, 1997; Nordstrom and Alpers, 1999). These reactions can reduce acid generation by forming an inhibitory surface coating on the reactive sulphides and acid-forming partly oxidized metal-sulphate minerals.

Carbonate minerals are the most active neutralization component in the deposit and these minerals (e.g., calcite, dolomite and ankerite) readily dissolve under acidic conditions to provide bicarbonate alkalinity, which results in neutralization of acid and precipitation of metal hydroxides. The order of carbonate neutralizing capacity is:

calcite>dolomite>malachite=ankerite>siderite.

In the case of siderite and, to a lesser extent ankerite, the reason for the limited neutralizing capacity is that ferrous iron in these minerals are an additional potential source of acidity due to the strong hydrolysis of the resulting ferrous iron in solution and for malachite, copper is produced that forms soluble copper-carbonate complexes in preference to carbonic acid or bicarbonate. This order of reactivity is partly controlled by equilibrium mass-action constraints and partly by kinetic limitations (Morse, 1983).

Carbonate minerals (especially calcite) have often erroneously been thought of as the only geological source of Neutralization Potential (NP). However, carbonates primarily occur in limestone, dolomite and marble rock types while the majority of geological materials are composed of silicates and hydroxide-oxide minerals. The weathering of silicate minerals (e.g. feldspar and amphibole) as a proton sink has been demonstrated in previous studies (e.g. Sverdrup, 1990; Moss and Edmunds, 1992; Kwong and Ferguson, 1997). To assess the buffering capacity of mine wastes, silicate and hydroxide minerals therefore must also be considered. From soil acidification studies, Sverdrup (1990) divided the most common minerals into six groups according to pH dependency of their dissolution rate (Table 1).

From the relative weathering rates of the mineral groups shown (Table 1), minerals in the poor to negligible neutralizing categories are unlikely to react, due to their sluggish reaction rates. Even for minerals in the intermediate and fast mineral weathering groups, they will not be practical neutralizing materials unless they occur in excess of ~10% (Sverdrup, 1990).

Table 1: Mineral Groups According to Neutralization Potential (Sverdrup, 1990)

Group Name	Typical minerals	Buffering pH Range ¹ (s.u.)	Approx. NP ² Range	Relative Reactivity ³
1.Dissolving	Calcite, aragonite, dolomite, magnesite, aragonite, portlandite and brucite	6 - 11.2	7.8-14.8	1.0
2.Fast weathering	Anorthite, nepheline, olivine, garnet, jadeite, leucite, clinocllore, spodumene, kutnahorite diopside, siderite and wollastonite	5.5 - 11	2.8-0.6.2	0.6
3.Intermediate weathering	Epidote, zoiste, enstatite, hyperthene, augite, hedenbergite, hornblende, glaucophane, tremolite, actinolite, anthophyllite, serpentine, chrysotile, talc, chlorite, biotite.	4.8 - 7.3	1.7-5.8	0.4
4.Slow weathering	Albite, oligoclase, labradorite, vermiculite, montmorillonite, manganite, goethite, gibbsite and kaolinite.	2.4 - 5.1	0.5-2.9	0.02
5.Very slow weathering	K-feldspar, ferrihydrite and muscovite	2.2 - 4.1	0.2-0.6	0.01
6.Inert	Quartz, hematite, rutile and zircon	3.3 - 3.5	<0.01	0.004

1 buffering pH range evaluated by crushing 5g of pure mineral and mixing with 5mL of distilled water and left to react for 30 minutes. The pH of the distilled water was 3.4 s.u.

2 NP range assessed as equivalent buffering potential of 10 g of pure mineral to calcite and titrated with hydrochloric acid. So for example, 10g of portlandite (Ca(OH)₂) was found to have the equivalent capacity to neutralize HCl acid as 14.8g of calcite, whereas 10g of hornblende was required to buffer HCl acid to a similar pH to only 3.1g of calcite.

3 Calculated from Sverdrup's equation (1990), see below and based on 100% mono-mineral sample

The accumulation of solutes in solution will lead to saturation with respect to some species. Consequently in response to either saturation or destabilization as aqueous species, these compounds precipitate as secondary minerals such as arsenates, phosphates, carbonates, sulphates or hydroxides. An important control on the diversity of the precipitated mineral assemblage is pH. At low pH, oxyhydroxides, and sulphates are commonly the main precipitates while at higher pH other salts such as carbonates and hydroxides become more abundant. Some solutes can be attenuated through adsorption onto mineral surfaces, noticeably iron hydroxides and clays. This is the process of element binding at the mineral-solution interface and is pH dependent (Sigg and Stumm, 1980; Deng and Stumm, 1994). Many oxide surfaces change from being positively-charged at low pH (thus attracting anions) to negatively-charged at high pH (thus attracting cations).

As water pH increases above 3 s.u., HFO may precipitate and ultimately crystallize to form goethite or other ferric hydroxides (Bigham, 1994). As pH increases, ferric hydroxide solubility tends to decrease with a minimum being around pH 6-7 su. At low pH, precipitated HFO tend to scavenge negatively charged oxyanions as the surface of the HFO is positively charged in the Helmholtz layer (Deng and Stumm, 1994). In low pH environments these HFO particles are usually colloidal sized and have a high reactivity proportional to their surface areas. As the pH increases and colloid particles aggregate as Fe-OH bonds become longer and more rigid due to the excess of hydroxyl molecules, the surface pH of the particles change and become negative. In the case of goethite this occurs at a pH between 6 and 9 (Hiemstra and van Riemsdijk, 1996). The point at which this occurs is termed the point of zero charge. As pH increases beyond the zero point of charge, the surface of the HFO becomes more negatively charged and particles tend to attract metallic cations and release any sorbed oxyanions.

Where seepage from waste dumps or tailings percolate through alluvium or rocks containing iron oxides or clays then chemical attenuation of trace elements may occur and as such present a passive form of water treatment. In circum-neutral to alkaline oxic environments, arsenic and selenium form species such as $\text{HnAsO}_4^{-(3-n)}$ and $\text{HnSeO}_4^{-(2-n)}$ respectively (Bowell, 1994). These show strong affinity in mildly acidic to neutral soils for attenuation and as such may be removed from seepage preferentially. At higher pH they do not form sparingly soluble solids and as such are mobilized. Conversely metallic cations are not adsorbed at low pH but as pH increases so too does attenuation by precipitation and adsorption mechanisms in the soil as they form strong metal-hydroxide affinity.

2 Background

2.1 Location

The Yaramoko project is located 1 km north east of the town of Bagassi, in the Balé province of south-central Burkina Faso as shown in Figure 1 and Figure 2.



Figure 1: Yaramoko Project Location Map

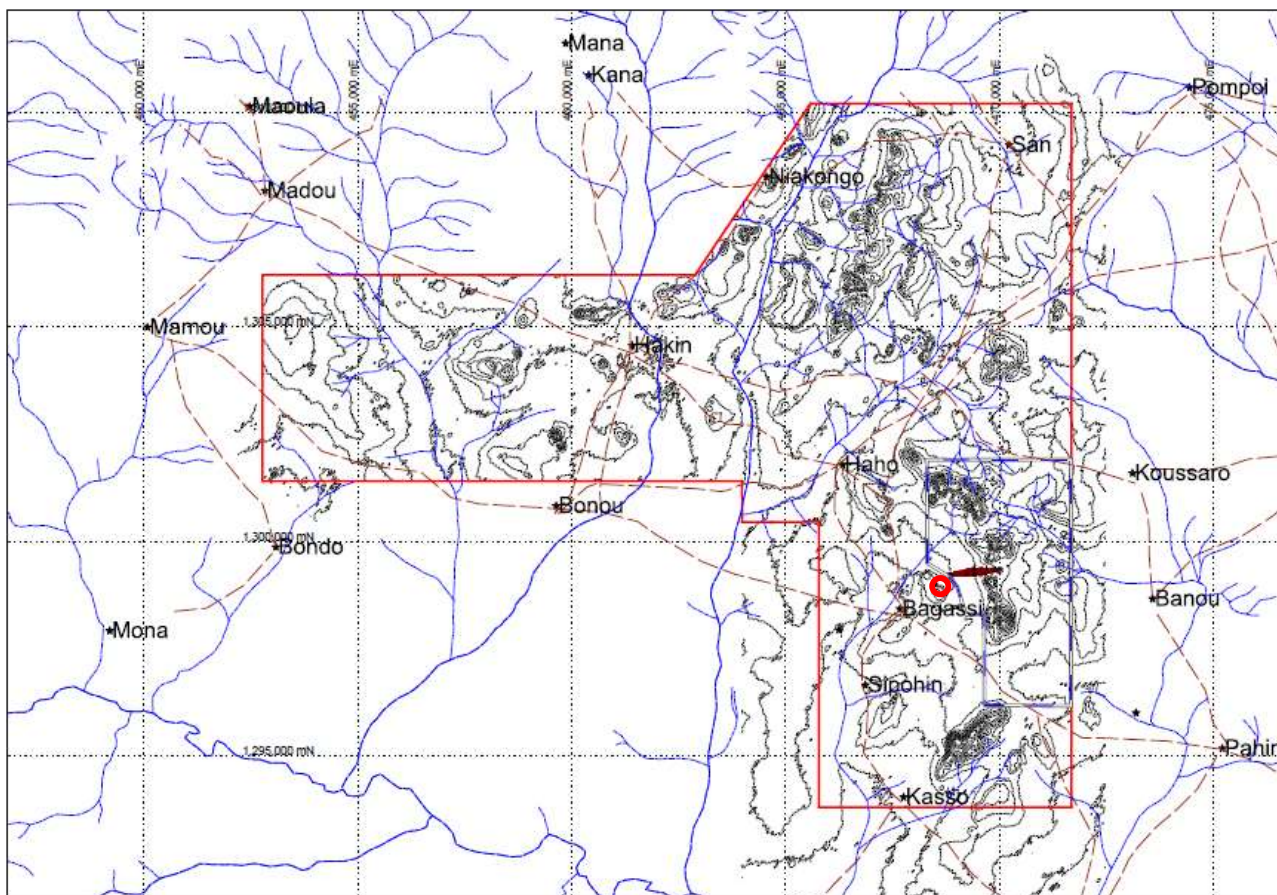


Figure 2: Yaramoko Concession (red circle) in Relation to Local Towns and Villages. Grid Squares Represent 5km

2.2 Climate

Burkina Faso has a primarily tropical climate with two very distinct seasons (Figure 3). The average monthly rainfall is depicted in Figure 4, in the rainy season, the country receives between 600 and 900 mm of rainfall. The rainy season lasts approximately seven months, starting in April and finishing in October.

The Boromo weather station (Figure 3) located 30 km west of the project was used in this report (EIES Yaramoko Report, 2013) and a monthly average of 72.4 mm was experienced throughout the year from 1971 to 2011 (Figure 4), while the dry season average (November to March) was 2.5 mm and the wet season average was 122.4 mm in the same time period. Minimum evaporation and evapotranspiration values are 139.2 mm and 122.8 mm respectively for the wet season. During the dry seasons these values are 346.2 and 181.6 mm.

The weather in Yaramoko is classified as North-Soudanian (Figure 3) with minimal and maximal temperature varying in a day between 16 °C and 39 °C.

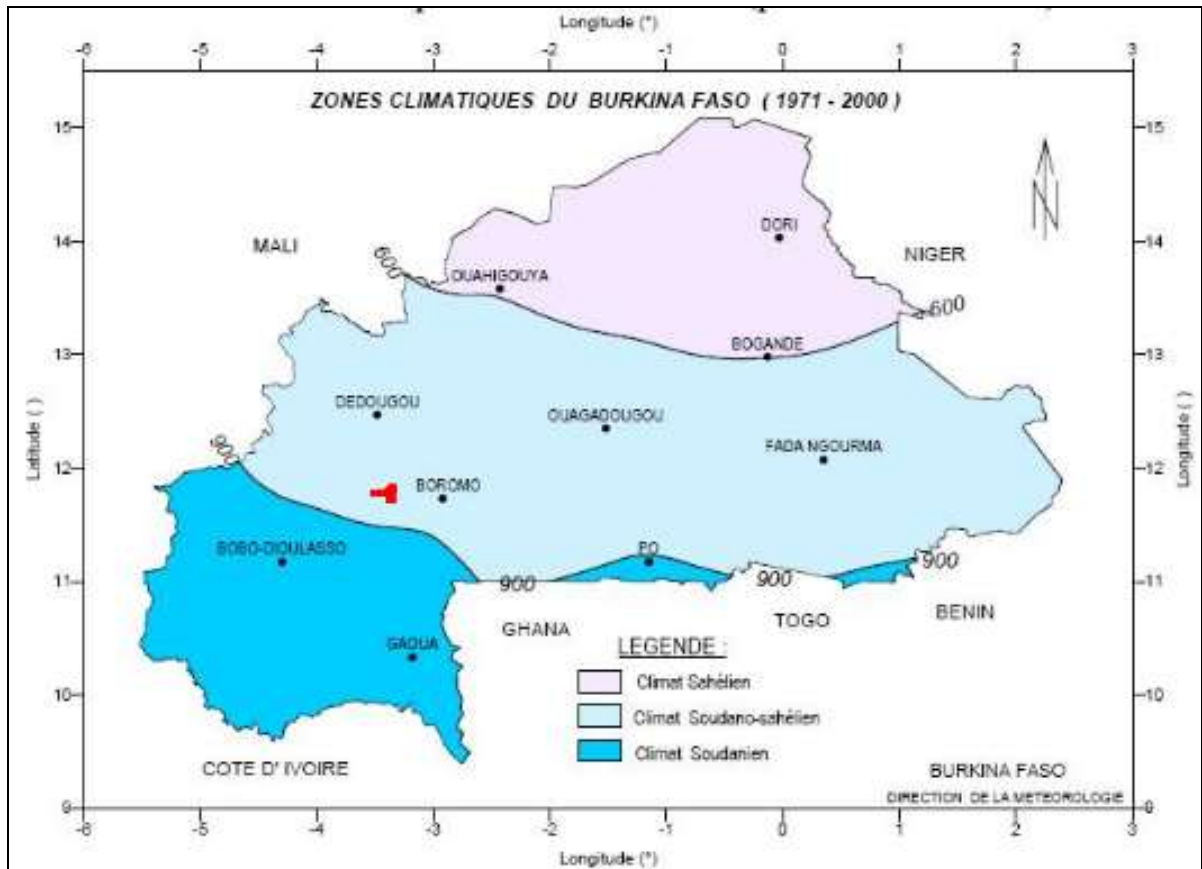


Figure 3: Burkina Faso Climatic Zones (EIES Yaramoko Report, 2013)

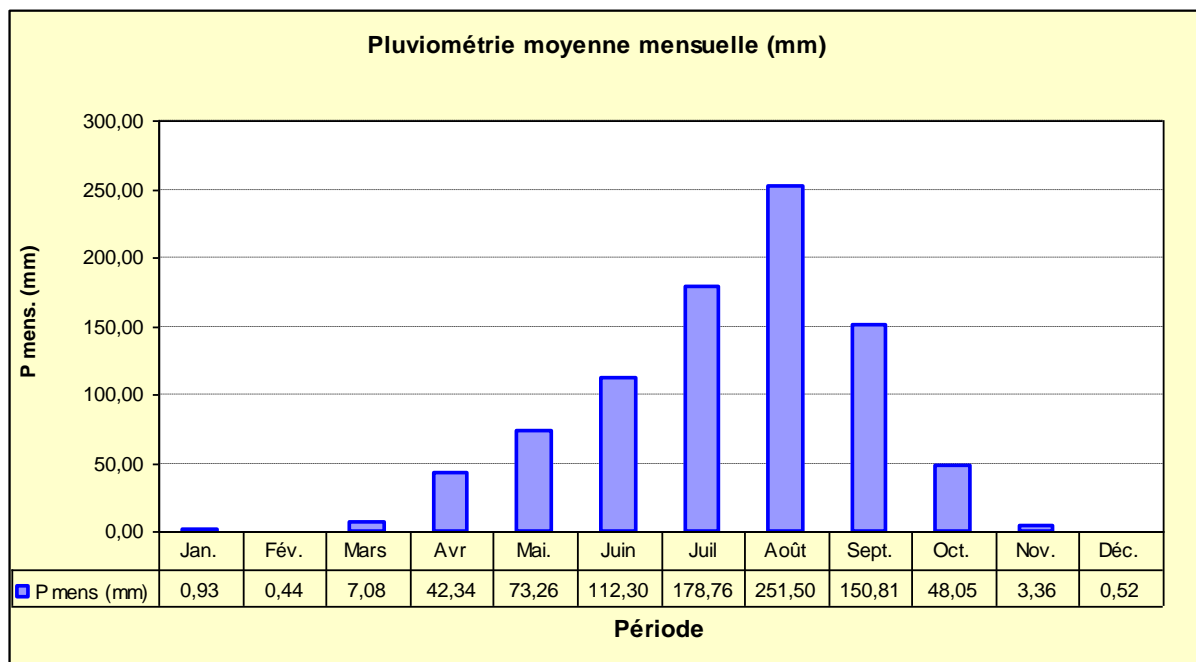


Figure 4: Average Monthly Rainfall in Boromo (1971 to 2011)

2.3 Geology and Mineralization

2.3.1 Regional Geology

The Yaramoko project is located in the Baole-Mossi Paleoproterozoic domain in Burkina Faso (Figure 5), which forms the southern part of the West African Craton. The NNE-trending Boni Shear Zone divides the project into predominantly volcanic and volcanoclastic rocks of the Houde Greenstone Belt to the west, and mixed intrusive and volcanic rocks of the Diebougu Granitoid Domain.

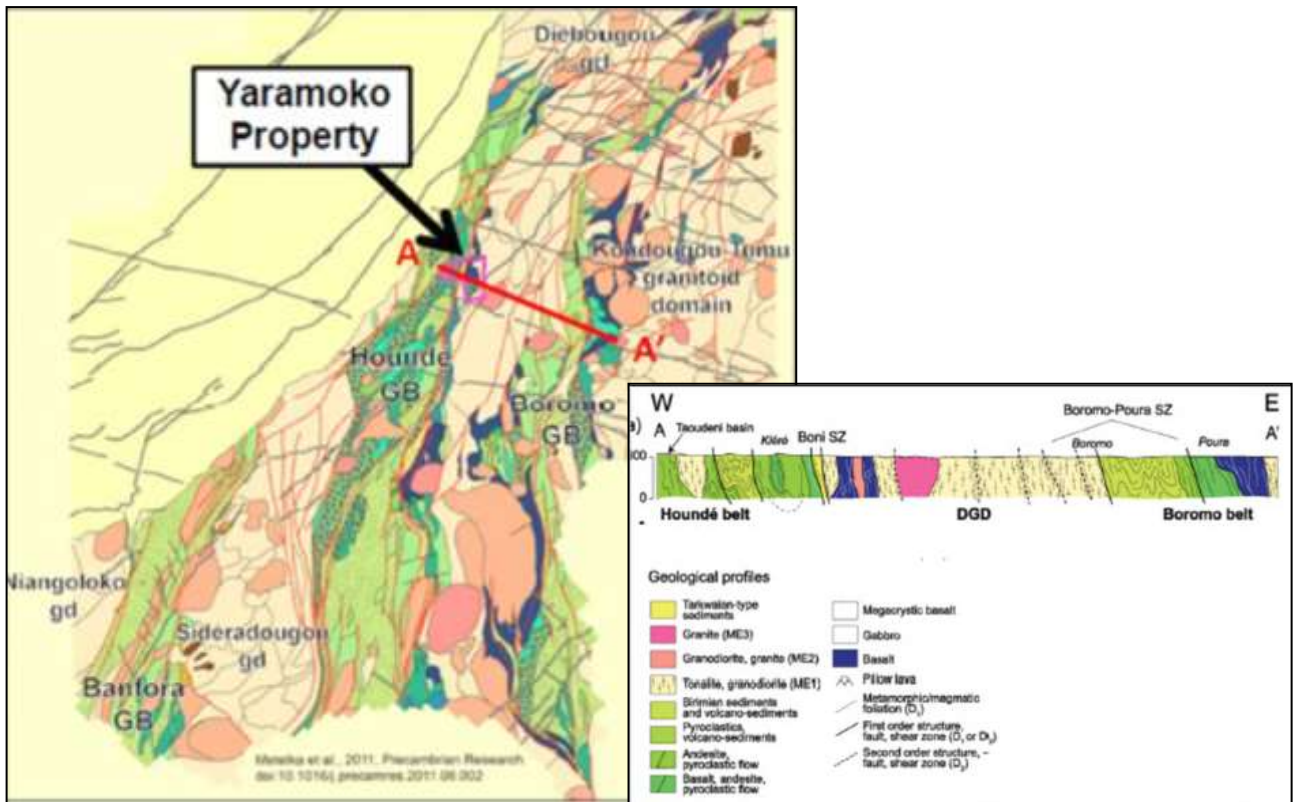


Figure 5: Geology of Greenstone Belts in SW Burkina Faso (Metalka et al., 2011)

2.4 Local Geology

Locally the site geology mainly comprizes granite and mafic volcanic rock with the overlying soils primarily comprising laterite and underlying saprolite composed mainly of residual weathered host rock and a surface of shallow transported material. The saprolite consists of alteration products derived from the underlying weathered rock; therefore its composition, thickness and extent differ from one rock type to another.

A representative generalized weathering profile for the mafic volcanic lithology, presented in Figure 6, was generated from the SRK Geotechnical boreholes.

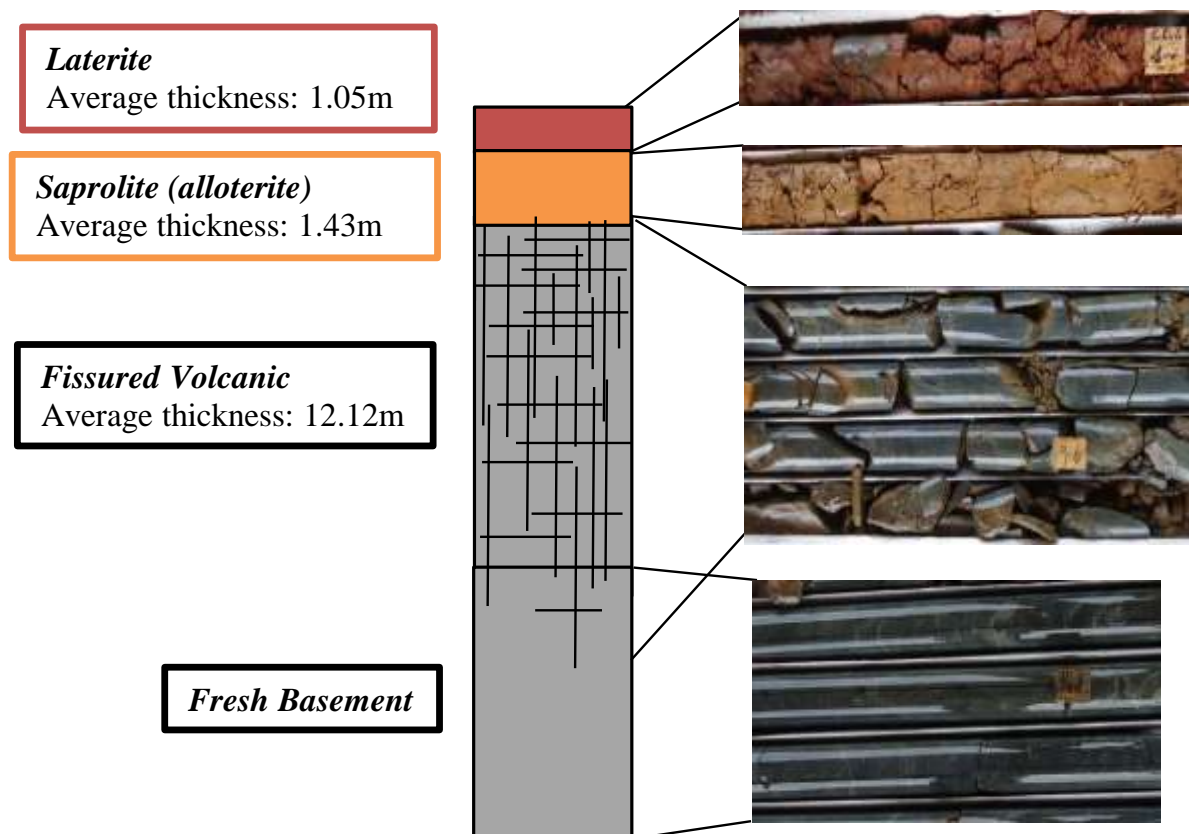


Figure 6: Generalized Vertical Section through the Weathered Mafic Volcanic Rock

From top to bottom the layers observed are:

- A thin layer of laterite (1.05m average thickness);
- A yellowish-green saprolite, clay rich, with an average thickness of 1.43m, strongly weathered, friable with remnant mafic volcanic fragments;
- The fissured mafic volcanic (average thickness of 7.84m), strongly fractured; and
- The fresh mafic volcanic (bedrock). Permeable only locally, where deeper discontinuities or propagation of fractures persist.

Similarly, a representative weathering profile for the granitoid rock is presented in Figure 7. The vertical weathering profile over granite at Yaramoko is significantly more developed than the mafic volcanic. Conversely, the fissured layer is of the mafic volcanic is generally much thicker than the granites. From top to bottom the layers observed are:

- A thin layer of laterite (0.97m average thickness);
- A yellowish-brown saprolite (alloterite), clayey-sandy composition, with an average thickness of 7.11m, strongly weathered, friable and mostly unconsolidated. Derived from prolonged in-situ decomposition of bedrock but contains only minor traces of granite. Exhibits a soil-like composition;

- A yellowish-grey thick saprolite (Isalterite), clayey-sandy composition with an average thickness of 9.80m, highly weathered, semi-consolidated with remnant granite and some preserved fissures;
- The fissured granite (average thickness of 7.84m), strongly fractured; and
- The fresh granite (bedrock). Permeable only locally, where deeper discontinuities exist.

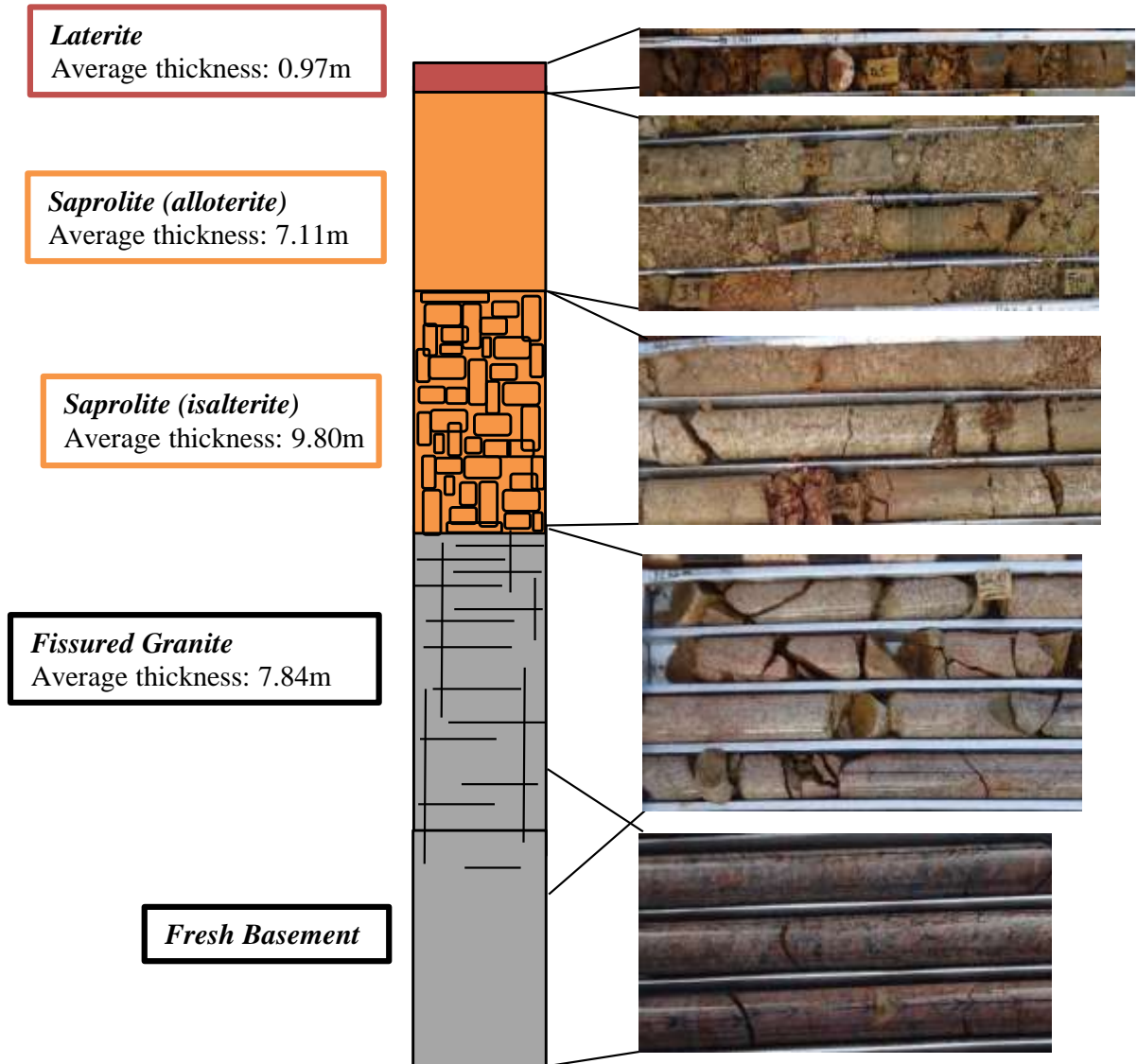


Figure 7: Generalized Vertical Section through the Weathering Granitic Rock

2.4.1 Mineralization

The Yaramoko project targets gold mineralization in the 55 Zone that is associated with low-sulphide quartz veins and attendant altered schists forming one tabular zone inside a narrow reverse-oblique shear zone dipping steeply to the south. The average thickness of the gold mineralization varies from

less than one to more than 17 m. The mineral resources extend from the surface to a depth more than 1,000 metres. The 55 Zone transects the contact of the granite and volcanic rocks of the Diebouyou Granitoid Domain.

2.5 Water

2.5.1 Hydrogeology

The groundwater flow system at Yaramoko consists of two inter-connected flow systems; the fissured weathered zone and permeable discontinuities in the fresh bedrock. Overlying the fissured weathered zone is a weathering profile of unsaturated laterites and saprolites.

The fissured weathered zone forms the transition from the unconsolidated saprolite to the unweathered (fresh) bedrock and has little intergranular porosity, but contains water in permeable fractures. This fissured layer acts as the main transmissive and storage layer in the overall composite aquifer. The thickness of this layer can be variable, between 3 and 15 m, with the greatest thicknesses often observed in mafic volcanic rock.

The fresh basement is permeable only locally where deeper discontinuities are present. These discontinuities can be as permeable as the fissured layer; however they occur much less frequently. Recharge to any permeable discontinuities is likely to be derived from the overlying fissured bedrock layer, where connected.

Measured groundwater elevations can vary between 265maRL and 333maRL in the project area. Groundwater elevations are highest to the north and lowest to the south, and indicate an overall southerly regional flow direction that mirrors topography in a subdued form. Based on flow directions and regional catchment delineation, groundwater is likely to be discharged into the Mouhoun River, although flow rates are considered to be low.

2.5.2 Hydrology

The Yaramoko project lies within the Grand Balé River catchment (Figure 8) which itself is a tributary of the Mouhoun River (Black Volta) which eventually flows into Lake Volta in Ghana, prior to discharge into the Atlantic Ocean. Although detailed information on local catchment discharge flows was not available at time of writing, an assessment based on regional information and local catchment delineation has been undertaken by the Bureau d'Etudes des Géosciences, des

Energies et de l'Environnement BEGE as part of the hydrological baseline assessment within the ESIA (BEGE, 2013).

A watershed exists between the deposit location and proposed location of the tailings and water storage dam with surface water flow drainage the area of the proposed tailings storage facilities (TSF) and WSD flowing to the south east towards the village of Pahin.

Currently no detailed information is available on surface water flow volumes in the sub catchments of the Grande Bale. All local river channels are intermittent flowing only in the wet season or in times of high rainfall. Man made permanent / semi-permanent water bodies have been created through construction of check dams. A check dam exists downstream of the Bagassi village receiving surface drainage from the mine location.

The river known as Grand Balé, whose tributaries drain the area of the mining permit has a hydrometric station. This station known as Grand Balé in Pâ is part of the national hydrometric network. Located downstream of the project area, it was created in 1966 and it is equipped with a staff gauge.

Grand Balé, in the Pâ station, has a watershed of 3,510 km²; the inter-annual flow of the river, 9 out of 12 months, is 2.71 m³/s (source : Explanatory note for the hydrogeological map of Burkina Faso, 1/500,000 scale, sheet of Bobo- Dioulasso, Ministry of Water ; IWACO, September 1993).

The volume of surface water resources mobilized by the dams is estimated at 3.29 million m³ (water balance program). The main facilities are constructed:

- The dam of Petit Balé;
- The dam of Vy (0.85 million m³);
- The dam of Bagassi (0.92 million m³); and
- The dam of Yaramoko (0.5 million m³).

The last three dams, above are irrigation dams with developed areas. The Influence Area of the Yaramoko project straddles sub-basins No. 3, 4 and 5 of the Grand Balé. Given the limited capacity of surface water mobilization works which exist there, and unfavourable hydrogeological context (hard-rock area), the operation of the proposed mine will require the construction of a dam to meet water needs.

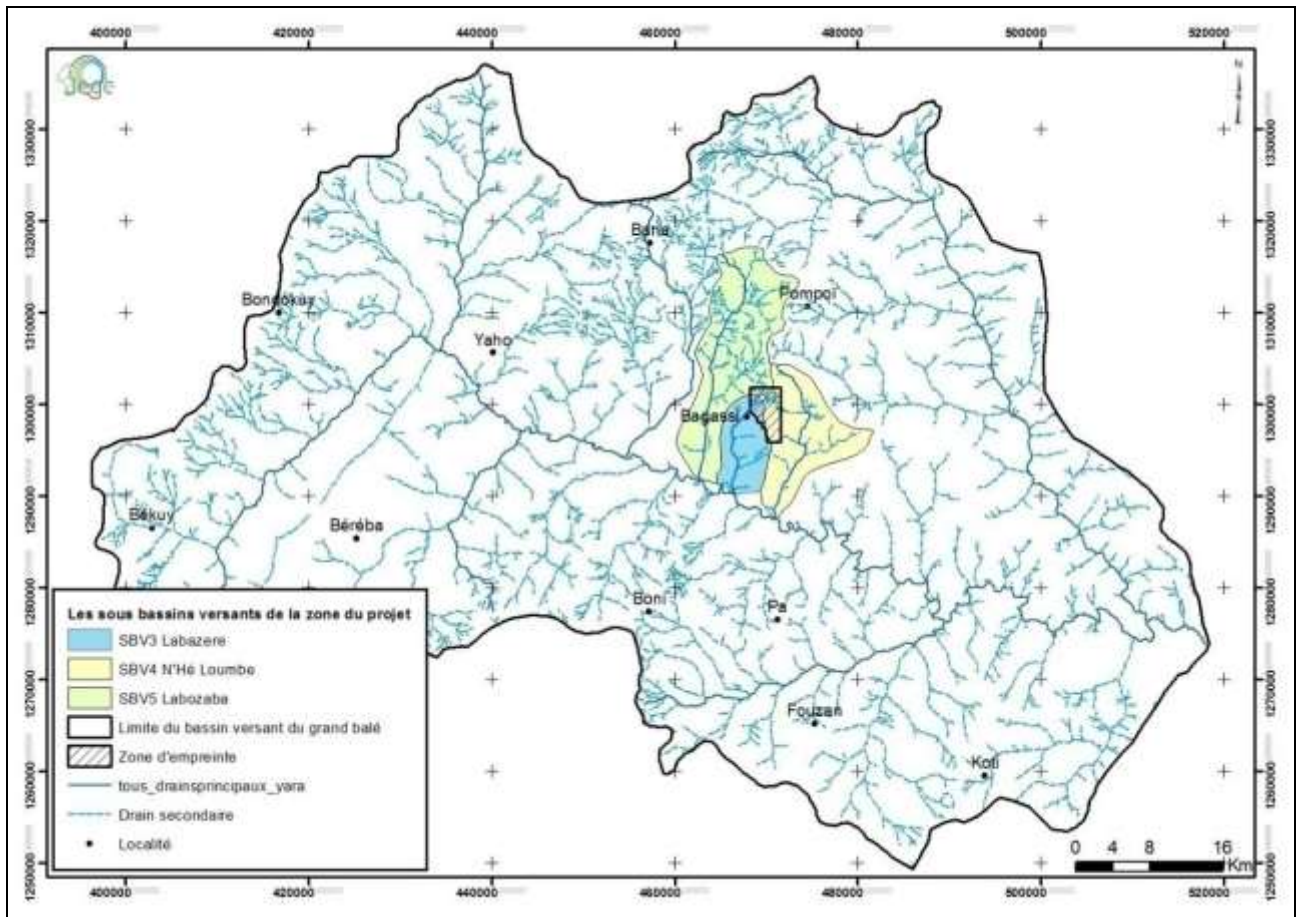


Figure 8: Catchment Area Relevant to the Yaramoko Project

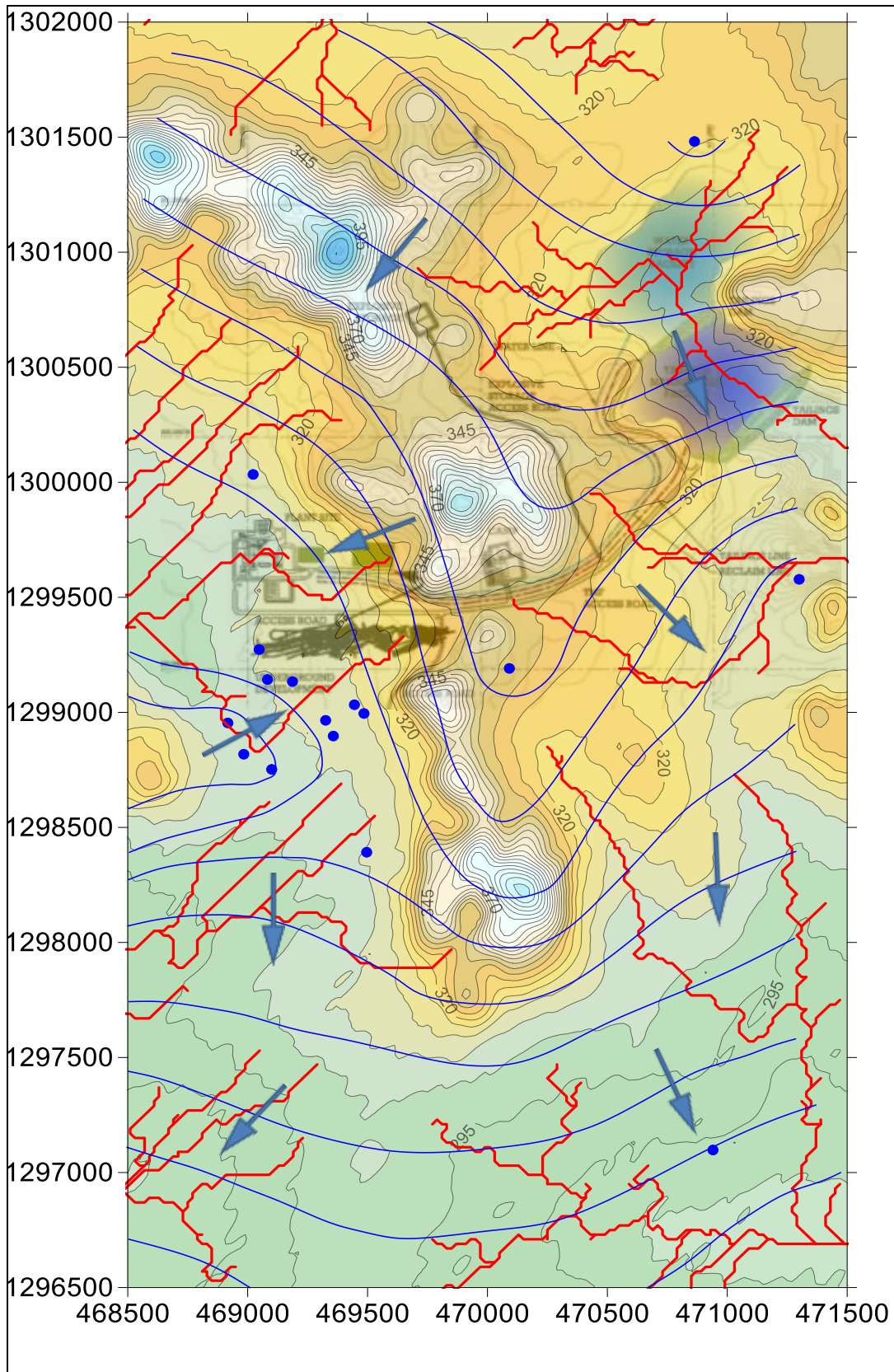


Figure 9: Groundwater Contours and Flow at Yaramoko with Proposed Site Layout Overlain

2.6 Mine Plan

The Yaramoko project described in Figure 10 is located 1 km north east of the town of Bagassi, in the Balé province of south-central Burkina Faso. The Indicated mineral resources are estimated at 2.2 million tonnes containing approximately 900,000 ounces of gold.

The proposed mine plan envision extraction of the Indicated mineral resources from an underground mine to a depth of approximately 700m (Figure 11). Typically a decline application with long-hole open stopping being the basis of the method employed. Due to the competency of the rock hosting the deposit, it is believed that minimal backfilling will be necessary to maintain mining operations and will only be performed when required. Backfilling will be conducted with waste rock.

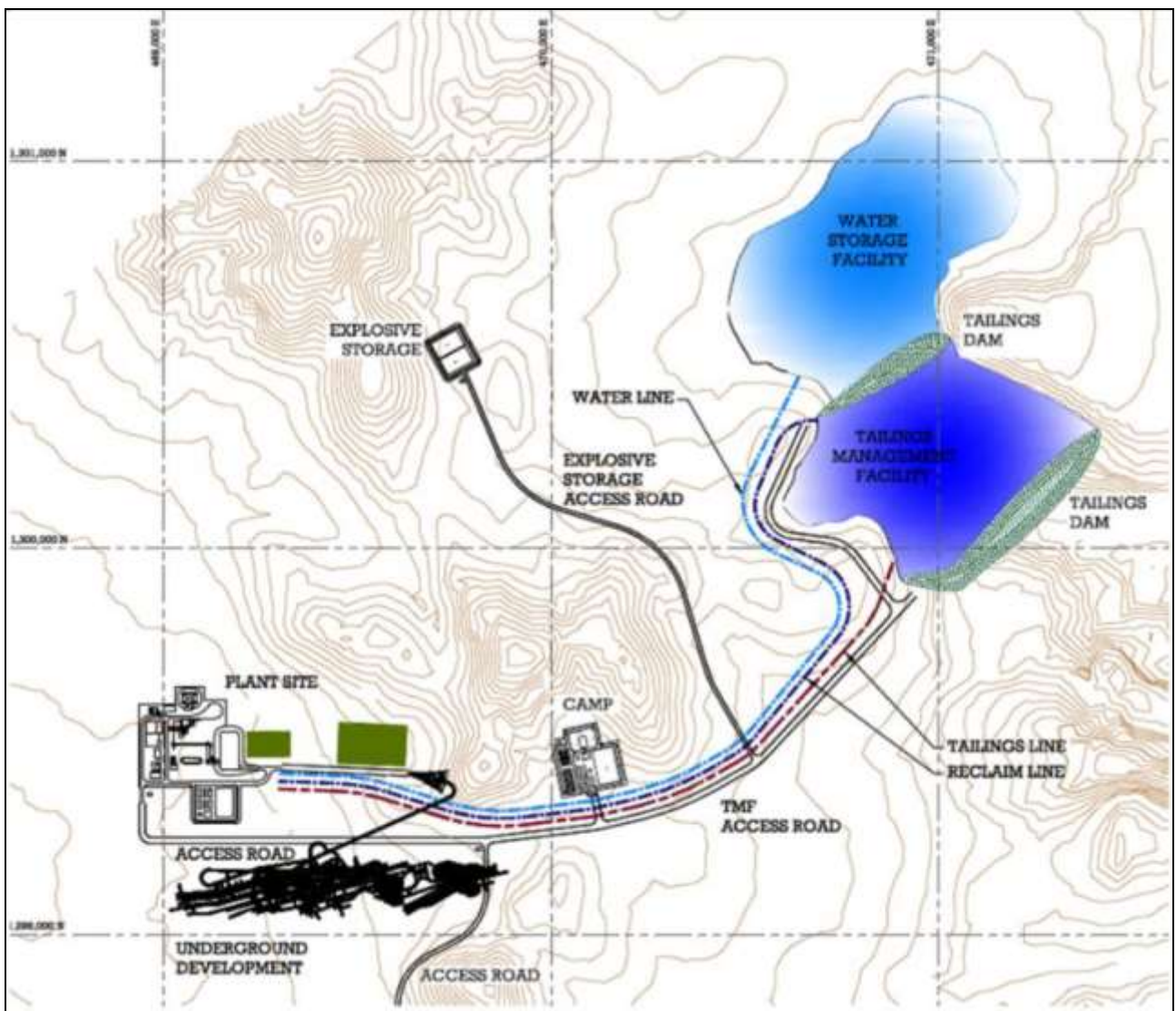
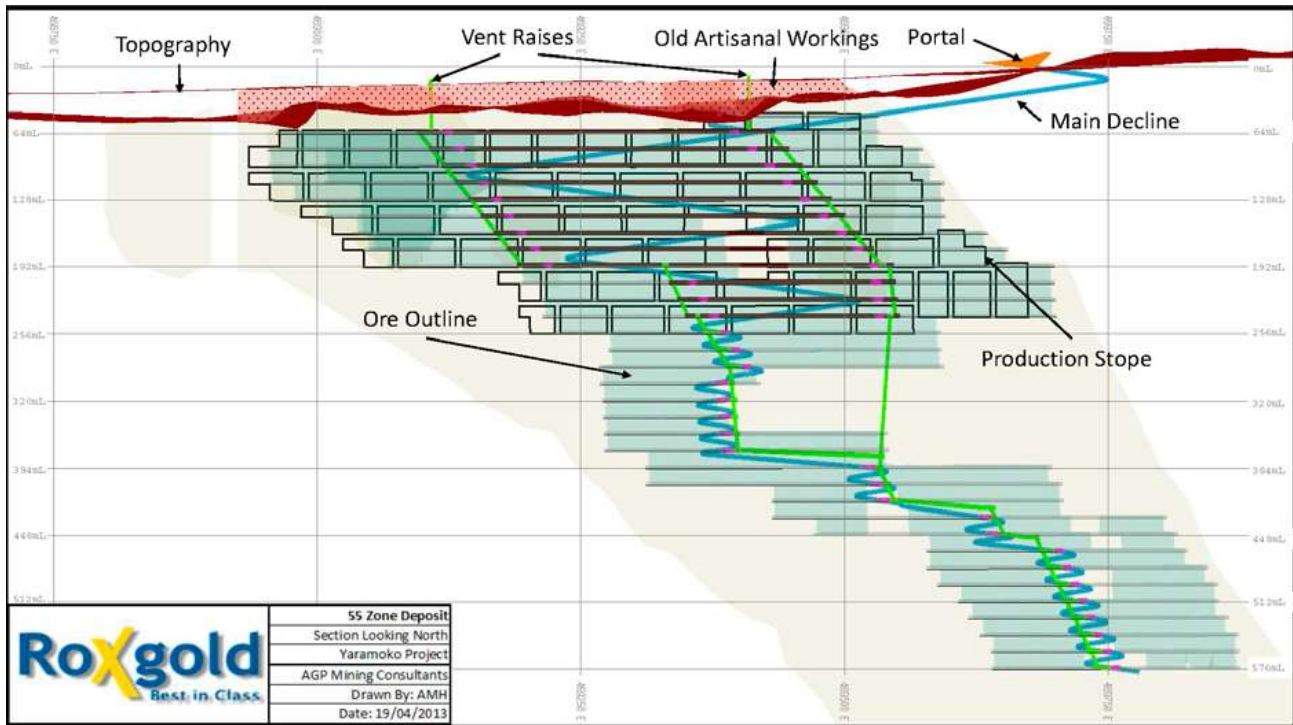


Figure 10: Site Layout Overview**Figure 11: Conceptual Underground Mine Plan Considered for the Preliminary Economic Assessment (AGP, 2013)**

A small pit may be developed at surface in order to remediate artisanal workings and generate some of the materials required for construction. This will be developed in the shallow zone above the underground mine.

This pit would also generate waste rock necessary for backfilling. Stockpiles of waste rock produced from the pit would be trucked back down to the underground operations and deposited in the voids created by mining. Any waste rock that is unable to be utilized immediately underground will be placed on a temporary waste rock dump located on surface. However, most / all of the waste rock generated during mining will be utilized as backfill by the end of mine life and that most / all waste rock stored in the temporary waste rock dump will be deployed for this purpose by end of mine life.

The preliminary economic assessment envisions an ore extraction rate of approximately 270,000 tonnes per year, an annual gold production of approximately 100,000 ounces for a Life of Mine of 10 years. The processing plant will involve crushing, gravity concentration and carbon in leach. The plant will operate 24 hours a day and 365 days per year. Water for the operation will be supplied with water from a storage dam (WSD) built in the northeast of the deposit, Electricity supply to the mine will be through the use of an oil-fired power plant. A TSF will be located to the northeast of the plant. Accommodation for 300 people will also be constructed at the site.

2.7 Previous Geochemical Testing

2.7.1 Waste Rock Geochemistry

A previous geochemistry study was undertaken by Lawrence Consulting (2013). This study was based on the results an ARD Static Test program carried out in the laboratories of Maxxam Analytics in Burnaby, British Columbia, Canada. Sixteen split core samples (0.3m in length) from geotechnical testing were selected by Roxgold for the test program. Roxgold indicate that the samples represent typical rocks from the hanging wall and footwall of the deposit. They comprized 3 lithologies: granitoid (GR), mafic volcanic (MV) and felsic dike material (FD). The Static Test program comprized detailed elemental analysis; short-term leachability testing; acid base accounting (ABA), including paste pH, paste EC, sulphur speciation Analyzes, and the determination of neutralization potential (NP) by three methods. The ABA results were used to classify samples as potentially acid gforming (PAF), Uncertain PAF, or non-acid forming (NAF).

The geochemistry of the rock samples is characterized by the low concentrations of most elements relative to crustal abundance reference values. In short-term leachability tests, the only metal of environmental concern that exceeded an arbitrary reference value was aluminium. The samples were also characterized by low concentrations of sulphide minerals. Neutralisation Potential (NP) values were relatively high, particularly with the MV lithology. The source of NP appears to be predominantly calcite.

The ABA data shows that 14 of the 16 samples tested can be classified as NAF due to low sulphur content and high NP. The remaining 2 samples were classified as PAF, although one of these is from the dike material and its contribution to the overall ABA balance of the deposit would be very small. The other PAF sample is from lithology GR and contained coarse pyrite grains. The abundance of such material should be determined. The results of the study support the preliminary conclusion that the risks of ARD and metal leaching at Yaramoko site are low.

3 Methodology

3.1 Introduction

SRK has undertaken a waste rock characterization program to define the potential of waste materials associated with the Yaramoko project to generate acid and/or leach deleterious constituents.

The following activities were completed as part of the geochemical characterization program:

- Review of site geology and delineation of the primary material types;
- Collection of 28 drill core samples representative of wall rock; and
- Static laboratory testing of selected samples.

The results of the characterization program that are applicable to the waste material evaluation are summarized in the following sections.

3.2 Sampling

3.2.1 Delineation of Material Types

The first step of the characterization program was to delineate the material types associated with the Yaramoko site. Mine waste is typically classified and tested according to material type and the number of samples selected for geochemical testing is based on the relative percentage of each material type predicted to be mined from the geologic model.

The term ‘material type’ typically denotes a unique combination of rock type, alteration type and oxidation state, referring to the basic lithological description of the rock.

The main rock types identified for the Yaramoko site include:

- Granitoid (GD);

- Mafic Volcanic (MV); and
- Quartz Vein Zone (QV).

Based on the observed variations in primary lithology, alteration and oxidation, a total of three material types were identified for the Yaramoko site.

3.2.2 Summary of Site Visit and Sampling

A site visit was undertaken from July 21 to 24, 2013 by Dr. Andrew Barnes (Senior Geochemist) and Dr. Julien Declercq (Consultant Geochemist) from SRK. The primary purpose of the site visit was to collect quarter core samples of the main lithological units to undergo static testwork characterization. Twenty-eight core samples were collected.

In addition, discrete grab samples were collected for mineralogical assessment to assist in the interpretation of analytical results.

Prior to the site visit a sample list was generated based on the information provided by Roxgold. The goal was to select core intervals representative of the main lithologies (i.e. granitoid and mafic volcanic rock), having a good spatial distribution to maximize representatively and avoiding the the gold mineralization as the interest laid in characterizing the geochemical properties of waste rock.

In order to focus the sampling program, a 10 metres zone on either side of the mineralized zone was defined and only the samples included in this zone were considered as being potentially exposed during mining.

In addition, as sulphide is a critical component in the generation of acid drainage, the samples were further sub-divided based on visual estimate of observed sulphide content in core as three categories:

- Less than 2.5 % sulphide;
- Between 2.5 and 5 % sulphide; and
- Above 5 % sulphide. .

Core descriptions log carbonate as absent or present only.

It should be noted that sulphide volume by areas determined from geological logging as opposed to geochemical methods is commonly associated with significant error. Therefore the above criteria was meant as a rough indication only of the actual sulphide content of each sample.

The above criteria were then used to select the sample intervals and samples from each group were selected. Two core intervals specifically belonging to a quartz vein zone were also selected being defined as representative of the ore materials. The selected core intervals are presented in Figure 12 and Figure 13.

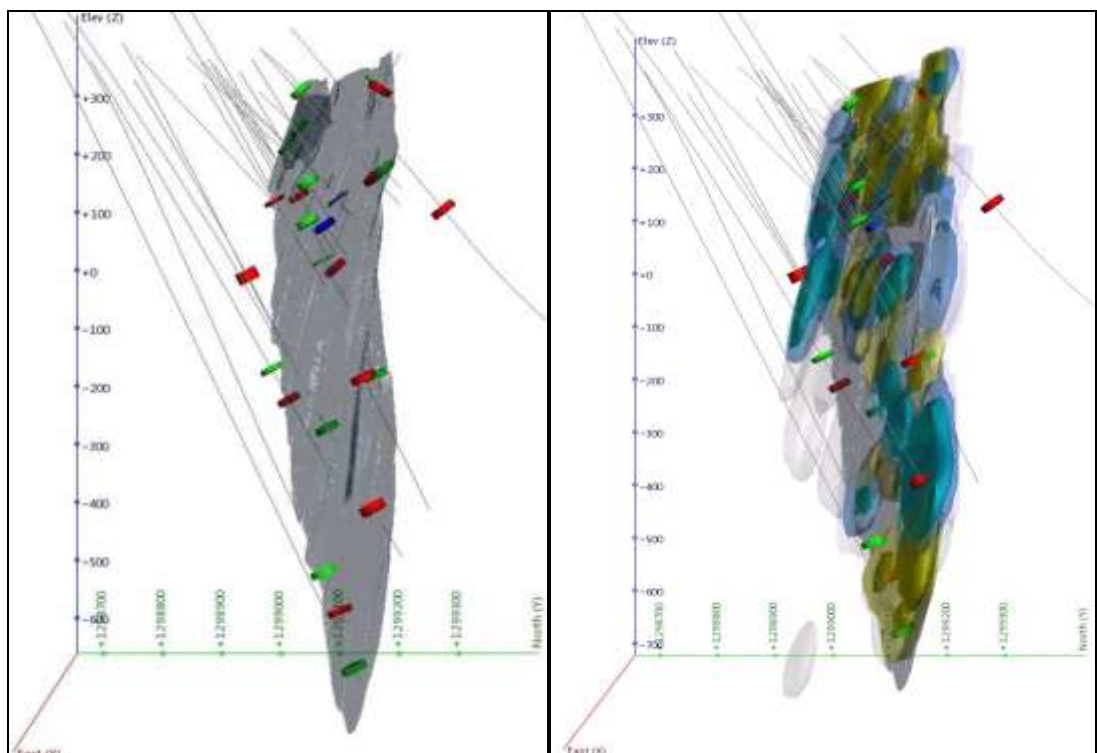


Figure 12: View Looking West (Leapfrog simulation)

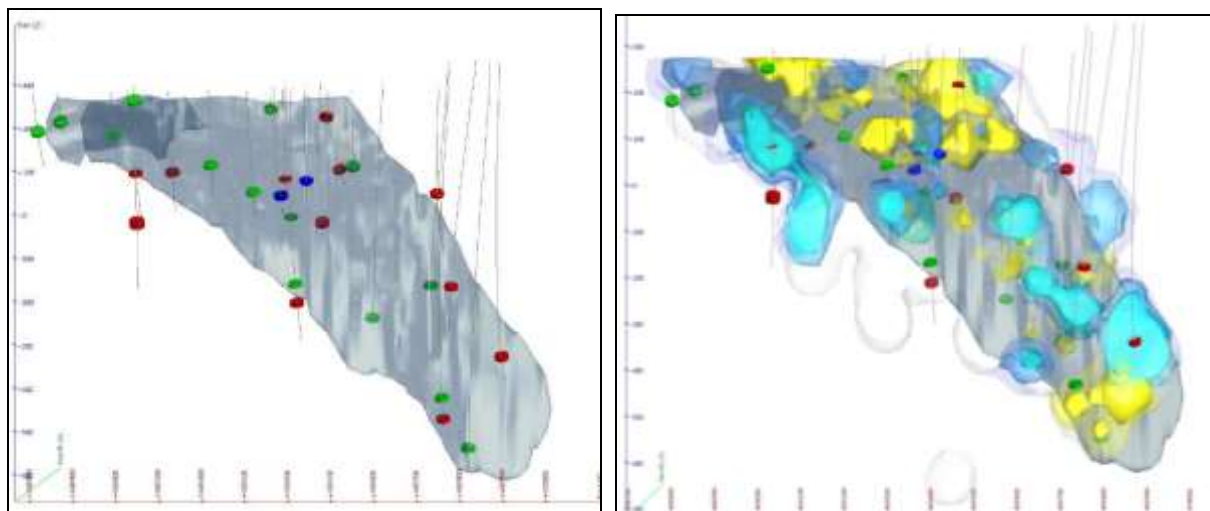


Figure 13: View Looking North (Leapfrog simulation)

Left: showing the distribution of the samples around the main gold zone, depicted in grey, red symbolizes the mafic volcanic lithology and green the granitoid.

Right: with the addition of the carbonate distribution (in transparent white), the gold distribution (in yellow for the <5 grams per tonne grade) and the sulphide distribution (in blue). The two samples in blue represent quartz vein zone.

Depicting the previous geochemical testing waste rock geochemistry exploration assays data with the spatial distribution of the samples coloured in accordance to their lithology. The final as collected sample list is given in Table 2.

Table 2: Core Intervals Selected for Analysis

Sample Description						Testing Undertaken					
SRK ID	Hole ID	From	To	Litho.	Duplicat.	ABA	WR A	MEN D	NAG	XRD	Microsc .
SRK 2835	YRM-11-DD-011	44.8	47.9	GR		-	-	-	-	-	
SRK 2839	YRM-11-DD-039	13.9	23.9	GR		-	-	-	-	-	-
SRK 2849	YRM-12-DD-084	201.3	211.3	GR		-	-	-	-	-	
SRK 2841	YRM-12-DD-088	85.4	95.4	GR		-	-	-	-	-	
SRK 2848	YRM-12-DD-100	119.7	129.7	GR		-	-	-	-	-	
SRK 2852	YRM-12-DD-117	251.0	261.0	GR		-	-	-	-	-	
SRK 2859	YRM-12-DD-168	278.4	288.4	GR		-	-	-	-	-	
SRK 2850	YRM-12-DD-176	634.0	644.0	GR		-	-	-	-	-	
SRK 2860	YRM-12-DD-204	543.4	550.5	GR		-	-	-	-	-	

SRK 2842	YRM-12-DD-205	351.9	355.5	GR		-	-	-	-	-
SRK 2864	YRM-12-DD-225	140.1	142.1	GR		-	-	-	-	-
SRK 2861	YRM-12-DD-242	860.4	870.4	GR		-	-	-	-	-
SRK 2863	YRM-12-DD-250	1,026.8	1,036.8	GR	SRK 2865	-	-	-	-	-
SRK 2862	YRM-13-DD-272	602.8	612.8	GR		-	-	-	-	-
SRK 2838	YRM-11-DD-024	58.5	68.5	MV		-	-	-	-	-
SRK 2836	YRM-11-DD-050	247.7	255.2	MV		-	-	-	-	-
SRK 2846	YRM-12-DD-112	219.7	229.7	MV	SRK 2866	-	-	-	-	-
SRK 2845	YRM-12-DD-148	224.4	229.7	MV		-	-	-	-	-
SRK 2858	YRM-12-DD-204	596.1	606.1	MV		-	-	-	-	-
SRK 2847	YRM-12-DD-219	248.3	249.8	MV		-	-	-	-	-
SRK 2843	YRM-12-DD-237	432.3	443.0	MV		-	-	-	-	-
SRK 2854	YRM-12-DD-242	920.0	930.0	MV		-	-	-	-	-
SRK 2856	YRM-12-DD-245	612.8	622.8	MV		-	-	-	-	-
SRK 2853	YRM-12-DD-253	819.6	823.2	MV	SRK 2867	-	-	-	-	-
SRK 2855	YRM-12-DD-253	823.2	831.7	MV		-	-	-	-	-
SRK 2840	YRM-12-DD-077	310.5	312.2	QV		-	-	-	-	-
SRK 2844	YRM-12-DD-169	310.0	319.7	QV		-	-	-	-	-
SRK 2837	YRM-12-DD-076	330.0	340.0	MV		-	-	-	-	-
SRK 2851	YRM-12-DD-157	360.0	380.0	MV		-	-	-	-	-

GR, Granitoid

MV, Mafic Volcanic

QV, Quartz Vein Zone

3.3 Sample Preparation

The samples selected onsite were cut into quarter core and the core was bagged on site prior to being sent to ACTLAB in Ouagadougou, Burkina Faso, for a preliminary preparation. This involved the following:

- Primary crush of the entire core interval to 100% < 6.3 mm;
- Split 25:75 sample through riffing and put aside 75% split of < 6.3 mm material;
- With 25 split of < 6.3 mm material, crush first to < 2.0 mm and then split a 500 g load to be pulverized;
- For samples in which duplicates are to be prepared, two 500 g pulverized splits should be produced. The duplicate and main sample should be labelled appropriately as indicated on the sample list;
- Split the remaining < 6.3 mm material to an approximately 3 kg sub sample. For duplicate samples, two 3 kg splits should be produced and labelled accordingly as indicated on the sample list; and
- The 500 g of pulp and corresponding 3 kg of < 6.3 mm sample should then be packaged and shipped to the chosen specialist ARD testing laboratory.

From the original 28 core samples, three duplicates were generated by ACTLAB and the total 31 samples were shipped to Maxxam industrial and Environmental laboratory in British Columbia, Canada.

3.4 Geochemical Testing

Static geochemical characterization of the material was undertaken by Maxxam Laboratories. The testwork methods selected for this project are designed to assess the bulk geochemical characteristic of the tailing sample and to determine the potential of this material to generate acid or release metal.

The methods selected assess the total acid generating or neutralising potential of the waste material and the aqueous elemental concentration of the solution reacting with the material. The testing methodologies used in the geochemical characterization are as follows:

Mineralogical Assessment – assessment of the potential mineralogical controls on acid generation and metal(loid) release using optical microscopy and X-Ray spectroscopy

Acid Base Accounting (ABA) – with siderite correction, analysis of potentially acid generating sulphur species and acid neutralizing carbonate species. Simple mass balance provides an estimate of the sample acidity generation potential.

Multi-element analysis of solids – acid dissolution of the sample and elemental analysis by ICP-OES/ICP-MS to determine total metal and metalloid content.

Deionized water leach – using the MEND SFE protocol at a liquid to solid ration of 3:1. In the test the sample is with deionized water and the resulting leachate Analyzed for dissolved constituents. This gives an indication of the elements immediately available for release from the sample.

Static Net Acid Generation (NAG) test with NAG leachate analysis – all the sulphide present in the sample are oxidized by reaction with hydrogen peroxide. Gives an indication of the high end estimate of the acidity potentially released by the sample through oxidative weathering.

3.5 Mineralogical Assessment

Mineralogical analysis of the waste material was undertaken using optical microscopy, Secondary Electron Microscopy with Energy Dispersive X-Ray Spectroscopy (SEM - EDS) and X-Ray diffraction (XRD).

Optical Microscopy

The principal method of mineralogical analysis used for this study is Optical Microscopy. This was completed on polished thin sections of core material. A Meiji MX9000 microscope fitted with a mounted Canon EOS 600D digital camera has been used in this study.

Scanning Electron Microscopy

A Cambridge S360 Scanning Electron Microscope with INCA wave- and energy-dispersive X-Ray spectroscopy was utilized for semi-quantitative analysis of minerals present within the polished thin sections. This method allows micro-chemical data to be collected that reports the chemical composition of the surface of the mineral phase in the polished section. The electron beam utilized to gather the information required is approximately 1 to 5 μm in diameter, so even very small phases can be quantified.

X-Ray Diffraction

The XRD analysis was undertaken at the School of Earth and Ocean Science, Cardiff University, UK. A scan was run using the Philips PW1710 Automated Powder Diffractometer using $\text{Cu K}\alpha$ radiation at 35kV and 40mA, between 2 and 70 $^{\circ}2\theta$ at a scan speed of 0.04 $^{\circ}2\theta/\text{s}$. From the scan, phases were identified using Philips PC Identify software and from the peak areas, semi quantitative analysis was performed and a percentage of each phase present calculated and weighting factors were applied where necessary.

3.6 Static Testwork

3.6.1 Acid Base Accounting

ABA undertaken by the Maxxam Laboratory and indicates the theoretical potential for a given material to produce net acid conditions. The approach does not take into account mineralogy, kinetics or other influencing factors controlling natural sulphide oxidation. The technique can be considered as characterising the ‘total potential reservoir of acidity or alkalinity in a given material’.

The ABA testwork is used to determine the acid generating potential (AP) and neutralising potential (NP). The Acid Potential (AP) is determined by the sulphide sulphur content while the neutralization potential is controlled by the inorganic carbon content of the sample. Results are expressed in kilograms of CaCO₃ equivalent per tonne.

From the values of AP and NP it is then possible to evaluate the Net Neutralization Potential (NNP), the balance between acid generation potential and the neutralisation potential, and Neutralization Potential Ratio (NPR) for the sample.

$$NNP(kg_{CaCO_3}) = NP - AP$$

And

$$NPR = \frac{NP}{AP}$$

The NNP allows the classification of samples according to their potential for acid generation or consumption, a positive value indicating a neutralisation capacity and a negative value, acid generation as summarized in Table 3.

Table 3: ABA Data Interpretation

Classification	NNP	NPR
	(kg CaCO ₃ eq/t)	
Potentially Acid Forming	NNP < -20	NPR < 1
Non Acid Forming (NAF)	NNP > 20	NPR > 3
Uncertain (UNC)	-20 < NNP < 20	1 < NPR < 3

3.6.2 Net Acid Generation Testing

Net acid generation tests (NAG) are based on the principle that hydrogen peroxide accelerates the oxidation of sulphide minerals. The acid generated would dissolve any acid neutralizing minerals and acid generation/neutralization could then be measured directly. The static NAG test differs from the ABA test in that it provides a direct semi empirical estimate of the overall sample reactivity, including any acidity generated by semi-soluble minerals (e.g. Alunite), as well as other potentially acid generating sulphates and sulphides.

As such the NAG test often provides a better estimate of field acid generation than the more commonly used ABA method which only uses the sample sulphide content.

The NAG analysis was carried out by Maxxam according to the method described by EGI (2002) which essentially involves intensive oxidation of a pulverized sample using hydrogen peroxide. For the purposes of the testwork, 2.5 g of pulverized sample was refluxed with 250mL H₂O₂ for a minimum of three hours. After the completion of the reaction a sub sample was collected for ICP-OES/ICP-MS analysis and the remaining leachate titrated with sodium hydroxide (NaOH) in two stages (to pH 4.5 and to pH 7) to determine the NAG value.

During the titration process metals will precipitate, generating acidity by releasing protons (H⁺) into the system. Thus the NAG value is characteristic of both the original hydrogen ion acidity and also the metal released acidity. The NAG value was calculated as follows:

$$NAG = \frac{V_{H_2O_2,i} \times 49 \times V_{NaOH} \times C_{NaOH}}{M}$$

With NAG the net acid generation of the sample expressed in kgH₂SO₄/tonne, V_{H₂O₂,i} representing the volume of initial hydrogen peroxide solution in mL, X depicting the volume used to determine the NAG by titration (mL), V_{NaOH} represents the volume of NaOH used in the titration procedure in mL, C_{NaOH} stands for the concentration in mol/L of NaOH used in the titration, and M is the mass of sample reacted in g.

In general a NAG pH less than 4.5 and a NAG value greater than 5 kg H₂SO₄ equivalent per tonne are indicative of a potentially acid forming material (PAF).

3.6.3 Paste Tests

Measurements of paste pH and paste Electrical Conductivity (EC) were carried out in order to assess the short-term reactivity of the waste material. The test involves mixing one part solid to two parts deionized for 15 minutes. Measurements of pH and EC are then measured and recorded.

pH is a measure of the acidity or basicity of an aqueous solution and the negative logarithm of the activity of H^+ .

EC is a measure of a material ability to conduct electricity; in solution it is proportional to the concentration of dissolved ions in solution. Thus it can be used as an approximation of the potential for solute leaching from the materials.

3.6.4 Multi Element Analysis of Solids

A multi elemental analysis of tailing material was compiled by Maxxam to provide an absolute upper limit on the available upper metal concentrations in the sample. The analysis was conducted by digesting the sample with acid using Aqua Regia (HCl , HNO_3) followed by the analysis of the resulting solution by ICP -MS. This determination included the major elements, e.g. aluminium, calcium, magnesium, sodium, potassium, iron, sulphur and trace elements, e.g. zinc, copper, cadmium and lead. The results of the multi elemental assay were compiled and compared to the Geochemical Abundance index (GAI) (Mason, 1996) which compares the concentration of an element to its average crustal abundance. This method is useful in determining the relative enrichment of a given element relative to its average abundance. GAI value for element i is calculated as follow:

$$GAI_i = \log \left[\frac{C_i}{1.5 S_i} \right]$$

Where C is the concentration of element i as measured by the multi elemental assay and S the average crustal abundance of i (Mason, 1996). Materials are then assigned a GAI value between 0 and 6 based on the degree of enrichment as summarized in Table 4. According to the INAP (2002) protocol, a GAI value greater than 3 indicates a significant enrichment.

Table 4: Interpretation of GAI Values for Multi-Elemental Assay Data

GAI Value	Interpretation
0	< 3 times average crustal concentrations
1	3 to 6 times average crustal concentrations
2	6 to 12 times average crustal concentrations

3	12 to 24 times average crustal concentrations
4	24 to 48 times average crustal concentrations
5	48 to 96 times average crustal concentrations
6	> 96 times average crustal concentrations

3.6.5 Deionized Water Leach

A deionized water leach was carried out to give an indication of short-term metal mobility and to identify constituents that are immediately available for release from the Yaramoko tailing sample. The testing was carried out by Maxxam and a single batch method using Standard MEND SFE methodology was followed. The test used a liquid:solid ratio of 3:1 and agitation for 24 hours. The solution was then filtered and measurements were made for pH, conductivity, major and minor elements.

3.6.6 Hydrogen Peroxide Leach (NAG test leachate)

The leachate generated during the NAG test was analyzed for aqueous species by inductively coupled plasma – optical emission spectrometry/ inductively coupled plasma – mass spectrometry (ICP-OES) / (ICP-MS) following filtration to <0.45µm. As the aggressive oxidising conditions of the H₂O₂ used in the NAG test effectively leached all physically exposed or chemically available sulphide minerals, this test gives an indication of the potential for high level metal release that would occur during exposure of the material to oxygen. The hydrogen peroxide leach oxidizes all available sulphides within the sample and therefore should theoretically mobilize all elements associated with those sulphide minerals. The NAG test gives a quantitative assessment of release from the NAG test, which itself, gives only quantitative information.

3.6.7 Guidelines Used For Assessment

Leachates generated from the deionized water leach were compared to internationally recognized guidelines such as the world health organisation (WHO) drinking water guidelines, the International Finance Corporation (IFC) mine effluent guidelines and the Canadian Council of the ministers of the Environment (CCME) guidelines for the protection of aquatic life. Burkina Faso also possesses water quality guidelines and the maximum allowable concentrations (MAC) for used water discharge in surface water as well as drinking water guidelines in Burkina Faso were used as a mean of comparison.

This comparison against water quality guidelines was carried out to assess the potential for contamination of local water supplies and to assess the potential future water quality of any source term generated. During the data assessment the minimum (i.e. most stringent) standard was used to identify potential non compliance (Table 5)

Table 5: Table of Water Guidelines Used Within this Study

Element	Units	WHO	IFC	CCME	Burkina Faso	Burkina Faso
		(2011)		(long term)	Effluent to Surface Water	Drinking Water
pH	s.u.	6.5 - 8.5	6-9	6.5-9	6.4-10.5	6.5-8.5
Antimony	mg/L	0.02			0.1	
Arsenic	mg/L	0.01	0.1	0.005	0.14	0.01
Barium	mg/L	0.7			5	0.1
Beryllium	mg/L				0.01	0
Boron	mg/L	2.4		1.5	2	1
Cadmium	mg/L	0.003	0.05	0.005	0.1	0.001
Chloride	mg/L			120	600	200
Chromium	mg/L	0.05	0.1		0.1	0.05
Cobalt	mg/L				0.5	
Copper	mg/L	2	0.3	0.002	1	0.02
Fluoride	mg/L	1.5		120	10	0.7
Iron	mg/L		2	0.3	20	0.1
Lead	mg/L	0.01	0.2	0.001	0.5	0.05
Magnesium	mg/L				200	0
Manganese	mg/L	0.4			1.2	0.05
Mercury	mg/L	0.006	0.002	0.026	0.17	0.0005
Molybdenum	mg/L	0.07			0.5	0
Nickel	mg/L	0.07	0.5	0.025	2	0
Nitrate	mg/L	11.3		13	50	25
Nitrite	mg/L	0.06		0.197	1	0

Selenium	mg/L	0.04	0.001	0.8	0.01
Sodium	mg/L			300	0
Tin	mg/L			0.8	0.01
Uranium	mg/L	0.015	0.015		
Zinc	mg/L		0.5	0.03	5

3.7 Quality Control / Quality Assurance

The Maxxam laboratories are accredited to the requirements of ISO/IEC 17025:2005. All analyzes conducted by the laboratory included Certified Reference Materials (CRM) or in-house standards as well as reagent blanks and duplicates. Three duplicates chosen by the lab were systematically assessed, in addition, three duplicate field samples were collected and analyzed blind as part of the geochemical characterization study. The laboratory analyzes of duplicate samples were compared in order to assess the reproducibility of the data. Data quality was assessed by means of the Relative Percentage Difference (RPD), which is calculated as the difference between the two values divided by their mean and expressed in percent.

Assessment of the values was then made using the following classification:

- RPD \leq 15 % - Acceptable
- RPD >15 % \leq 25 % - Semi-quantitative
- RPD > 25 % - Unacceptable

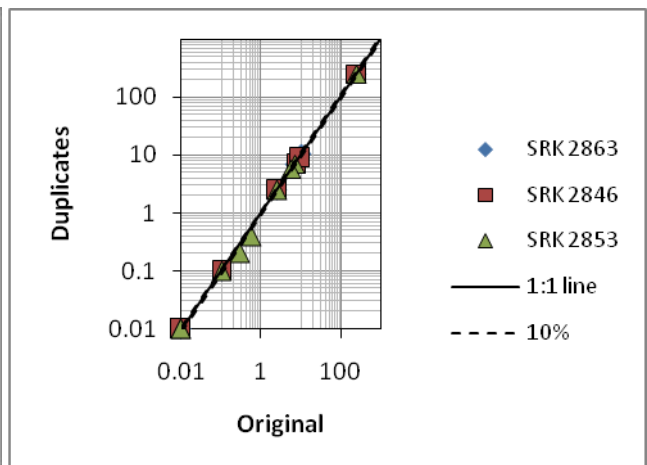
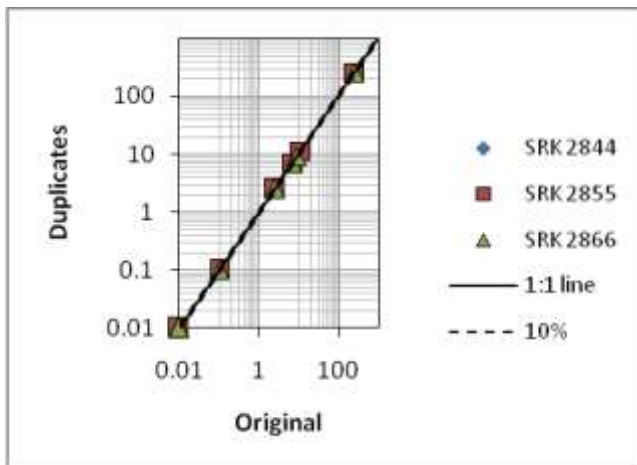
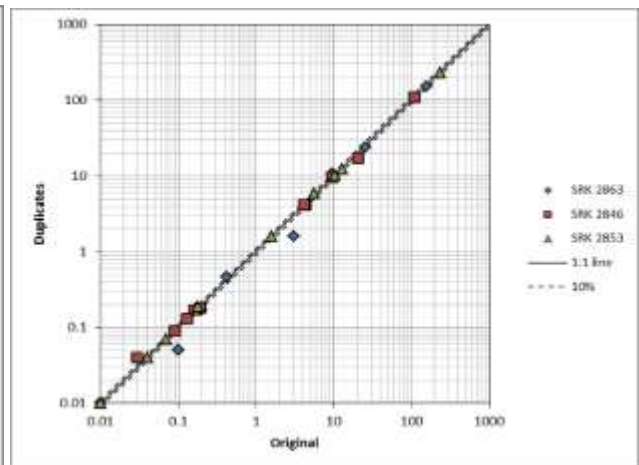
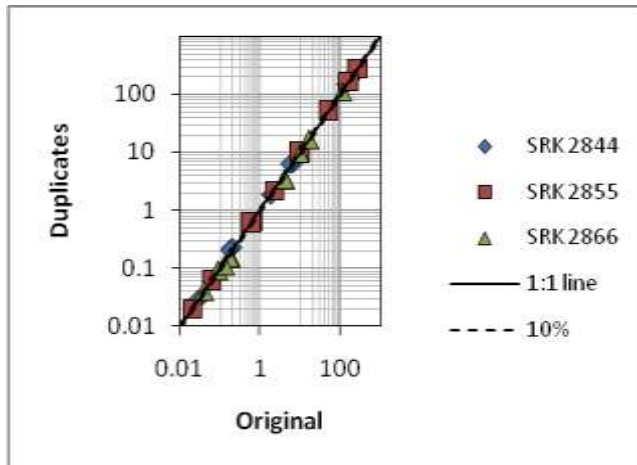
The results are presented in Table 6, which shows a variable percentage of acceptable RPDs for each of the laboratory methods. The slightly lower percentage of acceptable RPDs apparent for the NAG metals and deionized water leach results is likely to be a function of the low reported concentrations, with values that were generally at or near analytical detection limits. This results in greater apparent difference between replicate analyzes. All of the testwork methods showed a high proportion ($>90\%$) of acceptable RPDs, with the Field duplicates being generally less accurate (by 2% in average) than the internal Maxxam duplicates.

Table 6: Percentage of Acceptable RPDs for Duplicate Samples

Test	Percentage of Acceptable RPDs	Maxxam Internal Duplicates	Field Duplicates
------	-------------------------------	----------------------------	------------------

Paste tests	100%	100%	99%
ABA	81%	97%	94%
NAG	100%	99%	97%
NAG Metals	80%	94%	95%
Multi Element Analysis	93%	97%	99%
Deionized Water Leach	82%	96%	96%

Scatter plots comparing internal and field duplicates for the static tests are presented in Figure 14 and Figure 15. These show good correlation between replicate analyzes as well as between field duplicates. This indicates generally good data quality. In the case of the Deionized Water Leach field duplicates (Figure 15) not enough original sample was available to analyze the field duplicate of sample SRK 2853.



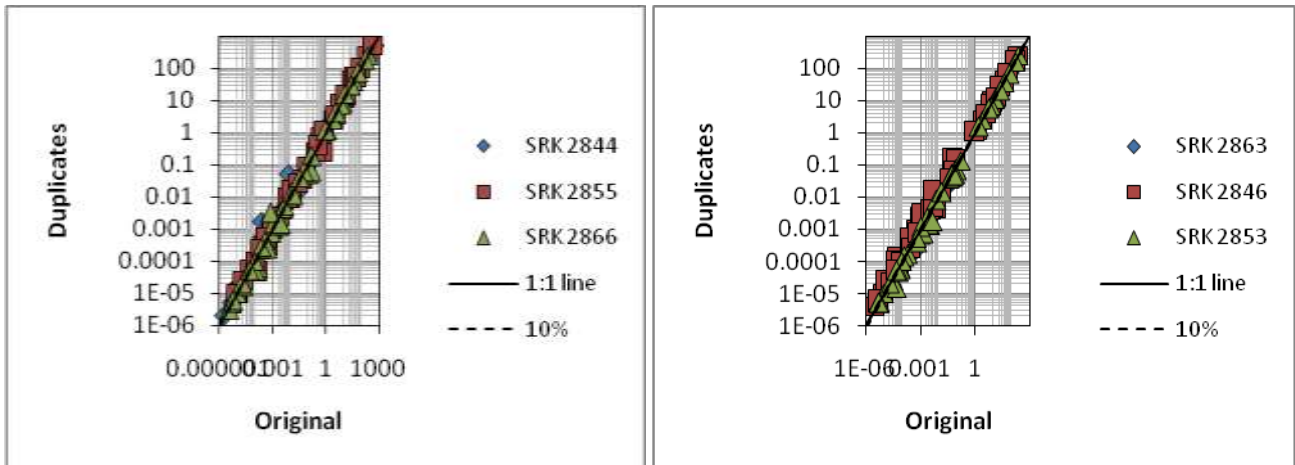


Figure 14: Scatter Plot Comparing the Field Duplicates for the NAG Solution Chemistry

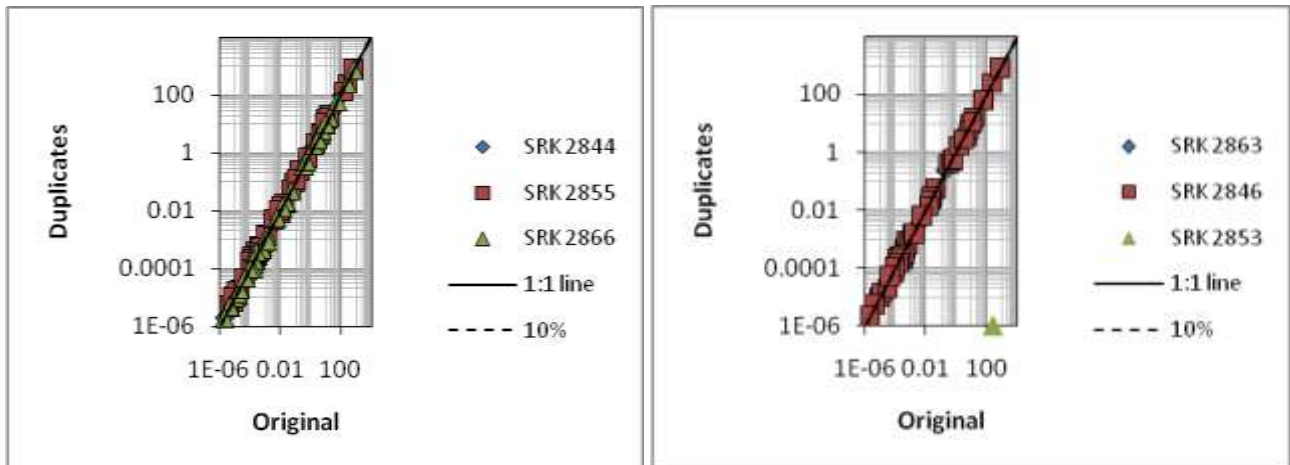
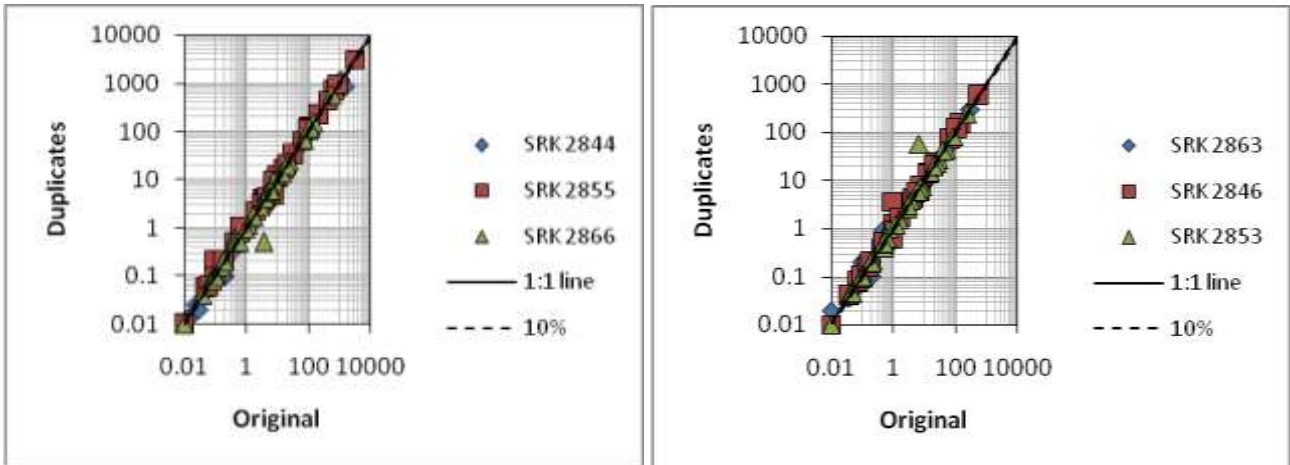


Figure 15: Scatter Plot Comparing the Field Duplicates for the Deionized Water Leach Test

Ion Balance

Ionic balances have been conducted for the major ion species, whereby all concentrations are evaluated with respect to their charge contribution in milliequivalents per litre (meq/L). On the basis that the samples should be electrically neutral, imbalances in the net charges reflect inaccuracies of the data or an incomplete analysis (i.e. an ionic component is unaccounted for). Analytical error due to natural variation is known to occur and is generally accepted; charge balance errors of around 5-10% are usually considered to be acceptable within typical analytical error margins. Charge balance errors in excess of 10% are indicative of either missing ion components (not included in the analysis) or poor analysis quality.

Ionic balance calculations were carried out for the NAG extract and deionized water leach test solutions to assess the electrical balance between cations and anions in Figure 16.

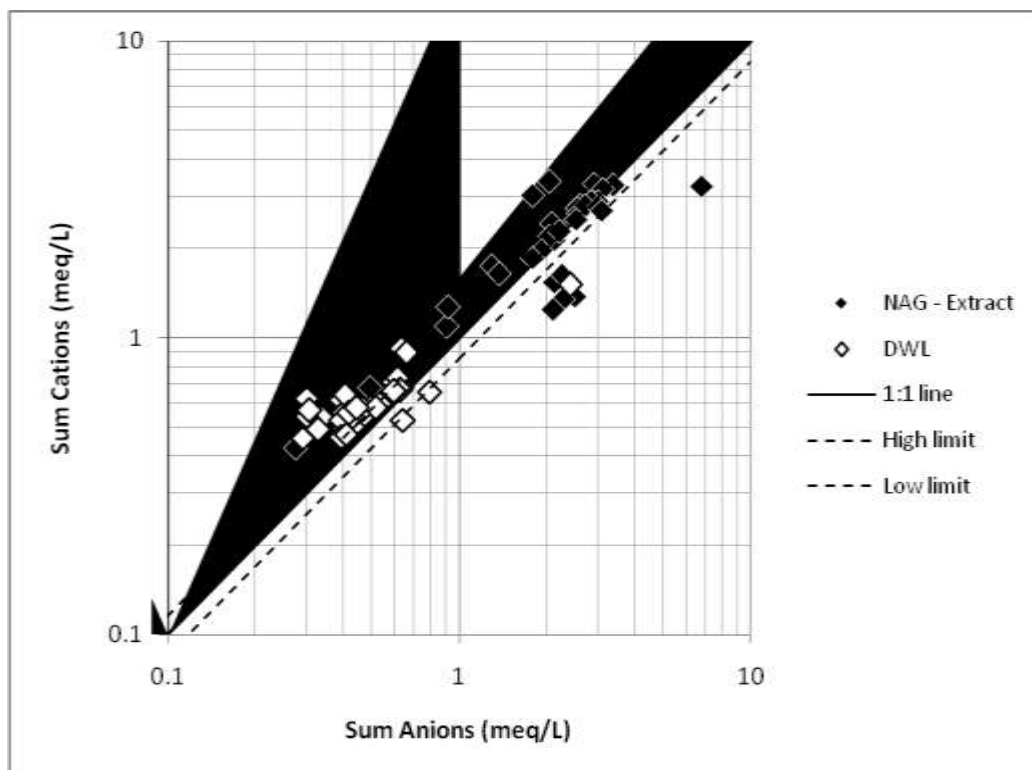


Figure 16: Ion Balance Plot for the NAG Extract and Deionized Water Leach Showing the Sum of Anions Plotted Against the Sum of Cations (meq/L)

It must be noted that while the suite of cation analyzed was complete, such was not the case for the anions where chloride was not analyzed. This missing major anion might generate Ion Balances shifted towards cations.

The results show that for the NAG extract (solid diamonds) ion balance generally follow a 1:1 relationship. 10 samples have error margins higher than 15%, which indicates poor analysis and 20 are within 10% indicating an analysis of reasonable quality. There is no apparent bias toward positive or negative values.

The results show that for the deionized water leach (empty diamonds) ion balance do not follow a 1:1 relationship. 12 samples have error margins higher than 15%, which indicates poor analysis and 12 are within 10% indicating an analysis of reasonable quality. There is a bias toward positive values consistent with alkalinity and chloride not being analyzed.

X-Ray Diffraction

The field duplicates were also Analyzed by XRD and the comparisons are reported in Table 7 and are shown in Figure 17. The difference between the different duplicates is less than 10% for all estimated amounts. The pattern also shows a good agreement between the original sample and the duplicate, the difference is in the intensity of the different rays. This difference in intensity can be explained by a different orientation of the various minerals present in the sample being Analyzed and/or a variation in the quantity of minerals.

Table 7: Phases Found and Their Relative Percentages in the Yaramoko Field Duplicates

Phase	SRK 2863 (%)	SRK 2865 (%)	Phase	SRK 2846 (%)	SRK 2866 (%)	Phase	SRK 2853 (%)	SRK 2867 (%)
Quartz	65	55	Quartz	40	38	Quartz	45	49
Albite	24	32	Actinolite	24	28	Albite	39	37
Illite	7	9	Albite	21	18	Illite	13	12
Clinochlore	3	3	Clinochlore	15	16	Clinochlore	2	2
Calcite	1	1				Actinolite	1	-

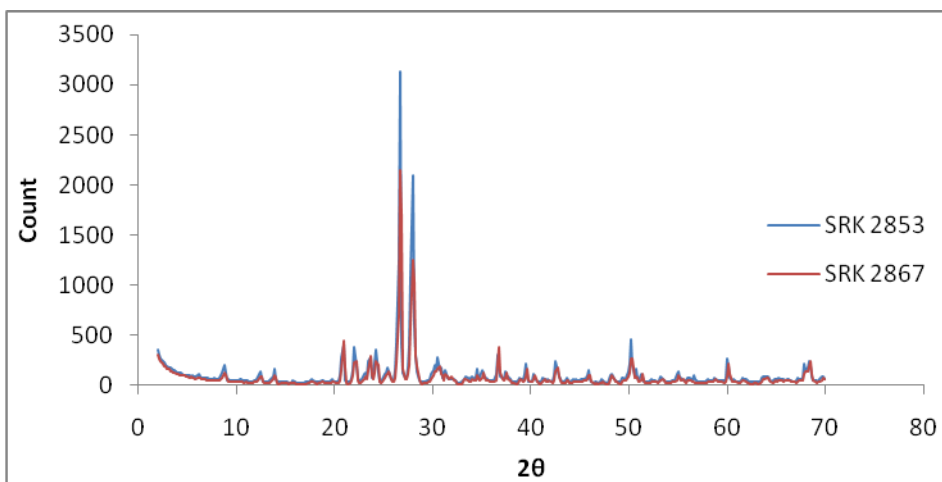
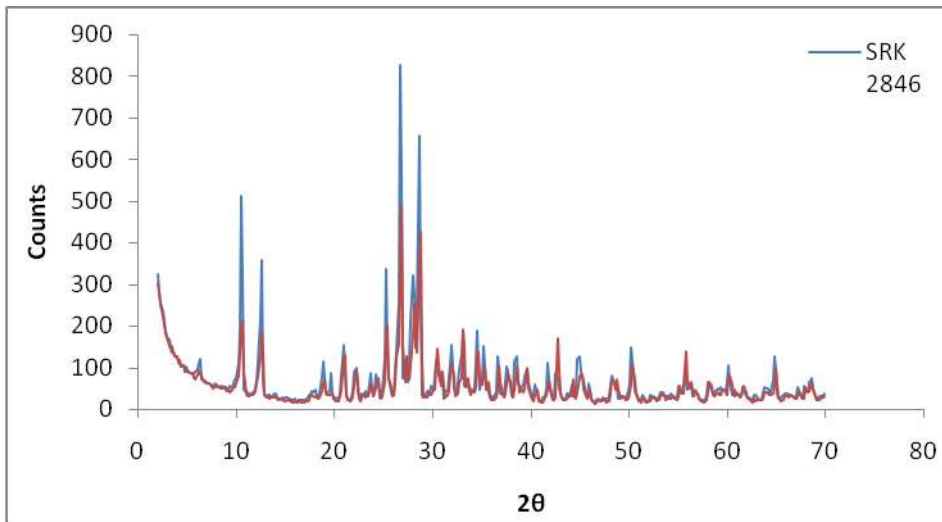
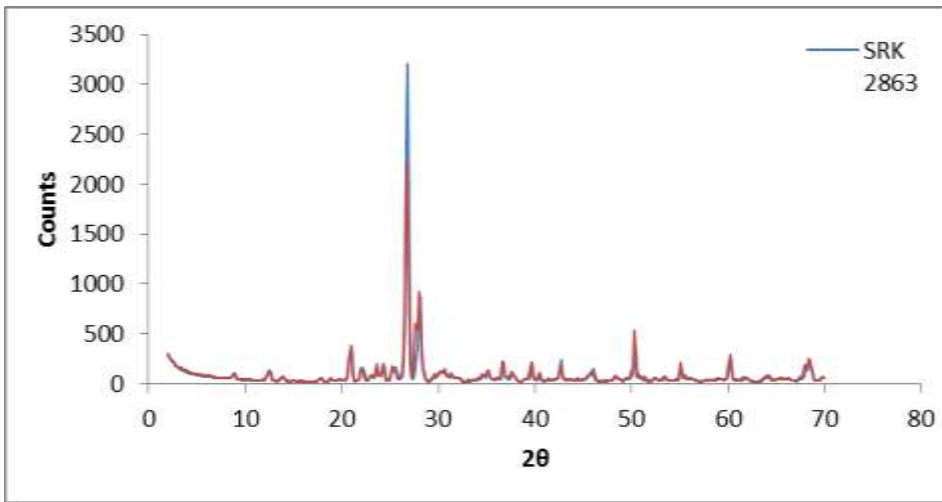


Figure 17: XRD Patterns: Sample SRK 2863 and its Duplicate SRK 2865 (top), Sample SRK 2846 and its Duplicate SRK 2866 (middle); and Sample SRK 2853 and its Duplicate SRK 2867 (bottom)

4 Results

4.1 Mineralogical Assessment

As part of the ARDML assessment 28 samples and three field duplicates of waste rock were submitted for X-Ray diffraction while ten samples were selected for mineralogical assessment (optical microscopy and SEM, see Appendix C). These were selected from core waste rock intervals. The XRD patterns acquired from the samples analysis are illustrated in Figure 18.

The patterns define three groups based on the major peaks and their intensities, these groups correspond to the three main lithologies previously defines (GR, MV, QV).

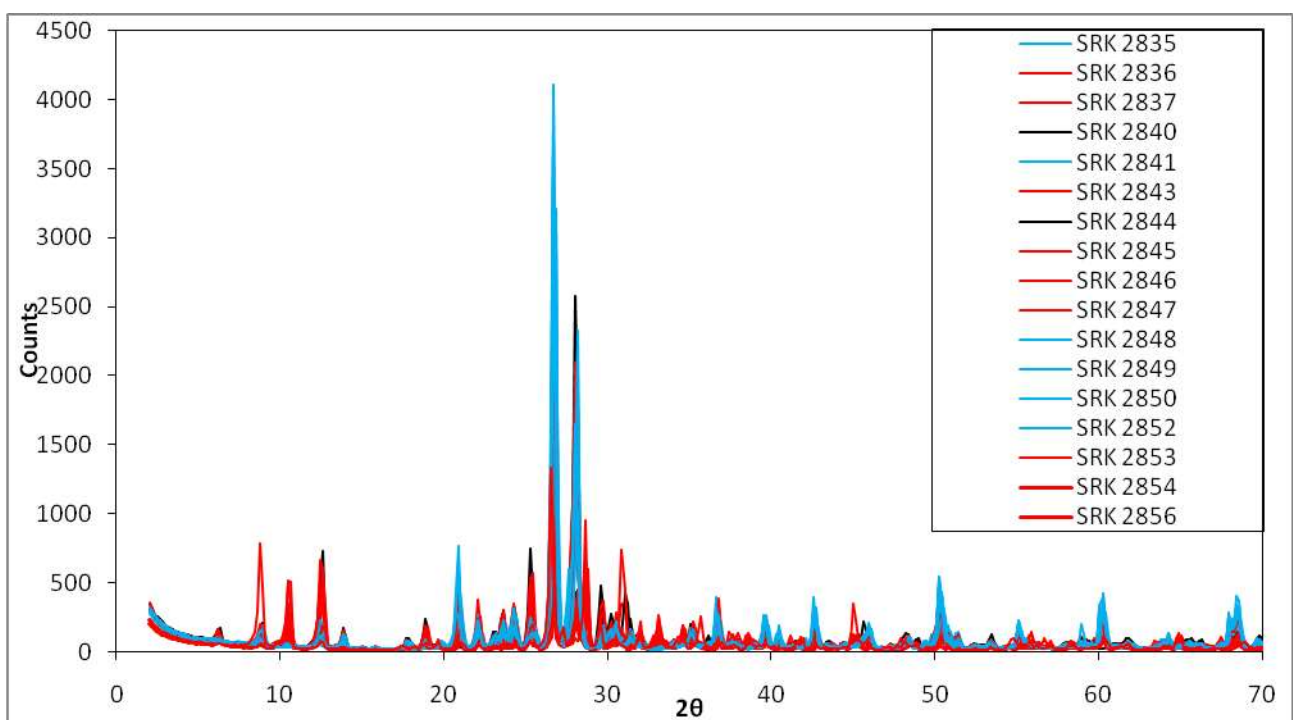


Figure 18: XRD Data for All Samples, Classified by Lithology

Blue: Granitoid (GD)

Red: Mafic Volcanic (MV)

Black: Quartz Vein Zone (QV)

Table 8: Mineralogy of Waste Rock Lithology

		Sample ID	GR	MV	QV
		Lithology	Average	Average	Average
Mineral Group	Mineral	Alteration / Ideal Formula	%	%	%
SiO ₂ polymorphs	Quartz	SiO ₂	55 ³	37 ³	20 ³
Feldspar	Albite	NaAlSi ₃ O ₈	33 ³	23 ³	41 ³
Amphibole	Actinolite	Ca ₂ (Mg,Fe) ₅ Si ₈ O ₂₂ (OH) ₂	0.1 ¹	11 ³	0
	Illite	K _{0.6} Mg _{0.25} Al _{1.8} Al _{0.5} Si _{3.5} O ₁₀ (OH) ₂	6 ²	6 ²	3 ²
Mica	Muscovite	KAl ₃ Si ₃ O ₁₀ (OH) ₂	2 ²	2 ²	10 ²
	Phlogopite	KAlMg ₃ Si ₃ O ₁₀ (OH) ₂	0	4 ²	0
Misc. Phyllosilicate	Clinochlore	Mg ₅ Al ₂ Si ₃ O ₁₀ (OH) ₈	3 ²	14 ³	13 ³
	Calcite	CaCO ₃	1 ²	3 ²	10 ²
Carbonate	Dolomite	CaMg(CO ₃) ₂	0	1 ²	6 ²
Sulphide*	Pyrite	FeS ₂	<1% ¹	<1% ¹	<1% ¹

* Determined by optical microscopy

1 <1% Trace minerals

2 1-10% Minor minerals

3 >10% Major minerals

XRD Summary

The results of the mineralogical assessment are summarized in Figure 19 and Table 9 and demonstrate that the potential waste rock material is characterized by a lack of sulphur bearing species. The absence of sulphur minerals suggests that the waste material will have a very low potential for acid generation. XRD is a method with lower sensitivity to sulphidic minerals, therefore those results will have to be corroborated by SEM and optical microscopy observations.

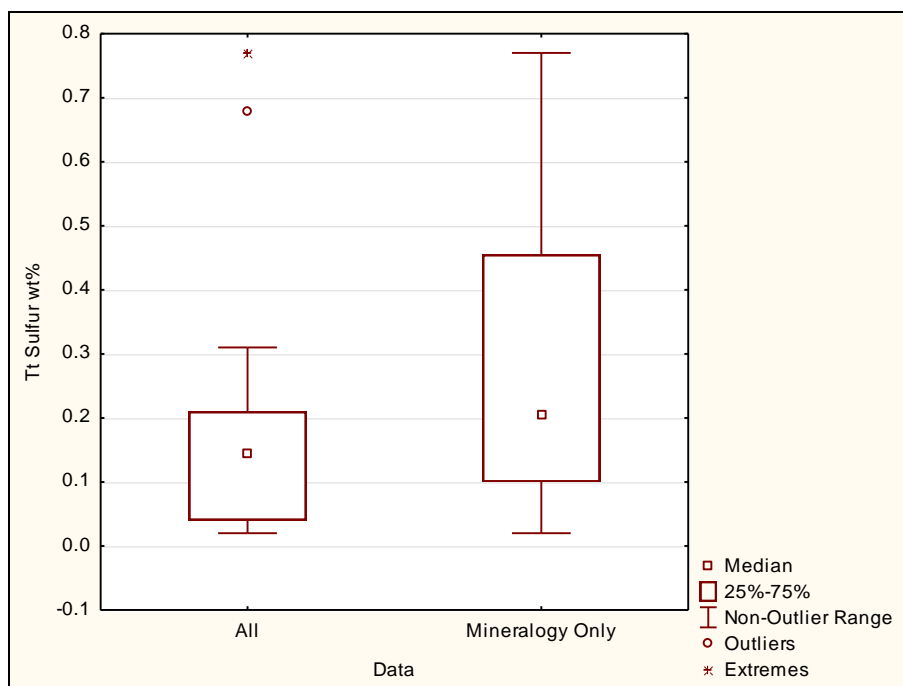


Figure 19: Box and Whisker Plot Describing the Distribution of Total Sulphur (wt%) in All the Samples and in the Samples Analyzed by Optical Microscopy

Total sulphur concentration provided by ABA test

Acid-neutralising minerals are present to some extent in most samples. In particular calcite is present as a minor component within 8 of the samples, two of which also contain dolomite as minor mineral, thus making carbonate minerals a significant component of those samples; and as a trace component within a further nine samples (Table 9).

Other acid-neutralising minerals are present in the form of ultramafic and mafic aluminosilicate minerals such as phlogopite (one samples) and actinolite (ten samples) mainly in the MV lithology.

Optical and SEM Summary

Sulphides were observed in all submitted samples at trace concentrations (<1 wt%). This optical assessment is confirmed by the accounting of total sulphur performed during the static test as illustrated by the box and whiskers plot of Figure 19. This figures depicts the total sulphur in all the samples and in the ones selected for the optical microscopy assessment, mean values for all the samples are 0.11 wt% and mean values in the sample selected for optical assessment is slightly higher at 0.20 wt%. Those values are well within the 1 wt% determined by optical and SEM microscopy. The main sulphide mineral observed was pyrite with ultra-trace (<0.1 wt%) proportions of chalcopyrite, pyrrhotite and molybdenite. Where observed the pyrite was usually subhedral to euhedral and medium-grained. Pyrite grains were generally located within the interstitial space between the main silicate minerals quartz, albite and clinocllore. Within three of the ten submitted waste rock samples gold was found located as inclusions within pyrite (SRK2834, SRK2844 and

SRK2845). This gold mineralization was generally fine-grained and consisted of gold amalgam (Au, Ag, Hg), with roughly 3 atomic % mercury present as solid solution which is likely to be mobilized by cyanide leach solutions in the process reporting to the tailings facility.

Carbonate minerals were observed in all but two submitted samples, and was present in minor or major proportions in four of the samples. The main carbonate mineral observed was calcite, though dolomite was a major mineral in one sample and ankerite was observed in three samples. From the wider static test investigation it is observed that the carbonates exceed the sulphide content with minimal acid-generation potential. However, the presence of ankerite within these three samples should be noted as their proportion in relation to calcite did not appear to be negligible. If this is a common occurrence throughout the waste rock then a reduction in neutralisation capacity can be expected.

In summary, sulphide proportions are generally low and predominantly consist of medium-grained pyrite. There is a general excess of carbonate material compared with sulphide material, and this is confirmed in the static tests performed to date. However, ankerite is present within three of the samples, and at proportions which would lead to a reduction in neutralisation potential if the latter is calculated solely on inorganic carbon content. Chalcopyrite and molybdenite contents were negligible, so although present they are unlikely to lead to much Cu or Mo leaching.

The mineralogical data suggests that there are few acid generating minerals in the samples tested and at least a moderate amount of neutralising minerals.

Majority of carbonates are present as calcite with some dolomite. Iron / manganese containing carbonates also present but although they are detected their amounts are negligible.

Sulphides mainly present as pyrite with trace pyrrhotite, chalcopyrite and molybdenite (only in one sample). Arsenic sulphides are not detected, and trace element concentrations within pyrite also not detected (As, Se, Sb, etc)

Table 9: Mineralogy of Waste Rock Samples

Mineral Group	Mineral	Alteration Ideal Formula	Sample ID	SRK 2835	SRK 2836	SRK 2837	SRK 2838	SRK 2839	SRK 2840	SRK 2841	SRK 2842	SRK 2843	SRK 2844	SRK 2845	SRK 2846	SRK 2847	SRK 2848	SRK 2849	SRK 2850
			Lithology	GR	MV	MV	MV	GR	QV	GR	GR	MV	QV	MV	MV	MV	GR	GR	GR
			%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
SiO ₂ polymorphs	Quartz	SiO ₂		46 ³	40 ³	30 ³	53 ³	61 ³	0	46 ³	58 ³	38 ³	39 ³	41 ³	40 ³	27 ³	55 ³	54 ³	55 ³
Feldspar	Albite	NaAlSi ₃ O ₈		40 ³	35 ³	20 ³	24 ³	29 ³	67 ³	42 ³	38 ³	26 ³	14 ³	15 ³	21 ³	12 ³	30 ³	36 ³	31 ³
Amphibole	Actinolite	Ca ₂ (Mg,Fe) ₅ Si ₈ O ₂₂ (OH) ₂ .		0	0	17 ³	0	0	0	0	0	20 ³	0	0	24 ³	0	0	0	0
Mica	Illite	K _{0.6} Mg _{0.25} Al _{1.8} Al _{0.5} Si _{3.5} O ₁₀ (OH) ₂		0	0	5 ²	6 ²	0	0	9 ²	2 ²	0	6 ²	13 ³	0	14 ³	0	6 ²	10 ²
	Muscovite	KAl ₃ Si ₃ O ₁₀ (OH) ₂		9 ²	16 ³	0	0	10	19 ³	0	0	0	0	0	0	0	10 ²	0	0
	Phlogopite	KAlMg ₃ Si ₃ O ₁₀ (OH) ₂		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Phyllosilicate	Clinoclhor e	Mg ₅ Al ₂ Si ₃ O ₁₀ (OH) ₈		3 ²	16 ³	23 ³	17 ³	0	3 ²	2 ²	2 ²	16 ³	22 ³	20 ³	15 ³	21 ³	2 ²	2 ²	3 ²
Carbonate	Calcite	CaCO ₃		2 ²	0	5 ²	0	0	11 ³	1 ²	0	0	8 ²	11 ³	0	8 ²	3 ²	2 ²	1 ²
	Dolomite	CaMg(CO ₃) ₂		0	0	0	0	0	0	0	0	0	11 ³	0	0	18 ³	0	0	0
Sulphide*	Pyrite	FeS ₂		n.d.	n.d.	n.d.	n.d.	<1% ₁	n.d.	n.d.	n.d.	n.d.	<1% ₁	<1% ₁	n.d.	n.d.	n.d.	n.d.	n.d.

Mineral Group	Mineral	Lithology	Sample ID															
			SRK 2852	SRK 2853	SRK 2854	SRK 2855	SRK 2856	SRK 2858	SRK 2859	SRK 2860	SRK 2861	SRK 2862	SRK 2863	SRK 2864	SRK 2865	SRK 2866	SRK 2867	
			GR	GR	MV	MV	MV	MV	GR	GR	GR	GR	GR	GR	GR	MV	MV	
SiO ₂ polymorphs	Quartz	SiO ₂	54 ³	45 ³	42 ³	0	37 ³	36 ³	54 ³	59 ³	50 ³	51 ³	65 ³	55 ³	55 ³	38 ³	49 ³	
Feldspar	Albite	NaAlSi ₃ O ₈	29 ³	39 ³	25 ³	0	21 ³	16 ³	39 ³	29 ³	31 ³	34 ³	24 ³	33 ³	32 ³	28 ³	37 ³	
Amphibole	Actinolite	Ca ₂ (Mg,Fe) ₅ Si ₈ O ₂₂ (OH) ₂	0	1 ²	9 ²	22 ³	10 ²	30 ³	0	0	0	1 ²	0	0	0	18 ³	0	
Mica	Illite	K _{0.6} Mg _{0.25} Al _{1.8} Al _{0.5} Si _{3.5} O ₁₀ (OH) ₂	6 ²	13 ³	8 ²	0	16 ³	0	5 ²	9 ²	15 ³	10 ²	7 ²	7 ²	9 ²	0	12 ³	
	Muscovite	KAl ₃ Si ₃ O ₁₀ (OH) ₂	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	
	Phlogopite	KAlMg ₃ Si ₃ O ₁₀ (OH) ₂	0	0	0	60 ³	0	0	0	0	0	0	0	0	0	0	0	
Misc. Phyllosilicate	Clinoclhor e	Mg ₅ Al ₂ Si ₃ O ₁₀ (OH) ₈	6 ²	2 ²	16 ³	5 ²	16 ³	8 ²	2 ²	0	4 ²	4 ²	3 ²	4 ²	3 ²	16 ³	2 ²	
Carbonate	Calcite	CaCO ₃	5 ²	0	0	13 ³	0	0	0	3 ²	0	0	1 ²	1 ²	1 ²	0	0	
	Dolomite	CaMg(CO ₃) ₂	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sulphide*	Pyrite	FeS ₂	n.d.	n.d.	<1% ₁	n.d.	n.d.	<1% ₁	n.d.	n.d.	<1% ₁	n.d.	<1% ₁	<1% ₁	n.d.	n.d.	n.d.	

* Determined by optical microscopy

n.d. Not determined

-
- 1 <1% Trace minerals
 - 2 1-10% Minor minerals
 - 3 >10% Major minerals

4.2 Acid Generating Potential

4.2.1 Paste pH and EC Measurements

Paste pH and EC tests were carried out in order to assess the short-term reactivity of the core samples and existing waste material. The results are provided in full in Appendix B and are presented as a box and whisker plot for each material type in Figure 20. This shows that all core samples generated moderately alkaline (pH 8.9 to 10.2) paste pH values, which is likely to be a function of the generally high carbonate content and disequilibrium between dissolved carbonate species and atmospheric CO₂(g).

Paste EC values ranged between 110 and 335 µS/cm with a mean for all samples of 179 µS/cm.

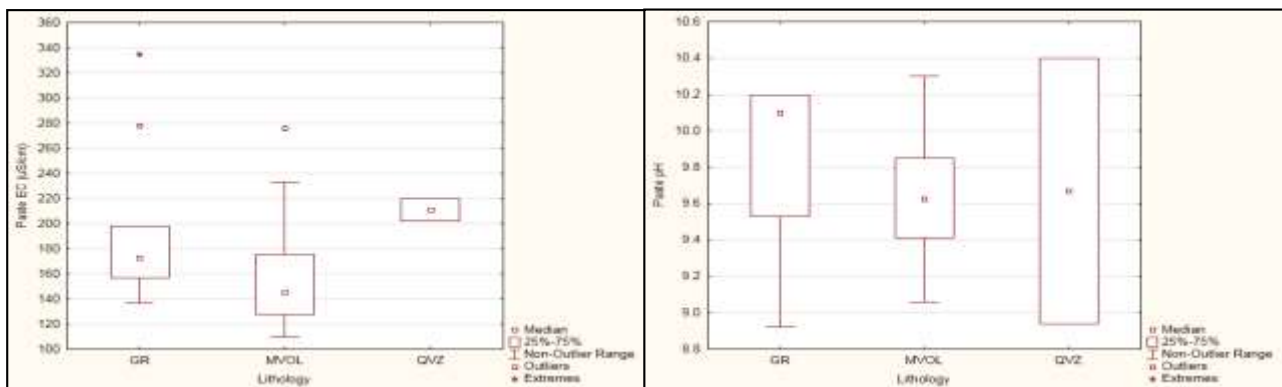


Figure 20: Box and Whisker Plot of Paste EC and pH Measurements for the Waste Rock

4.2.2 Assessment of Acid Potential and Neutralisation Potential

In order to undertake ABA, it is necessary to determine both an Acid generation Potential (AP) and acid Neutralising Potential (NP) for each sample. For the Yaramoko project, AP was determined from the total sulphur content of the sample assuming that all sulphur was present as pyrite (FeS₂). The total sulphur content of the core samples which was used in the calculation of AP was found to vary from below analytical detection limits (<0.01 wt%) in the majority of the material types to a maximum of 0.68 wt% in one of the MV samples. Use of total sulphur for calculation of AP is justified at Yaramoko as due to the generally low sulphate sulphur content of most samples (<0.1wt%). Use of the calculated sulphide sulphur value is likely to introduce a considerable error into the calculations that may result in spurious results.

NP was calculated via two methods:

-
1. NP by titration (NPTITR) - assesses actual neutralising potential through titration with acid. Although this method largely assesses the potential for carbonate mineral buffering, some fast reacting silicate minerals are also partially dissolved in the test.
 2. The NP titration included a hydrogen peroxide step in order to correct for potential errors due to the presence of iron and manganese in the carbonate minerals like siderite (FeCO_3) and ankerite (Ca(Fe,Mn)Mg(CO_3) which were observed during the site visit. Iron and manganese in carbonates reduces the overall buffering capacity of these minerals.

The results of the two methods, measured and corrected NP values have been compared in Figure 21. The data follow a trend and show a clear bias toward the siderite corrected values which seems to indicate an overestimation of the siderite amount in the samples. This observation is consistent with the results of the mineralogical assessment in which iron and manganese bearing carbonate (ankerite) was only detected in trace amounts.

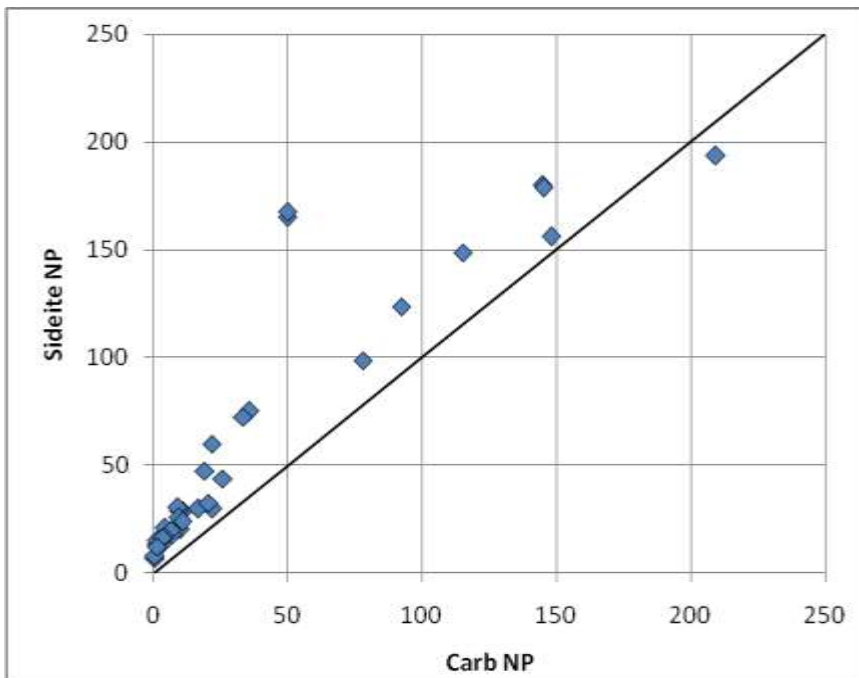


Figure 21: Comparison of Neutralization Potential Calculated from Carbonates and with Siderite Correction

4.2.3 Acid Base Accounting

ABA was carried out in order to assess the balance of AP and NP of the samples. ABA was carried out on 28 samples of core material representative of potential waste material. The results are summarized in Table 10 and are provided in full in Appendix B. In addition, scatter plots showing the acid generating characteristics of the core samples are provided in Figure 22.

Table 10: Summary of Waste Rock ABA Testwork Results

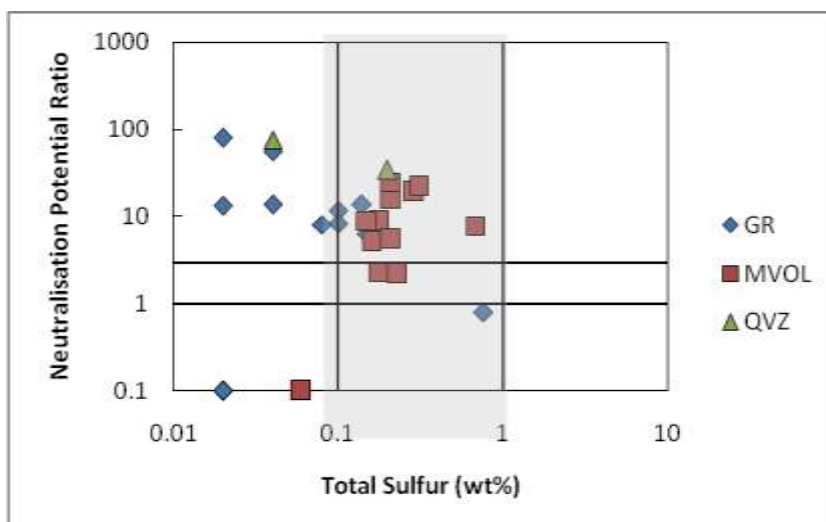
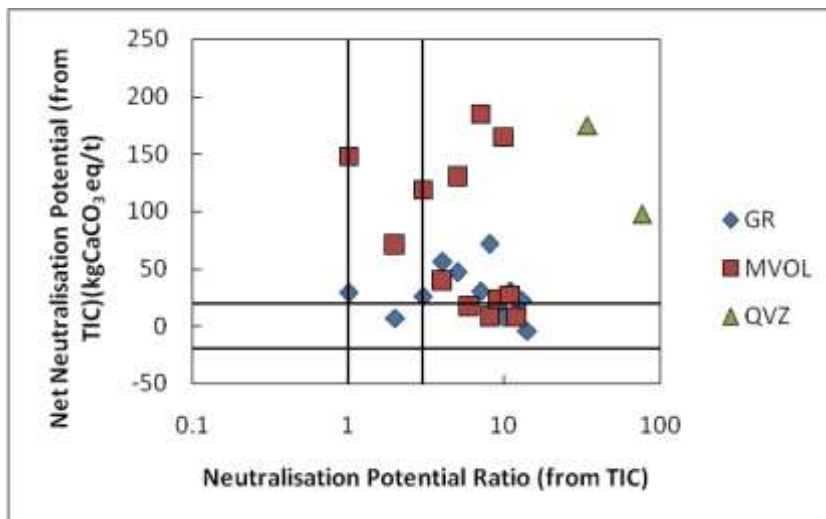
Lithology	#	Total Sulphur	Avg Acid Generation	Avg Neutralizing	NNP	NPR

			Potential**	Potential		
wt%			kg CaCO ₃ eq/t			
GR	14	0.11	3.4	29.5	26.3*	21.1*
MV	12	0.24	4.0	38.6	34.8*	20.9*
QV	2	0.12	4.2	43.5	39.3*	20.5*

Number of samples representing material type

* Indicates non-acid forming characteristics

** From total sulphur



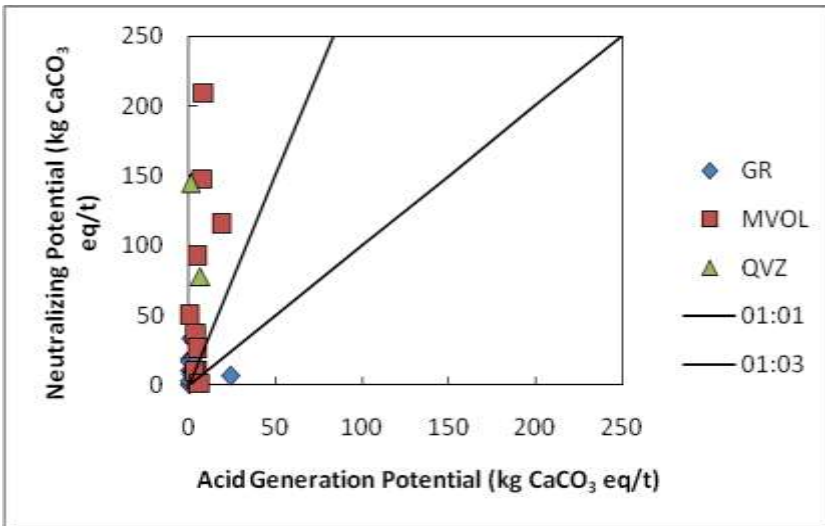


Figure 22: Scatter Plot Comparing: NPR* and NNP* (top), Total Sulphur and NPR (middle); and Acid Generating Potential and Neutralizing Potential of the Waste Rock Material (bottom)

* Both calculated from total inorganic carbon

Total sulphur is compared to the sulphide/sulphur content (wt%) in Figure 23 and describes a 1:1 linear relationship. Total sulphur can then be used interchangeably in the following of this study.

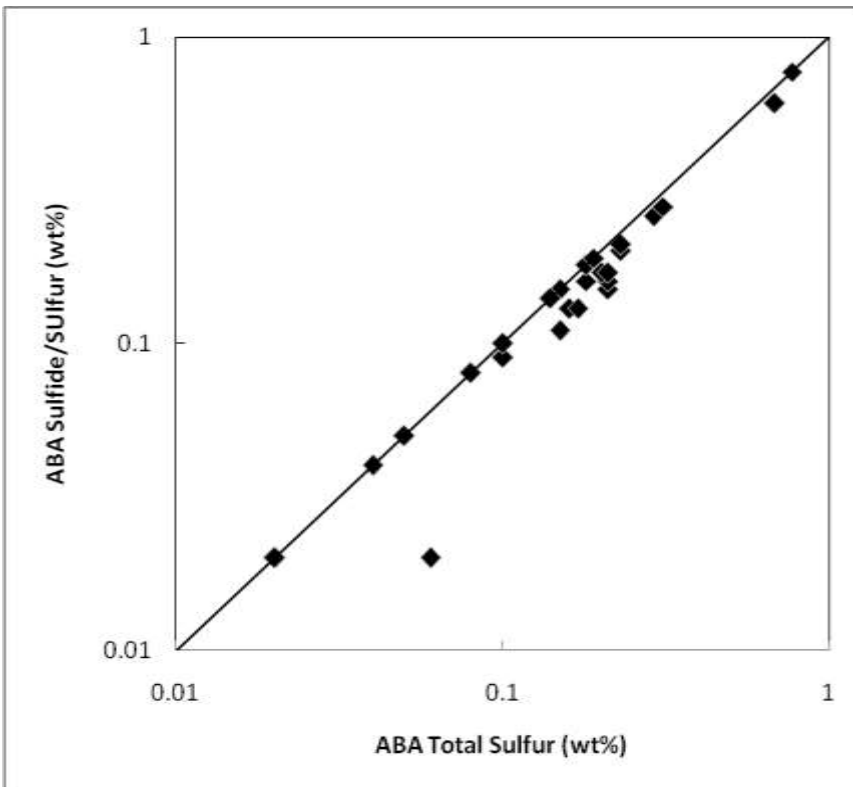
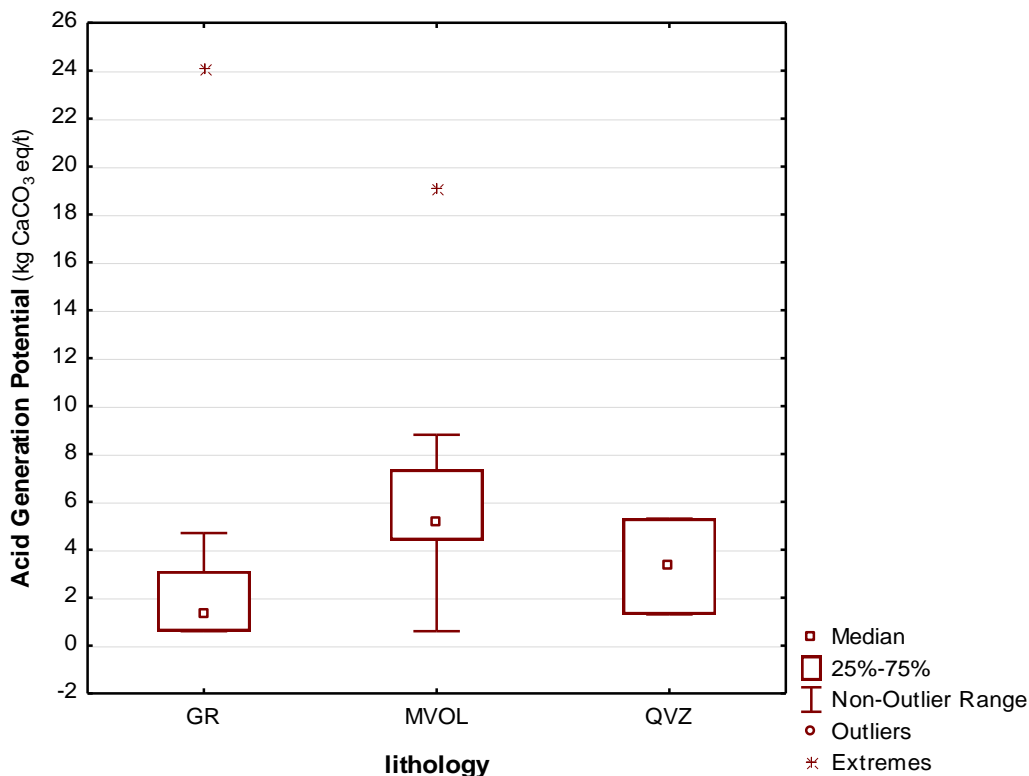


Figure 23: Scatter Plot comparing the Total Sulphur to the Sulphide Sulphur (wt%) in the ABA Testwork

Materials are generally considered to be non-acid forming (NAF) if there is three times excess of neutralizing capacity (i.e., NP/AP > 3), but are considered potentially acid forming (PAF) if the ratio of NP to AP is less than 1 (Figure 22). The average acid generating potential was found to be between 3.4 and 4.2 kg CaCO₃ eq/t for all material. Average neutralization potential by titration was found to be greater than 20 kg CaCO₃ eq/t for all material types with the highest being in the Quartz Vein Zone (43.5 kg CaCO₃ eq/t). This indicates that in most cases the available NP is in significant excess to the available AP and the majority of the samples can therefore be classified as a Non Acid Forming (NAF) material.

Three GR samples are considered uncertain by comparing the NPR with NP (Figure 22), of those, only one sample is defined as potentially acid forming when comparing NPR with total sulphur (Figure 22) and NP with the acid generation potential (Figure 22), this sample SRK2864 became acid in the NAG test with a solution pH of 3.2 (NAG extract). The gray shaded areas in the figures indicate the uncertain zone where the samples might generate acidity.

Similarly three MV samples are considered uncertain with regard to their acid generation potential (Figure 22) as well as when comparing NPR with Total Sulphur (Figure 22) and NP with Acid Generation Potential (Figure 22). But none of those sample developed acidity in the NAG test.



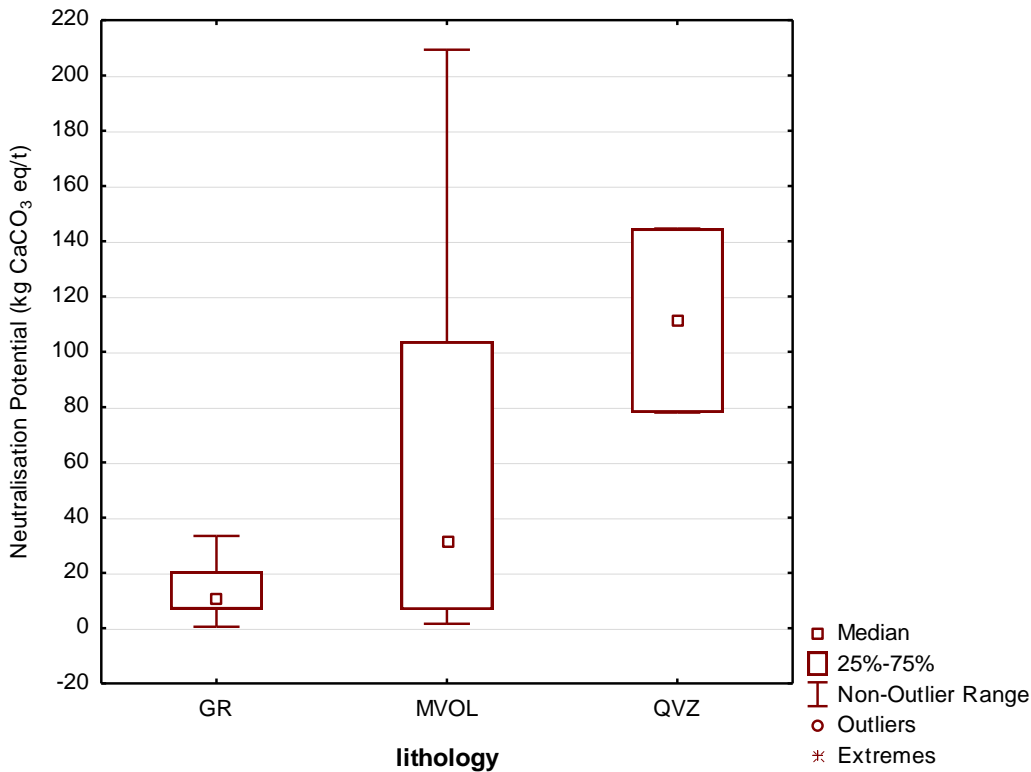


Figure 24: Box and Whisker Plot of the Acid (top) and Neutralization (bottom) Potential of Each Lithological Type

4.2.4 Net Acid Generation Testing

Net Acid Generation (NAG) testing was carried out to determine the maximum potential acidity release given complete oxidation of all exposed sulphide minerals in the samples. NAG testing was carried out on 28 samples of waste material.

During the test the sample is reacted with H₂O₂ at room temperature for 18 hours then heated up until it stop degassing and finally boiled for five minutes. In this study the pH of the solution was measured before and after heating the samples. The majority of the heat treated samples exhibit higher pHs than before heating. The reason for this bias is unclear at present but may be linked to the activation of carbonates species (calcite and dolomite). The samples showing an increase of acidity after heat treatment, SRK 2853, 58 and 64 have traces or no carbonates which support this hypothesis.

The results are summarized in Table 11 and the NAG pH is plotted against the Net Neutralization potential in Figure 25 and with the sulphide content in the rock in Figure 26. There is a lower sulphide content in the GR than MV and despite having both a low neutralization ratio and high sulphide the NAG pH remains basic for both GR and MV.

A minimum NAG pH of 3.1 from a post heating GR sample was the only evident low pH, with the next lowest pH (from MV) being 5.65. Although greater than 4.5 pH units, both these NAG pH values are indicative that acid generation might occur without being fully neutralized by the available NP. This demonstrates that these samples (SRK2425 and SRK2426) do have the potential to generate acidity if weathering conditions favoured depletion of NP before AP was fully depleted.

All other samples showed neutral NAG pH indicative of carbonate buffering.

The average NAG pH for the different lithologies is comprised between 7 and 7.5, which is neutral and therefore indicative of potentially NAF material. This result is consistent with the ABA testwork results.

Table 11: Summary of Waste Rock NAG Testwork Results

Lithology	#	Average NAG pH *	Average NAG pH **	Average NAG Value kg H₂SO₄ eq/t
GR	14	7.0	9.9	3.4
MV	12	7.2	9.6	6.4
QV	2	7.5	9.7	3.3
Total	28	7.2	9.7	4.4

* Before heating

** After heating

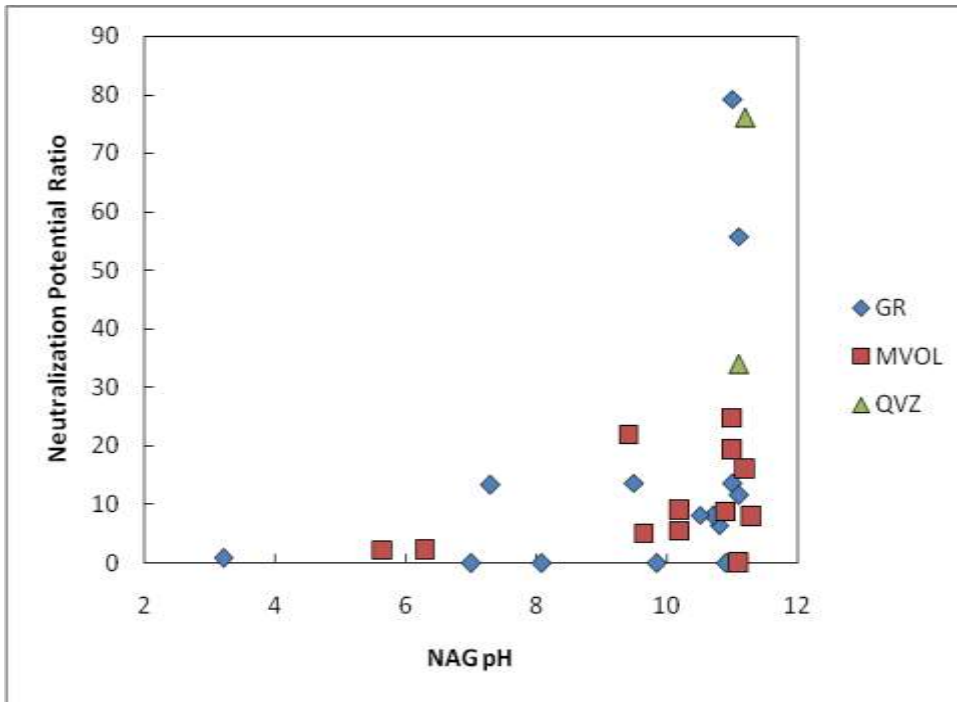


Figure 25: Scatter Plot Comparing Measured NAG pH with Neutralization Potential Ratio

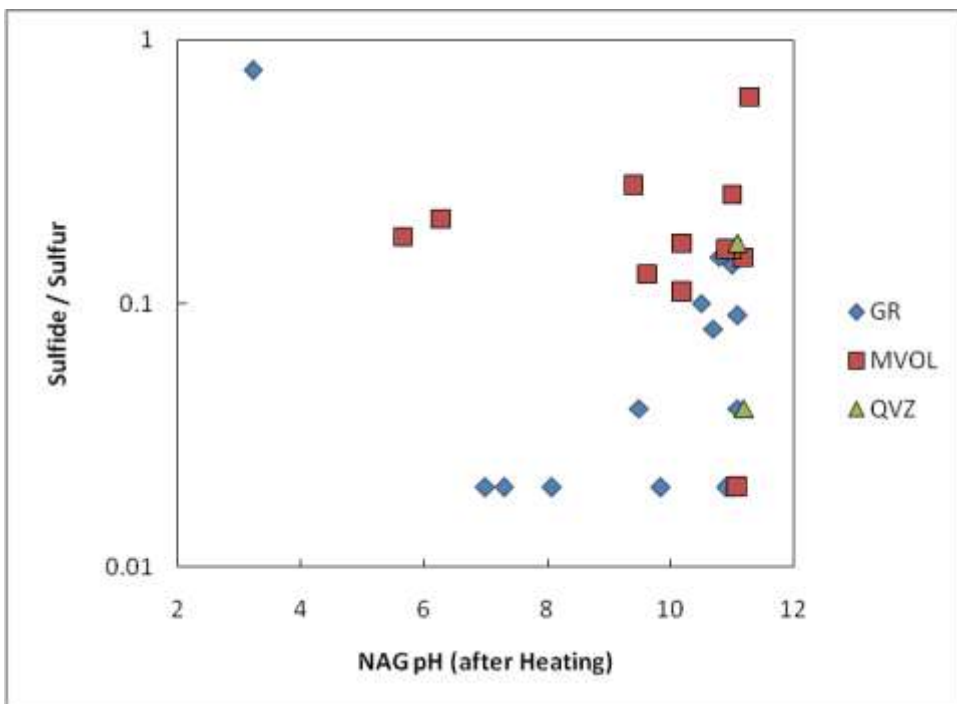


Figure 26: Scatter Plot Comparing NAG pH Measured After Heating the Sample and Sulphide Sulphur Content of the Waste Rock

4.2.5 Acid Generating Capacity Summary

The general excess of NP to AP in the Yaramoko waste rock material means that the potential for acid generation is considered to be low. However, although the probability of the entire waste material generating acidic leachate is low, it is possible that localized generation of acid may occur in small pockets of higher sulphur / lower carbonate material where acid generating potential exceeds acid neutralising potential.

4.3 Solute Leaching Potential

4.3.1 Multi-Element Analysis

Aqua Regia acid digestion followed by solution analysis was used to determine the available metal content of reduced minerals in the core samples that could be potentially released to the environment. The results of the multi-element assay are summarized in Table 12 which shows concentrations of key parameters relating to ARDML compared to average crustal abundance.

Table 12: Summary of Multi-Element Assay Showing GAI Values for Key Parameters Relating to ARDML

Lithology	#	Al	As	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	S	Sb	Se	U	Zn
		mg/Kg															
Avg Crustal Abundance***		81,300	1.8	0.2	100	25	55	50,000	13	950	1.5	75	260	0.2	0.05	1.8	70
GR	14	6,579	1.0	0.1	10	5	17	16,021	2	296	1	8	1,207*	0.1	0.5	0.7	42
MV	12	20,767	3.1	0.1	94	28	82	51,342	2	800	1	40	2,342**	0.1	0.6	0.3	79
QV	2	18,950	4.4	0.1	42	19	44	42,800	2	765	0	27	1,400*	0.1	0.6	0.3	72
Average	28	15,432	3	0	49	17	48	36,721	2	620	0	25	1,650*	0.1	1	0.4	64

* 3 to 6 times average crustal concentrations

** 6 to 12 times average crustal concentrations

*** Mason, 1966

The results show that most that most environmentally significant elements are below or close to their relative natural abundance in the waste material. However, gold, arsenic, sulphur and selenium are shown to be enriched compared to average crustal concentrations. Antimony was not found to

be enriched with respect to average crustal abundance despite being mobilized to some extent in the NAG test. Ag, P, La and Ba are also enriched with respect to their respective GAI values but only in a limited number of samples. Their enrichment might be due to the presence of a phosphate bearing phase where phosphorus is substituted in minor amounts by lanthanum and barium.

It should be noted here that Aqua Regia does not facilitate a complete digestion of all minerals within a sample. In most cases there will be a residue silicate matrix that will resist acid breakdown. However, Aqua Regia is effective in the breakdown of most sulphide minerals, secondary sulphate minerals, and the majority of oxide and hydroxide minerals as well as most gold and gold amalgams. Aqua Regia is given here to represent the complete element quotient that may potentially be available for release during natural weathering processes. As Aqua Regia digestion is not a total analysis method, the comparison to average crustal abundance through the calculation of GAI is taken as an approximation only in order to highlight where elemental concentrations are elevated.

Tellurium calculated GAI values shows apparent enrichment in the averaged lithologies compared to average crustal concentrations however this trace element is below the detection limits of the analytical techniques, therefore this apparent enrichment is artificial and due to the reporting limit used.

4.3.2 Deionized Water Leach

A single stage deionized water leach was carried out on the waste rock samples. The leach was carried out to determine the components that are immediately available for release from the samples. In particular the leaching of key parameters relating to ARDML was assessed to determine their potential mobility in the secondary environment. The leaching procedure utilized a single stage leach, with a liquid to solid ratio of 3 to 1.

The results of the deionized water leach test are summarized in Table 13, which shows elemental concentrations compared to WHO, IFC, CCME and Burkina Faso MAC guidelines. The pH of the solution is moderately alkaline (pH 9.6) which confirms the results of the NAG and ABA tests and supports the observation that the Yaramoko waste material is non-acid forming. The Ficklin metal (the sum of copper, cadmium, cobalt, nickel, lead and zinc) release from the waste sample was 0.1 mg/L. This constitutes an alkaline solution with low metal concentrations.

Table 13: Deionized Leach Elemental Concentrations (in mg/L) Compared to WHO, IFC, CCME and Burkina Faso MAC Guidelines

		Al	As	Cd	Cr	Co	Cu	Fe	Pb
Lithology	#	pH							
		mg/L							

Detection Limit			0.0005	0.00002	0.000005	0.0001	0.000005	0.00009	0.001	0.000005
GR	14	9.5	0.275	0.0008	0.000005	0.0001	0.00003	0.0008	0.014	0.00002
MV	12	9.6	0.253	0.0004	0.000005	0.0002	0.00001	0.0005	0.013	0.000007
QV	2	9.6	0.400	0.0005	0.000005	0.0001	0.00003	0.0014	0.005	0.000007
Total / Avg	28	9.6	0.309	0.0005	0.000005	0.0001	0.00002	0.0009	0.010	0.00001
WHO		6.5 -8.5	-	0.01	0.003	0.05	-	2	-	0.01
IFC		6 - 9	-	0.1	0.05	0.1	-	0.3	2	0.2
CCME		6.5 -9	-	0.005	0.005	-	-	0.002	0.3	0.001
MAC		6.4 -10.5	10	0.14	0.1	0.1	0.5	1	20	0.5
BF DW		6.5 - 8.5	0.7	0.01	0.001	0.05	-	0.02	0.1	0.05
			Mn	Mo	Ni	S	Sb	Se	U	Zn
Lithology	#	pH	mg/L							
Detection Limit			0.05	0.00005	0.00005	10	0.00005	0.00002	0.000002	0.0001
GR	14	9.5	0.001	0.0009	0.004	10.9	0.0009	0.0002	0.00006	0.0006
MV	12	9.6	0.001	0.0006	0.001	10.0	0.0006	0.0002	0.00001	0.0003
QV	2	9.6	0.0008	0.0002	0.001	10.0	0.0002	0.0002	0.00004	0.0004
Total / Avg	28	9.6	0.001	0.0006	0.002	10.3	0.001	0.0002	0.00003	0.0004
WHO		6.5 -8.5	0.4	0.07	0.07	-	0.02	0.04	0.015	-
IFC		6 - 9	-	-	0.5	-	-	-	-	0.5
CCME		6.5 -9	-	-	0.025	-	-	0.001	0.015	0.03
MAC		6.4 -10.5	1.2	0.5	2	-	0.1	0.8	-	5
BF DW		6.5 - 8.5	0.05	-	-	-	-	0.01	-	0.5

4.3.3 NAG Leachate

The results of the hydrogen peroxide leach test are summarized in Figure 27. This shows elemental release of Fiklin metals (sum of Cd, Co, Cu, Ni, Pb, Zn) (in mg/kg) compared to solution pH. The gray area indicates the uncertain zone where sample can possibly go acid, one GR sample belongs to this category. This shows that while several elements are released at detectable concentrations, generally less than 5% of metal inventory of the waste was mobilized under the intensive oxidising conditions of the NAG test. Consequently elemental release from the wall material is considered low. Figure 28, Figure 29 and Figure 30 show Sb, As and Se release against NAG test pH. These elements constitute oxyanions which are characterized by general increasing mobility with

increasing pH. This habit can be seen with antimony which shows a maximum release of less than 0.1 mg/kg release. Arsenic and selenium both show a greater release generally between 0.01 and 1 mg/kg.

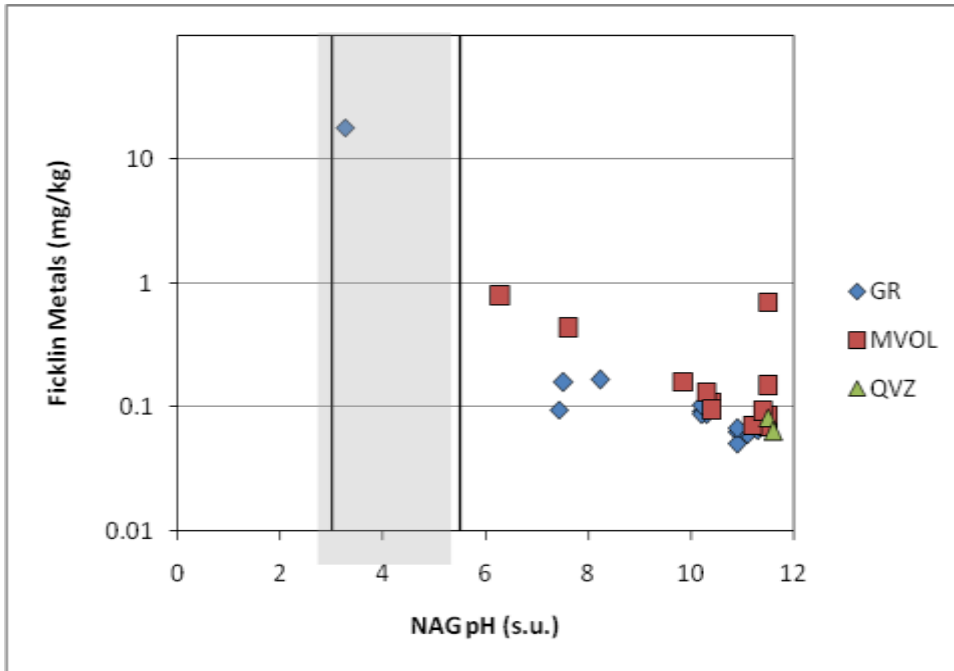


Figure 27: Scatter Plot of the Ficklin Metals (mg/kg) Release as a Function of NAG pH

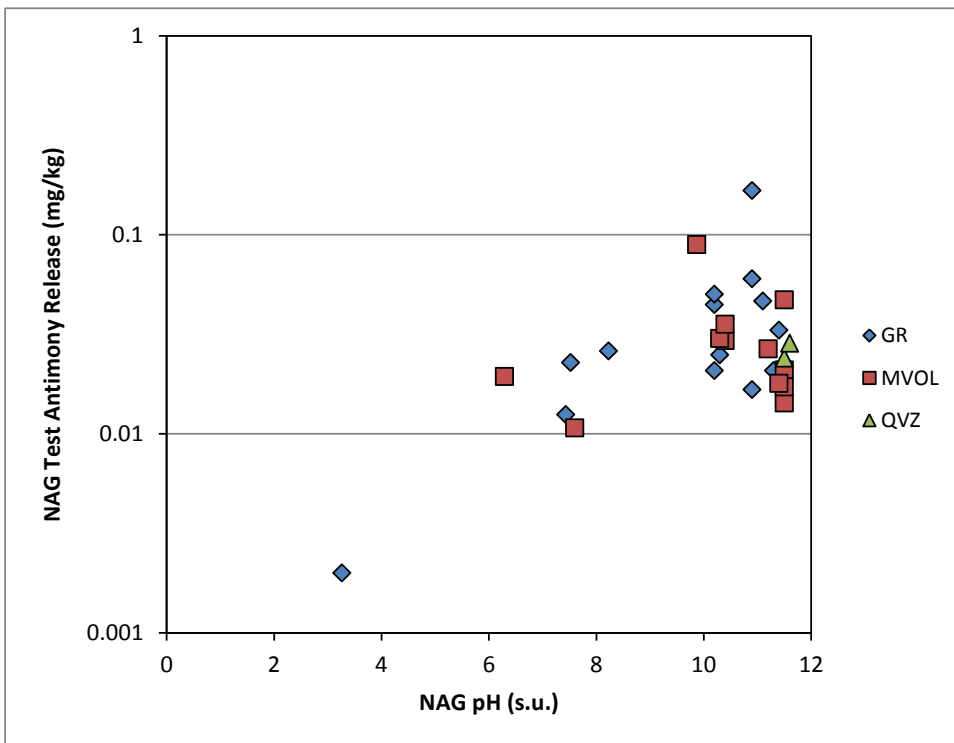


Figure 28: Scatter Plot of Antimony Release (mg/kg) as a Function of NAG pH

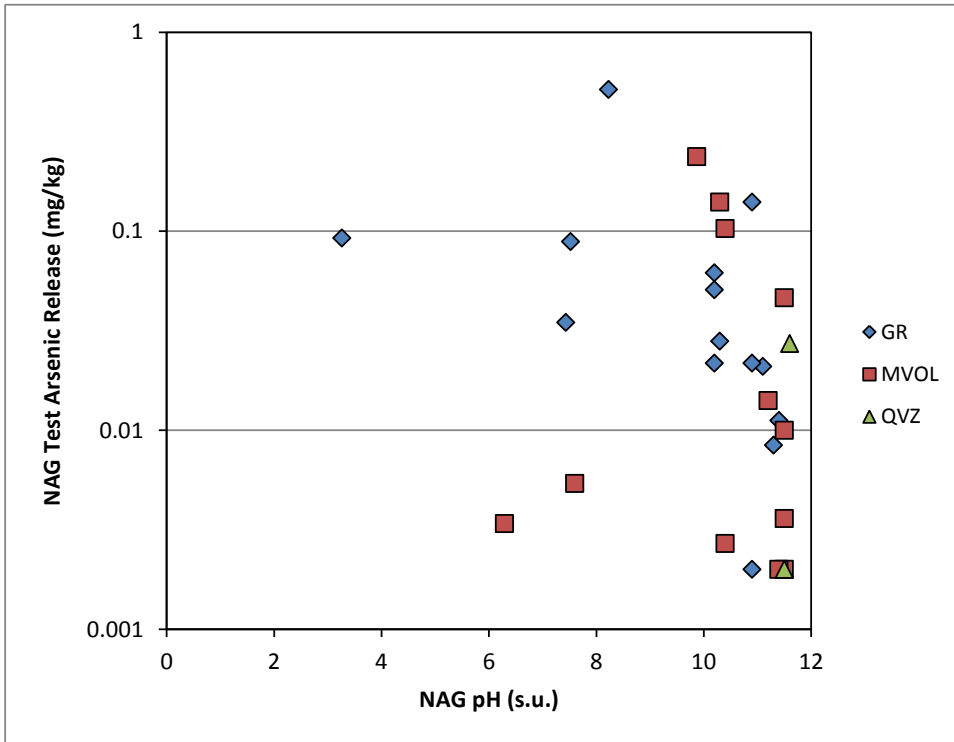


Figure 29: Scatter Plot of the Arsenic Release (mg/kg) as a Function of NAG pH

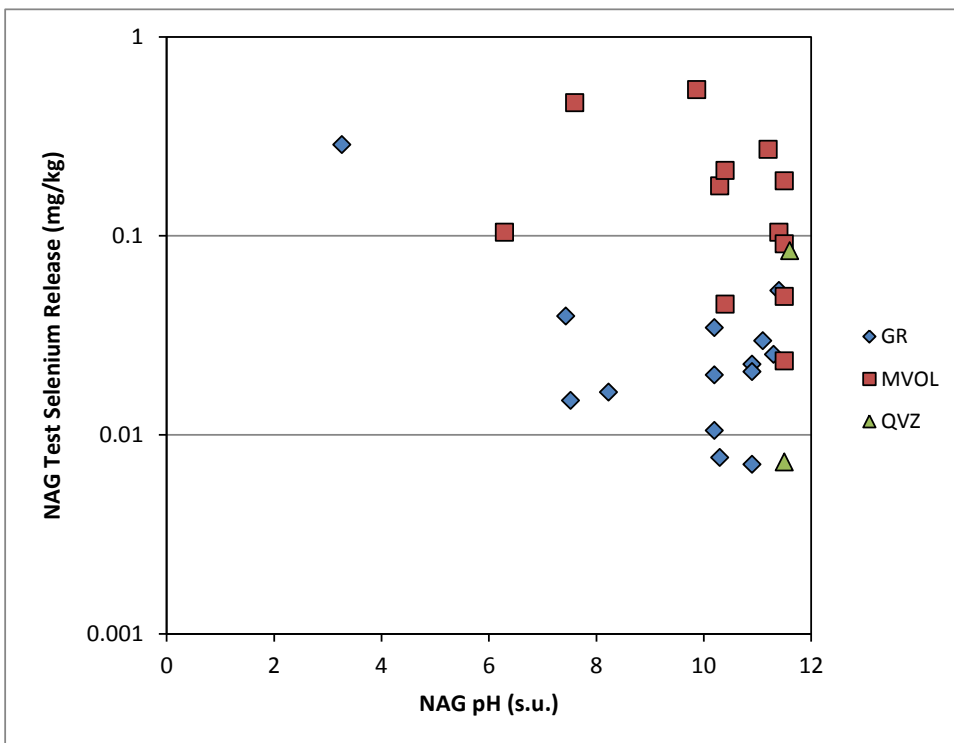


Figure 30: Scatter Plot of the Selenium Release (mg/kg) as a Function of NAG pH

Table 14: Hydrogen Peroxide Leach Elemental Concentrations (in mg/L) Compared to Guidelines

Lithology	#	pH	Al	As	Cd	Cr	Co	Cu	Fe	Pb
			mg/L							
Detection Limit			0.0005	0.00002	0.000005	0.0001	0.000005	0.00005	0.0011	0.000005
GR	14	9.6	2.35	0.0008	0.00002	0.003	0.003	0.009	0.036	0.00012
MV	12	10.3	1.61	0.0005	0.00001	0.01	0.0005	0.0009	0.143	0.00004
QV	2	11.6	3.49	0.0001	0.000005	0.006	0.00001	0.0003	0.009	0.00003
Total / Avg	28	10.5	2.48	0.0005	0.00001	0.007	0.001	0.003	0.063	0.00006
WHO		6.5 - 8.5	-	0.01	0.003	0.05	-	2	-	0.01
IFC		6-9	-	0.1	0.05	0.1	-	0.3	2	0.2
CCME		6.5 - 9	-	0.005	0.0051	-	-	0.002	0.3	0.001
MAC		6.4 - 10.5	10	0.14	0.1	0.1	0.5	1	20	0.5
BF DW		6.5 - 8.5	0.7	0.01	0.001	0.05	-	0.02	0.1	0.05
Lithology	#	pH	Mn	Mo	Ni	SO ₄	Sb	Se	U	Zn
			mg/L							
Detection Limit			0.00005	0.00005	0.00002	-	0.00002	0.00004	0.000002	0.0001
GR	14	9.6	0.070	0.005	0.0014	22.7	0.0004	0.0004	0.0002	0.006
MV	12	10.3	0.019	0.006	0.0008	29.5	0.0003	0.002	0.00002	0.001
QV	2	11.6	0.001	0.003	0.0003	7.6	0.0003	0.0005	0.000002	0.001
Total / Avg	28	10.5	0.030	0.005	0.0008	19.9	0.0003	0.0009	0.00006	0.003
WHO		6.5 - 8.5	0.4	0.07	0.07	-	0.02	0.04	0.015	-
IFC		6-9	-	-	0.5	-	-	-	-	0.5
CCME		6.5 - 9	-	-	0.025	-	-	0.001	0.015	0.03
MAC		6.4 - 10.5	1.2	0.5	2	600	0.1	0.8	-	5
BF DW		6.5 - 8.5	0.05	-	-	150	-	0.01	-	0.5

Table 15: Hydrogen Peroxide Leach Elemental Release (in mg/kg) Compared to the Whole Rock Concentrations

			Al	As	Cd	Cr	Co	Cu	Fe		
Lithology	#	pH	mg/kg								
GR	14	9.6	235	0.08	0.002	0.30	0.31	0.90	3.55		
MV	12	10.3	161	0.05	0.001	1.06	0.05	0.09	14.30		
QV	2	11.6	349	0.01	0.001	0.60	0.00	0.03	0.94		
Total / Avg	28	10.5	248	0.05	0.001	0.65	0.12	0.34	6.26		

			Pb	Mn	Ni	S	Sb	Se	U	Zn	
Lithology	#	pH	mg/kg								
GR	14	9.6	0.012	6.99	0.14	1443*	0.04	0.04	0.02	0.64	
MV	12	10.3	0.004	1.94	0.08	1675*	0.03	0.19**	0.002	0.13	
QV	2	11.6	0.003	0.09	0.03	1000*	0.03	0.05	0.0002	0.15	
Total / Avg	28	10.5	0.006	3.01	0.08	1373*	0.03	0.09	0.006	0.31	

* Indicates >75% of sample inventory leached

** Indicates between 25% and 50% of sample inventory leached

5 Conclusions

The static testwork carried on the predicted waste material from the Yaramoko project can be characterized as having globally low potential for acid generation, with a low risk of developing metal leaching behaviour that will have a negative catchment scale impact. However, the reader should be mindful that a number of elements were slightly elevated in some samples and were found to be mobilized in aggressive leaching tests. With this in mind, including common sense mitigation measures to minimize local scale water quality impacts is advisable. The main conclusions are discussed in more detail as follow:

5.1 Acid Generation

The results of the ABA and NAG testwork demonstrate that the majority of waste rock at Yaramoko can be largely classified as non-acid forming (NAF) material. Six samples are categorized as uncertain but only one of the 28 samples collected are considered to be Potentially Acid Forming (PAF) material as determined through Acid Base Accounting (ABA). This sample generated acidic pH leachate (pH 3) during the Net Acid Generation (NAG) tests, with the remainder of the samples generating circum-neutral (pH 7 to 7.5) leachates. This lack of acid generation behaviour can be attributed to the generally low content of acid generating sulphide minerals combined with high concentration of carbonate minerals within the waste rock material.

The potential for acid generation of the Yaramoko waste rock material is considered to be low. Localized generation of acid may occur in small pockets containing higher sulphide content.

5.2 Metal Leaching Potential

The results found arsenic, sulphur, selenium and gold to be enriched in all material types with respect to the Geochemical Abundance Index (GAI) values and silver, phosphorus, lanthanum and barium in a three samples. Despite being enriched all the values with the exception of gold were close to the analytical method detection limit and represent the generally low content of these elements in the rock.

During the deionized water leach test (carried out at a liquid to solid ratio of 3:1), no metal(loid)s were found to be released at concentrations in excess of relevant water quality guidelines, it can therefore be deduced that the potential for immediate (short term) release of problematic solutes from the WRD facility should be minimal.

During the NAG leach extraction in which the sulphide minerals are oxidized with hydrogen peroxide, the following observations were made:

- No element were found to exceed the IFC and Burkina Faso effluent discharge to surface water guidelines in addition; and
- Only aluminium was found to exceed the Burkina Faso drinking water guidelines in all lithologies, and is likely a reflection of the alkaline pH of the final leach solution and the elevated solubility of aluminium under these pH conditions.

In the case of the Granitoid lithology, copper (0.009mg/L) and manganese (0.07 mg/L) were found to be higher than the CCME and the Burkina Faso Drinking Water guidelines respectively.

Selenium (0.0019 mg/L) and Iron (0.14 mg/L) were found higher than the Drinking water and CCME guidelines in the Mafic Volcanic lithology.

It must be noted that the concentrations are generally low and concern the solution generated by the waste material prior to any geochemical effect e.g. lab to field upscaling, precipitation of secondary minerals, surface complexation, and dilution. Therefore it is important that a preliminary calculation of source term concentration be undertaken to fully quantify the leaching potential of the above elements.

It should be noted, that although not detected in leachates from the waste rock, mercury was identified in Au:Ag:Hg amalgam within sulphide. The mercury associated with gold will likely be mobilized during cyanidation leaching of the ore and be entrained in the tailings pore water. Therefore, monitoring of mercury concentrations in the tailings should be made during mine operation.

5.3 Metal Leaching Potential

The findings of this report demonstrate that the potential waste rock samples from the Yaramoko project have a low acid generation potential and are unlikely to release significantly elevated concentrations of problematic elements under normal weathering conditions. However, a low potential for leaching of elements arsenic, selenium, antimony, copper and manganese has been indicated.

Two potential sources have been identified in the Yaramoko deposit from the following sources:

- Temporary waste rock dump;
- Underground workings, backfilled waste and wall rock; and
- Leaching of waste rock used for construction within the mine facilities.

Potential water quality impacts resulting from these sources are given in Table 16.

Table 16: Summary of Potential Water Quality Impacts at the Yaramoko Project

Source	Cause	Impact	Receptor
Temporary waste rock dump	Atmospheric weathering / oxidation of waste rock followed by subsequent leaching by rainwater	Potential for low level leaching of sulphate, selenium, antimony, arsenic, copper and manganese.	Surface water and groundwater receptors in receiving catchment
Underground workings, backfilled waste and wall rock	Atmospheric weathering / oxidation of backfill and wall rock during mine life followed by mobilisation during mine void flooding	Potential for low level leaching of sulphate, selenium, antimony, arsenic, copper and manganese.	Groundwater in vicinity of the 55 zone once groundwater has fully recovered
Waste rock used as construction material	Atmospheric weathering / oxidation of waste rock followed by subsequent leaching by rainwater	Potential for low level leaching of sulphate, selenium, antimony, arsenic, copper and manganese.	Surface water and groundwater receptors in receiving catchment

In addition to the waste rock, mineralogical assessment of samples showed the presence of AuAgHg amalgam within sulphide minerals. Although this is not a risk within the waste rock materials, the mercury associated with gold will likely be mobilized during cyanidation leaching of the ore material and be entrained in the tailings pore water. Therefore, monitoring of mercury concentrations in the tailings should be made during mine operation.

6 Recommendations

6.1 Prior to Operation

- It is recommended that sequential NAG tests are carried out on samples with a net neutralisation potential less than 20 kg CaCO₃ eq/t. This will give a better indication of the total leachable component and potential final leach pH of the samples;
- It is recommended that conservative geochemical modelling of the source term is performed to fully quantify the leaching potential of the waste and wall rock; and
- Humidity cell testing should also be considered if conservative geochemical modelling indicates the potential for water quality impacts downstream of the mine waste facility.

6.2 Mine Operation and Closure Mitigation Requirements

- It is recommended to locate the temporary waste rock storage facility on low permeability layer collect and monitors seepage water quality prior to reuse or discharge to the environment. This will ensure that suitable mitigation control measures are in place in the event that low quality water is realized;
- The backfilling of all waste rock to a level below the recovered water table should be undertaken prior to, or at point of mine closure to limit the potential weathering of solutes from these materials;
- Monitoring dewatering water quality prior to discharge. Ensure that suitable mitigation control measures are in place in the event that non-compliant water quality is realized; and
- Monitoring of surface and ground water quality downstream from the mine site during operation and following closure. Assessment of the water quality against a set of site specific water quality objectives based water usage and key receptors to be agreed with the relevant regulating authority.

7 References

- AGP, (2013) AGP Mining Consultant Inc. Yaramoko technical report, prepared for Roxgold Inc.
- Baldwin, G., Addis, R., Clark, J., Rosevear, A. 1997. Use of industrial by-products in road construction – water quality effects. CIRIA Report 167. Construction Industry Research and Information Association, London. 151pp.
- BCR (2013) Metallurgical Testwork Report, prepared for Roxgold Inc.
- BEGE (2013) Etude d'impact environnemental et social du projet aurifère de Yaramoko, BEGE. Prepared for Roxgold Inc
- Bowell, R.J., 1994, Arsenic sorptions by iron oxyhydroxides and oxides. *Applied Geochemistry*, 9, p. 279-286.
- Bowell, R.J., Fuge, R., Connelly, R.J., and Sadler, P.K.J., 1996, Controls on ochre chemistry and precipitation in coal and metal mine drainage, in *Minerals, Metals and the Environment II*, Prague, September 1996, I.M.M. Londong, p. 291-323.
- Bingham, J.M., 1994, Mineralogy of ochre deposits, in Jambor, J.L. and Blowes, D.W. (eds), *Environmental Geochemistry of Sulfide Mine Waste*, Mineralogical association of Canada, Ottawa, Canada, p. 103-131.
- Broughton, L.M., and A.M. Robertson, 1992. Acid Rock Drainage from Mines - Where We Are Now. IMM Minerals, Metals and Environment Conference, February 4-6, Manchester, UK
- CCME (2013) Canadian Council of ministries and Environment, guidelines for the protection of aquatic life.
- Cravotta, C.A. III. 1994. Secondary Iron Sulphate minerals as sources of sulphate and acidity. In: *Environmental Geochemistry of Sulfide Oxidation* (eds: C.N. Alpers and D.W. Blowes). *Am.Chem.Soc.Sym.Series*, 550. 345-364.
- Decret n°2001-185 PRES/PM/PPME Normes de rejet des polluants dans l'air, l'eau et le sol.
- Deng, Y. and Strumm, W., 1994, Reactivity of aquatic iron (III) oxyhydroxides – implications for redox cycling of iron in natural waters. *Applied Geochemistry*, 9, p. 23-36.
- Dzombak, D. and Morel, F., 1990. *Surface Complexation Modeling: Hydrated Ferric Oxide*. J. Wiley, New York.
- EGI (2002). Net acid generation (NAG) test procedures; unpublished report for BHP Billiton, February, 2002, 6pp
- EIES Yaramoko Report (2013) Environmental and social impact assessment for the Yaramoko gold project, vol.2, BEGE, prepared for Roxgold Inc.
- Ferguson, K.D. and Leask, S.M. 1988. The Export of Nutrients From Surface Coal Mines. Regional Program Report 87-12. Environment Canada Conservation and Protection, Pacific and Yukon Region, West Vancouver, British Columbia. March 1988

-
- Heimstra, and Van Riemsdijk, 1996, Calculated values for point of zero charge for some common minerals, *Journal of Colloidal and Interface Science*, 179, p. 488-508.
- Hitzman, M.W., Oreskes, N., and Einaudi, M.T., 1992, Geological characteristics and tectonic setting of Proterozoic iron oxide (Cu-U-Au-REE) deposits. *Precambrian Research*, v.58; 241-287
- IFC (2007) Environmental Risk Assessment Guidelines – Mining Industry. International Finance Corporation.
- INAP (International Network for Acid Production) (2002). Prediction and kinetic control of AMD: Australian Mineral Industries Research Association (AMIRA), Project P387A, May 2002, 42pp.
- Kwong, Y.T.J., and Ferguson, K.D., (1997), Mineralogical changes during MP determination and their implications. Proceedings from ICARD '97, Vancouver, Mine Environment Neutral Drainage Program, Ottawa, Canada, p. 435-447.
- Langmuir, D. (1996.) *Aqueous Environmental Geochemistry*. Prentice and Hall. 600 pages.
- Lawrence Consulting (2013) *Geochemical Characterization of Rock Samples by Static Testing*. Prepared for Roxgold Inc.
- Lawrence, R.W. and Wang, Y. (1997), Determination of neutralization in prediction of acid rock drainage. Proceedings from ICARD '97, Vancouver, Mine Environmental Neutral Drainage Program, Ottawa, Canada, p. 451-464.
- Mason, B (1966). *Principles of Geochemistry*. Third Edition. John Wiley, 329pp.
- MEND (1995) *Hydrogeology of Waste Rock Dumps*. Mend Associate Project PA-1.
- MEND (2009) *Prediction Manual for Drainage Chemistry from Sulphidic Geological Materials*. MEND Report 1.20.1. December 2009
- Morse, J.W., 1983, The kinetics of calcium carbonate dissolution and precipitation, in Reeder, R.J. (ed), *Reviews in mineralogy*, Mineralogical Society of America, 11, p. 227-264.
- Nesbitt, H.W. and Jambor, J.L. (2008). Role of mafic minerals in neutralizing ARD, demonstrated using a chemical weathering methodology. In: L.J. Cabri and D.J. Vaughan (eds) *Modern Approaches to Ore and Environmental Mineralogy*. Mineralogical Association of Canada Short Course Volume 27, pp 403-421
- Nordstrom, D. K. (1982) Aqueous pyrite oxidation and the consequent formation of secondary iron minerals, In: Kittrick, J. A., Fanning, D. S., and Hossner, L. R., eds., *Acid Sulphate Weathering*, Soil Sci. Soc. Am. Publ., 37 56.
- Nordstrom, D.K., and Alpers, C.N., 1999, Geochemistry of acid mine waters, in Plumlee, G.S. and Logsdon, M.J. (eds), *The Environmental geochemistry of mineral deposits*, *Reviews in economic geology*, 6A, p. 133-160.
- Parkhurst, D.L., Appelo, C.A.J. 2012. *Users Guide to PhreeqC (Version 2)—A Computer Program for Speciation Batch-Reaction, One-Dimensional Transport and Inverse Geochemical Calculations*. Distributed with PhreeqC interactive Version 2.17.5.4799. USGS.

Sigg, L. & Strumm, W., 1980, The interaction of anions and weak acids with the hydrous goethite surface. *Colloidal Surface*, 2, p. 101-117.

SRK (2013a). Yaramoko interim water quality report. Report prepared for Roxgold Inc. SRK Consulting (UK) Ltd.

Stewart, W.A., Miller, S.D., Smart, R. (2006). Advances in Acid Rock Drainage (ARD) Characterization of Mine Waste. Paper presented at the 7th International Conference on Acid Rock Drainage (ICARD) 2006. St Louise MO.

Sverdrup, H.U., 1990, The kinetics of base cation release due to chemical weathering, Lund University Press, Lund.

WHO (2011) Guidelines for drinking water quality – Fourth Edition. World Health Organization.

APPENDIX A

Laboratory Results

Table 7.1: Aqua Regia Metals Test Results for project YARAMOKO

Maxxam Sample No	Sample ID	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th
	Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm
HT8629	SRK 2835	0.7	20.7	1.6	34	<0.1	12.7	7.1	303	2.08	0.5	0.7	4.5	3.1
HT8630	SRK 2836	1.4	53.1	2.2	77	<0.1	29.7	26.2	1080	5.51	3.7	0.2	696	0.6
HT8631	SRK 2837	0.6	88.9	0.6	78	<0.1	34.0	31.9	846	5.43	5.1	<0.1	5.7	0.5
HT8632	SRK 2838	0.5	30.8	1.0	112	<0.1	3.1	29.7	1140	7.58	1.2	0.2	27.6	0.9
HT8633	SRK 2839	0.5	19.1	2.4	31	<0.1	3.4	3.2	277	1.88	1.5	0.5	139	5.1
HT8634	SRK 2840	0.1	0.4	2.5	45	<0.1	5.5	4.6	389	1.40	<0.5	0.4	21.8	1.9
HT8635	SRK 2841	0.7	13.5	2.6	30	<0.1	3.1	2.7	234	1.16	1.0	0.5	18.3	5.2
HT8636	SRK 2842	0.2	38.3	2.1	41	<0.1	2.8	6.1	316	2.05	0.6	0.8	22.9	3.6
HT8637	SRK 2843	0.5	131	0.9	61	<0.1	16.6	23.5	587	4.37	1.4	<0.1	431	0.4
HT8638	SRK 2844	0.3	87.4	1.3	98	0.2	48.1	33.7	1140	7.16	8.2	0.2	1490	0.7
HT8639	SRK 2844 DUP	0.3	81.3	1.1	99	0.1	48.6	35.6	1150	7.38	7.4	0.1	822	0.7
HT8640	SRK 2845	0.7	73.6	1.6	95	1.0	45.3	31.7	1240	6.59	2.1	<0.1	3120	0.4
HT8641	SRK 2846	0.5	150	0.4	70	<0.1	14.5	24.4	567	4.47	2.9	<0.1	1.0	0.5
HT8642	SRK 2847	0.3	68.6	2.3	121	0.1	36.4	43.4	1540	8.10	3.5	<0.1	113	0.7
HT8643	SRK 2848	1.3	11.1	2.3	47	<0.1	1.8	2.2	324	1.15	1.0	0.7	60.9	3.1
HT8644	SRK 2849	0.5	7.5	3.0	34	<0.1	1.3	1.7	226	1.19	0.7	0.5	13.9	5.0
HT8645	SRK 2850	0.3	16.4	1.9	43	<0.1	6.9	5.2	329	1.50	1.9	1.2	10.9	3.9
HT8646	SRK 2852	0.3	21.1	1.8	45	<0.1	35.2	9.8	440	2.17	0.5	0.6	61.7	3.4
HT8647	SRK 2853	0.7	28.5	3.6	51	<0.1	8.4	7.3	232	1.55	<0.5	0.5	6.8	2.9
HT8648	SRK 2854	1.4	60.8	0.5	102	<0.1	14.8	29.5	687	6.12	2.6	0.3	7.5	1.1
HT8649	SRK 2855	<0.1	114	10.3	62	<0.1	219	33.1	701	3.73	11.0	2.1	7.6	16.8
HT8650	SRK 2855 DUP	<0.1	117	10.7	65	<0.1	216	32.5	691	3.70	11.5	2.3	4.7	17.3
HT8651	SRK 2856	0.3	89.9	0.4	71	<0.1	30.9	26.2	610	4.76	1.6	0.2	5.8	0.6
HT8652	SRK 2858	0.6	97.7	0.5	53	<0.1	26.9	23.5	368	3.40	1.9	0.1	2.1	0.6
HT8653	SRK 2859	0.3	4.3	2.3	40	<0.1	1.7	1.6	207	1.20	<0.5	0.8	0.8	5.4
HT8654	SRK 2860	0.7	6.6	0.8	47	<0.1	2.3	3.5	247	1.67	0.6	0.3	1.4	2.1
HT8655	SRK 2861	0.6	25.0	2.0	55	<0.1	10.5	7.6	364	1.55	<0.5	0.9	3.1	3.0
HT8656	SRK 2862	0.2	10.8	2.3	52	<0.1	8.4	6.2	313	1.71	2.1	0.7	2.8	3.4
HT8657	SRK 2863	1.8	23.0	1.6	56	<0.1	9.8	7.0	298	1.46	0.9	0.5	<0.5	3.3
HT8658	SRK 2864	0.1	18.6	1.3	34	<0.1	5.2	7.4	263	1.96	2.1	0.5	16.9	4.0
HT8659	SRK 2865	2.0	22.1	1.6	48	<0.1	8.6	6.6	303	1.48	<0.5	0.5	0.9	2.6
HT8660	SRK 2866	0.4	147	0.4	71	<0.1	13.7	24.2	573	4.43	2.9	<0.1	3.6	0.5
HT8661	SRK 2866 DUP	0.6	153	0.5	69	<0.1	14.1	24.1	575	4.51	2.8	0.1	<0.5	0.5
HT8662	SRK 2867	1.0	27.6	3.9	43	<0.1	7.6	6.9	239	1.56	0.5	0.4	57.1	2.6
QAQC														
Duplicates														
HT8659 Dup	SRK 2865	1.8	22.2	1.6	49	<0.1	9.2	6.8	297	1.46	0.7	0.7	<0.5	3.0
Blanks														
Method Blank										<0.01				
Method Blank		<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<1		<0.5	<0.1		<0.1
Method Blank													<0.5	
Reference Material														
REF OREAS45EA (%)										22.0				
True Values REF OREAS45EA										22.65				
Percent Difference										-2.9				
Reference Material														
REF OREAS45EA PPM		1.20	646	14.2	31.0	0.200	367	51.1	402		8.90	1.70		10.3
True Values REF OREAS45EA PPM		1.78	709	14.3	30.6	0.311	357	52	400		11.4	1.73		10.7
Percent Difference		-32.6	-8.9	-0.7	1.3	-35.7	2.9	-1.7	0.5		-21.9	-1.7		-3.7
Reference Material														
REF OREAS45EA PPB													59.3	
True Values REF OREAS45EA PPB													53	
Percent Difference													11.9	
Reference Material														
DS10 %										2.71				
True Values DS10 %										2.719				
Percent Difference										-0.3				
Reference Material														
DS10 ppm		13.8	158	154	369	1.90	77.0	12.8	893		47.2	2.60		7.60
True Values DS10 ppm		14.69	154.61	150.55	352.9	1.96	74.6	12.9	861		43.7	2.59		7.5
Percent Difference		-6.1	1.9	2.5	4.6	-3.1	3.2	-0.8	3.7		8.0	0.4		1.3
Reference Material														
DS10 ppb													60.2	
True Values DS10 ppb													91.9	
Percent Difference													-34.5	
Detection Limits		0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1
Acme		1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX

Table 7.2: Aqua Regia Metals Test Results for project YARAMOKO

Maxxam Sample No	Sample ID	Sr	Cd	Sb	Bi	V	Ca	P	La	Cr	Mg	Ba	Tl	B
		ppm	ppm	ppm	ppm	ppm	%	%	ppm	ppm	%	ppm	%	ppm
	Units													
HT8629	SRK 2835	15	<0.1	<0.1	<0.1	23	0.77	0.032	18	12	0.63	31	0.033	<20
HT8630	SRK 2836	93	0.1	<0.1	0.2	128	4.29	0.034	6	34	1.83	13	0.042	<20
HT8631	SRK 2837	19	<0.1	0.1	<0.1	168	2.07	0.057	5	17	1.61	10	0.193	<20
HT8632	SRK 2838	53	<0.1	0.1	<0.1	176	3.39	0.081	7	<1	1.70	18	0.060	<20
HT8633	SRK 2839	11	<0.1	0.1	0.2	15	0.15	0.015	49	3	0.12	49	0.018	<20
HT8634	SRK 2840	127	<0.1	<0.1	<0.1	16	3.12	0.034	14	2	0.22	35	0.004	<20
HT8635	SRK 2841	14	<0.1	0.1	0.1	2	0.80	0.010	29	2	0.20	35	0.004	<20
HT8636	SRK 2842	13	<0.1	<0.1	<0.1	27	1.11	0.019	26	2	0.36	39	0.041	<20
HT8637	SRK 2843	20	<0.1	<0.1	<0.1	140	1.57	0.069	4	13	1.13	8	0.140	<20
HT8638	SRK 2844	63	<0.1	<0.1	<0.1	216	4.58	0.069	5	81	2.73	13	0.024	<20
HT8639	SRK 2844 DUP	63	<0.1	<0.1	<0.1	223	4.69	0.068	5	83	2.81	14	0.026	<20
HT8640	SRK 2845	27	<0.1	<0.1	0.2	125	4.31	0.058	6	44	2.27	23	0.013	<20
HT8641	SRK 2846	14	<0.1	0.2	<0.1	114	1.11	0.078	4	8	0.96	7	0.200	<20
HT8642	SRK 2847	135	0.2	<0.1	0.1	201	5.52	0.045	6	24	2.27	11	0.030	<20
HT8643	SRK 2848	21	<0.1	<0.1	<0.1	3	0.96	0.014	20	2	0.17	31	0.007	<20
HT8644	SRK 2849	12	<0.1	<0.1	<0.1	2	0.61	0.009	55	2	0.12	30	0.022	<20
HT8645	SRK 2850	19	<0.1	0.3	<0.1	14	0.93	0.028	20	2	0.41	31	0.046	<20
HT8646	SRK 2852	34	<0.1	<0.1	<0.1	31	1.68	0.023	26	92	0.91	23	0.039	<20
HT8647	SRK 2853	40	<0.1	0.2	<0.1	15	0.46	0.044	25	6	0.47	87	0.090	<20
HT8648	SRK 2854	19	<0.1	0.1	<0.1	127	1.28	0.103	7	7	1.20	13	0.176	<20
HT8649	SRK 2855	420	<0.1	0.1	0.1	111	3.82	0.462	102	932	4.11	2990	0.045	<20
HT8650	SRK 2855 DUP	439	<0.1	0.2	0.1	109	3.79	0.470	104	961	4.16	3100	0.057	<20
HT8651	SRK 2856	17	<0.1	<0.1	<0.1	164	1.18	0.060	4	23	1.30	22	0.205	<20
HT8652	SRK 2858	11	0.1	0.1	<0.1	106	1.12	0.099	3	19	0.84	27	0.162	<20
HT8653	SRK 2859	9	<0.1	<0.1	<0.1	3	0.53	0.008	37	3	0.13	29	0.023	<20
HT8654	SRK 2860	12	<0.1	<0.1	<0.1	8	0.29	0.016	22	3	0.22	44	0.076	<20
HT8655	SRK 2861	42	<0.1	0.2	0.1	10	1.29	0.043	16	5	0.45	25	0.039	<20
HT8656	SRK 2862	15	0.2	<0.1	<0.1	19	0.50	0.035	22	6	0.43	28	0.070	<20
HT8657	SRK 2863	25	<0.1	<0.1	0.2	13	0.88	0.036	22	6	0.40	30	0.059	<20
HT8658	SRK 2864	9	<0.1	<0.1	<0.1	17	0.62	0.021	25	3	0.36	32	0.038	<20
HT8659	SRK 2865	23	<0.1	0.1	<0.1	12	0.87	0.037	20	5	0.40	29	0.057	<20
HT8660	SRK 2866	14	<0.1	0.2	<0.1	115	1.15	0.077	4	8	0.95	6	0.198	<20
HT8661	SRK 2866 DUP	14	<0.1	0.2	<0.1	117	1.16	0.080	4	9	0.96	7	0.203	<20
HT8662	SRK 2867	41	<0.1	0.2	<0.1	15	0.48	0.045	23	6	0.48	84	0.092	<20
QAQC														
Duplicates														
HT8659 Dup	SRK 2865	24	<0.1	<0.1	<0.1	12	0.86	0.036	21	5	0.39	29	0.057	<20
Blanks														
Method Blank														
Method Blank		<1	<0.1	<0.1	<0.1	<2	<0.01	<0.001	<1	<1	<0.01	<1	<0.001	<20
Method Blank														
Reference Material														
REF OREAS45EA (%)							0.0400	0.0280			0.0900		0.0860	
True Values REF OREAS45EA							0.032	0.029			0.095		0.106	
Percent Difference							25.0	-3.4			-5.3		-18.9	
Reference Material														
REF OREAS45EA PPM		4.00	<0.1	0.200	0.200	308			7.00	873		145		<20
True Values REF OREAS45EA PPM		4.05	0.03	0.64	0.26	295			8.19	849		148		
Percent Difference		-1.2		-69.8	-23.1	4.4			-14.5	2.8		-2.0		
Reference Material														
REF OREAS45EA PPB														
True Values REF OREAS45EA PPB														
Percent Difference														
Reference Material														
DS10 %							1.07	0.0740			0.780		0.0720	
True Values DS10 %							1.09	0.079			0.81		0.077	
Percent Difference							-1.8	-6.3			-3.7		-6.5	
Reference Material														
DS10 ppm		66.0	2.60	7.10	11.5	42.0			16.0	58.0		421		<20
True Values DS10 ppm		67.1	2.48	9.51	11.65	43			17.5	54.6				
Percent Difference		-1.6	4.8	-25.3	-1.3	-2.3			-8.6	6.2				
Reference Material														
DS10 ppb														
True Values DS10 ppb														
Percent Difference														
Detection Limits		1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20
Acme		1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX

Table 7.3: Aqua Regia Metals Test Results for project YARAMOKO

Maxxam Sample No	Sample ID	Al	Na	K	W	Hg	Sc	Tl	S	Ga	Se	Te
		Units	%	%	%	ppm	ppm	ppm	ppm	%	ppm	ppm
HT8629	SRK 2835	0.82	0.047	0.11	0.3	0.01	2.2	<-0.1	<-0.05	5	<-0.5	<-0.2
HT8630	SRK 2836	1.86	0.025	0.07	0.1	<-0.01	14.9	<-0.1	0.32	7	<-0.5	<-0.2
HT8631	SRK 2837	2.39	0.060	0.07	0.3	0.02	8.3	<-0.1	0.19	9	<-0.5	<-0.2
HT8632	SRK 2838	2.44	0.020	0.08	0.1	0.01	20.5	<-0.1	0.19	13	<-0.5	<-0.2
HT8633	SRK 2839	0.47	0.038	0.13	2.7	0.01	1.4	<-0.1	<-0.05	2	<-0.5	<-0.2
HT8634	SRK 2840	0.63	0.065	0.17	<-0.1	0.01	3.2	<-0.1	0.06	3	<-0.5	<-0.2
HT8635	SRK 2841	0.32	0.029	0.11	<-0.1	0.04	0.6	<-0.1	0.11	1	<-0.5	<-0.2
HT8636	SRK 2842	0.72	0.039	0.13	0.4	0.01	3.2	<-0.1	0.14	4	<-0.5	<-0.2
HT8637	SRK 2843	1.63	0.064	0.08	<-0.1	0.01	10.2	<-0.1	0.20	7	0.6	<-0.2
HT8638	SRK 2844	3.16	0.014	0.07	0.2	0.03	21.1	<-0.1	0.22	11	0.7	<-0.2
HT8639	SRK 2844 DUP	3.19	0.013	0.07	0.2	0.02	21.7	<-0.1	0.22	12	0.9	<-0.2
HT8640	SRK 2845	3.02	0.007	0.12	<-0.1	0.14	10.9	<-0.1	0.61	10	<-0.5	2.6
HT8641	SRK 2846	1.73	0.076	0.04	<-0.1	0.01	5.2	<-0.1	0.16	6	1.0	<-0.2
HT8642	SRK 2847	2.71	0.014	0.09	<-0.1	<-0.01	15.5	<-0.1	0.29	10	<-0.5	<-0.2
HT8643	SRK 2848	0.49	0.043	0.14	<-0.1	0.03	0.9	<-0.1	<-0.05	2	<-0.5	<-0.2
HT8644	SRK 2849	0.41	0.034	0.11	<-0.1	<-0.01	1.0	<-0.1	0.08	2	<-0.5	<-0.2
HT8645	SRK 2850	0.75	0.048	0.17	<-0.1	0.01	1.1	<-0.1	<-0.05	3	<-0.5	<-0.2
HT8646	SRK 2852	1.13	0.033	0.13	<-0.1	<-0.01	3.7	<-0.1	0.05	4	<-0.5	<-0.2
HT8647	SRK 2853	0.63	0.048	0.22	0.1	<-0.01	1.2	<-0.1	0.20	3	<-0.5	<-0.2
HT8648	SRK 2854	1.88	0.055	0.10	0.5	0.01	4.7	<-0.1	0.21	8	<-0.5	<-0.2
HT8649	SRK 2855	3.32	0.010	2.99	0.2	<-0.01	4.4	0.7	0.06	8	0.6	<-0.2
HT8650	SRK 2855 DUP	3.47	0.010	3.02	0.2	0.01	4.5	0.8	0.06	9	1.0	<-0.2
HT8651	SRK 2856	1.91	0.056	0.30	0.3	<-0.01	6.7	<-0.1	0.16	7	<-0.5	<-0.2
HT8652	SRK 2858	1.40	0.101	0.16	<-0.1	0.02	6.2	<-0.1	0.22	5	0.6	<-0.2
HT8653	SRK 2859	0.44	0.044	0.09	<-0.1	<-0.01	1.1	<-0.1	<-0.05	3	<-0.5	<-0.2
HT8654	SRK 2860	0.69	0.041	0.16	<-0.1	0.03	0.8	0.2	<-0.05	3	<-0.5	<-0.2
HT8655	SRK 2861	0.76	0.040	0.11	<-0.1	<-0.01	1.0	<-0.1	0.10	3	0.8	<-0.2
HT8656	SRK 2862	0.82	0.043	0.17	0.1	<-0.01	1.1	<-0.1	<-0.05	4	<-0.5	<-0.2
HT8657	SRK 2863	0.75	0.044	0.13	0.1	0.01	1.0	<-0.1	0.07	3	<-0.5	<-0.2
HT8658	SRK 2864	0.64	0.058	0.11	<-0.1	0.02	1.7	<-0.1	0.79	4	0.6	<-0.2
HT8659	SRK 2865	0.74	0.038	0.12	0.2	0.02	0.9	<-0.1	0.06	3	<-0.5	<-0.2
HT8660	SRK 2866	1.73	0.080	0.04	<-0.1	0.01	5.5	<-0.1	0.16	6	0.6	<-0.2
HT8661	SRK 2866 DUP	1.75	0.080	0.04	<-0.1	<-0.01	5.6	<-0.1	0.16	6	0.5	<-0.2
HT8662	SRK 2867	0.63	0.047	0.22	0.1	0.01	1.2	<-0.1	0.20	3	<-0.5	<-0.2
QAQC												
Duplicates												
HT8659 Dup	SRK 2865	0.73	0.038	0.12	0.1	<-0.01	0.9	<-0.1	0.07	3	<-0.5	<-0.2
Blanks												
Method Blank		<0.01	<0.001	<0.01					<0.05			
Method Blank					<-0.1	<-0.01	<0.1	<-0.1		<1	<-0.5	<-0.2
Method Blank												
Reference Material												
REF OREAS45EA (%)		3.06	0.0160	0.0500					<0.05			
True Values REF OREAS45EA		3.32	0.027	0.053					0.044			
Percent Difference		-7.8	-40.7	-5.7								
Reference Material												
REF OREAS45EA PPM					<-0.1	0.0200	77.9	<-0.1		12.0	0.700	<-0.2
True Values REF OREAS45EA PPM						0.34	78	0.072		11.7	2.09	0.11
Percent Difference						-94.1	-0.1			2.6	-66.5	
Reference Material												
REF OREAS45EA PPB												
True Values REF OREAS45EA PPB												
Percent Difference												
Reference Material												
DS10 %		1.04	0.0670	0.340					0.290			
True Values DS10 %		1.06	0.066	0.35					0.3			
Percent Difference		-1.9	1.5	-2.9					-3.3			
Reference Material												
DS10 ppm					3.00	0.330	2.90	5.00		4.00	2.60	5.30
True Values DS10 ppm					3.34	0.289	2.8	4.79		4.3	2.3	4.9
Percent Difference					-10.2	14.2	3.6	4.4		-7.0	13.0	8.4
Reference Material												
DS10 ppb												
True Values DS10 ppb												
Percent Difference												
Detection Limits		0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	0.2
Acme		1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX

APPENDIX B

XRD Data - Mineralogy

XRD Analysis of 31 Samples (Project U5629)

Bulk analyses were carried out on the 31 samples. Scans were run using the Philips PW1710 Automated Powder Diffractometer using Cu K α radiation at 35kV and 40mA, between 2 and 70 °2 θ at a scan speed of 0.04 °2 θ /s. From the scans, phases were identified and from the peak areas, semi quantitative analysis was performed and a percentage of each phase present calculated. Weighting factors were applied where necessary.

Therefore, results for the samples are as follows:

SRK 2835

Phase Found	Percentage
Quartz	46
Albite	40
Muscovite	9
Clinochlore	3
Calcite	2

SRK 2836

Phase Found	Percentage
Quartz	40
Albite	35
Clinochlore	16
Muscovite	9

SRK 2837

Phase Found	Percentage
Quartz	30
Clinochlore	23
Albite	20
Actinolite	17
Illite	5
Calcite	5

SRK 2838

Phase Found	Percentage
Quartz	53
Albite	24
Clinchlore	17
Illite	6

SRK 2839

Phase Found	Percentage
Quartz	61
Albite	29
Muscovite	10

SRK 2840

Phase Found	Percentage
Albite	67
Muscovite	19
Calcite	11
Clinchlore	3

SRK 2841

Phase Found	Percentage
Quartz	46
Albite	42
Illite	9
Clinchlore	2
Calcite	1

SRK 2842

Phase Found	Percentage
Quartz	58
Albite	38
Clinochlore	2
Illite	2

SRK 2843

Phase Found	Percentage
Quartz	38
Albite	26
Actinolite	20
Clinochlore	16

SRK 2844

Phase Found	Percentage
Quartz	39
Clinochlore	22
Albite	14
Dolomite	11
Calcite	8
Illite	6

SRK 2845

Phase Found	Percentage
Quartz	41
Clinochlore	20
Albite	15
Illite	13
Calcite	11

SRK 2846

Phase Found	Percentage
Quartz	40
Actinolite	24
Albite	21
Clinochlore	15

SRK 2847

Phase Found	Percentage
Quartz	27
Clinochlore	21
Dolomite	18
Illite	14
Albite	12
Calcite	8

SRK 2848

Phase Found	Percentage
Quartz	55
Albite	30
Muscovite	10
Calcite	3
Clinochlore	2

SRK 2849

Phase Found	Percentage
Quartz	54
Albite	36
Illite	6
Clinochlore	2
Calcite	2

SRK 2850

Phase Found	Percentage
Quartz	55
Albite	31
Illite	10
Clinochlore	3
Calcite	1

SRK 2852

Phase Found	Percentage
Quartz	54
Albite	29
Illite	6
Clinochlore	6
Calcite	5

SRK 2853

Phase Found	Percentage
Quartz	45
Albite	39
Illite	13
Clinochlore	2
Actinolite	1

SRK 2854

Phase Found	Percentage
Quartz	42
Albite	25
Clinochlore	16
Actinolite	9
Illite	8

SRK 2855

Phase Found	Percentage
Phlogopite	60
Actinolite	22
Calcite	13
Clinochlore	5

SRK 2856

Phase Found	Percentage
Quartz	37
Albite	21
Illite	16
Clinochlore	16
Actinolite	10

SRK 2858

Phase Found	Percentage
Quartz	36
Actinolite	30
Albite	16
Muscovite	10
Clinochlore	8

SRK 2859

Phase Found	Percentage
Quartz	54
Albite	39
Illite	5
Clinochlore	2

SRK 2860

Phase Found	Percentage
Quartz	59
Albite	29
Illite	9
Clinchlore	3

SRK 2861

Phase Found	Percentage
Quartz	50
Albite	31
Illite	15
Clinchlore	4

SRK 2862

Phase Found	Percentage
Quartz	51
Albite	34
Illite	10
Clinchlore	4
Actinolite	1

SRK 2863

Phase Found	Percentage
Quartz	65
Albite	24
Illite	7
Clinchlore	3
Calcite	1

SRK 2864

Phase Found	Percentage
Quartz	55
Albite	33
Illite	7
Clinochlore	4
Calcite	1

SRK 2865

Phase Found	Percentage
Quartz	55
Albite	32
Illite	9
Clinochlore	3
Calcite	1

SRK 2866

Phase Found	Percentage
Quartz	38
Albite	28
Actinolite	18
Clinochlore	16

SRK 2867

Phase Found	Percentage
Quartz	49
Albite	37
Illite	12
Clinochlore	2

131013

APPENDIX 4 :
**RESULTS OF SOIL BASELINE LEVEL ANALYSES (CHEMICAL
ANALYSIS AND PROFILES OF SOIL STUDIED)**

Profile BA 55

Description date (authors) : 13/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Poorly developed regosolic erosion soils
- WRB : regosol thaptoleptic.
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : Bagassi-Koussaro road
- Vegetation and/or use : sorghum field in Faidherbia albida park
- Physiographic Position : connecting glacis
- Surrounding Topography : slightly undulated
- Microtopography : none.
- Slope : 0;5%
- Parent Material : schists
- Hydric Condition : dry profile
- Drainage : normal
- Groundwater : not affected
- Surface coarse elements : abundant quartzite pebbles
- Rocky Outcrop : schists and quartzites
- Erosion : strong sheet erosion
- Human Influence : crops

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-14 cm: dark brown (7.5 YR 3/4) when moist; sandy loam; 60% of ferruginous gravel and quartz; subangular blocky structure poorly developed into fine and medium elements; soft consistency; numerous fine, very fine and average pores; many roots ranging from very fine to fine; well developed biological activity; distinct transition.

12-48 cm: yellowish red (5YR4/6) when moist; clay loam; 90% of ferruginized schists ; crumbly consistency ; numerous pores that are large, medium and fine; and many roots ranging from very fine to fine; well developed biological activity; distinct transition.

48-110 cm: horizon of weathered and soft schists; few and very fine roots; less visible biological activity.

Over 110 cm: unaltered schist bed

BA 55 soil sample analysis results

No. of Laboratory	1409	1410
No. of origin	BA 55	

Depth (cm)	0 - 14	14 - 48
TEXTURE	LS	A
Clay %	13.73	41.18
Total silt %	25.49	25.49
Total sand %	60.78	33.33
WATER CONSTANTS		
pF 2.5 %	23.88	33.02
pF 3.0 %	15.98	25.15
pF 4.2 %	10.80	18.01
ORGANIC MATTER		
Total organic matter %	3,822	2,276
Total carbon %	2,217	1,320
Total nitrogen %	0,147	0,111
C/N	15	12
PHOSPHORUS in ppm of P		
Total phosphorus	405.5	419.0
Available phosphorus	5.74	5.74
POTASSIUM in ppm of K		
Total Potassium	641.1	438.3
Available Potassium	79.09	27.36
SOIL REACTION		
pH of water (p/v: 1/2.5)	6.28	6.35

Profile BA84

Description Date (authors) : 21/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Brown, eutrophic, tropical and poorly developed soils
- WRB : Episkeletal, hypoveritic Cambisols
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : North of Yaramoko
- Vegetation and/or use : sorghum field under Vitellaria paradoxa and Faidherbia albida park.
- Physiographic Position : peripheral depression
- Surrounding Topography : slightly undulated
- Microtopography : none
- Slope : 1.5%
- Parent Material : schists
- Hydric Condition : dry to fresh profile
- Drainage : normal
- Groundwater : not affected
- Surface coarse elements : abundant quartzite pebbles
- Rocky Outcrop : none
- Erosion : sheet erosion
- Human Influence : crops

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-20 cm: dark brown (10YR3/3) when moist ; spotless; clay loam; 60% of ferruginous gravel and quartz; subangular blocky structure poorly to moderately developed into fine and medium elements ; crumbly consistency ; many pores ranging from very fine, fine, medium to large; fairly numerous roots ranging from very fine to fine; well developed biological activity; distinct transition.

20-50 cm: light olive brown (2.5 Y 5/6), when moist; silty clay; 20% quartz gravel and ferruginous and ferro-manganic concretions; subangular blocky structure poorly to moderately developed into medium and coarse elements ; consistency ranging from firm to fresh; quite many pores ranging from very fine to fine; quite numerous roots ranging from very fine to fine; well developed biological activity; distinct transition.

50-66 cm: light olive brown (2.5Y5/6) when moist; silty clay; 15% of ferruginous concretions and weathered rock debris; sub-angular blocky structure poorly to moderately developed into medium, coarse and fine elements; firm consistency ; few pressure faces ; fairly numerous pores ranging from very fine to fine and medium; few and very fine roots; poorly developed biological activity; distinct transition.

66-120 cm: horizon of weathered rock; very few and very fine roots; poorly developed biological activity.

Note: presence of some fine shrinkage cracks in the profile.

Results of the analyses of BA 84 soil samples

No. of Laboratory	1425	1426	1427
No. of origin	BA 84		
Depth (cm)	0 - 20	20 - 50	50 - 66
TEXTURE	LA	AL	LAF
Clay %	33.33	41.18	37.25
Total silts %	31.38	43.13	45.10
Total sands %	35.29	15.69	17.65
WATER CONSTANTS			
pF 2.5 %	30.16	36.17	35.62
pF 3.0 %	21.28	28.21	27.65
pF 4.2 %	18.69	23.59	24.01
ORGANIC MATTER			
Total organic matters %	0.710	0.481	1.422
Total carbon %	0.412	0.279	0.825
Total Nitrogen %	0.034	0.026	0.073
C/N	12	11	11
PHOSPHORUS in ppm of P			
Total Phosphorus	243.3	135.2	108.1
Available Phosphorus	9.66	8.75	10.56
POTASSIUM in ppm of K			
Total Potassium	4049.3	2111.6	1792.9
Available Potassium	82.07	30.34	31.34
SOIL REACTION			
pH of water (p/v: 1/2.5)	6.25	6.37	6.45

Profile BA 39

Date of description (authors) : 19/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Hydromorphic, brown, eutrophic, and tropical soil
- WRB : Gleyic Cambisol
- Coordinates :

2°) ENVIRONMENT OF THE PROFILE

- Location : lowland of Bagassi
- Vegetation and/or use : cornfield in savannah park with *Faidherbia albida*
- Physiographic Position : Lowland
- Surrounding Topography : almost flat
- Microtopography : None
- Slope : 0.5%
- Parent Material : alluvium
- Water Status : fresh at surface, wet in depth
- Drainage : imperfect
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : none
- Erosion : very poor sheet erosion
- Human Influence : Plowing

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-22 cm: dark brown (10YR4/3) when moist ; few brown spots; silty clay; subangular blocky structure moderately developed into medium, coarse and fine elements; crumbly consistency ; numerous pores ranging from medium to fine and very fine ; numerous roots ranging from fine to very fine; well developed biological activity, distinct transition.

22-62 cm: olive brown (2.5Y4/3) when moist; some brown spots; clay; some fine ferruginous gravel; subangular blocky structure poorly to moderately developed into coarse and medium elements; firm and fresh consistency; numerous pores being very fine and fine; quite a few roots ranging from very fine to fine; well developed biological activity; gradual transition.

62-105 cm: olive brown (2.5Y4/4) when moist; 15% of yellowish dark brown spots (10YR4/6) and gray (10YR5/1) clay ; few ferruginous concretions ; angular blocky structure moderately developed into coarse and medium elements; sticky to wet consistency; some sliding surfaces ; fairly numerous pores ranging from fine to very fine and medium; very few and very fine roots ; fairly developed biological activity.

Results of the analyses of BA 39 soil samples

No. of Laboratory	1404	1405	1406
No of origin	BA 39		
Depth (cm)	0 - 22	22 - 62	62 - 105
TEXTURE	LAF	A	AS

Clay	%	31.37	43.14	41.18
Total Silts	%	49.02	37.25	3.92
Total Sands	%	19.61	19.61	54.90
WATER CONSTANTS				
pF 2.5	%	37.65	31.65	33.57
pF 3.0	%	29.10	25.34	26.73
pF 4.2	%	16.84	16.60	16.76
ORGANIC MATTERS				
Total organic matters	%	3.751	1.619	1.155
Total Carbon	%	2.176	0.939	0.670
Total Nitrogen	%	0.147	0.073	0.058
C/N		15	13	12
PHOSPHORUS in ppm of P				
Total Phosphorus		729.9	364.9	283.8
Available Phosphorus		11.77	7.85	3.62
POTASSIUM in ppm of K				
Total Potassium		2730.9	1977.6	1035.9
Available Potassium		108.43	170.11	116.39
SOIL REACTION				
pH of water (p/v: 1/2.5)		6.86	7.12	7.24

Profile BA60

Date of description (authors) : 17/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : *Vertic, hydromorphic, tropical, and eutrophic brown soil*
- WRB : Gleyic and vertic Cambisols
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : developed lowland of Yaramoko
- Vegetation and/or use : Corn plots in savannah park with *Ficus gnaphalocarpa*,
Nauclea latifolia, *Cordia mixa*
- Physiographic Position : developed plain
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material : alluvium
- Water Status : fresh
- Drainage : imperfect
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : none
- Erosion : in poor sheet
- Human Influence : plowing

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-22 cm: very dark grayish brown (10YR3/2) when moist ; spotless ; silty clay; some ferruginous gravels; angular blocky structure moderately developed into medium and coarse elements ; firm consistency ; fairly numerous pores ranging from fine to very fine and medium; numerous roots that are very fine and fine; well developed biological activity; gradual transition.

22-60 cm: olive brown (2.5Y4/3) when moist; 5% gray spots (10YR5/1) and dark grayish brown spots (10YR4/6); clay ; few ferruginous gravels; angular blocky structure moderately developed into coarse and medium elements; many sliding surfaces ; firm consistency ; few pores ranging from very fine to fine; few roots ranging from fine to very fine; well developed biological activity; gradual transition.

60-100 cm: olive brown (2.5Y4/3) when moist ; 10% yellowish brown spots (10YR5/6) and gray spots (10YR5/1); clay ; few ferruginous and ferro-manganic concretions; angular blocky structure poorly to moderately developed into coarse and medium elements; firm consistency ; fairly numerous sliding surfaces ; few pores ranging from very fine to fine; rare and very fine roots ; poorly developed biological activity.

Note: presence of fine shrinkage cracks in the profile and at the ground surface.

Results of the analyses of BA 60 soil

samples

No. of Laboratory	1411	1412	1413
No. of origin	BA 60		
Depth (cm)	0 - 22	22 - 60	60 - 100
TEXTURE	A	A	A
Clay %	47.06	52.94	50.98
Total silts %	39.21	33.33	35.29
Total sands %	13.73	13.73	13.73
WATER CONSTANTS			
pF 2.5 %	38.27	40.72	55.17
pF 3.0 %	30.71	32.60	31.68
pF 4.2 %	19.18	21.32	20.44
ORGANIC MATTER			
Total organic matter %	3.398	1.315	0.941
Total Carbon %	1.971	0.763	0.546
Total nitrogen %	0.154	0.066	0.051
C/N	13	12	11
PHOSPHORUS in ppm of P			
Total Phosphorus	675.8	324.4	270.3
Available Phosphore	12.07	6.64	4.83
POTASSIUM in ppm of K			
Total Potassium	1412.6	1035.9	1789.2
Available Potassium	148.22	41.28	35.32
SOIL REACTION			
pH of water (p/v: 1/2.5)	6.40	7.24	7.26

Profile BA25

Date of description (authors) : 18/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Vertic, ferruginized, torpical, eutrophic brown soil.
- WRB : Endohypogleyic and hypoveritic Cambisol
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : Bagassi-Yaramoko Road
- Vegetation and/or use : Sorghum field in savannah park with albida, Vitellaria paradoxa, Acacia seyal
- Physiographic Position : peripheral depression
- Surrounding Topography : slightly undulated
- Microtopography : none
- Slope : 1%
- Parent material : schists
- Water Status : dry profile
- Drainage : normal
- Groundwater : not affected
- Surface coarse elements : spreading of quartz gravel
- Rocky Outcrop : none
- Erosion : in diffuse sheet
- Human Influence : culture

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-24 cm: brown (10YR4/3) when wet; silty clay; 10% ferruginous gravel and quartz subangular blocky structure moderately developed into medium and fine elements ; crumbly consistency; numerous pores ranging from fine to very fine and medium ; many roots ranging from fine to medium, very fine; well developed biological activity; distinct transition.

24-52 cm: yellowish brown (10YR5/4) when moist; clay; 20% ferruginous gravel and quartz; angular blocky structure moderately developed into coarse, fine and medium elements; firm consistency; some sliding surfaces; quite numerous pores ranging from medium to very fine and fine; quite numerous roots that are fine, medium and very fine; well developed biological activity; distinct transition.

52-77 cm: yellowish brown (10YR5/6) when moist; clay; 15% quartz gravels and ferruginous concretions ; angular blocky structure poorly to moderately developed into medium and coarse elements; firm consistency; some sliding surfaces ; few pores that are very fine and fine; few roots ranging from fine and very fine; fairly developed biological activity ; gradual transition.

77-105 cm: light olive brown (2.5Y5/6) when moist ; 10% gray spots (2.5Y5/2); clay; 5% quartz gravel, weathered rock and ferruginous concretions ; angular blocky structure poorly developed into coarse, medium and fine elements ; firm and fresh consistency; some sliding surfaces ; few pores being very fine and fine ; rare roots being fine and very fine ; fairly well developed biological activity; gradual transition.

105-125 cm: horizon of weathered rocks; not visible roots; poorly developed biological activity

Note: Presence of fine shrinkage cracks of 2nd to 3rd places

Results of the analyses of BA 25 soil samples

No. of Laboratory	1397	1398	1399	1400
No. of origin	BA 25			
Depth (cm)	0 - 24	24 - 52	52 - 77	77 - 105
TEXTURE	LA	A	A	A
Clay %	39.22	52.94	43.14	45.10
Total silts %	25.49	25.49	25.49	33.33
Total Sands %	35.29	21.57	31.37	21.57
WATER CONSTANTS				
pF 2.5 %	27.74	35.17	35.94	44.97
pF 3.0 %	20.81	29.18	28.99	36.00
pF 4.2 %	13.78	19.50	19.48	24.31
ORGANIC MATTER				
Total organic matter %	2.188	1.102	0.481	0.336
Total Carbon %	1.269	0.639	0.279	0.195
Total nitrogen %	0.096	0.055	0.026	0.019
C/N	13	12	11	10
PHOSPHORUS in ppm of P				
Total Phosphorus	256.8	175.7	162.2	175.7
Available Phosphorus	5.43	4.83	5.74	4.53
POTASSIUM in ppm of K				
Total Potassium	387.5	329.6	235.4	119.5
Available Potassium	34.32	32.33	27.36	35.32
SOIL REACTION				
pH of water (p/v: 1/2.5)	6.48	6.39	6.48	6.55

Profile BA31

Date of description (authors) : 16/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Hydromorphic ferruginized, torpical, eutrophic brown soil
- WRB : Endohypogleyic Cambisol
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : Bagassi-Ouahabou road
- Vegetation and/or use : sorghum field in park with *Vitellaria paradoxa*, *Piliostigma thoningii*, *Lannea microcarpa*, *Ziziphus mauritiana*.
- Physiographic Position : peripheral depression
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material : -
- Water Status : dry profile
- Drainage : normal to moderate
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : none
- Erosion : in diffuse sheet
- Human Influence : plowing

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-24 cm: Dark yellowish brown (10YR3/4) when moist; clay loam ; few ferruginous and ferro-manganic concretions; subangular blocky structure poorly developed into medium, fine and coarse elements; crumbly consistency ; numerous pores that are medium, fine and very fine; many roots ranging from fine to very fine; well-developed biological activity ; gradual transition.

24-60 cm: Dark yellowish brown (10YR4/4) when moist; silty clay; 5% of ferruginous and ferro-manganic concretions; subangular blocky structure poorly to moderately developed into medium, fine and coarse elements; firm consistency; quite numerous pores that are fine, very fine and medium ; fairly numerous roots that are medium, coarse and fine; well developed biological activity; gradual transition.

60-106 cm: olive brown (2.5Y4/4) when moist; 5% gray spots (10YR5/1) and dark yellowish brown spots (10YR4/6): 20% of ferruginous and ferro-manganic concretions; angular blocky structure weakly to moderately developed into coarse, medium and fine elements; firm consistency ; few pressure faces ; few pores that are very fine and fine ; quite many roots that are fine, medium, and very fine.

Results of the analyses of BA 31 soil samples

No. of Laboratory	1401	1402	1403
-------------------	------	------	------

No. of origin Depth (cm)	BA 31		
	0 - 24	24 - 60	06 - 106
TEXTURE	L	LA	LA
Clay %	27.45	29.41	37.25
Total Silts %	37.26	33.34	31.38
Total Sands %	35.29	37.25	31.37
WATER CONSTANTS			
pF 2.5 %	27.14	28.01	32.52
pF 3.0 %	17.21	18.63	23.11
pF 4.2 %	10.06	11.03	15.14
ORGANIC MATTER			
Total organic matter %	2.115	0.890	0.871
Total Carbon %	1.227	0.516	0.505
Total nitrogen %	0.087	0.044	0.044
C/N	14	12	11
PHOSPHORUS in ppm of P			
Total Phosphorus	202.7	169.0	121.6
Available Phosphorus	3.32	5.74	4.23
POTASSIUM in ppm of K			
Total Potassium	220.9	105.0	199.2
Available Potassium	42.28	52.72	33.33
SOIL REACTION			
pH of water (p/v: 1/2.5)	5.96	6.10	6.41

Profile BA 69

Date of description (authors) : 19/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Leached tropical ferruginous soil with concretions
- WRB : Ferric Lixisols
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : Road of Niankongo to Kahin
- Vegetation and/or use : savanna shrubland with *Balanites aegyptiaca*, *Lannea acida*,
Tamarindus indica, *Securinega virosa*, *Anogeissus leiocarpus*, *Acacia machrostachya*.
- Physiographic Position : upper slope
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 1-2% N-S
- Parent Material : -
- Water Status : dry profile
- Drainage : normal
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : crust
- Erosion : gully erosion
- Human Influence : field in the vicinity

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-13 cm: light gray (10YR7/2) when dry; brown (10YR5/3) when moist; sandy loam; without coarse elements ; subangular blocky structure weakly developed into fine and medium elements; soft consistency: many pores ranging from very fine to fine and medium; quite many roots being fine, very fine and large; well-developed biological activity ; distinct transition.

13-32 cm: very pale brown (10YR7/3) when dry; yellowish brown (10YR5/4) when moist; sandy clay loam ; few ferruginous concretions ; subangular blocky structure poorly developed into fine, medium and coarse elements; hard consistency: numerous pores being large, medium, fine, very fine; fairly numerous roots that are fine, very fine, medium; well-developed biological activity ; gradual transition.

32-75 cm: very pale brown (10YR7/4) when dry; yellowish brown (10YR5/6) when moist; sandy clay; some ferruginous concretions ; subangular blocky structure poorly developed into coarse and medium elements; very hard consistency; many pores being very fine, fine, medium and large; few roots that are fine, very fine ; well developed biological activity; distinct transition.

75-110 cm: very pale brown (10YR7/4) when dry, brownish yellow (10YR6/6) when moist; 5% yellowish red spots (5YR5/6); clay loam; 20% of ferruginous concretions ; subangular blocky structure developed into coarse, medium, fine elements; hard consistency; many pores that are large, medium, fine; few roots that are very fine and fine, poorly developed biological activity.

Note: slaking crusts on the surface and many channels of water erosion.

Results of the analyses of BA 69 soil samples

No. of Laboratory	1414	1415	1416	1417
No. of origin	BA 69			
Depth (cm)	0 - 13	13 - 32	32 - 75	75 - 110
TEXTURE	L	LS	L	L
Clay %	13.73	15.69	27.45	23.53
Total silt %	41.17	31.37	29.41	39.22
Total sand %	45.10	52.94	43.14	37.25
WATER CONSTANTS				
pF 2.5 %	17.43	15.97	18.79	22.01
pF 3.0 %	12.32	12.81	15.92	18.23
pF 4.2 %	5.17	9.51	13.16	15.24
ORGANIC MATTER				
Total organic matter %	1.919	1.138	0.802	0.693
Total Carbon %	1.113	0.660	0.465	0.402
Total nitrogen %	0.087	0.055	0.044	0.036
C/N	13	12	11	11
PHOSPHORUS in ppm of P				
Total Phosphorus	175.7	162.2	135.2	108.1
Available Phosphorus	11.77	7.24	10.56	9.66
POTASSIUM in ppm of K				
Total Potassium	10641.2	11394.5	9699.5	8757.8
Available Potassium	55.21	16.41	19.40	24.37
SOIL REACTION				
pH of water (p/v: 1/2.5)	5.16	4.60	4.33	4.43

Profile BA76

Date of description (authors) : 18/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Leached ferruginous tropical soil with spots and concretions
- WRB : gleyic, hypoferric, rhodic lixisol
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : South of San
- Vegetation and/or use : sorghum field in savannah park with *Vitellaria paradoxa* *Lannea microcarpa*, *Acacia seyal*, *Piliostigma thonningii*, *Parkia biglobosa*, *Diospyros mespiliformis*.
- Physiographic Position : downslope
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material : -
- Water Status : dry profile
- Drainage : normal to moderate
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : none
- Erosion : diffuse sheet
- Human Influence : crops

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-17 cm: dark brown (7.5 YR 3 /4) when moist; sandy loam ; few ferruginous concretions ; subangular blocky structure poorly developed into coarse, medium, fine elements; hard consistency; numerous pores that are large, medium, fine; fairly numerous roots that are fine and very fine; well-developed biological activity ; distinct transition.

17-40 cm: bright brown (7.5 YR4/6) when moist; sandy clay; subangular blocky structure poorly developed into coarse and medium elements; little hard consistency when dry ; numerous fine and large pores; numerous roots that are fine, medium and large; well developed biological activity; 5% of ferruginous and ferro-manganic concretions; distinct transition.

40-76 cm: yellowish red (5YR4/6) when moist ; 10% of grayish brown spots (10YR5/2); silty clay; 15 % of ferruginous and ferro-manganic concretions; massive structure ; hard consistency ; many pores that are medium, fine, very fine, large; few roots that are fine and very fine; well-developed biological activity ; gradual transition.

76-110 cm: bright brown (7.5 YR4/6) when moist; 20% of yellowish red and gray spots; silty clay; 10% of ferruginous concretions; massive structure; very hard consistency when dry ; numerous pores that are fine and very fine; few roots being fine and very fine; well-developed biological activity.

Results of the analyses of BA 76 soil samples

No. of Laboratory	1421	1422	1423	1424
No. of origin	BA 76			
Depth (cm)	0 - 17	17 - 40	40 - 76	76 - 110
TEXTURE	L	LA	A	A
Clay %	13.73	35.29	41.18	41.18
Total silt %	43.13	33.34	27.45	27.45
Total sand %	43.14	31.37	31.37	31.37
WATER CONSTANTS				
pF 2.5 %	22.61	21.82	26.15	26.30
pF 3.0 %	10.02	15.88	18.53	18.89
pF 4.2 %	7.96	14.26	15.93	16.41
ORGANIC MATTER				
Total organic matter %	1.564	0.657	0.445	3.183
Total carbon %	0.907	0.381	0.258	1.846
Total nitrogen %	0.070	0.029	0.022	0.125
C/N	13	13	12	15
PHOSPHORUS in ppm of P				
Total Phosphorus	189.2	202.7	148.7	148.7
Available Phosphorus	5.74	9.36	9.96	10.87
POTASSIUM in ppm of K				
Total Potassium	9322.8	996.0	3672.6	3861.0
Available Potassium	48.25	31.34	55.21	73.12
SOIL REACTION				
pH of water (p/v: 1/2.5)	5.88	5.15	5.15	5.20

Profile BA103

Date of description (authors) : 18/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Leached ferruginous tropical soils with spots and concretions
- WRB : gleyic, hypoferric, rhodic lixisol.
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : East Kahin
- Vegetation and/or use : sorghum field in savannah park with *Vitellaria paradoxa* *Parkia biglobosa*.
- Physiographic Position : average slope
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material : -
- Water Status : dry profil
- Drainage : moderate
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : none
- Erosion : in diffuse sheet
- Human Influence : crops

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-14 cm: brown (10YR4/3) when moist; sandy loam; subangular blocky structure poorly developed into fine, medium and coarse elements; soft consistency; numerous pores that are large, medium and fine; few roots that are fine and very fine ; well-developed biological activity; distinct transition.

14-36 cm: dark brown (7.5YR4/4) when moist ; 5% of yellowish dark brown spots (10YR4/6); clay loam ; few ferruginous and ferro-manganic concretions; subangular blocky structure poorly developed into coarse and means elements; hard consistency when dry , numerous large, medium and fine pores, rare roots that are very fine; well developed biological activity; distinct transition.

36-64 cm: bright brown (7.5 YR4/6) when moist ; 10% of yellowish red spots (5YR4/6); silty clay; 30% of ferruginous concretions ; subangular blocky structure poorly developed into coarse and medium elements; hard consistency; numerous pores that are medium, fine, large; not visible roots; well developed biological activity; gradual transition.

64-103 cm: yellowish brown (10YR5/4) when moist ; 10% of yellowish red spots; silty clay; 50% of ferruginous and ferro-manganic concretions; massive structure; very hard when dry; numerous pores that are large, medium and fine; not visible roots; well developed biological activity.

Results of the analyses of BA 103 soil samples

No. of Laboratory	1431	1432	1433	1434
No. of origin	BA 103			
Depth (cm)	0 - 14	14 - 36	36 - 64	64 - 103
TEXTURE	LF	LA	A	A
Clay %	15.69	33.33	43.14	43.14
Total silt %	56.86	41.18	35.29	33.33
Total sand %	27.45	25.49	21.57	23.53
WATER CONSTANTS				
pF 2.5 %	22.87	24.35	31.73	26.91
pF 3.0 %	13.35	16.60	21.28	20.23
pF 4.2 %	9.87	13.65	18.06	16.12
ORGANIC MATTER				
Total organic matter %	2.064	1.531	0.978	0.586
Total Carbon %	1.197	0.888	0.567	0.340
Total nitrogen %	0.087	0.070	0.048	0.034
C/N	14	13	12	10
PHOSPHORUS in ppm of P				
Total Phosphorus	162.2	162.2	189.2	175.7
Available Phosphorus	5.13	2.41	5.43	4.23
POTASSIUM in ppm of K				
Total Potassium	916.3	1314.8	1713.2	1633.5
Available Potassium	130.32	49.24	34.32	30.34
SOIL REACTION				
pH of water (p/v : 1/2.5)	5.89	5.51	5.52	5.49

Profile BA44

Date of description (authors) : 17/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Moderately deep, indurated, leached, ferruginous and tropical soil
- WRB : Epipetric Plinthosols
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : South of Sipohin
- Vegetation and/or use : millet field in park with Vitellaria paradoxa.
- Physiographic Position : Upper slope
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material : -
- Water Status : fresh profile
- Drainage : normal
- Groundwater : not affected
- Surface coarse elements : ferruginous gravel
- Rocky Outcrop : crust at 10 m of profile
- Erosion : sheet erosion
- Human Influence : crops

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-20 cm: brown (10YR4/3) when moist; sandy loam; 40% of ferruginous gravel; subangular blocky structure poorly developed into fine and very fine elements; crumbly consistency; numerous pores that are large, medium and fine ; fairly numerous roots that are fine, very fine; well developed biological activity; distinct transition.

20-48 cm: yellowish brown (10YR4/3) when dry; sandy clay loam; 5 % of ferruginous gravel; subangular blocky structure poorly developed into medium and fine elements; crumbly consistency; numerous pores being large, medium and fine; few roots that are fine and very fine; poorly developed biological activity; regular abrupt transition.

48-95 cm: horizon ferruginous and porous shell, weakly cemented; very few and very fine roots.

Results of the analyses of BA 44 soil samples

No. of Laboratory	1407	1408
No. of origin	BA 44	
Depth (cm)	0 - 20	20 - 48
TEXTURE	L	L
Clay %	11.76	13.73
Total silt %	37.26	35.29
Total sand %	50.98	50.98
WATER CONSTANTS		
pF 2.5 %	16.92	17.01
pF 3.0 %	10.61	11.04
pF 4.2 %	6.75	6.56
ORGANIC MATTER		
Total organic matter %	2.133	1.065
Total Carbon %	1.237	0.618
Total nitrogen %	0.096	0.051
C/N	13	12
PHOSPHORUS in ppm of P		
Total Phosphorus	202.7	189.2
Available Phosphorus	5.43	8.15
POTASSIUM in ppm of K		
Total Potassium	503.5	460.0
Available Potassium	61.18	21.39
SOIL REACTION		
pH of water (p/v: 1/2.5)	6.64	6.51

Profile BA 12

Date of description (authors) : 20/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : *Deep, indurated, leached, tropical and ferruginous soil*
- WRB : endopetroplinthic, ferric, chromic Lixisol
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : Bounou-Mamou Road
- Vegetation and/or use : corn field in park with *Lannea microcarpa*, *L. acida*, *L. velutina*, *Prosopis africana*, *Vitellaria paradoxa*, *Parkia biglobosa*, *Sclerocarya birrea*, *Diospyros mespiliformis*.
- Physiographic Position : upper slope
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material :-
- Water Status : dry profile
- Drainage : normal
- Groundwater : not affected
- Surface coarse elements : Spreading of gravel
- Rocky Outcrop : none
- Erosion : low sheet erosion
- Human Influence : crops

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-10 cm: brown (10YR4/3) when moist; sandy clay loam; 10% of ferruginous gravel; subangular blocky structure poorly developed into coarse and medium elements; hard consistency ; numerous pores that are large and fine; few roots that are very fine and fine ; well developed biological activity; distinct transition.

10-64 cm: brown (7.5 YR5/4) when moist; silty clay; 90% of ferro-manganic concretions; sub-angular blocky structure poorly developed into fine and very fine elements ; hard consistency ; numerous pores that are medium, large and fine; few roots that are very fine; well developed biological activity; irregular abrupt transition .

64-90 cm: horizon of ferruginous carapace; not visible roots; low biological activity.

Results of the analyses of BA 44 soil samples

No. of Laboratory	1395	1396
No. of origin	BA 12	

Depth (cm)	0 - 10	10 - 64
TEXTURE	L F	A
Clay %	15.69	43.14
Total silt %	54.90	39.21
Total sand %	29.41	17.65
WATER CONSTANTS		
pF 2.5 %	26.81	27.84
pF 3.0 %	16.35	22.33
pF 4.2 %	7.84	16.09
ORGANIC MATTER		
Total organic matter %	2.633	1.459
Total Carbon %	1.527	0.846
Total nitrogen %	0.111	0.073
C/N	14	12
PHOSPHORUS in ppm of P		
Total Phosphorus	256.8	243.3
Available Phosphore	6.34	2.41
POTASSIUM in ppm of K		
Total Potassium	1977.6	4103.6
Available Potassium	190.01	52.23
SOIL REACTION		
pH of water (p/v: 1/2.5)	6.64	6.73

Profile BA 101

Date of description (authors) : 20/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Deep, indurated, leached, tropical and ferruginous soil
- WRB : Gleyinc and endopetroplinthic lixisol
- Coordinates : -

2°) ENVIRONNEMENT OF THE PROFILE

- Location : Bounou-Mamou Road
- Vegetation and/or use : sorghum field in park with *Vitellaria paradoxa*.
- Physiographic Position : downslope
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material : -
- Water Status : dry profile
- Drainage : moderate.
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : none
- Erosion : in sheet erosion
- Human Influence : crops.

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-18 cm: pale brown (10YR6/3) when dry ; 5% of bright brown spots (7.5YR4/6); sandy loam ; subangular blocky structure poorly developed into fines, coarse and medium elements; soft consistency; numerous pores being very fine, fine and medium; fairly numerous roots that are very fine and fine; well developed biological activity; gradual transition.

18-41 cm: pale brown (10YR6/3) when dry; 10% of bright brown spots (7.5YR5/6); clay loam ; subangular blocky structure poorly developed into coarse, medium and fine elements; slightly hard consistency ; numerous pores that are very fine, fine; medium and large; few and very fine roots ; well developed biological activity; distinct transition.

41-63 cm: brownish gray (10YR6/2) when dry ; 5% of bright brown spots (7.5 YR5/6); silty clay ; 15% of ferruginous concretions ; subangular blocky structure poorly developed into fine means and coarse elements; little hard consistency when dry; few pores that are large, medium and fine; rare roots that are very fine; well developed biological activity; irregular abrupt transition.

More than 63 cm: ferruginous shell

Results of the analyses of BA 101 soil samples

No. of Laboratory	1428	1429	1430
No. of origin	BA 101		

Depth (cm)	0 - 18	18 - 41	41 - 63
TEXTURE	LF	LF	LA
Clay %	9.80	15.69	37.25
Total silt %	68.63	58.82	41.18
Total sand %	21.57	25.49	21.57
WATER CONSTANTS			
pF 2,5 %	20.53	23.09	31.99
pF 3,0 %	9.79	15.37	18.88
pF 4,2 %	6.82	12.58	17.09
ORGANIC MATTER			
Total organic matter %	0.978	0.838	0.817
Total Carbon %	0.567	0.486	0.474
Total nitrogen %	0.044	0.041	0.041
C/N	13	12	12
PHOSPHORUS in ppm of P			
Total Phosphorus	135.2	148.7	148.7
Available Phosphorus	10.26	3.32	3.92
POTASSIUM in ppm of K			
Total Potassium	1155.4	2669.4	3625.5
Available Potassium	42.28	25.37	36.31
SOIL REACTION			
pH of water (p/v: 1/2.5)	5.59	4.87	4.89

Profile BA72

Date of description (authors) : 19/06/2012 (NEBIE, PARE)

1°) SOIL CLASSIFICATION

- CPCS (1967) : Surface pseudogley, low humic hydromorphic soil
- WRB : **vertic gleysol**
- Coordinates : -

2°) ENVIRONMENT OF THE PROFILE

- Location : lowland of Niankongo
- Vegetation and/or use : **rice field in park with** *Mitragyna inermis*, *Ficus gnaphalocarpa*.
- Physiographic Position : lowland
- Surrounding Topography : almost flat
- Microtopography : none
- Slope : 0.5%
- Parent Material : alluvium
- Water Status : dry profile in the 1st horizon, fresh beyond
- Drainage : imperfect.
- Groundwater : not affected
- Surface coarse elements : none
- Rocky Outcrop : none
- Erosion : in sheet erosion
- Human Influence : crops

3°) MORPHOLOGICAL DESCRIPTION OF THE PROFILE

0-26 cm: dark brown (10YR3/3) when moist; 30% of yellowish red spots (5YR4/6); silty clay; subangular blocky structure poorly developed into very coarse material; very hard consistency; few pores that are very fine and fine; numerous roots that are very fine, fine and medium; well developed biological activity; distinct transition.

26-67 cm: dark gray (10YR4/1) when moist; 20% of dark brown yellowish spots (10YR4/6); clay ; angular blocky structure moderately developed into coarse, medium and fine elements; firm consistency; few pores that are fine and very fine; numerous roots being fine and very fine; poorly developed biological activity; gradual transition.

67-115 cm : gray (10YR5/1) when wet; 20% of dark yellowish brown spots (10YR4/6); clay ; angular blocky structure poorly developed into coarse and very coarse elements; firm consistency; some pressure faces; few pores that are very fine and fine; few and very fine roots ; poorly developed biological activity.

Note: presence of a number of shrinkage cracks in the profile and at the ground surface.

Results of the analyses of BA 72 soil samples

No. of Laboratory	1418	1419	1420
No. of origin	BA 72		
Depth (cm)	0 - 26	26 - 67	67 - 115
TEXTURE	LAF	A	A
Clay %	35.29	54.90	58.82
Total silt %	54.91	35.30	25.49
Total sand %	9.80	9.80	15.69
WATER CONSTANTS			
pF 2.5 %	40.98	72.47	44.81
pF 3.0 %	31.72	37.25	36.68
pF 4.2 %	27.74	33.19	32.43
ORGANIC MATTER			
Total organic matter %	3.574	2.489	1.210
Total Carbon %	2.073	1.444	0.702
Total nitrogen %	0.140	0.125	0.066
C/N	15	12	11
PHOSPHORUS in ppm of P			
Total Phosphorus	581.2	601.5	216.3
Available Phosphorus	7.24	5.13	6.64
POTASSIUM in ppm of K			
Total Potassium	3107.6	7251.1	3861.0
Available Potassium	60.18	62.17	46.26
SOIL REACTION			
pH of water (p/v: 1/2.5)	4.45	5.41	5.96

Table of the contents of heavy metals

SOIL SAMPLES / PROFILES-PROF	Recvd Wt.	Arsenic (As)	Cadmium (Cd)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)
DESCRIPTION	kg	ppm	Ppm	ppm	Ppm	ppm	ppm	ppm
DETECTION	0.02	0.02	0.01	0.01	0.005	0.1	0.01	0.1
BA12 0 -10	0.66	13.45	0.01	29.3	0.015	13.0	11.25	15.0
BA12 10 - 64	0.84	27.0	0.04	64.7	0.011	21.2	30.9	22.0
BA25 0 - 24	0.58	5.81	0.06	100.0	0.024	41.0	5.60	54.8
BA25 24 - 52	0.62	3.97	0.04	109.5	0.025	42.0	4.39	67.8
BA25 52 - 77	0.53	4.12	0.04	125.5	0.018	43.6	3.51	80.4
BA25 77 - 105	0.56	2.47	0.03	124.5	0.014	32.7	2.35	92.4
BA31 0 - 24	0.63	1.96	0.02	71.9	0.015	60.4	5.87	24.9
BA31 24 - 60	0.68	4.26	0.02	94.7	0.016	76.6	6.89	21.1
BA31 60 - 106	0.77	3.36	0.05	95.5	0.016	91.8	9.01	24.2
BA39 0 - 22	0.66	4.03	0.06	74.8	0.040	28.9	8.12	73.4
BA39 22 - 62	0.65	2.17	0.03	78.4	0.017	34.3	6.55	58.3
BA39 62 - 105	0.76	1.68	0.02	71.5	0.012	31.2	5.38	52.2
BA44 0 - 20	1.01	14.00	0.01	41.3	0.017	12.0	15.15	14.9
BA44 20 - 48	0.91	16.40	<0.01	50.7	0.016	11.8	20.2	14.2
BA55 0 - 14	0.80	8.37	0.04	227	0.019	51.2	10.85	55.6
BA55 14 - 48	0.79	6.03	0.05	263	0.019	77.2	12.15	56.1
BA60 0 - 22	0.73	2.74	0.07	85.6	0.019	35.3	5.67	70.6
BA60 22 - 60	0.80	2.16	0.03	82.5	0.015	38.2	5.49	65.4
BA60 60 - 100	0.67	1.85	0.03	73.2	0.011	35.6	5.31	56.6
BA69 0 - 13	0.55	2.94	0.01	19.75	0.014	12.0	4.03	3.7
BA69 13 - 32	0.55	3.07	<0.01	19.80	0.009	11.9	4.10	2.9
BA69 32 - 75	0.59	3.23	<0.01	16.05	0.010	9.2	4.62	2.9
BA69 75-110	0.61	7.79	<0.01	17.15	0.012	8.5	7.10	2.8
BA72 0 - 26	0.57	2.08	0.06	43.5	0.027	22.5	7.12	45.9
BA72 26 - 67	0.52	2.94	0.06	65.4	0.015	37.0	8.79	62.2
BA72 67 - 115	0.58	4.59	0.05	78.4	0.019	51.9	7.91	63.6
BA76 0 - 17	0.56	1.75	0.01	18.85	0.013	12.9	7.54	9.5
BA76 17 - 40	0.64	4.43	0.01	23.9	0.008	15.1	10.25	10.2
BA76 40 - 76	0.58	4.33	<0.01	23.9	0.012	15.9	14.75	9.4
BA76 76 - 110	0.58	2.10	<0.01	18.70	0.011	13.3	12.85	8.2
BA84 0 - 20	0.65	9.09	0.04	156.5	0.012	63.1	9.02	44.2
BA84 20 - 50	0.60	2.11	0.02	62.6	0.018	35.8	5.33	35.9
BA84 50 - 66	0.64	1.78	0.05	65.0	0.023	52.7	4.54	42.7
BA101 0 - 18	0.69	1.08	0.02	9.34	<0.005	6.0	3.72	3.8
BA101 18 - 41	0.67	1.06	<0.01	11.65	<0.005	6.7	4.79	3.8
BA101 41 - 63	0.78	3.59	<0.01	23.8	<0.005	11.6	7.34	4.8
BA103 0 - 14	0.57	1.89	0.01	12.00	0.005	8.3	4.87	7.4
BA103 14 - 36	0.56	3.66	0.01	18.55	0.007	12.2	5.70	8.1
BA103 36 - 64	0.60	7.78	<0.01	26.7	<0.005	15.0	9.03	9.8

SOIL SAMPLES / PROFILES-PROF	Recvd Wt.	Arsenic (As)	Cadmiu m (Cd)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)
BA103 64 -103	0.67	12.90	<0.01	35.6	0.010	15.4	18.05	7.1

APPENDIX 5 :
AIR QUALITY REPORT

Roxgold Baseline Monitoring Study

Report Prepared for

Roxgold S.A.R.L



Report Prepared by

 **srk** consulting

October 2013

Roxgold Baseline Monitoring Study

Roxgold S.A.R.L

SRK Consulting (South Africa) Pty Ltd.

Section A Second Floor

IBM House

54 Norfolk Terrace

Westville 3630

South Africa

e-mail: Durban@srk.co.za

website: www.srk.co.za

Tel: +27 (0) 31 279 1200

Fax: +27 (0) 31 279 1204

SRK Project Number 457084

October 2013

Compiled by:

D. Naidoo
Scientist

Email: dnaidoo@srk.co.za

Authors:

D. Naidoo

Peer Reviewed by:

V.S. Reddy (Pr. Sci. Nat)
Partner

Executive Summary

Introduction

Roxgold Inc appointed SRK Consulting (South Africa) Pty Ltd to undertake a baseline air quality monitoring study for the proposed gold mining project near Yaramoko, Burkina Faso.

This report documents the findings of the first four months of baseline air quality monitoring that was undertaken from May to August 2013.

Objectives

The following objectives have been outlined for the baseline study:

- Describe the climatic conditions of the proposed project area;
- Conduct four months of baseline air quality monitoring to assess and determine ambient air quality conditions within the proposed project area and areas that are likely to be affected by the project activities for the period under review; and
- Identify existing sources of emissions (particulate and gaseous) in the project area.

Scope of work

The following scope of work was undertaken for the baseline study:

- The relevant regulatory framework (World Bank/International Finance Corporation guidelines) for air quality control was reviewed and summarised, as they apply to the project;
- A site visit was undertaken during April 2013 and the following tasks were completed:
 - An air quality sampling protocol was prepared for this site;
 - A dust and gas monitoring network to monitor to undertake periodic air quality sampling and analysis of dust fallout, particulate matter <10 microns, particulate matter <2.5 microns, nitrogen dioxide and sulfur dioxide was installed;
 - A weather station was also installed at the Roxgold Mine Camp to monitor rainfall, temperature, wind speed and wind direction on an hourly basis;
 - Roxgold staff were trained to maintain and operate the monitoring network that was set up for this site;
- Laboratory results were assessed and compared against relevant standards or guidelines; and
- A baseline report (this report) was compiled detailing the following:
 - A description of relevant climatic conditions, and
 - A description of the baseline air quality within the project area.

Climate

Meteorological data has been collected for the period from May 2013 to August 2013. The total rainfall for the period is 840 mm most of which falls from June to August. The average temperature for the period under review is 27.8°C, with a maximum temperature of 40°C recorded in May and a minimum temperature of 20° recorded in June, July and August. The prevailing winds are from the north and northwest with a lower occurrence of winds from the north-northwest and north-northeast. The average wind speed at the Roxgold Mine Camp for all hours is 1.69 m/s (6.1 km/hr.) with maximum speeds lower than 8.8 m/s (31.7 km/hr.) for the period May 2013 to August 2013. With the current climatic conditions observed in the area it is expected that the potential for dust dispersion is lower during this period (May to August) as a result of the relatively wet conditions and low winds speeds.

Summary of baseline air quality results

The following was observed from the dust fallout data:

- Dust fallout concentrations exceeded the Action Residential Level 14 times and the Action Industrial Level 7 times during the monitoring period (Details of exceedances are provided in Table ES 1); and
- The highest measured dust fallout concentration was 2,026 mg/m²/day at RGDM05 and the lowest recorded concentration was 24 mg/m²/day also at RGDM05.

Table ES 1: Summary of dust fallout results

Sampling point	Minimum measured concentration (mg/m ² /day)	Maximum measured concentration (mg/m ² /day)	No. of exceedances of Action Residential Level	No. of exceedances of Action Industrial Level
RGDM01	137	973	2	0
RGDM02	48	1,611	2	1
RGDM03	85	1,572	1	1
RGDM04	40	1,175	1	0
RGDM05	24	2,026	2	2
RGDM06	168	1,216	2	1
RGDM07	435	784	1	0
RGDM08	364	2,061	3	2

The following was observed from the PM data:

- The 24-hour PM₁₀ concentrations are low and below the World Bank/IFC guideline level of 50 µg/m³ except on the 26 June 2013 where a PM₁₀ concentration of 148 µg/m³ was measured. The average 24-hour PM₁₀ concentrations were below the World Bank/International Finance Corporation guideline of 50 µg/m³ for the entire monitoring period with a maximum average 24-hour concentration of at 34.8 µg/m³.
- The baseline 24-hour PM_{2.5} concentrations were low and below the World Bank/IFC guideline of 20 µg/m³ for most of the monitoring period, the World Bank guideline level was exceeded two times, on the 29 April 2013 (33.1 µg/m³) and the 30 April 2013 (22.7 µg/m³). The PM_{2.5} concentrations were below the World Bank/International Finance Corporation guideline of 20 µg/m³ for the entire monitoring period, with a maximum average 24-hour concentration measured at 12.2 µg/m³.

Table ES 2: Summary of PM₁₀ results

Sampling point	Minimum measured concentration (µg/m ³)	Maximum average 24 hour measured concentration (µg/m ³)	No. of exceedances of guideline
PM ₁₀	11.2	34.8	0
PM _{2.5}	3.2	12.2	0

The following was observed from the gas data:

The gas concentrations were below the respective guidelines for the entire monitoring period from May 2013 to August 2013.

Table ES 3: Summary of gas results

Sampling	Minimum measured	Maximum measured	No. of exceedances
----------	------------------	------------------	--------------------

point	concentration ($\mu\text{g}/\text{m}^3$)	concentration ($\mu\text{g}/\text{m}^3$)	of guidelines
SO ₂	<0.27	6.95	0
NO ₂	<0.35	0.47	0

Conclusions

Based on the findings of this assessment the following were concluded:

- Based on SRK's observations made during the site visit no major dust sources were identified within the proposed project area other than windblown dust and the entrainment of dust by vehicles, especially on unpaved roads;
- Based on the location of the site and the tropical climate of the area, windblown dust generation within the project area is expected to be low as a result of rainfall occurring during the wet season and high during the dry season;
- The on-site weather station is suitably located to record climatic data in the area, and compares very well to data obtained from the Boromo weather station (located ~ 34km east) similarities between the datasets were observed;
- The dust fallout data for the period from May 2013 to October 2013 falls entirely within the wet season (March to October) experienced in the project area. The May results may be representative of the transition between the two seasons and this may be the reason for the relatively elevated dust fallout concentrations measured during May;
- The 24-hour PM₁₀ concentrations are low and below the World Bank/IFC guideline level of 50 $\mu\text{g}/\text{m}^3$ except on the 26 June 2013 where a PM₁₀ concentration of 148 $\mu\text{g}/\text{m}^3$ was measured. Dust generating activities such as vehicle entrainment of dust, windblown dust from the roadside etc. may contribute to the PM₁₀ concentrations measured at the Roxgold mine camp;
- The baseline 24-hour PM_{2.5} concentrations were low and below the World Bank/IFC guideline of 20 $\mu\text{g}/\text{m}^3$ for most of the monitoring period, the World Bank guideline level was exceeded two times, on the 29 April 2013 (33.1 $\mu\text{g}/\text{m}^3$) and the 30 April 2013 (22.7 $\mu\text{g}/\text{m}^3$). The PM_{2.5} monitor experienced a fault which affected the collection of suitable data for two months (June and July) during the monitoring, however, it has been repaired and monitoring has continued;
- The baseline SO₂ and NO₂ levels in the project area suggest that the levels of these gases in the ambient air in the area are low. The 24-hr SO₂ and 1-hr NO₂ monitoring results were below their respective World Bank/IFC guidelines for the period under observation; and
- Currently, the villages within and surrounding the proposed project areas have been identified as sensitive receptors. The villages of Yaro, Haho, Doussi, Kaho, Siphohin and Bagassi are closest to the mining operations and may be within the impacted zone. Baseline dust fallout levels exceed the Action Residential Level during May, suggesting that during the dry season dust fallout levels are naturally elevated in the area.

Recommendations

- The continuation of the existing monitoring program to determine seasonal trends for dust and gas is required. Monitoring during construction and operational phases to determine the levels and extent of impacts associated with the mining operation will be required to compare against baseline concentrations.
- Where necessary during the construction and operational phase make minor adjustments to accommodate the installation of new infrastructure as and when this occurs i.e. should new infrastructure result in the existing network being damaged then a substitute point in the vicinity of the existing location must be installed. In instances where activities change such that monitoring of dust and gas is required then the network must be adjusted accordingly;
- Log any activities taking place in and around the mine area that could impact on air quality should, so as to determine whether that activity has had an influence on air quality;
- PM₁₀ and PM_{2.5} monitoring needs to continue as monitoring in order to establish dry season conditions (November to March). Continuous monitoring during the seasons will allow for suitable trends in PM₁₀ and PM_{2.5} to be established; and
- Reduce project vehicle speeds on unpaved roads and limit speeds to less than 40 km/hr on roads especially those passing through villages.

Table of Contents

Executive Summary	ii
Disclaimer	vii
1 Introduction and Background.....	1
1.1 Introduction.....	1
1.2 Background	1
2 Objectives and Scope of Work	4
2.1 Objectives.....	4
2.2 Scope of Work	4
3 Assumptions and Limitations	4
4 Ambient air quality guidelines and standards	5
4.1 Particulate Matter.....	5
4.1.1 PM ₁₀	5
4.1.2 PM _{2.5}	5
4.2 Sulfur dioxide (SO ₂)	6
4.3 Nitrogen dioxide (NO ₂)	7
4.4 Dust fallout standards	8
5 Methodology	9
5.1 Site visit.....	9
5.2 Installation and set-up of baseline monitoring network	9
5.2.1 Selection of monitoring locations.....	10
5.2.2 Installation et méthodes d'échantillonnage.....	12
5.3 Installation and sampling methodologies	15
5.4 Data processing and reporting	14
5.4.1 PM ₁₀ and PM _{2.5}	15
5.4.2 Dust fallout	14
5.4.3 Passive gas sampling.....	15
5.4.4 Meteorological data	15
6 Meteorological Conditions.....	166
6.1 Rainfall.....	16
6.2 Température.....	20
6.3 Wind	20
7 Baseline Air Quality Results	22
7.1 Dust Fallout.....	22
7.2 Particulate Matter.....	23
7.2.1 PM ₁₀	30
7.2.2 PM _{2.5}	31

7.3	Passive Gas Sampling.....	29
7.3.1	SO ₂	32
7.3.2	NO ₂	33
8	Conclusions	34
9	Recommendations.....	34
10	References	37
Appendix A:	Laboratory Certificates	Error! Bookmark not defined.

List of Tables

Table 4-1:	Air quality guidelines and standards for PM ₁₀ in µg/m ³	5
Table 4-2:	Air quality guidelines and standards for PM _{2.5} in µg/m ³	6
Table 4-3:	Ambient air quality guidelines and standards for SO ₂ in µg/m ³	6
Table 4-4:	Ambient air quality guidelines and standards for NO ₂ in µg/m ³	8
Table 4-5:	SANS 1929:2011. Target values given in mg/m ² /day.....	8
Table 5-1:	Air quality sampling locations	10
Table 6-1:	Total monthly rainfall at the Roxgold mine camp for the period May 2013 to August 2013.	20
Table 6-2:	Average, maximum and minimum monthly temperatures at the Roxgold mine camp for the period April 2013 to August 2013.....	21
Table 6-4:	Comparison of wind speeds at the Roxgold Mine Camp and Boromo in m/s.....	21
Table 7-1:	Dust fallout results for the period May 2013 to August 2013 in mg/m ² /day.	26
Table 7-2:	Average 24 hour PM ₁₀ concentrations for the period from May 2013 to August 2013.....	27
Table 7-3:	Average 24 hour PM _{2.5} concentrations for the period from May 2013 to August 2013.....	30
	Average 24 hour PM _{2.5} concentrations for the period from May 2013 to August 2013..	31
Table 7-4:	SO ₂ results for the period May 2013 to August 2013 in µg/m ³	32
Table 7-5:	NO ₂ results for the period May 2013 to August 2013 in µg/m ³	33

List of Figures

Figure 1-1:	Site Locality	3
Figure 5-1:	Location of monitoring points.....	11
Figure 5-2:	Dust fallout monitor installed within the Roxgold mine concession.....	12
Figure 5-3:	PM ₁₀ and PM _{2.5} monitors installed at the Roxgold Mine Camp.....	13
Figure 5-4:	Radiello gas monitors.....	14
Figure 5-5:	Weather station at Roxgold Mine Camp.....	15
Figure 6-1:	Location of weather stations.....	19
Figure 6-2:	Rainfall at the Roxgold mine camp for the period May 2013 to August 2013.....	20
Figure 6-3:	Comparison of average monthly temperatures at the Roxgold mine camp and Boromo.....	21
Figure 6-4:	Wind class frequency distribution.....	23

Figure 6-5: All hours, day time and night time wind roses.....	24
Figure 6-6: Monthly wind roses.....	25
Figure 6-7: Comparison of average monthly wind speeds at the Roxgold Mine Camp and Boromo.....	26
Figure 7-1: Dust fallout results for the period May 2013 to August 2013.....	29
Figure 7-2: 24 hour PM ₁₀ concentrations for the period May 2013 to August 2013.....	31
Figure 7-3: 24 hour PM _{2.5} concentrations at the Roxgold mine camp for the period 14 May 2013 to 31 August 2013.....	32

Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) Pty Ltd (SRK) by Roxgold S.A.R.L (Roxgold). The opinions in this Report are provided in response to a specific request from Roxgold to do so. SRK has exercised all due care in reviewing the supplied information. 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 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.

1 Introduction and Background

1.1 Introduction

Roxgold Inc (Roxgold) appointed SRK Consulting (South Africa) Pty Ltd (SRK) to undertake a baseline air quality monitoring study for the proposed gold mining project near Yaramoko, Burkina Faso.

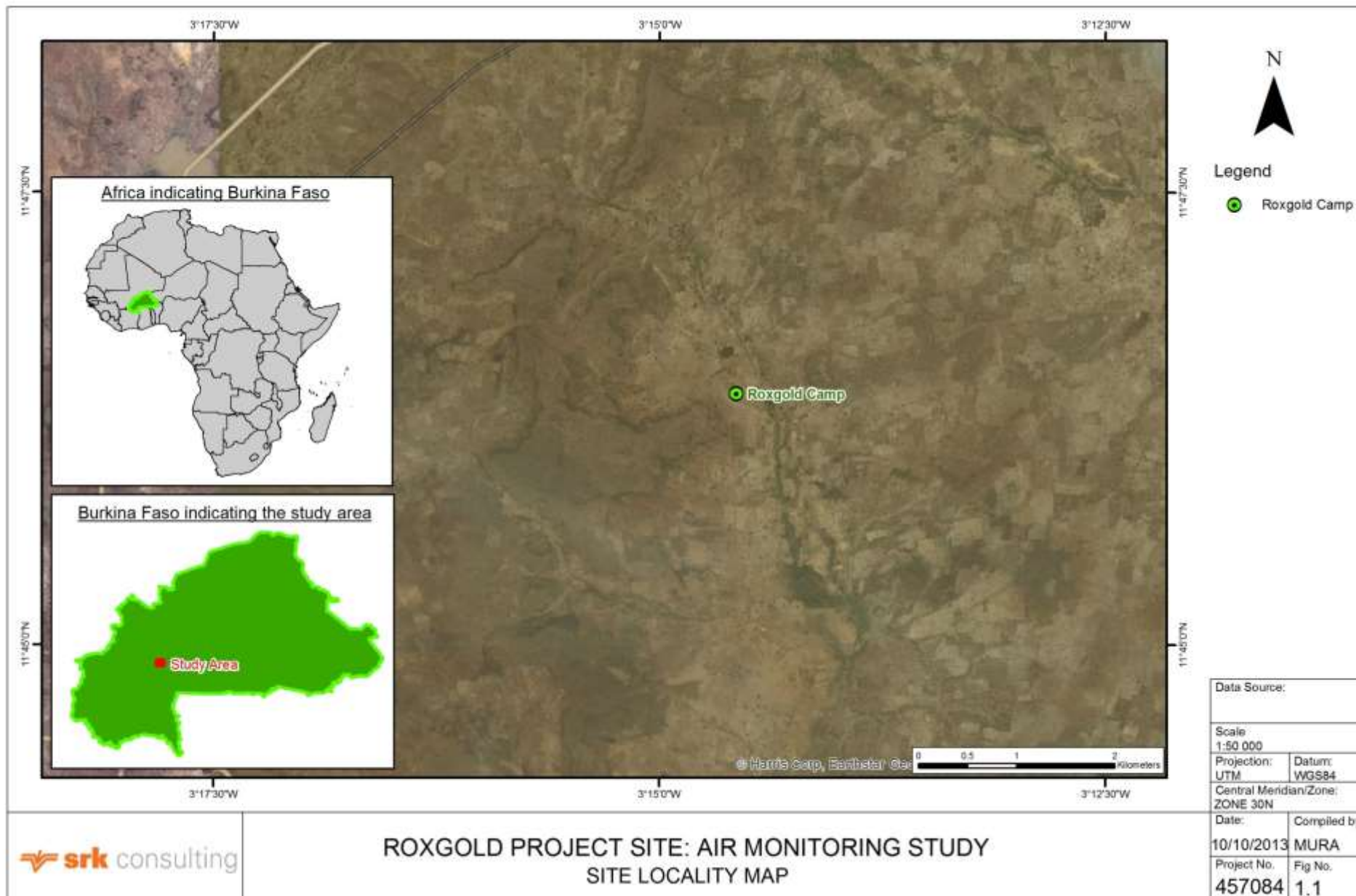
This report documents the findings of the first four months of baseline air quality monitoring that was undertaken from May to August 2013.

1.2 Background

Roxgold is a Canadian registered company, listed on the TSX Venture Exchange, with exploration assets in Burkina Faso as well as registered offices in Toronto and in Ouagadougou where its Burkinabe entity, Roxgold SARL is based. It is a gold focussed exploration company with 5 tenements in the country (Yaramoko, Solna (3) and Bouboulou), with the focus being on its Yaramoko concession, where the company intends to develop its project around the 55 Zone gold deposit. The total company tenements in Burkina Faso cover an area of 620km². The proposed project area in the Yaramoko concession is 167 km².

The Yaramoko Gold Project is 100% owned by Roxgold and features the proposed development of an underground mining operation, processing plant, tailings storage facility, accommodation camp and all related infrastructure to mine and process ore from the 55 Zone gold deposit. The project is located in Burkina Faso, West Africa, approximately 180 km southwest of the capital, Ouagadougou (Fig 1-1 – Site locality).

The mining operation is estimated to deliver up to 300,000 tonnes of ore annually to the processing plant, producing approximately 100,000 troy ounces of gold per annum. The project resource is estimated at approximately 2.4 million tonnes of ore containing nearly 1 million ounces of gold. It is anticipated that the project will have a project development period of approximately 2 years and then operate for a further seven to ten years. In addition, Roxgold is actively exploring on the Yaramoko Concession which has the potential to increase both production and the mine life.



Data Source:	
Scale 1:50 000	
Projection: UTM	Datum: WGS84
Central Meridian/Zone: ZONE 30N	
Date: 10/10/2013	Compiled by: MURA
Project No. 457084	Fig No. 1.1



**ROXGOLD PROJECT SITE: AIR MONITORING STUDY
SITE LOCALITY MAP**

2 Objectives and Scope of Work

2.1 Objectives

The following objectives have been outlined for the baseline study:

- Describe the climatic conditions of the proposed project area;
- Conduct four months of baseline air quality monitoring to assess and determine ambient air quality conditions within the proposed project area and areas that are likely to be affected by the project activities for the period under review; and
- Identify existing sources of emissions (particulate and gaseous) in the project area.

2.2 Scope of Work

The following scope of work was undertaken for the baseline study:

- The relevant regulatory framework (IFC guidelines) for air quality control was reviewed and summarised, as they apply to the project;
- A site visit was undertaken during April 2013 and the following tasks were completed:
 - An air quality sampling protocol was prepared for this site;
 - A dust and gas monitoring network to monitor to undertake periodic air quality sampling and analysis of dust fallout, particulate matter <10 microns (PM₁₀), particulate matter <2.5 microns (PM_{2.5}), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) was installed;
 - A weather station was also installed at the Roxgold Mine Camp to monitor rainfall, temperature, wind speed and wind direction on an hourly basis;
 - Roxgold staff were trained to maintain and operate the monitoring network that was set up for this site;
- Laboratory results were assessed and compared against relevant standards or guidelines; and
- A baseline report (this report) was compiled detailing the following:
 - A description of relevant climatic conditions, and
 - A description of the baseline air quality within the project area.

3 Assumptions and Limitations

The following assumptions and limitations apply to this study:

- Dust (PM₁₀, PM_{2.5} and dust fallout) is the main pollutant of concern that has been identified and assessed in this study. Gases such as SO₂ and NO₂ have also been identified as potential pollutants of concern. However, they are considered to be minor pollutants that are unlikely to have a major impact on the project environment during all phases of the development;
- The monitoring period is too short to determine any significant trends in the baseline data. This report has included all data collected to date i.e. May 2013 to August 2013; and
- Data from the on-site weather station is limited as monitoring began in April 2013 and where data is available, the period of the data is too short to determine any trends.

4 Ambient air quality guidelines and standards

Guidelines published by the World Bank/International Finance Corporation (WB/IFC) in the Environmental, Health and Safety (EHS) General Guidelines document in 2007 is presented in this section. It should be noted that the guidelines presented in the EHS document have been adopted from the World Health Organization (WHO) guidelines. The SANS 1929:2011 standards have been used to interpret the dust fallout results and have been included as reference standards.

4.1 Particulate Matter

Particulate matter (PM) comprises of airborne particles that include dust, smoke and soot. Particulate matter can either be emitted naturally (e.g. windblown dust of roads) or through human activity (e.g. stack emissions). It is defined by size, with coarse particles being between 2.5-10 microns, fine particles less than 2.5 microns, and ultrafine particles less than 0.1 microns.

Particulate matter has adverse effects on humans such as respiratory illnesses (asthma and bronchitis) or cardiovascular diseases. It also can affect vegetation in two ways, firstly, by inhibiting the plant's photosynthetic properties by coating the leaves, thereby blocking the penetration of natural light. Secondly, various chemical compounds e.g. metals in the particulate matter could be deposited onto soils and absorbed by vegetation, hindering plant growth. The uptake of metals by plants has the potential to contaminate the vegetables and fruit that may be consumed by humans and animals.

4.1.1 PM₁₀

Ambient air quality guidelines and standards for inhalable particles or PM₁₀ (i.e. particulates with an aerodynamic diameter of less than 10 µm) are presented in Table 4-1. PM₁₀ is important as it provides a measure of coarse respirable dust, which has the potential to affect human health.

Table 4-1: Air quality guidelines and standards for PM₁₀ in µg/m³.

WB/IFC Guidelines ¹	Maximum 24-hour Concentration	Annual Average Concentration
Interim Target 1	150 ²	70 ²
Interim Target 2	100 ³	50 ³
Interim Target 3	75 ⁴	30 ⁴
Guideline	50 ⁵	20 ⁵

1) World Bank/IFC, 2007.Environmental, Health and Safety guidelines. General EHS guidelines: Environmental. Air emissions and ambient air quality.

2) Interim target-1 (IT-1) – These levels are associated with about a 15 % higher long term mortality risk relative to the AQG level.

3) 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

4) 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

5) 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}

4.1.2 PM_{2.5}

Ambient air quality guidelines and standards for inhalable particles or PM_{2.5} (i.e. particulates with an aerodynamic diameter of less than 2.5 µm) are presented in Table 4-2. PM_{2.5} provides a measure of fine respirable dust which has the potential to affect human health.

Table 4-2: Air quality guidelines and standards for PM_{2.5} in µg/m³.

WB/IFC Guidelines ¹	Maximum 24-hour Concentration	Annual Average Concentration
Interim Target 1	75 ²	35 ²
Interim Target 2	50 ³	25 ³
Interim Target 3	37.5 ⁴	15 ⁴
Guideline	20 ⁵	10 ⁵

1) World Bank/IFC, 2007.Environmental, Health and Safety guidelines. General EHS guidelines: Environmental. Air emissions and ambient air quality.

2) Interim target-1 (IT-1) – These levels are associated with about a 15 % higher long term mortality risk relative to the AQG level.

3) 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.

4) 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.

5) 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}.

4.2 Sulfurdioxide (SO₂)

Sulfur dioxide (SO₂) is a colourless gas and has a strong odour. It is a primary pollutant, which can react easily with other substances and form secondary pollutants such as sulfur trioxide and sulfuric acid, amongst others. SO₂ is formed through human activities through mainly industrial processes that contain sulfur.

SO₂ is damaging to the human respiratory function when inhaled, causing coughing and shortness of breath. Either long term exposure or exposure to a large dose can result in chronic respiratory disease and the risk of acute respiratory illness. The relevant international guidelines and standards for ambient SO₂ levels are presented in Table 4-3.

Table 4-3: Ambient air quality guidelines and standards for SO₂ in µg/m³.

WB/IFC Guideline ¹	Maximum 24-hour Concentration in µg/m ³
Interim Target 1	125 ²
Interim Target 2	50 ³
Guideline	20 ⁴

1) World Bank/IFC, 2007.Environmental, Health and Safety guidelines. General EHS guidelines: Environmental. Air emissions and ambient air quality.

2) Interim target -1 (IT-1).

3) Interim target -2 (IT-2) – Intermediate goal based on controlling either motor vehicle emissions, industrial emissions and/or emissions from power production. This would be a reasonable and feasible goal for some developing countries (it would be achieved within a few years) which would lead to significant health improvements that, in turn, would justify further improvements (such as aiming for that AQG guidelines).

4) Guidelines (AQG)

4.3 Nitrogen dioxide (NO₂)

Nitrogen dioxide (NO₂) is a naturally forming gas with a strong odour. Small quantities can be produced by plants, soil and water, but anthropogenic activities such as the combustion of fossil fuels, and biomass are the source of most NO₂ in the air. Human respiratory tract irritation represents a direct effect of NO₂ exposures. Due to it being relatively insoluble (relative to sulfur dioxide), NO₂ can penetrate deep into the lungs, causing potential tissue damage. Effects of NO₂ exposure include alveolar tissue disruption and obstruction of the respiratory bronchioles. Long

term effects of exposure include increased potential for lung infections. The relevant international guidelines and standards for ambient NO₂ levels are presented in Table 4-4.

Table 4-4: Ambient air quality guidelines and standards for NO₂ in µg/m³.

WB/IFC Guideline ¹	Maximum 1-hour Concentration	Annual Average Concentration
Guideline	200	40
1) World Bank/IFC, 2007. Environmental, Health and Safety guidelines. General EHS guidelines: Environmental. Air emissions and ambient air quality.		
2) N/S – not specified		

4.4 Dust fallout standards

Monitoring of dust deposition is considered to be the most practical and cost effective approach to obtaining an indication of baseline dust levels across the concession area, and was therefore implemented for this Project.

As Burkina Faso does not have standards or guidelines for dust deposition, South African standards have been used as a reference guideline to interpret the data and not as a compliance standard. South African National Standards (SANS 1929:2011) for dust deposition are presented in Table 4-5. There are international standards for dust deposition, but these are mainly for residential areas, so to compare these international dust deposition standards to a mine site may not be appropriate. However, the SANS 1929:2011 dust depositions standards have been designed to accommodate areas such as the mining industry. Furthermore the dust fallout monitoring is being used as an indicator of dust levels in the project area and alert authorities, environmental and/or operational managers of problematic areas that may need some form of management or mitigation to be implemented.

Table 4-5: SANS 1929:2011. Target values given in mg/m²/day.

Level	Dust fall rate (D) (mg/m ² /day, 30-day average)	Permitted frequency of exceeding dust fallout rate
Target	300	-
Action residential	600	Three within any year, no two sequential months
Action industrial	1 200	Three within any year, not two sequential months
Alert threshold	2 400	None. First incidence of dust fall rate being exceeded requires remediation and compulsory report to relevant authorities.

The SANS 1929:2011 standards stipulate Action and Alert Levels with guidelines on what actions should be taken if there are frequent exceedances above a stipulated level (Table 4-5). Three exceedances of the Action Residential Level and Action Industrial Level are permitted within a year, but not for two sequential months. If there are more than three exceedances within a year, or two in consecutive months, then remediation will be required to reduce dust fallout to the acceptable levels. Any exceedance above the Alert Threshold Level will result in immediate remediation and the relevant authorities must be informed. As these standards are used for interpretive purposes these conditions will not be adhered to.

5 Methodology

The baseline climate and air quality monitoring undertaken to date entailed collating and reviewing the available information, reviewing legal requirements, undertaking field surveys, and analysing data. To achieve the objectives and to ensure the relevant climate and air quality information was reviewed and incorporated into the study, a phased approach was adopted. The following phases of work were undertaken:

- Phase 1: Site visit, data collection (existing data), and data review.
- Phase 2: Setting up of the baseline gas, dust fallout and PM monitoring network and training Roxgold staff to operate the monitoring system.
- Phase 3: Data collection for dust fallout, PM₁₀, PM_{2.5} and gas.
- Phase 4: Data processing and reporting.

5.1 Site visit

Prior to SRK's site visit, Roxgold staff had already undertaken a site reconnaissance based on eight locations that SRK had identified prior to them undertaking the site visit. Based on Roxgold's findings it was decided that these eight locations were suitable to install the air quality monitoring equipment. SRK's site visit took place from the 25 April 2013 to 29 April 2013.

5.2 Installation and set-up of baseline monitoring network

5.2.1 Selection of monitoring locations

A meteorological and air quality monitoring network was set up by the air quality specialist team from SRK and Roxgold to monitor baseline conditions in and around the project area. Monitoring commenced on 26 April 2013 and was completed until 31 August 2013. The monitoring network is currently run and maintained by Roxgold staff, who were trained by SRK during April 2013.

The climate and air monitoring network comprises the following:

- One weather station;
- One continuous PM₁₀ monitoring station;
- One continuous PM_{2.5} monitoring station;
- Eight dust fallout monitoring points; and
- Six passive gas monitoring points.

The monitors are appropriately located in and around the mine concession area. The dust and gas monitoring locations (Table 5.1 and Figure 5.1) were selected taking cognisance of the proposed mine layout in relation to the sensitive receptors and the required security of the monitoring equipment.

Due to security concerns and lack of a reliable power source, PM₁₀ and PM_{2.5} could only be monitored at the Roxgold mine camp. Within the mine concession area, dust fallout was measured to obtain spatial information regarding dust deposition levels within the project area.

Table 5-1: Air quality sampling locations.

Monitoring	Field ID	Village	Co-ordinates (WGS) 84
Dust and gas	RGDM 01	Yaro	0467543m E; 1304237m N
	RGDM/GM ¹ 02	Haho	0466726m E; 1301701m N
	RGDM/GM 03	Doussi	0465973m E; 1297812m N
	RGDM04	Kaho	0467941m E; 1293937m N
	RGDM/GM 05	Siphohin	0466796m E; 1296758m N
	RGDM/GM 06	Bagassi	0467895m E; 1298398m N
	RGDM/GM07	Bagassi (55 Zone)	0469915m E; 1299057m N
	RGDM/GM08	Roxgold Camp	0473578m E; 1301298m N
Particulate Matter	RGPM ₁₀ -0001	Roxgold Camp	0473578m E; 1301298m N
	RGPM _{2.5} -0002	Roxgold Camp	0473578m E; 1301298m N
Weather station	Weather Station	Roxgold Camp	0473578m E; 1301298m N

¹ RGDM/GM refers to Roxgold Dust Monitoring/Gas Monitoring Point.



- Legend**
- Roxgold Camp Monitoring Points
 - Monitoring Points

Data Source:	
Scale 1:80 000	
Projection: UTM	Datum: WGS84
Central Meridian/Zone: ZONE 30N	
Date: 10/10/2013	Compiled by: REEL
Project No. 457084	Fig No. 5.1



**ROXGOLD PROJECT SITE: AIR MONITORING STUDY
MONITORING POINT LOCATIONS**

5.2.2 Installation and sampling methodologies

This section summarises the methodology and activities undertaken to date. A detailed dust and gas monitoring protocol is included in Appendix A.

Dust fallout

- For the purposes of this investigation the dust sampling period was monthly (30 days \pm 2 days);
- Where possible the sample buckets were swapped on the first working day of every month;
- No sample preservation was required other than ensuring the buckets were sealed immediately after the buckets were removed from the stands;
- The sealed buckets were dispatched to, M&L Laboratory Services a SANAS accredited laboratory based in Johannesburg South Africa for analysis;
- The samples were dispatched on a monthly basis as per the standard accepted protocol used for the dispatch of water samples from the site; and
- Results were normalised to a daily or thirty day period.

An example of the dust fallout monitor that was used is presented in Figure 5-2.



Figure 5-2: Dust fallout monitor installed within the Roxgold mine concession.

PM₁₀ and PM_{2.5} monitoring

Ambient PM₁₀ and PM_{2.5} monitoring is being conducted on a continuous basis at the Roxgold mine camp since the start of the monitoring. The results were normalised to daily and 24-hour averaging periods. PM₁₀ and PM_{2.5} monitoring commenced on the 29 April 2013. A photograph of the PM monitoring stations is presented in Figure 5-3.



Figure 5-3: PM₁₀ and PM_{2.5} monitors installed at the Roxgold Mine Camp.

Passive gas sampling

- Gas monitoring was conducted using Radiello passive gas monitoring badges which contain the absorbent gas cartridges (Figure 5-4). The badges were exposed to the atmosphere over a 24-hour period at all sampling points. The gas cartridges were returned to the original vial marked with the sample location on the side of the vial;
- Gas samples were collected every month since the start of the monitoring program from May to August 2013;
- The gas cartridges were exposed for a 24-hour period with the start and end time and date being recorded on the field sampling logs sheet;
- No sample preservation was required other than keeping the samples cool (out of direct sunlight); and
- The gas cartridges were sent to an accredited laboratory, M&L Laboratory Services.



Figure 5-4: Radiello gas monitors

Weather station

Meteorological monitoring is being conducted on a continuous basis at the Roxgold mine camp since the start of the monitoring. The weather station was installed on top of the Roxgold offices (Fig. 5-5) at the mine camp. The results were normalised to hourly averaging periods. Meteorological monitoring commenced in April 2013.



Figure 5-5: Weather station at Roxgold Mine Camp

5.3 Data collection

Data for the different air pollutants that were targeted were collected in the following manner:

- PM₁₀ and PM_{2.5}:
 - Monthly downloads by Roxgold staff. Data was sent through in an Excel spreadsheet.
- Dust fallout:
 - Dust fallout buckets collected by Roxgold staff were sent to M&L Laboratory Service in South Africa. The buckets were gravimetrically analysed for dust and laboratory certificates which were sent to SRK. These results were captured into an Excel spreadsheet and a dust fallout concentration was calculated and expressed in mg/m²/day.
- Passive gas sampling:
 - Passive gas badges were sent to M&L Laboratory Service in South Africa as well. The badges were analysed for SO₂ and NO₂. Laboratory certificates were sent after the analyses for either pollutant.
- Meteorological data:
 - Monthly downloads from Roxgold staff. Data was sent through in a text format and processed by SRK.

5.4 Data processing and reporting

5.4.1 PM₁₀ and PM_{2.5}

PM data is recorded for every hour on the monitors. A 24-hour concentrations was calculated and compared to the from the WB/IFC guidelines. The results were tabulated and presented in graphs.

5.4.2 Dust fallout

The dust fallout sampling method is based on the American Society for Testing and Materials (ASTM) D1739 – 94 (Standard Method for Collection and Measurement of Dustfall). Dust fallout results are reported in milligrams (mg) from the laboratory. These results were then added to the calculation below, and the reported in mg/m²/day. These results are then compared to the SANS 1929:2011 standards for dust fallout.

Calculate the fallout rate D² in milligrams/m² (mg/m²):

$$D = \left(\frac{W}{A} \right) \text{mg}^{-2}$$

Where: D – Deposition rate;

W – Total mass of particulate matter (soluble and insoluble); and

A – Cross sectional area of the inside diameter of the top of the sampling container.

5.4.3 Passive gas sampling

No data processing is required for the gas results, apart from the NO₂ results which had to be re-calculated to 1 hour concentrations. The gas samples were compared to the respective 24 hour SO₂ and 1 hour NO₂ guidelines.

5.4.4 Meteorological data

Meteorological data was recorded every hour by the on-site weather station for a few parameters such as rainfall, temperature, wind speed and wind direction for the purposes of establishing and understanding site specific meteorological conditions. Meteorological data are important as it affects the dispersion of dust within the project area. The wind speed and wind direction are summarised into a spread sheet and then imported into the Lakes Environmental wind rose plot program to produce wind roses for specific times or seasons. The rainfall and temperature data are summarised by month for the period under review and presented in tables and graphs.

6 Meteorological Conditions

Meteorological data was downloaded from the on-site weather station located at the Roxgold Mine camp. The data collected was collected from May 2013 to August 2013.

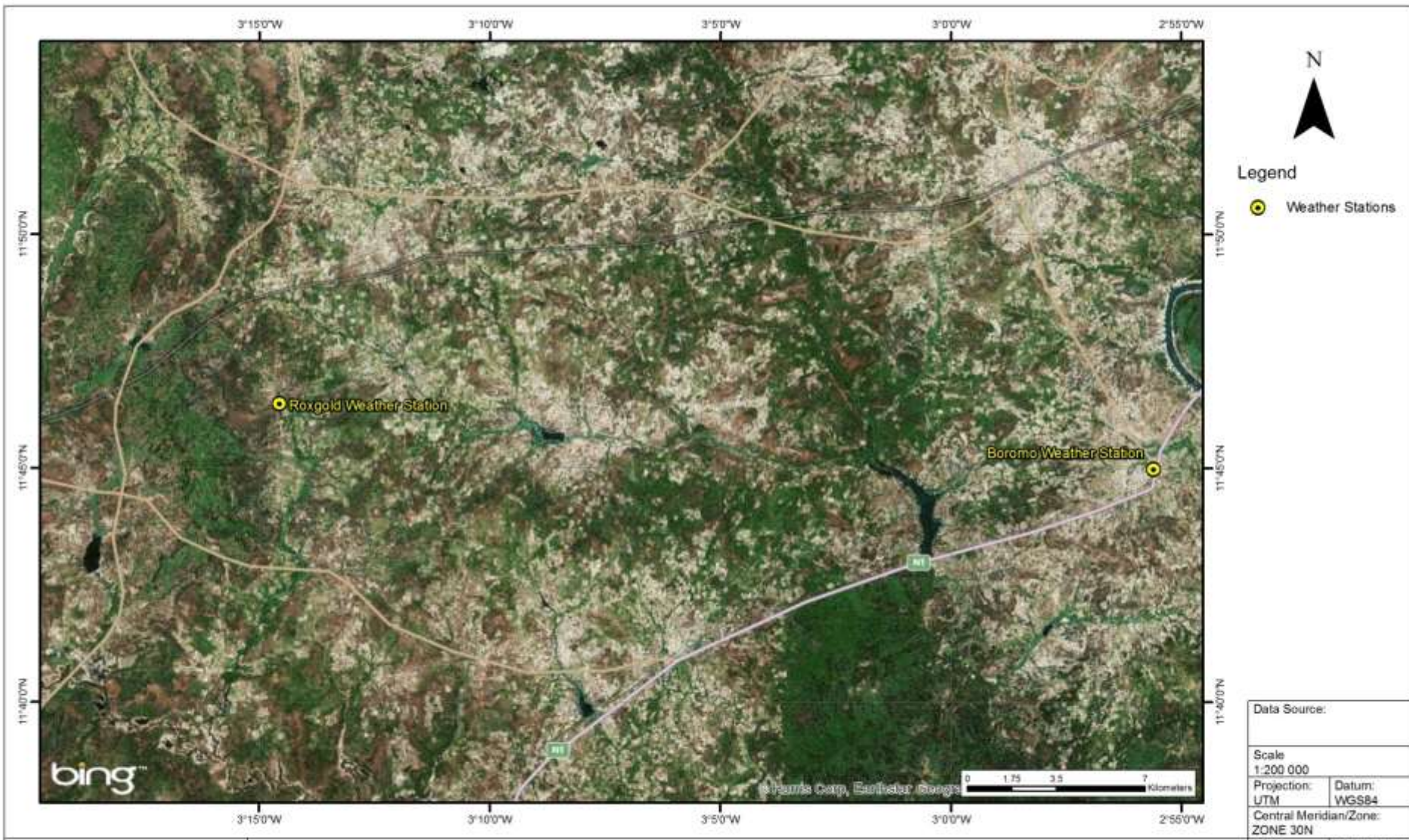
Meteorological data was also downloaded from www.weatherbase.com. The closest weather station to the Roxgold site is Boromo which is located approximately 34 km east of the Roxgold weather station. Rainfall data for Boromowere not available. Meteorological data for this weather station will be used to compare against data obtained from the on-site Roxgold weather station.

The following datasets were downloaded from the site:

- Temperature data for a 22 year period; and

²Should the user need to determine the daily rate of deposition then the deposition rate D from above needs to be divided by the number of days that the dust monitor has been exposed to the atmosphere and to obtain a monthly rate of deposition the daily rate of deposition needs to be multiplied by 30 days to give a deposition rate in milligrams/m²/month (mg/m²/month).

- Average wind speed data for a 16 year period.



**ROXGOLD PROJECT SITE: AIR MONITORING STUDY
LOCATION OF WEATHER STATIONS**

Data Source:	
Scale 1:200 000	
Projection: UTM	Datum: WGS84
Central Meridian/Zone: ZONE 30N	
Date: 10/10/2013	Compiled by: REEL
Project No. 457084	Fig No. 6.1

6.1 Rainfall

Rainfall is an important parameter with respect to air quality, since air quality deteriorates during the dry season and improves during the wet season especially with respect to dust. During the wet season, air pollution, and more specifically in this case, dust particles, are removed from the atmosphere. Dust emissions are suppressed due to the damp soil conditions and increased vegetation cover. During the dry season dust emission levels increase as the soils dry up and the vegetation cover decreases. On-site rainfall data was obtained from the on-site weather station situated at the Roxgold mine camp.

The rainfall data was downloaded for the period May 2013 to August 2013. The total rainfall for the period is 840mm, with the highest rainfall falling in July (267 mm) and the lowest in May (161 mm). The on-site rainfall data is presented in Table 6-1 and Figure 6-2.

Table 6-1: Total monthly rainfall at the Roxgold mine camp for the period May 2013 to August 2013.

Month	Rainfall (mm)
May	161
June	164
July	267
August	248
Total	840

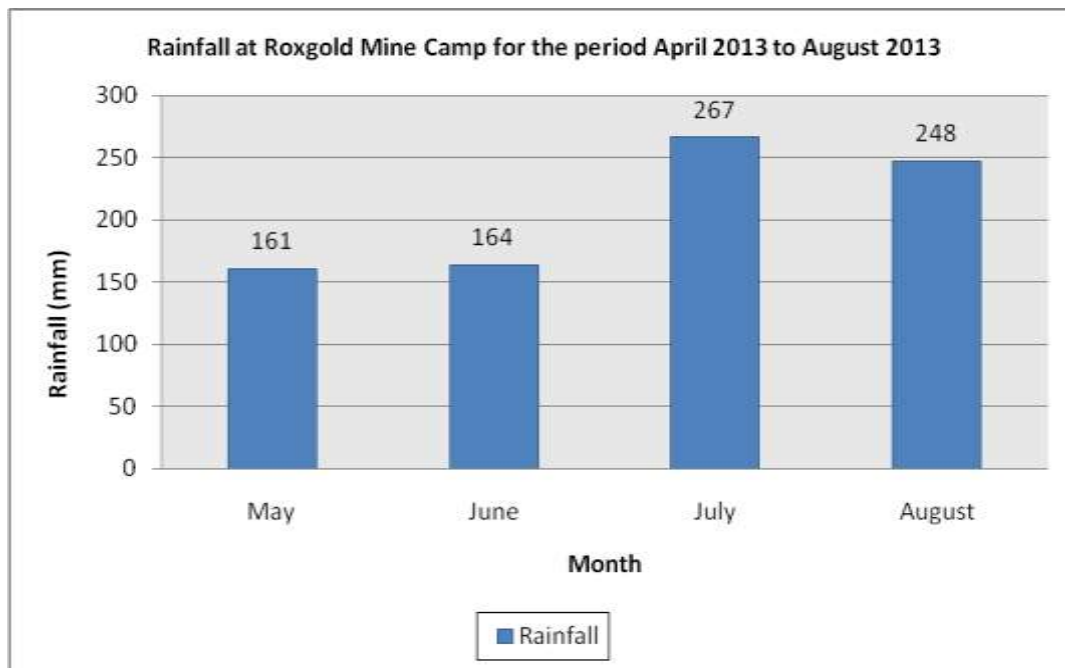


Figure 6-2: Rainfall at the Roxgold mine camp for the period May 2013 to August 2013

6.2 Temperature

The average, maximum and minimum monthly temperatures calculated using the recorded the on-site weather station data for the period May to August 2013 are presented in Table 6-2. Temperature data from www.weatherbase.com for Boromo is presented in Table 6-3. A comparison of the average temperatures from the on-site weather station and Boromo are presented in Figure 6-3.

The average monthly temperatures for the on-site weather station ranges from 25°C (August) to 31°C (May) with a maximum recorded temperature of 40°C (May) and a minimum recorded temperature of 20°C (June, July and August).

Table 6-2: Average, maximum and minimum monthly temperatures at the Roxgold mine camp for the period April 2013 to August 2013

Month	Average	Maximum	Minimum
May	31	40	22
June	29	36	20
July	26	34	20
August	25	31	20

The average temperatures are similar between both the sites, as temperatures recorded at Boromo are 26°C (August) to 31°C (May). The maximum temperature at Boromo was 42°C (May, June and August) and the minimum temperature was 16°C (July).

Table 6-3: Average monthly, maximum and minimum temperature at Boromo for a 22 year period

Month	Average	Maximum	Minimum
May	31	42	20
June	28	42	20
July	27	38	16
August	26	42	20

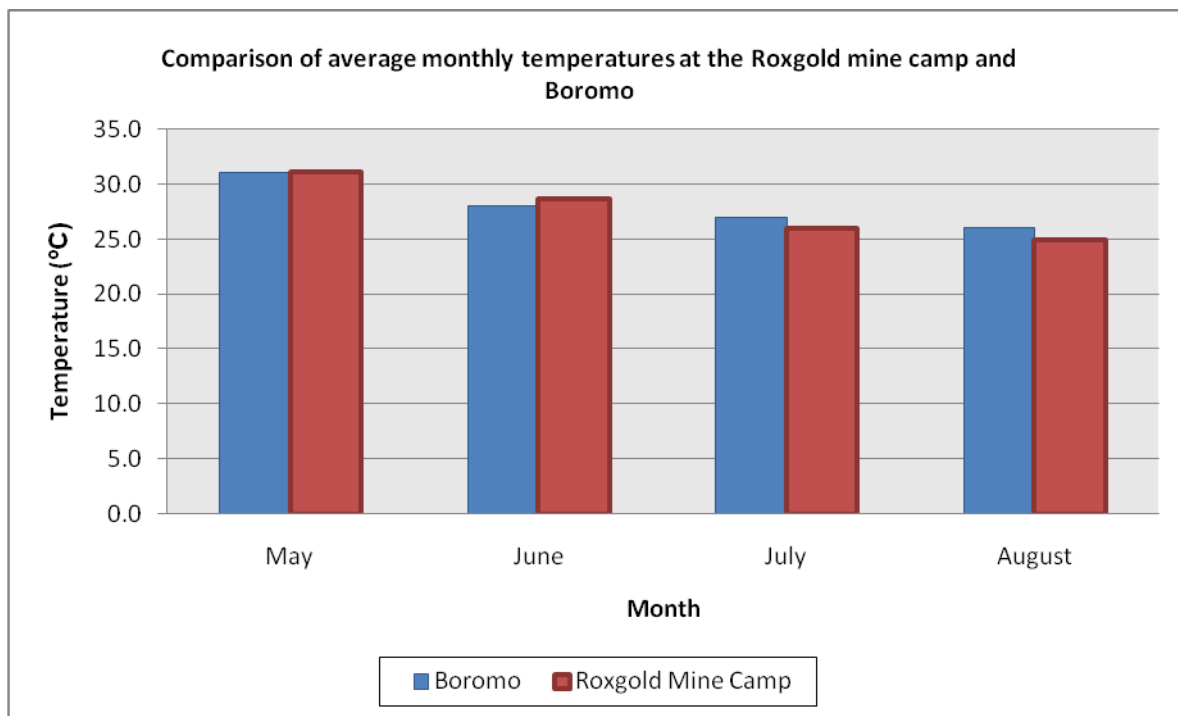


Figure 6-3: Comparison of average monthly temperatures at the Roxgold mine camp and Boromo

6.3 Wind

The wind field for an area is an important parameter with respect to air quality and winds can generate dust emissions as well as control the dispersion of an emissions plume. The degree to

which winds can influence dispersion depends on wind speed. Higher wind speeds result in longer travel distance and dilution of the pollutants and lower, more stable wind conditions result in shorter travel distance and build-up of pollutant levels (especially gases) over a smaller area.

Hourly meteorological data were obtained from the on-site weather station at the Roxgold Mine Camp for the period May 2013 to August 2013. Figure 6-4 presents the wind class frequency distribution which shows that 89.5% of wind speeds are below 3.6 m/s at the site, whilst 10.5% occur above 3.6m/s. Winds speeds are low in and around the project area.

The prevailing winds are from the north and northwest with a lower occurrence of winds from the north-northwest and north-northeast (Figure 6-5a). Wind patterns observed during the day (Figure 6-5b) and at night (Figure 6-5 c-d) are different, with the winds from the north being more prominent during the day and a relatively higher prevalence of winds from south-southwest together with prevailing winds from the northwest to north-northeast at night. The average wind speed at the Roxgold Mine Camp for all hours is 1.69 m/s (6.1 km/hr.) with maximum speeds lower than 8.8 m/s (31.7 km/hr.) for the period May 2013 to August 2013. The average wind speeds for daytime during the year are 2.11 m/s (7.6 km/hr.) with calms of 9.90%. The average wind speed during the earlier parts of the night is 1.27 m/s (4.6 km/hr.) and the wind speed decreases during the latter parts of the night to 1.13 m/s (4.1 km/hr.) with calms prevailing 36.47 % of the time.

Wind roses were also created for each month during the monitoring period (Figure 6-6). The prevailing wind directions vary during the months, with the south-southwest winds prevailing in May, northwest winds in June and the northerly components in July and August. The month with highest average wind speed was June (2.15 m/s (7.74km/hr.)) with August (1.06 m/s (3.8 km/hr.)) recording the lowest average wind speed. The winds speeds recorded in May and July are 2.09 m/s (7.5 km/hr.) and 1.44 m/s (5.2 km/hr.) respectively.

Based on the prevailing wind directions, any receptors located to the southeast and south-southeast may be affected by dust generation by mine related activities especially during high speeds of greater than 5.7 m/s (~20.5 km/hr.). Prevailing winds at the Roxgold Mine Camp can be characterised as low speed winds that are relatively consistent throughout the period at the mine.

Table 6.4 and Figure 6-7 present a comparison of average monthly wind speeds for the Roxgold Mine Camp and Boromo. Winds speeds at Boromo are slightly higher than wind speeds observed at the Roxgold Mine Camp; however, the average monthly winds speeds are still very low. The Boromo data verifies that wind speed data collected at the Roxgold mine camp is similar to regional conditions.

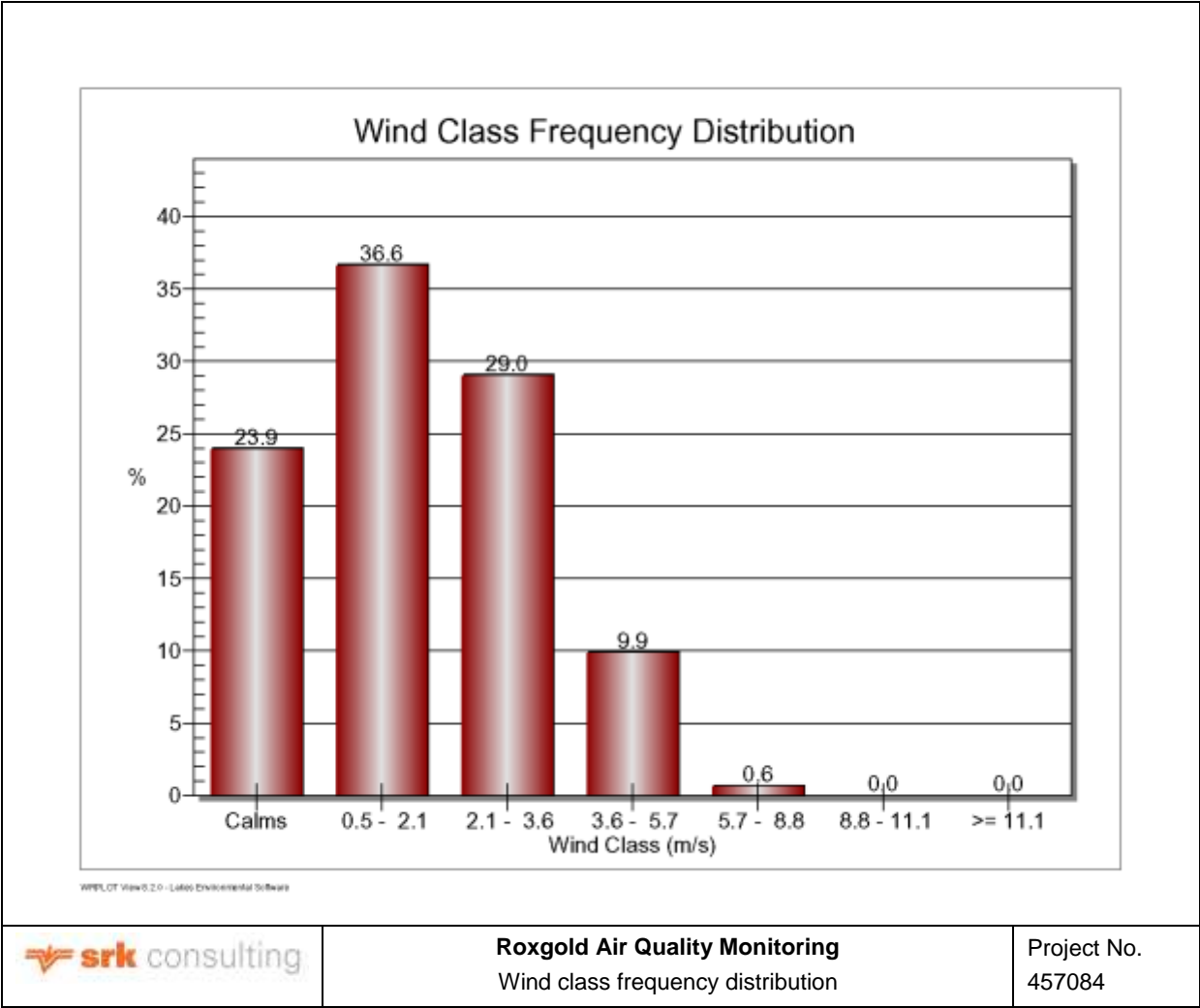


Figure 6-4: Wind class frequency distribution.

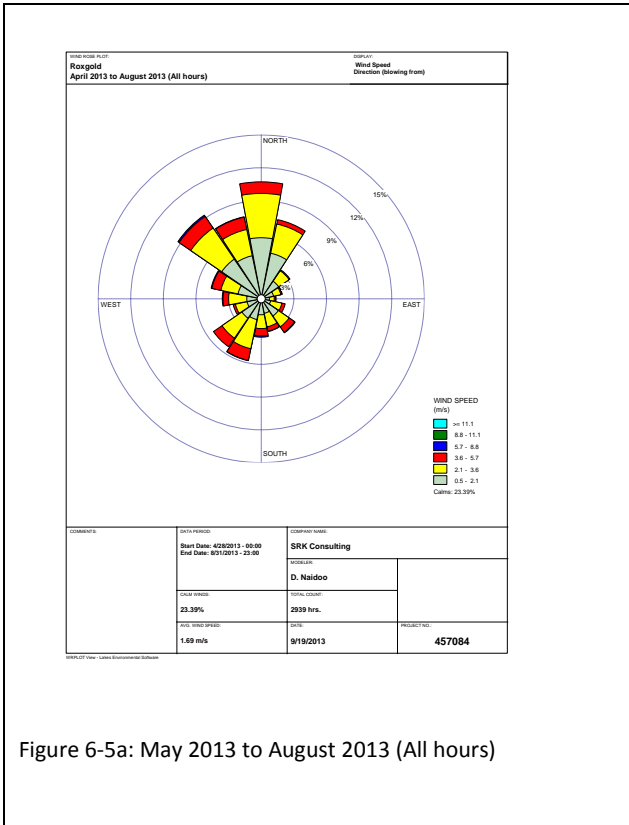


Figure 6-5a: May 2013 to August 2013 (All hours)

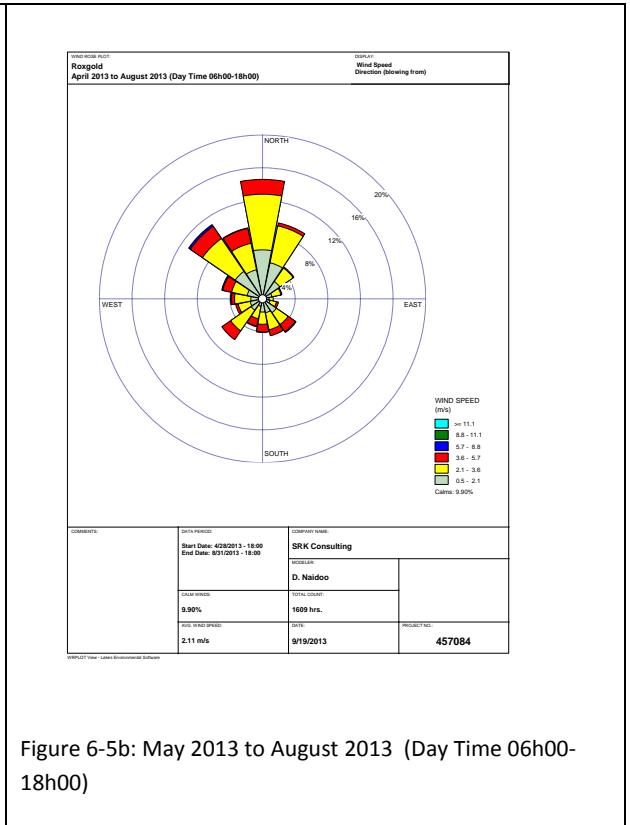


Figure 6-5b: May 2013 to August 2013 (Day Time 06h00-18h00)

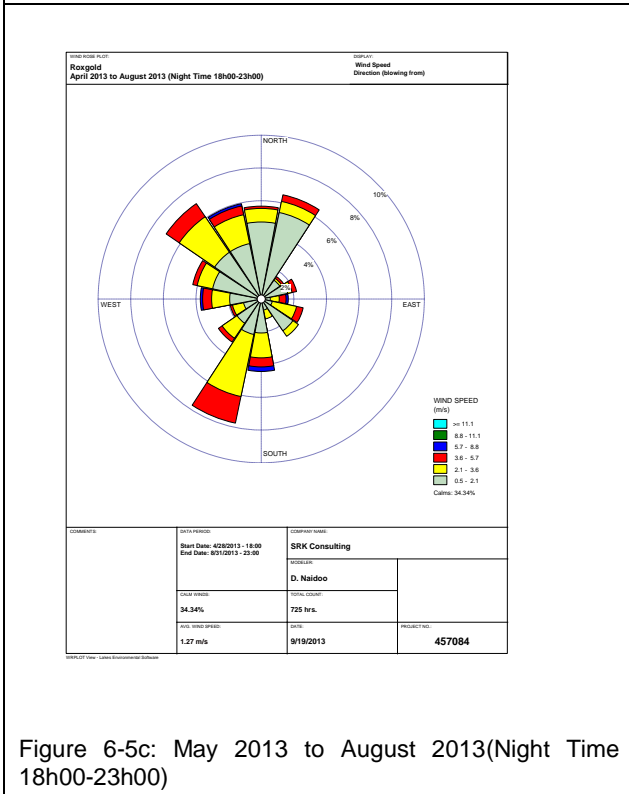


Figure 6-5c: May 2013 to August 2013 (Night Time 18h00-23h00)

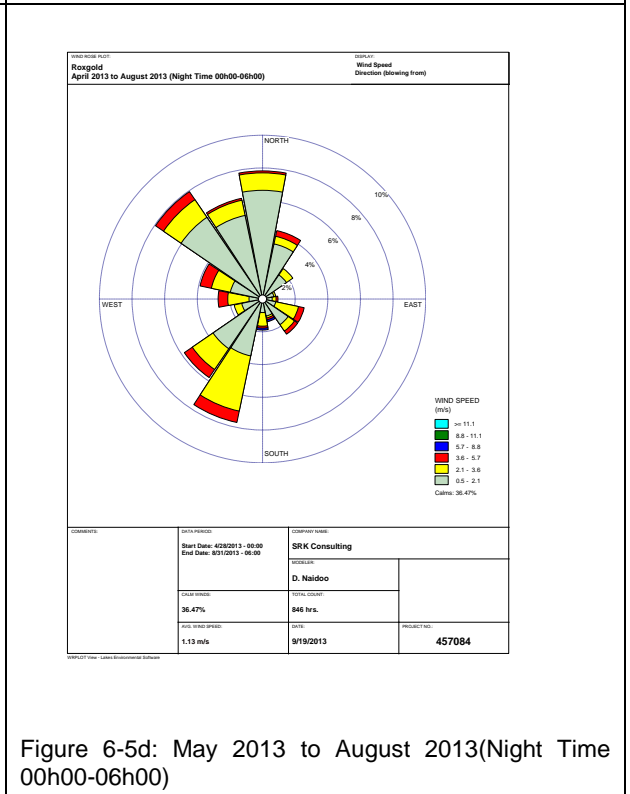


Figure 6-5d: May 2013 to August 2013 (Night Time 00h00-06h00)

	<p>Roxgold Air Quality Monitoring All hours, day time and night time wind roses</p>	<p>Project No. 457084</p>
--	--	-------------------------------

Figure 6-5: All hours, day time and night time wind roses.

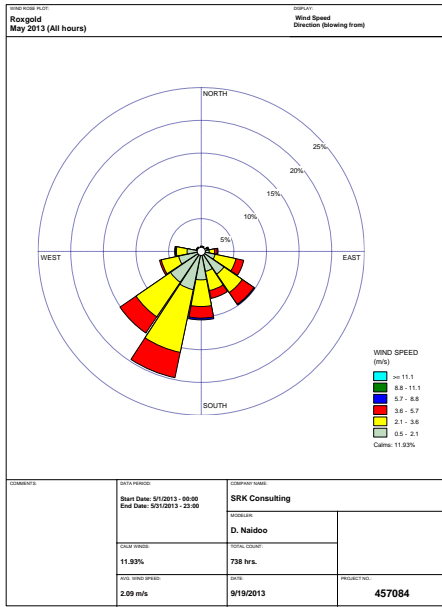


Figure 6-6a: May 2013 (All hours)

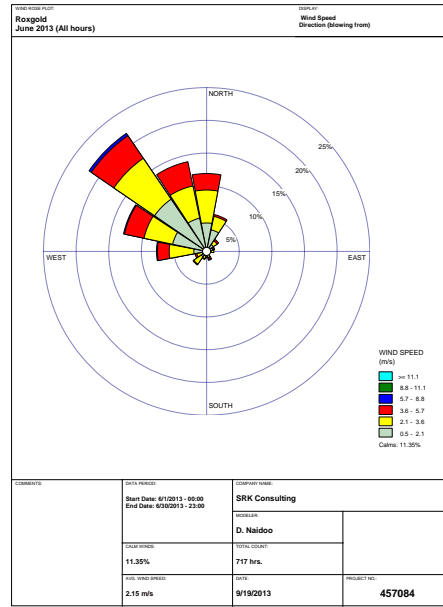


Figure 6-6b: June 2013 (All hours)

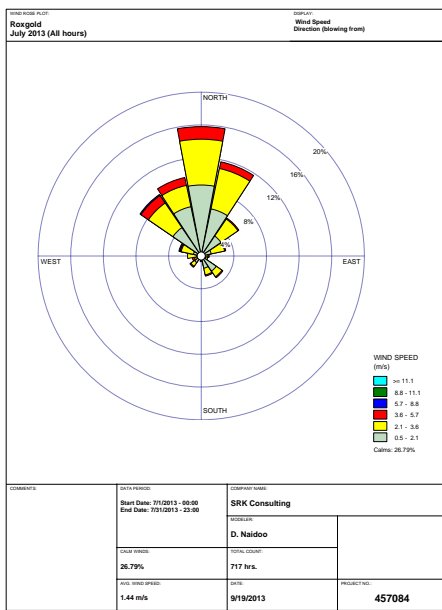


Figure 6-6c: July 2013 (All hours)

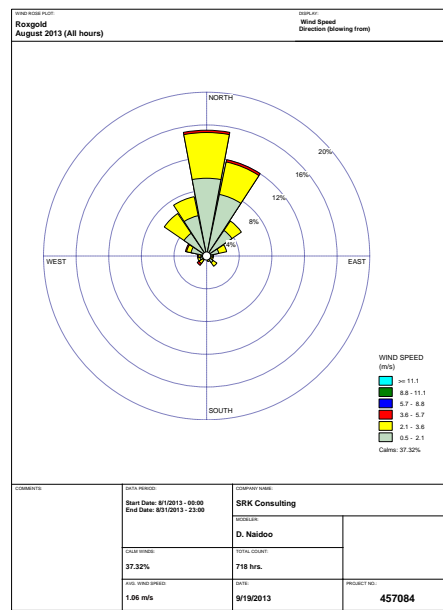


Figure 6-6d: August 2013 (All hours)

	Roxgold Air Quality Monitoring Monthly wind roses	Project No. 457084
--	---	-----------------------

Figure 6-6: Monthly wind roses.

Table 6-4: Comparison of wind speeds at the Roxgold Mine Camp and Boromo in m/s.

Month	Roxgold Mine Camp	Boromo
May	2.09	2.2
June	2.15	2.2
July	1.44	2.2
August	1.06	1.6

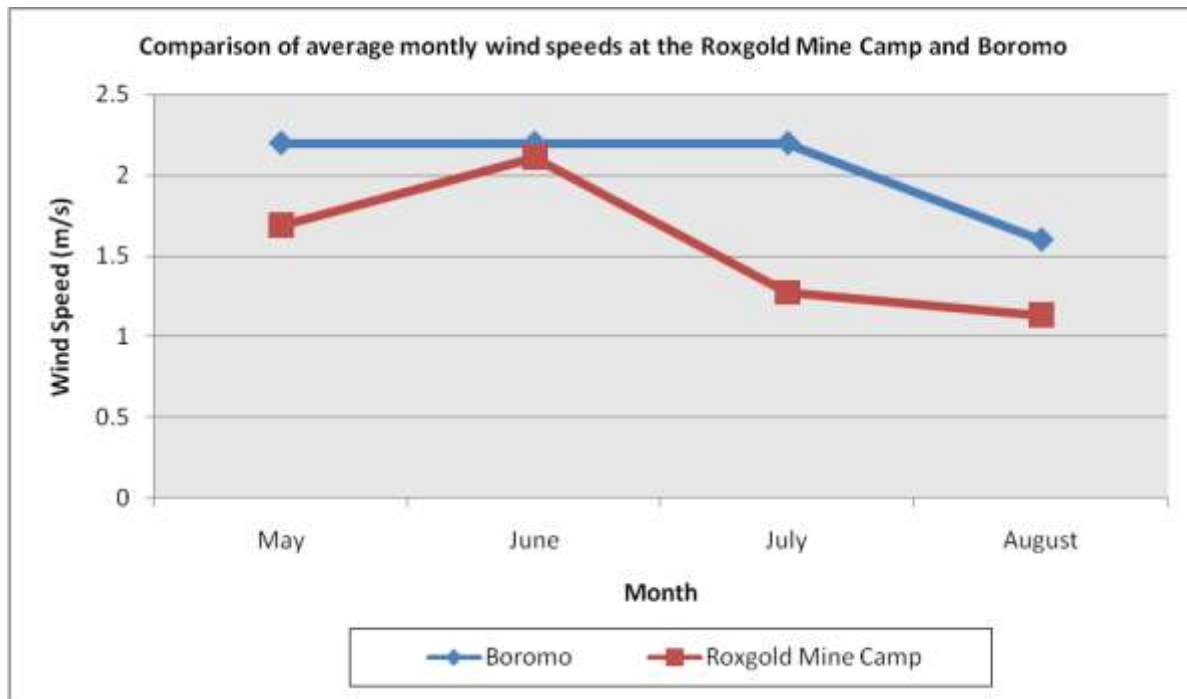


Figure 6-7: Comparison of average monthly wind speeds at the Roxgold Mine Camp and Boromo.

7 Baseline Air Quality Results

7.1 Dust fallout

The SANS 1929:2011 dust fallout standards were used to interpret the dust fallout results.

Dust fallout results for the eight locations are presented in Table 7-1 for the period May 2013 to August 2013 and Figure 7-1.

The following was observed from the dust fallout data received for the project area:

- In May 2013, the Action Residential Level of 600mg/m²/day was exceeded at every location during the monitoring period. This is important as it suggests that baseline dust levels during the dry season are elevated even in the villages. Dust fallout may have been high during this month due to the dusty conditions observed in the area as it was the end of the dry season.
- Eighty seven percent of dust fallout concentrations were below Action Residential Level of 600 mg/m²/day for June 2013 with 13 % above the Level. Dust fallout concentrations at RGDM08 exceeded the Action Industrial Level during May and June. However, this point is not unexpected as this point is in the Roxgold Mine Camp and dust generating activities from the vehicle entrainment of dust will be the major source.
- In July 2013, there was only one exceedance of the Action Residential Level at RGDM01 with a dust fallout concentration of 624 mg/m²/day. Eighty seven percent of dust fallout concentrations were below the Action Residential Level; and

- The Action Residential Level was exceeded 50% of the time during August. Dust fallout concentrations measured at RGDM05 (2,026 mg/m²/day) was above the Action Industrial Level.
- The daily dust fallout data shows that at least 78 % of the measured concentrations are above 300 mg/m²/day (SANS Target Level), whereas 78 % are below 1,200 mg/m²/day.
- Although the monitoring period is too short to determine any significant annual seasonal trends in dust fallout, it has been noted that dust fallout has decreased during June and July which coincided with the start of the rainy season when compared to dust fallout concentrations in May.
- Furthermore baseline dust fallout levels in the villages occasionally exceed the action residential levels for the period under review suggesting elevated baseline dust levels can be expected especially during the dry season.

Table 7-1: Dust fallout results for the period May 2013 to August 2013 in mg/m²/day.

Field ID	May-13	Jun-13	Jul-13	Aug-13
RGDM01	973	137	624	142
RGDM02	1,611	48	433	606
RGDM03	1,572	85	364	577
RGDM04	1,175	40	369	412
RGDM05	1,649	24	535	2,026
RGDM06	1,216	168	388	1,143
RGDM07	784	453	435	441
RGDM08	2,061	2,049	364	764
SANS Target	300	300	300	300
SANS Action Residential	600	600	600	600
SANS Action Industrial	1,200	1,200	1,200	1,200
SANS Alert Threshold	2,400	2,400	2,400	2,400

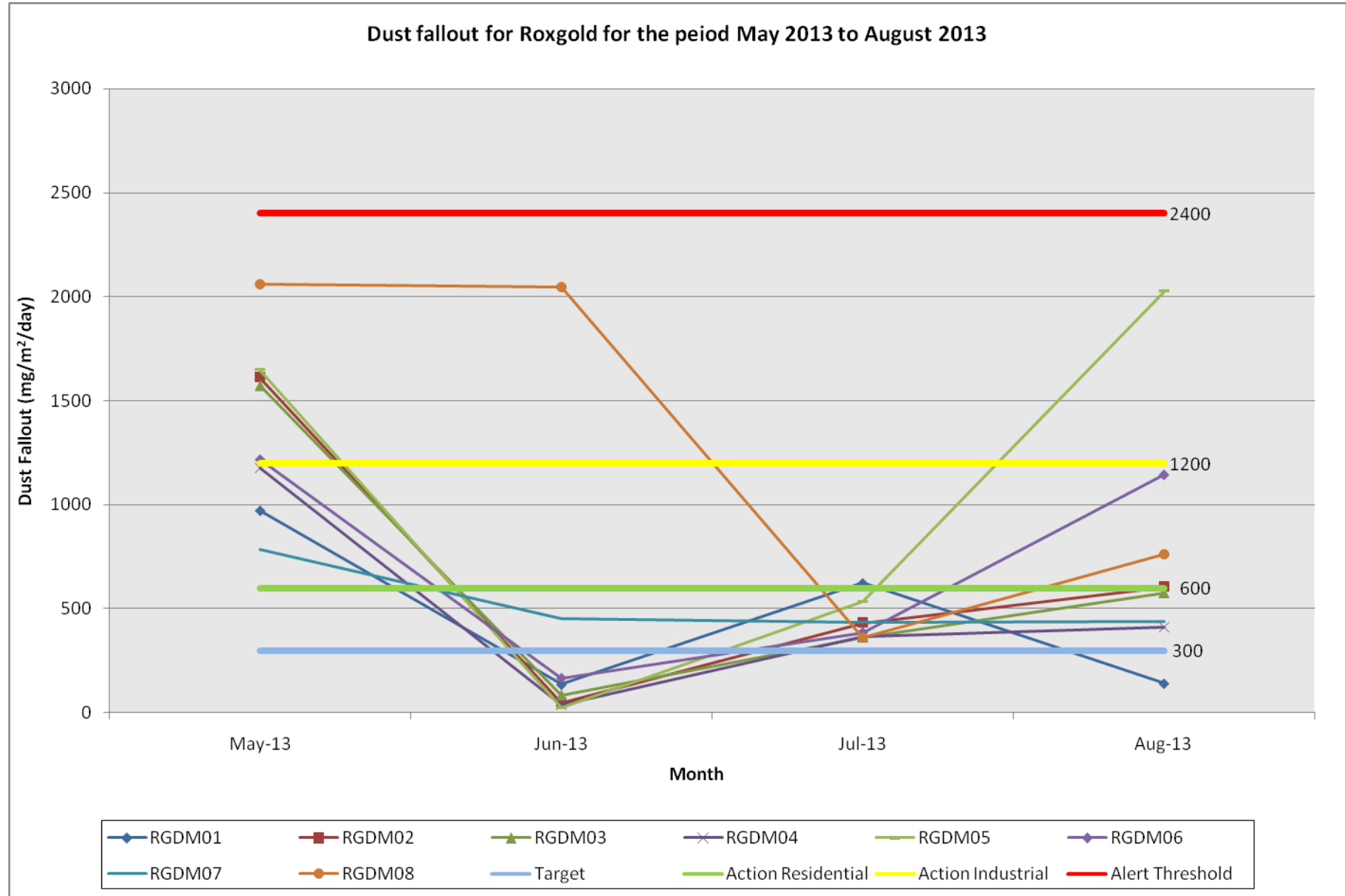


Figure 7-1: Dust fallout results for the period May 2013 to August 2013.

7.2 Particulate Matter

7.2.1 PM₁₀

PM₁₀ data was collected for the period May 2013 to August 2013. The average daily concentrations for the period are presented in Table 7-2 and the 24-hour concentrations in Figure 7.2 for this period. The 24-hour PM₁₀ concentrations presented in Figure 7-2 show one exceedance of the WB/IFC 24-hour PM₁₀ guideline of 50 µg/m³. A concentration of 148 µg/m³ was recorded on 26 June 2013 which may be attributed to an increase in vehicle movement at the Roxgold Mine Camp. The average daily concentrations show no exceedances of the WB/IFC guideline (Table 7-2).

Table 7-2: Average 24 hour PM₁₀ concentrations for the period from May 2013 to August 2013.

Month	PM ₁₀ concentration
May-13	11.2
Jun-13	22.6
Jul-13	15.3
Aug-13	34.8
WB/IFC Guideline	50
WB/IFC IT1	75
WB/IFC IT2	100
WB/IFC IT3	150

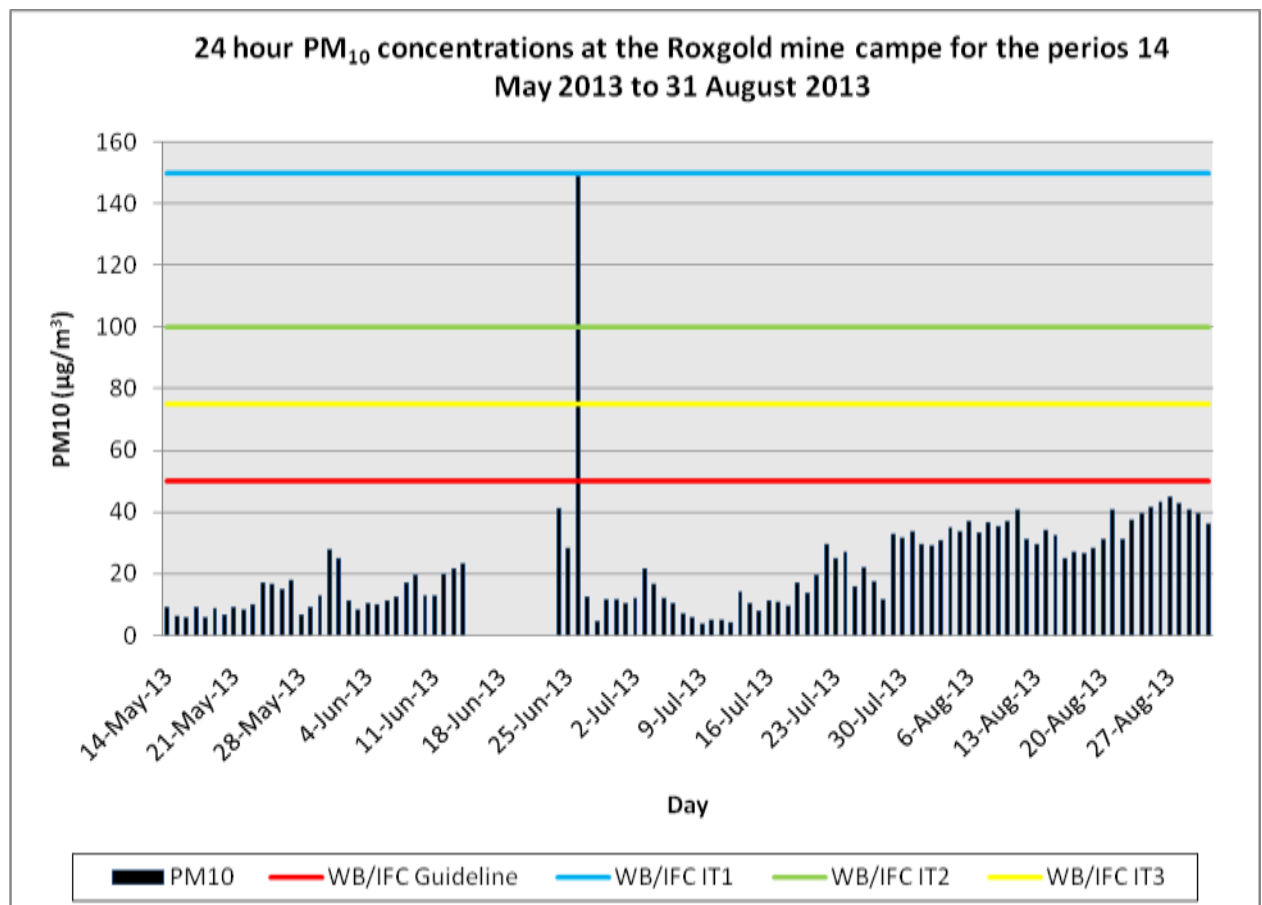


Figure 7-2: 24 hour PM₁₀ concentrations for the period May 2013 to August 2013.

7.2.2 PM_{2.5}

PM_{2.5} data was collected for the period 29 April 2013 to 31 August 2013, however, there is a gap of two months in the dataset as the monitor has been sent to South Africa for repairs. The average daily concentrations are presented in Table 7-3 and the 24-hour concentrations in Figure 7-3. The average daily concentrations for May 2013 (12.2 µg/m³) and August 2013 (3.2 µg/m³) are below the World Bank/IFC PM_{2.5} guideline of 20 µg/m³.

The 24-hour PM_{2.5} concentrations presented in Figure 7.3 show two instances where the 24-hour World Bank/IFC air quality guideline of 20 µg/m³ was exceeded on 29 April 2013 and 30 April 2013. The highest concentration recorded during the monitoring period was 33.1 µg/m³ recorded on 29 April 2013.

Table 7-3: Average 24 hour PM_{2.5} concentrations for the period from May 2013 to August 2013.

Month	PM_{2.5} concentration
May-13	12.2
Jun-13	-
Jul-13	-
Aug-13	3.2
WB/IFC Guideline	20
WB/IFC IT1	37.5
WB/IFC IT2	50
WB/IFC IT3	75

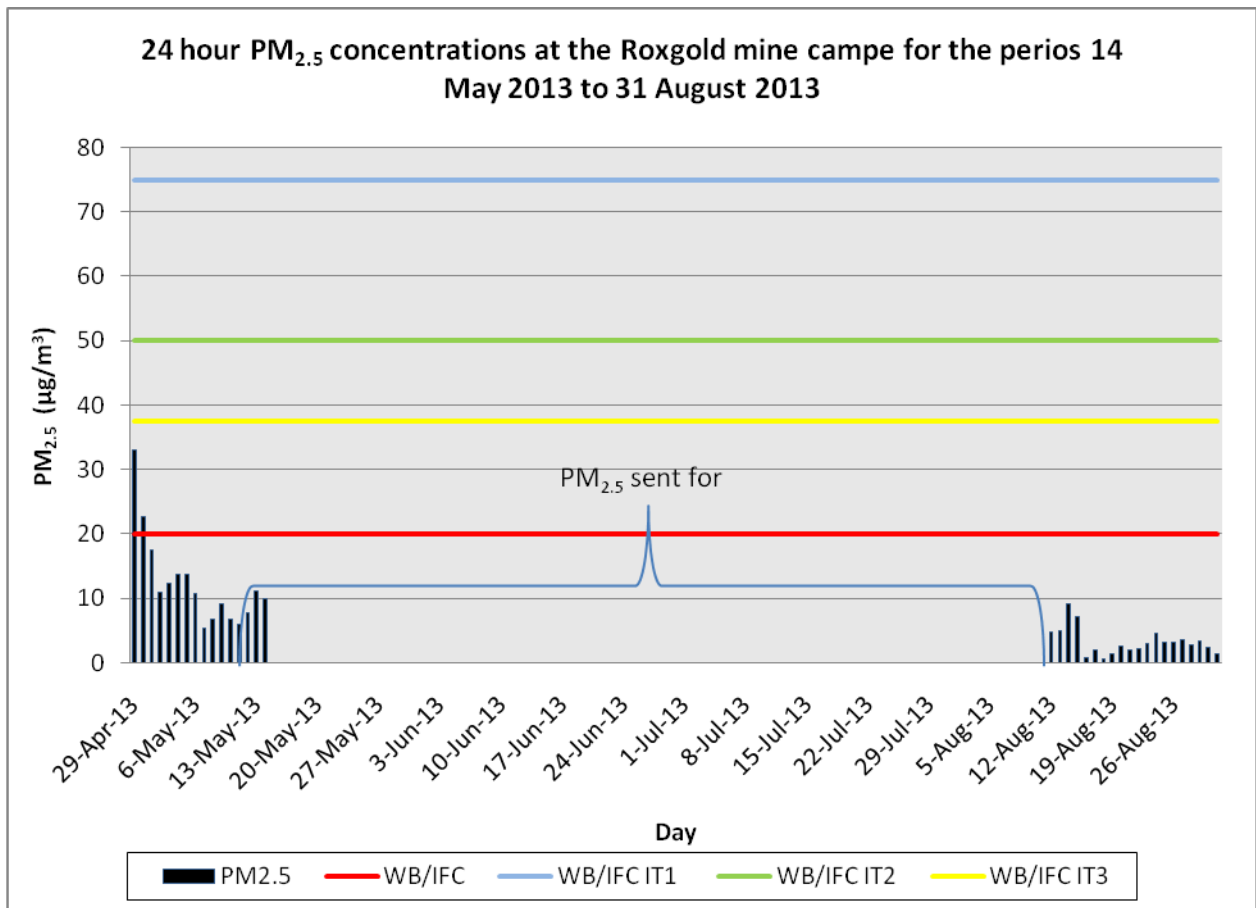


Figure 7-3: 24 hour PM_{2.5} concentrations at the Roxgold mine camp for the period 14 May 2013 to 31 August 2013.

7.3 Passive Gas Sampling

Gas monitoring within the project area was undertaken over a 24-hr period during from May 2013 to August 2013 at selected locations. The results were compared to the World Bank guidelines. The 24-hr SO₂ and 1-hr NO₂ results are presented in Table 7.4 and Table 7.5 respectively. Laboratory certificates are presented in Appendix 2.

7.3.1 SO₂

The 24 hour SO₂ results for the four months selected were well below the World Bank/IFC air quality guideline of 20 µg/m³ at all points.

Table 7-4: SO₂ results for the period May 2013 to August 2013 in µg/m³.

Field ID	May-13	Jun-13	Jul-13	Aug-13
RGDM02	2.1	4	0.40	-
RGDM03	<0.27	3.95	<0.27	<0.27
RGDM05	2.5	4.35	<0.27	-
RGDM06	<0.27	3.85	<0.27	<0.27
RGDM07	5	6.95	<0.27	-
RGDM08	<0.27	3.65	2.85	-
World Bank/IFC IT1	125	125	125	125

World Bank/IFC IT2	50	50	50	50
World Bank/IFC AQG	20	20	20	20

7.3.2 NO₂

The 1-hour NO₂ results were well below the World Bank/IFC guideline of 200 µg/m³ for all months when the monitoring was undertaken.

Table 7-5: NO₂ results for the period May 2013 to August 2013 in µg/m³.

Field ID	May-13	Jun-13	Jul-13	Aug-13
RGDM02	0.40	0.39	0.45	-
RGDM03	0.36	0.39	<0.35	<0.35
RGDM05	<0.35	<0.35	<0.35	-
RGDM06	0.38	0.50	<0.35	<0.35
RGDM07	<0.29	<0.35	<0.35	-
RGDM08	0.40	0.51	0.47	-
World Bank/IFC AQG	200	200	200	200

8 Conclusions

Based on the findings of this assessment the following were concluded:

- Based on SRK's observations made during the site visit no major dust sources were identified within the proposed project area other than windblown dust and the entrainment of dust by vehicles, especially on unpaved roads;
- Based on the location of the site and the tropical climate of the area, windblown dust generation within the project area is expected to be low as a result of rainfall occurring during the wet season and high during the dry season;
- The on-site weather station is suitably located to record climatic data in the area, and compares very well to data obtained from the Boromo weather station (located ~ 34km east) similarities between the datasets were observed;
- The dust fallout data for the period from May 2013 to October 2013 falls entirely within the wet season (March to October) experienced in the project area. The May results may be representative of the transition between the two seasons and this may be the reason for the relatively elevated dust fallout concentrations measured during May;
- The 24-hour PM₁₀ concentrations are low and below the World Bank/IFC guideline level of 50 µg/m³ except on the 26 June 2013 where a PM₁₀ concentration of 148 µg/m³ was measured. Dust generating activities such as vehicle entrainment of dust, windblown dust from the roadside etc. may contribute to the PM₁₀ concentrations measured at the Roxgold mine camp;
- The baseline 24-hour PM_{2.5} concentrations were low and below the World Bank/IFC guideline of 20 µg/m³ for most of the monitoring period, the World Bank guideline level was exceeded two times, on the 29 April 2013 (33.1 µg/m³) and the 30 April 2013 (22.7 µg/m³). The PM_{2.5} monitor experienced a fault which affected the collection of suitable data for two months (June and July) during the monitoring, however, it has been repaired and monitoring has continued;
- The baseline SO₂ and NO₂ levels in the project area suggest that the levels of these gases in the ambient air in the area are low. The 24-hr SO₂ and 1-hr NO₂ monitoring results were below their respective World Bank/IFC guidelines for the period under observation; and
- Currently, the villages within and surrounding the proposed project areas have been identified as sensitive receptors. The villages of Yaro, Haho, Doussi, Kaho, Siphohin and Bagassi are closest to the mining operations and may be within the impacted zone. Baseline dust fallout levels exceed the Action Residential Level during May, suggesting that during the dry season dust fallout levels are naturally elevated in the area.

9 Recommendations

Based on the findings of these initial data the following are recommended:

- The continuation of the existing monitoring program to determine seasonal trends for dust and gas is required. Monitoring during construction and operational phases to determine the levels and extent of impacts associated with the mining operation will be required to compare against baseline concentrations.
- Where necessary during the construction and operational phase make minor adjustments to accommodate the installation of new infrastructure as and when this occurs i.e. should new infrastructure result in the existing network being damaged then a substitute point in the vicinity of the existing location must be installed. In instances where activities change such that monitoring of dust and gas is required then the network must be adjusted accordingly;

- Log any activities taking place in and around the mine area that could impact on air quality should, so as to determine whether that activity has had an influence on air quality;
- PM₁₀ and PM_{2.5} monitoring needs to continue as monitoring in order to establish dry season conditions (November to March). Continuous monitoring during the seasons will allow for suitable trends in PM₁₀ and PM_{2.5} to be established; and
- Reduce project vehicle speeds on unpaved roads and limit speeds to less than 40 km/hr on roads especially those passing through villages.

Prepared by

SRK Consulting - Certified Electronic Signature
 *[Handwritten Signature]*
457084/41584/Report1
9271-9353-5985-NADH
This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database.

D. Naidoo

Scientist

Reviewed by

SRK Consulting - Certified Electronic Signature
 *[Handwritten Signature]*
457084/41584/Report1
5106-2322-2926-REDD
This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database.

V.S. Reddy (Pr. Sci. Nat)

Partner

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.

This report is protected by copyright vested in SRK (SA) Pty Ltd. It may not be reproduced or transmitted in any form or by any means whatsoever to any person without the written permission of the copyright holder, SRK.

10 References

South African National Standard (2011) Ambient air quality - Limits for common air pollutants, SANS 1929:2011.

World Bank/International Finance Corporation, 2007. Environmental, Health and Safety guidelines. General EHS guidelines: Environmental. Air emissions and ambient air quality.

Appendix A: Laboratory Certificates

M and L Laboratory Services (Pty) Ltd
 Reg No. 1974/001476/07 VAT No. 478013505
 P O Box 82124
 Southdale, 2135
 40 Modulus Road
 Ormonde, 2091
 T: +27 661 7900
 F: +27 496 2238
 E: joanne.barton@sa.bureauveritas.com
www.bureauveritas.com



Ref No. : 7697270
 Issued at : Johannesburg
 Date : 29/07/2013
 AA/cw : Page 1 of 1

COMPANY NAME : SRK CONSULTING – DURBAN
 ADDRESS : PO BOX 1969, WESTVILLE, 3630
 SUBJECT : ANALYSIS OF 6 RADIELLO TUBES
 MARKED : AS BELOW
 INSTRUCTED BY : DHIREN NAIDOO
 ORDER NO : 457084
 RECEIVED ON : 07/06/2013
 LAB NO(S) : H06810-H06815
 DATE ANALYSED : 18/06/2013

Results: $\mu\text{g}/\text{m}^3$

Test: Gases for SO_2 AND NO_2

Test Ref.: Radiello Method

Results: $\mu\text{g}/\text{sample}$

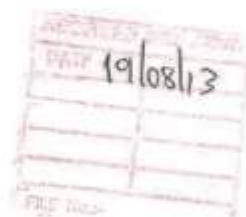
SAMPLE MARKS	Nitrogen Dioxide NO_2	Sulfur Dioxide SO_2
RGM02	9.45	4.00
RGM03	8.95	3.95
RGM05	7.10	4.35
RGM06	12.05	3.85
RGM07	<0.35	6.95
RGM08	12.35	3.65

B.D.L. = Below Detection Limit

$\text{NO}_2 = 0.35 \mu\text{g}/\text{m}^3$

$\text{SO}_2 = 0.27 \mu\text{g}/\text{m}^3$

Note: The results was supplied by Sub Contracted Laboratory



JOANNE BARTON
 MANAGER
 M & L LABORATORY SERVICES

Authorized Signature (original blue ink)

All services are rendered in accordance with Bureau Veritas M&L Laboratory Services (Pty) Ltd General Terms and conditions of Business, which has been supplied to you, this certificate cannot be reproduced except in full without the written consent of M and L Laboratory Services.

M and L Laboratory Services (Pty) Ltd
 Reg No. 1974/001476/07 VAT No. 478013505
 P O Box 82124
 Southdale, 2135
 40 Modulus Road
 Ormonde, 2091
 T: +27 661 7900
 F: +27 496 2238
 E: joanne.barton@m&l.bureauveritas.com
www.bureauveritas.com



M&L LABS

Ref No. : 7591392
 Issued : Johannesburg
 at
 Date : 24/06/2013
 AA/cw : Page 1 of 1

COMPANY NAME : SRK CONSULTING - DURBAN
 ADDRESS : PO BOX 1969, WESTVILLE, 3630
 SUBJECT : ANALYSIS OF 6 RADIELLO TUBES
 MARKED : AS BELOW
 INSTRUCTED BY : DHIREN NAIDOO
 ORDER NO : 457084
 RECEIVED ON : 07/05/2013
 LAB NO(S) : H06766-H06771
 DATE ANALYSED : 20/05/2013

Results: $\mu\text{g}/\text{m}^3$

Test: Gases for SO_2 AND NO_2

Test Ref: Radiello Method

Results: $\mu\text{g}/\text{sample}$

SAMPLE MARKS	BARCODE	Nitrogen Dioxide NO_2	Sulfur Dioxide SO_2
RGDM02	UG665	9.50	2.10
RGDM03	UG664	8.60	<0.27
RGDM05	UG661	8.20	2.50
RGDM06	UG662	9.15	<0.27
RGDM07	UG663	6.90	5.00
RGDM08	UG666	9.60	<0.27

B.D.L. = Below Detection Limit

$\text{NO}_2 = 0.35 \mu\text{g}/\text{m}^3$

$\text{SO}_2 = 0.27 \mu\text{g}/\text{m}^3$

Note: The results was supplied by Sub Contracted Laboratory



JOANNE BARTON
 MANAGER
 M & L LABORATORY SERVICES

.....
 Authorised Signature (original blue ink)

All services are rendered in accordance with Bureau Veritas M&L Laboratory Services (Pty) Ltd General Terms and conditions of Business, which has been supplied to you, this certificate cannot be reproduced except in full without the written consent of M and L Laboratory Services.

M and L Laboratory Services (Pty) Ltd
 Reg No. 1974/001476/07 VAT No. 478013505
 P O Box 82124
 Southdale, 2135
 40 Madulus Road
 Ormonde, 2091
 T: +27 661 7900
 F: +27 496 2238
 E: joanne.barton@za.bureauveritas.com
 www.bureauveritas.com



M&L LABS

Ref.No. : 7894804

Issued at : Johannesburg

Date : 23/08/2013

Page : 1 of 2

COMPANY NAME : SRK CONSULTING
 ADDRESS : P O BOX 1969 WESTVILLE 3630
 SUBJECT : ANALYSIS OF 8 SAMPLES OF DUST
 MARKED : ROXGOLD AND AS BELOW
 INSTRUCTED BY : DHIREN NAIDOO
 ORDER NO. : Q6441
 RECEIVED ON : 2013/08/13
 LAB NO(S) : E19983 - E19990
 DATE ANALYSED : 2013/08/13

Analysis on an as received basis:

SAMPLE MARKS	Lab No:	Insoluble matter (mg)
RGDM 01	E19983	499
RGDM 02	E19984	346
RGDM 03	E19985	291
RGDM 04	E19986	295
RGDM 05	E19987	428
RGDM 06	E19988	310
RGDM 07	E19989	348
RGDM 08	E19990	291

Note: The samples were filtered through a 125mm 1µ filter before filtration with a 0.45µ filter and the weights the combined.

Method Ref: METHOD ASTM D1739.



ALISON ACKERMAN
 OPERATIONAL MANAGER

Authorised Signature (original blue ink)

All services are rendered in accordance with Bureau Veritas M&L Laboratory Services (Pty) Ltd General Terms and conditions of Business, which has been supplied to you, this certificate cannot be reproduced except in full without the written consent of M and L Laboratory Services.

M and L Laboratory Services (Pty) Ltd
 Reg No. 1974/001476/07 VAT No. 478013505
 P O Box 42124
 Southdale, 2135
 40 Modder Road
 Omondia, 2091
 T: +27 60 7900
 F: +27 60 2238
 E: joanne.barford@za.bureauveritas.com
www.bureauveritas.com



M&L LABS

Ref.No. : 7967418
 Issued at : Johannesburg
 Date : 26/09/2013
 Page : 1 of 2

COMPANY NAME :SRK CONSULTING
 ADDRESS :P O BOX 1969 WESTVILLE 3630
 SUBJECT :ANALYSIS OF 8 SAMPLES OF DUST
 MARKED :ROXGOLD AND AS BELOW
 INSTRUCTED BY :DHIREN NAIDOO
 ORDER NO. :Q6503
 RECEIVED ON :2013/09/10
 LAB NO(S) :E21051-E21058
 DATE ANALYSED :2013/09/24

Analysis on an as received basis:

SAMPLE MARKS	Lab No:	Insoluble matter (mg)
RGDM 01	E21051	103
RGDM 02	E21052	439
RGDM 03	E21053	418
RGDM 04	E21054	299
RGDM 05	E21055	1469
RGDM 06	E21056	829
RGDM 07	E21057	320
RGDM 08	E021058	554

Note: The samples were filtered through a 125mm 1µ filter before filtration with a 0.45µ filter and the weights the combined.

Method Ref:METHODASTM D1739.



ALISON ACKERMAN
 OPERATIONAL MANAGER

.....
 Authorised Signature (original blue ink)

All services are rendered in accordance with Bureau Veritas M&L Laboratory Services (Pty) Ltd General Terms and conditions of Business, which has been supplied to you, this certificate cannot be reproduced except in full without the written consent of M and L Laboratory Services.

M and L Laboratory Services (Pty) Ltd
 Reg No. 1974/001476/07 VAT No. 478013505
 P O Box 82124
 Southdale, 7135
 40 Modulus Road
 Ormiston, 2051
 T: +27 861 7990
 F: +27 496 2288
 E: joanne.barton@m&l-bureauveritas.com
www.bureauveritas.com



M & L LABS

Ref.No. : 7804679
 Issued at : Johannesburg
 Date : 22/07/2013
 Page : 1 of 2

COMPANY NAME :SRK CONSULTING
 ADDRESS :P O BOX 1969 WESTVILLE 3630
 SUBJECT :ANALYSIS OF 8 SAMPLES OF DUST
 MARKED :ROXGOLD AND AS BELOW
 INSTRUCTED BY :DHIREN NAIDOO
 ORDER NO. :Q4017
 RECEIVED ON :2013/07/15
 LAB NO(S) :E19251 - E19258
 DATE ANALYSED :2013/07/19

Analysis on an as received basis:


SAMPLE MARKS	Lab No:	Insoluble matter (mg)
RGDM 01	E19251	120
RGDM 02	E19252	42
RGDM 03	E19253	74
RGDM 04	E19254	35
RGDM 05	E19255	21
RGDM 06	E19256	147
RGDM 07	E19257	396
RGDM 08	E19258	1793

Note: The samples were filtered through a 125mm 1µ filter before filtration with a 0.45µ filter and the weights the combined.

Method Ref:METHODASTM D1739.



ALISON ACKERMAN
 OPERATIONAL MANAGER


 Authorised Signature (original blue ink)

All services are rendered in accordance with Bureau Veritas M&L Laboratory Services (Pty) Ltd General Terms and conditions of business, which has been supplied to you, this certificate cannot be reproduced except in full without the written consent of M and L Laboratory Services.

M and L Laboratory Services (Pty) Ltd
 Reg No. 1974/001476/07 VAT No. 478013505
 P O Box 82124
 Southdale, 2135
 40 Modulus Road
 Durmidge, 2091
 T: +27 861 7900
 F: +27 866 2238
 E: joanne.barton@ra.bureauveritas.com
www.bureauveritas.com



M&L LABS

Ref.No. :7686288
 Issued : Johannesburg
 at
 Date : 27/06/2013
 Page : 1 of 2

COMPANY NAME :SRK CONSULTING
 ADDRESS :P O BOX 1969 WESTVILLE 3630
 SUBJECT :ANALYSIS OF 8 SAMPLES OF DUST
 MARKED :ROXGOLD AND AS BELOW
 INSTRUCTED BY :DHIREN NAIDOO
 ORDER NO. :Q3939
 RECEIVED ON :2013/06/06
 LAB NO(S) :E17797 - E17804
 DATE ANALYSED :2013/06/10

Analysis on an as received basis:

SAMPLE MARKS	Lab No:	Insoluble matter (mg)
RGDM 01	E17797	730
RGDM 02	E17798	1208
RGDM 03	E17799	1179
RGDM 04	E17800	881
RGDM 05	E17801	1237
RGDM 06	E17802	912
RGDM 07	E17803	588
RGDM 08	E17804	1546

Note: The samples were filtered through a 125mm 1µ filter before filtration with a 0.45µ filter and the weights the combined.

Method Ref:METHODASTM D1739.

All services are rendered in accordance with Bureau Veritas M&L Laboratory Services (Pty) Ltd General Terms and conditions of Business, which has been supplied to you, this certificate cannot be reproduced except in full without the written consent of M and L Laboratory Services.

RECEIVED SRK DNN.	
DATE	16/07/13
FILE No	

ALISON ACKERMAN
 OPERATIONAL MANAGER

.....
 Authorised Signature (original blue ink)

P.O. Box 82124,
Southdale, 2135,
South Africa.
TEL (011) 496-2228
FAX (011) 496-2239



Ref No. : 7944180
Issued at : Johannesburg
Date : 09/10/2013
AA/cw : Page 1 of 1

COMPANY NAME : SRK CONSULTING – DURBAN
ADDRESS : PO BOX 1969, WESTVILLE, 3630
SUBJECT : ANALYSIS OF 2 RADIELLO TUBES
MARKED : AS BELOW
INSTRUCTED BY : DHIREN NAIDOO
ORDER NO : N/A
RECEIVED ON : 13/08/2013
LAB NO(S) : H07114-H07115
DATE ANALYSED : 31/08/2013

Results: $\mu\text{g}/\text{m}^3$

Test: Gases for SO_2 AND NO_2

Test Ref: Radiello Method

Results: $\mu\text{g}/\text{sample}$

<u>SAMPLE MARKS</u>	<u>Nitrogen Dioxide NO_2</u>	<u>Sulfur Dioxide SO_2</u>
UG679	<0.35	<0.27
UG680	<0.35	<0.27

B.D.L. = Below Detection Limit

$\text{NO}_2 = 0.35 \mu\text{g}/\text{m}^3$

$\text{SO}_2 = 0.27 \mu\text{g}/\text{m}^3$

Note: The results was supplied by Sub Contracted Laboratory

APPENDIX 6
NOISE MONITORING STUDY

NOISE BASELINE STUDY FOR THE YARAMOKO GOLD PROJECT IN BURKINA FASO

AUGUST 2013

Report Number 13/3/2 Final

F le Malherbe Pr Eng

Report Prepared for

Roxgold S.A.R.L

Report Prepared by

 **srk** consulting

Introduction

In preparation for an eventual full Environmental Impact Assessment (EIA) an estimation of the pre-development ambient noise levels in the environment of the project is required. This report describes the methodology, results and findings of the required baseline noise study.

Purpose of the baseline noise study

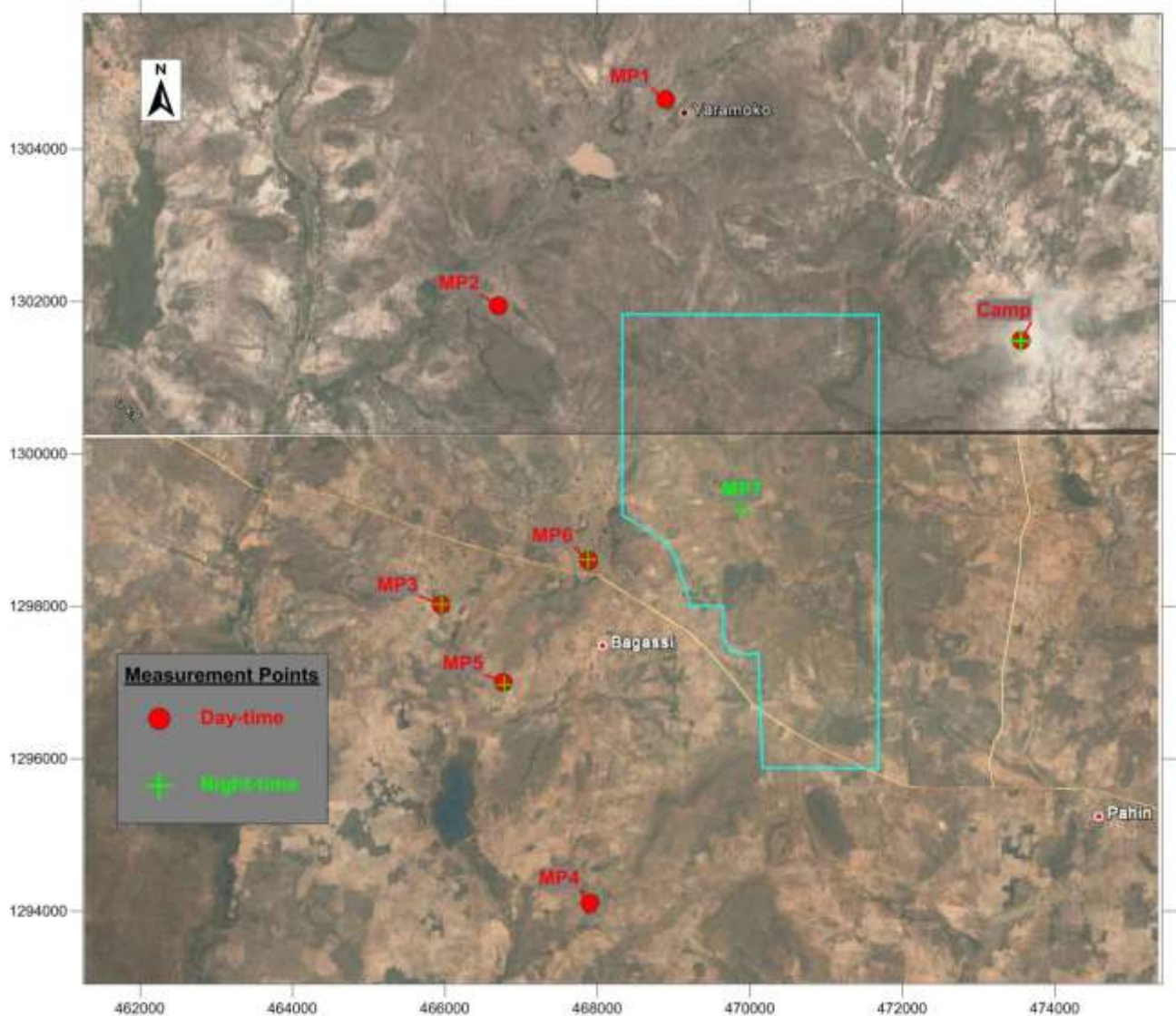
The purpose of this baseline noise study is to:

- Study the available information on the Yaramoko gold project (the Project);
- Conduct a site visit;
- Identify the noise sensitive receptors nearest to the Project;
- Take representative ambient noise level measurements; and
- Process the results in order to obtain a realistic estimate of pre-development ambient noise levels.

Methodology of the noise study

A site visit was undertaken between the 26th and 30th of April 2013. The purpose of the site visit was for orientation, the gathering of information on the environment of the Project, the selection of representative noise measurement points and the taking of noise measurement samples.

The current ambient noise levels were sampled at seven measurement points. These are indicated in the Figure below.



Noise level measurements

All the noise measurements were taken in accordance with the procedures specified in SANS 10103 ⁵.

At measurement points MP1 to MP7 the measurement parameters were:

- L_{Aeq} (15 min): The A-weighted equivalent sound pressure level with a minimum duration of 15 minutes per sample;
- L_{A90} : The concurrent A-weighted 90-percentile sound pressure level;
- The third octave frequency band spectrum of the sampled ambient noise levels; and
- A sound recording of the ambient noise level in order to assist with the identification of noise sources during analysis of the measurement results.

At the exploration camp an instrument was installed to continuously measure the ambient noise level over a longer period from the 26th to the 29th of April 2013. The measurements comprised of:

- L_{Aeq} (1 min): The A-weighted equivalent sound pressure level over the longer period determined in continuous intervals with a duration of 1 minute each;

- L_{A90} : The concurrent A-weighted 90-percentile sound pressure level; and
- A sound recording of the ambient noise level in order to assist with the identification of noise sources during analysis of the measurement results.

The measurement results were assessed against the guidelines provided by the WHO, IFC and SANS 10103⁵.

Brief description of the project environment

The topography of the area is flat, but interspersed with hillocks that will provide screening against the propagation of noise over longer distances. The vegetation mostly is grassland with some medium to tall trees.

The Project environment has a rural character, although there is a considerable amount of artisanal mining around. Small villages and hamlets are scattered across the area, the largest of them being Bagassi. These are the primary noise sensitive receptors in the area.

Apart from the current exploration activities the dominant noise sources are:

- Localised traffic, mostly consisting of scooters, motorcycles and fewer light vehicles;
- Domestic activities, including utilities such as small petrol generators;
- Domestic animals, i.e. dogs, poultry, goats, cattle and donkeys; and
- Other natural sounds, e.g. birds, insects and frogs.

Conclusions

Based on the findings of this baseline noise study the conclusions that can be drawn are:

- The Project area is rural, with scattered villages and small hamlets which are the primary noise sensitive receptors of future mining related noise emissions;
- Although windy conditions on the first day (2013/04/26) dominated the measurement results it may be safely assumed that general ambient noise levels during the day will be below 50 dBA. The exceptions are at the centres of larger villages, such as Bagassi;
- This is confirmed by the measurement results taken on the second day (2013/04/27) with low wind speeds, and especially at the exploration camp. The day-time measurement results range from approximately 42 dBA to 46 dBA and may be accepted as representative for pre-development conditions;
- The processed measurement results suggest that night-time ambient noise levels are well below 40 dBA, and it is suggested that 36 dBA will provide a reliable estimate of pre-development conditions during the night.
- The measurement results confirm that the present ambient noise levels in the environment of the Project fall within the guidelines provided by the WHO, IFC and SANS 10103⁵.

MEASUREMENT INSTRUMENTATION

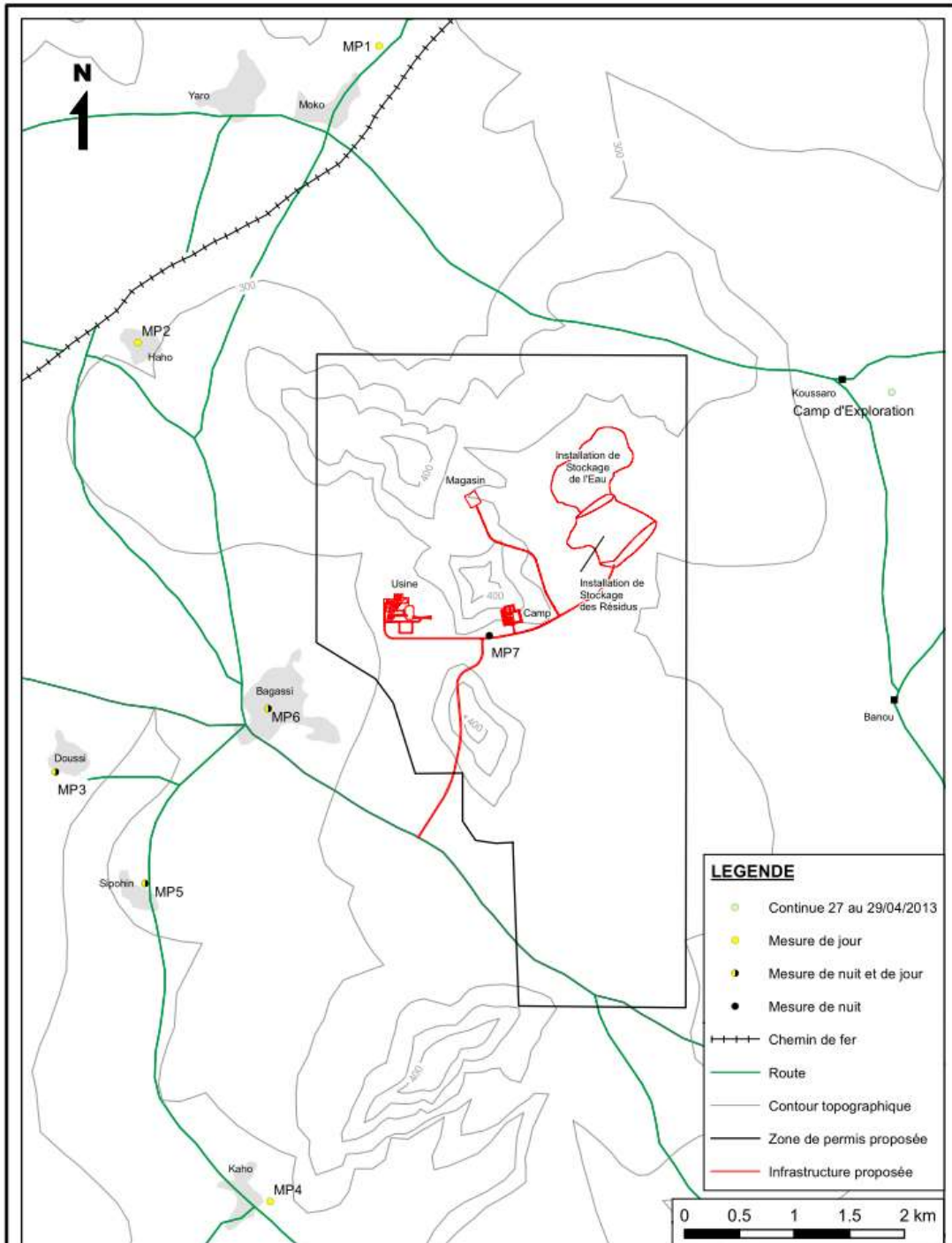
The measurement instrumentation that was used in this noise study is summarised in Table A-1. The measurement instrumentation complies with the accuracy requirements specified for a Type 1 instrument in:

- SANS 61672-1/IEC 61672-1, *Electro acoustics – Sound level meters – Part 1: Specifications. Amdt 1*
- SANS 60942/IEC 60942 (SABS IEC 60942), *Electro acoustics – Sound calibrators.*

TABLE B-1
Measurement instrumentation

Instrument	Type	Serial Number	Date calibrated	Calibration Certificate
Sound level meter	Rion NL-32	661742	2008/02/13	2008-201
Microphone	Rion UC-53A	310007	2008/02/13	2008-201
1/3 Octave Filter	Rion NX22RT	30761509	2008/02/13	2008-201
Sound level meter	B&K 2250	2645150	2011/11/18	AV\AS-4165
Microphone	B&K 4189	2643500	2011/11/18	AV\AS-4165
Sound level calibrator	Rion NC-73	11086877	2011/11/18	AV\AS-4165

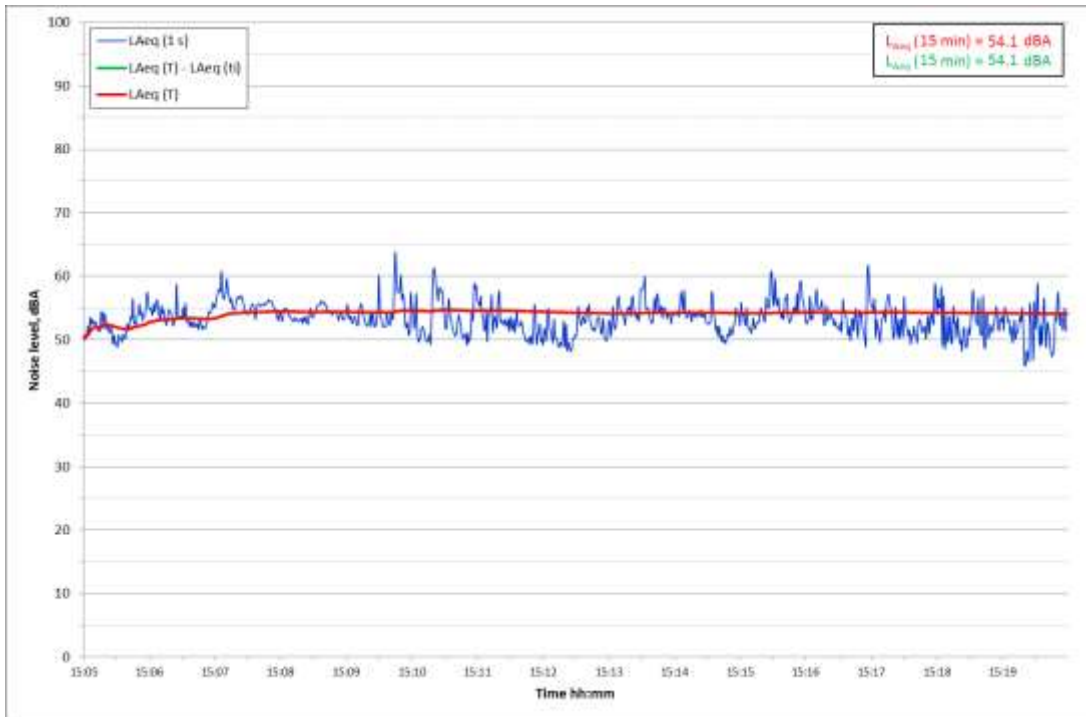
The calibration status of the instrumentation was checked before and after each set of measurements against a calibrated signal with a level of 94,0 dB at 1 kHz. In each case the instrument displayed a reading of within 1 dB of the calibrated value. A windshield supplied by the manufacturer of the instrument was used during all the measurements.



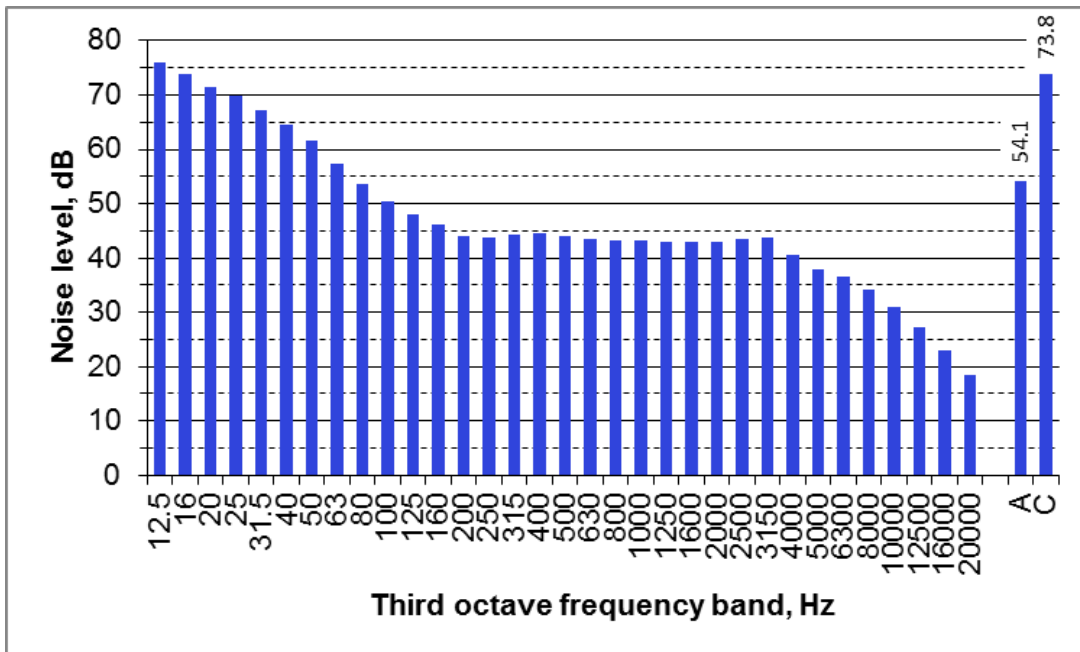
NOVEMBRE 2013	U5629	EIES YARAMOKO	
		Carte d'Emplacement de Surveillance du Bruit	8 - 2

DETAILED MEASUREMENT RESULTS

The detailed measurement results are given in Figures B-1 to B-11 and Table B-1.

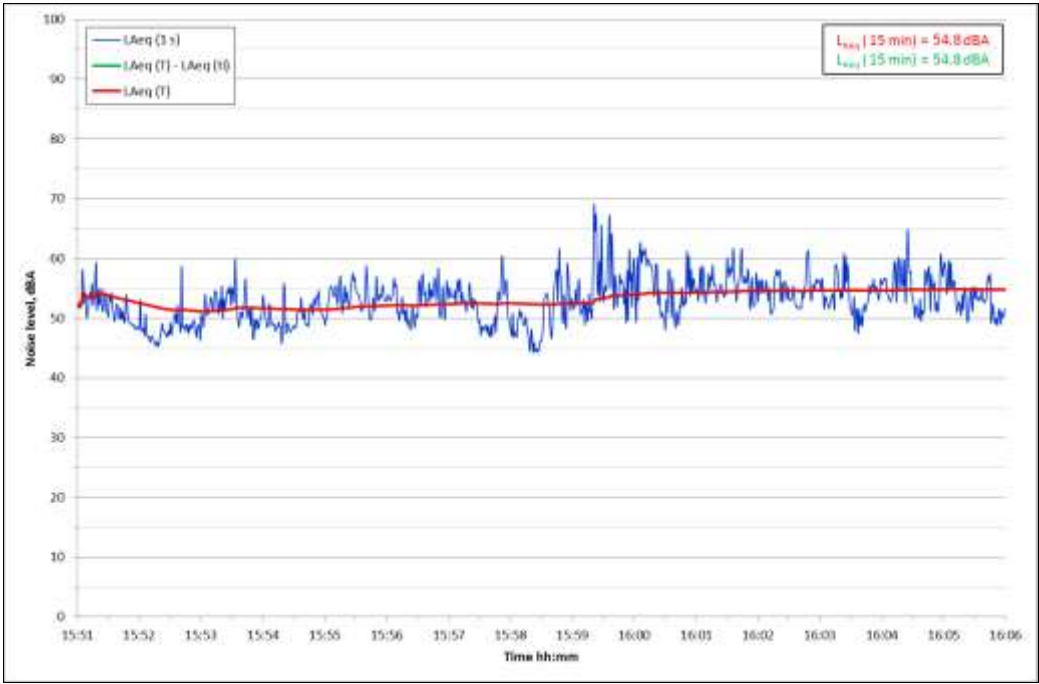


a)

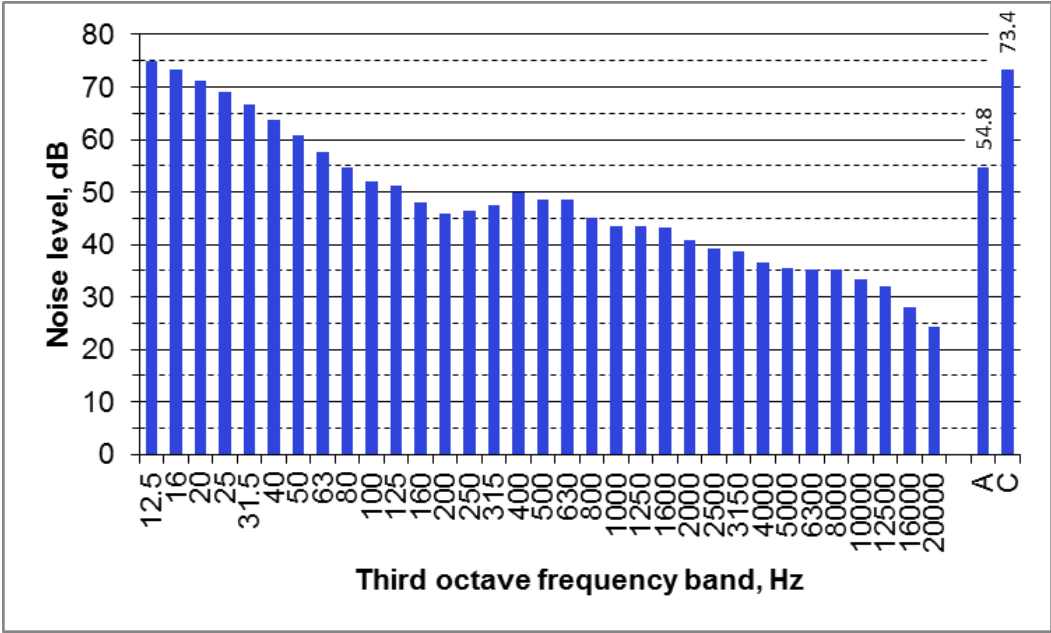


b)

Figure B-1: Ambient noise level measured at MP1 during the day: a) profile of the measurement and b) third octave band frequency spectrum.

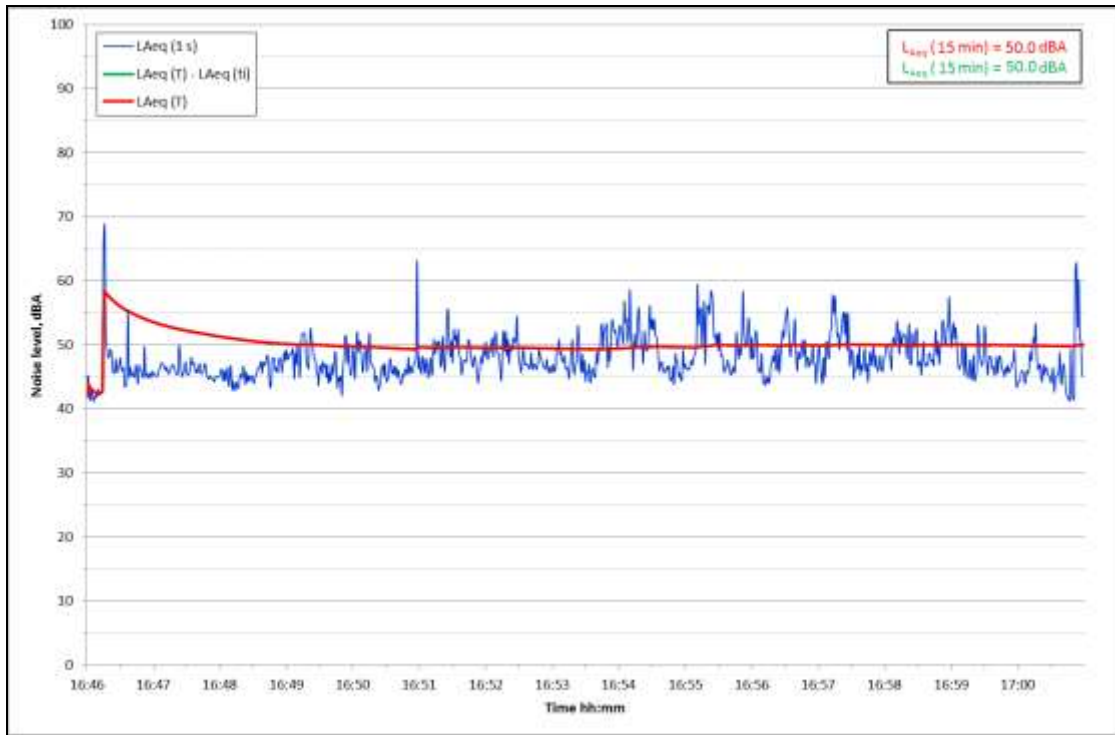


a)

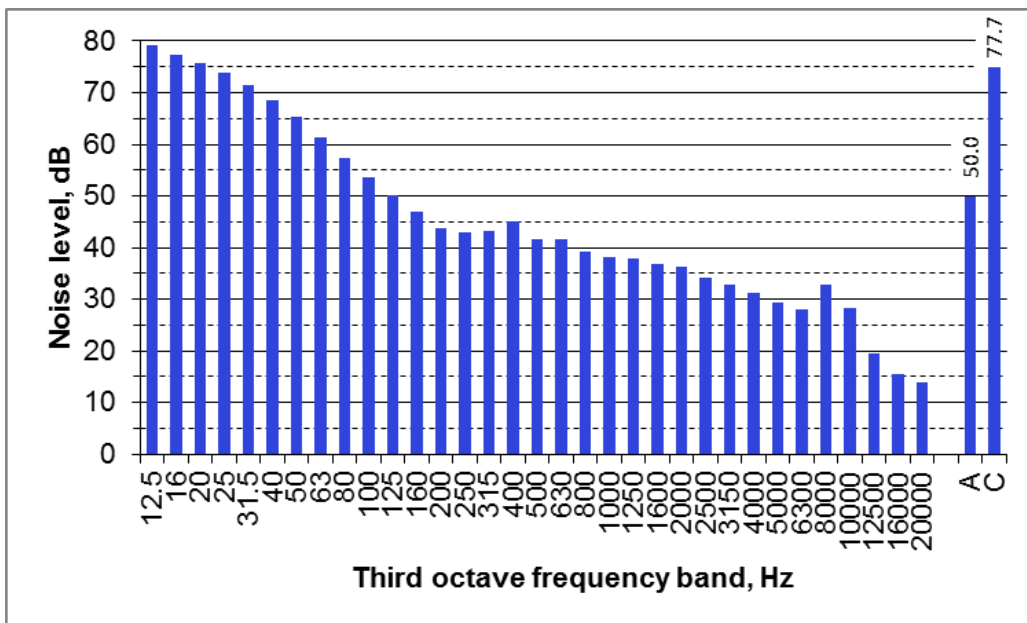


b)

Figure B-2: Ambient noise level measured at MP2 during the day: a) profile of the measurement and b) third octave band frequency spectrum.

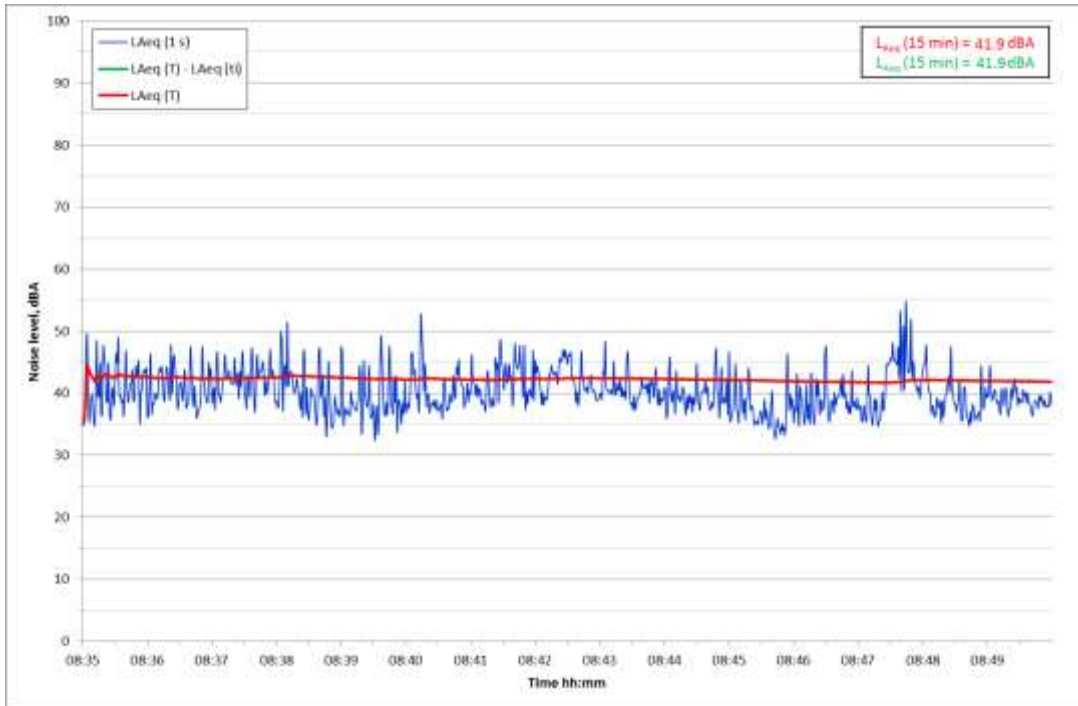


a)

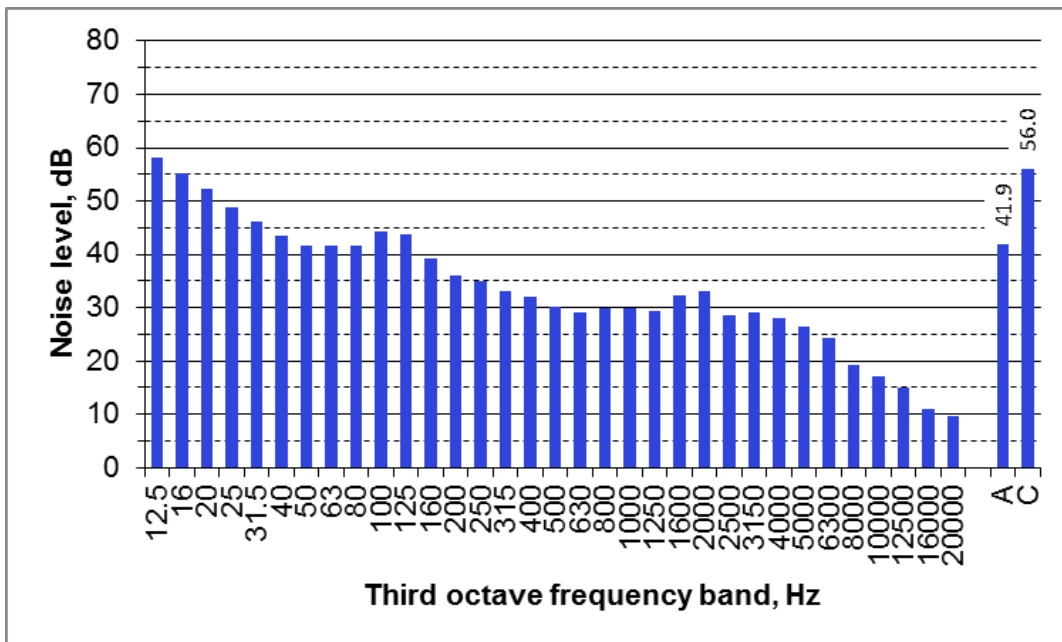


b)

Figure B-3: Ambient noise level measured at MP3 during the day: a) profile of the measurement and b) third octave band frequency spectrum.

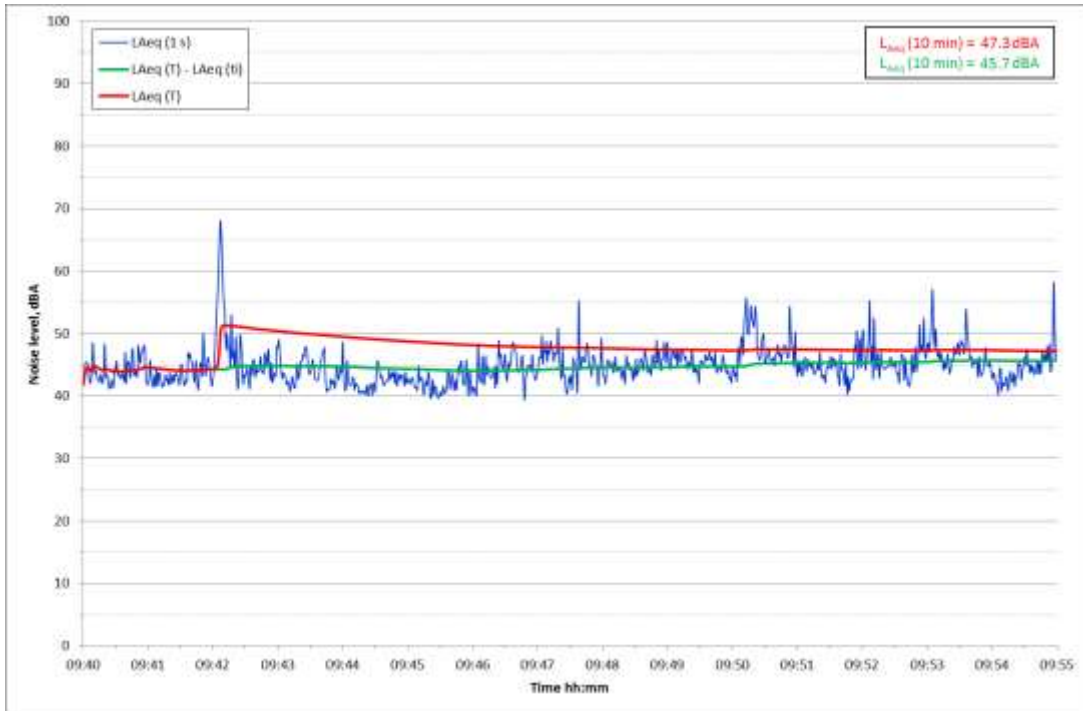


a)

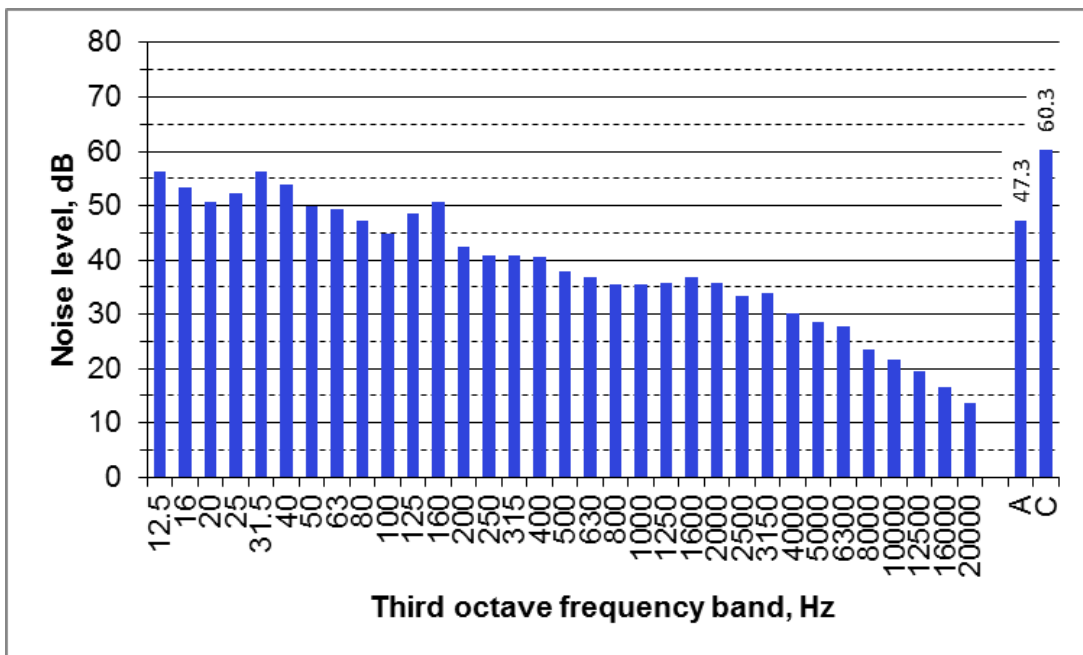


b)

Figure B-4: Ambient noise level measured at MP4 during the day: a) profile of the measurement and b) third octave band frequency spectrum.

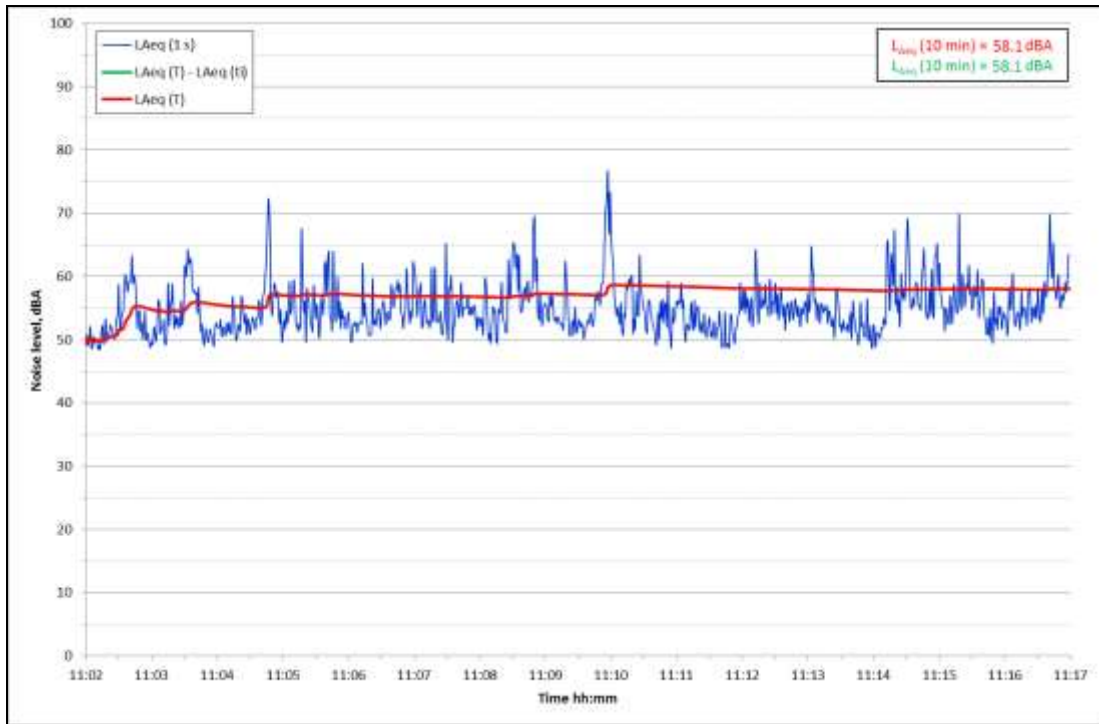


a)

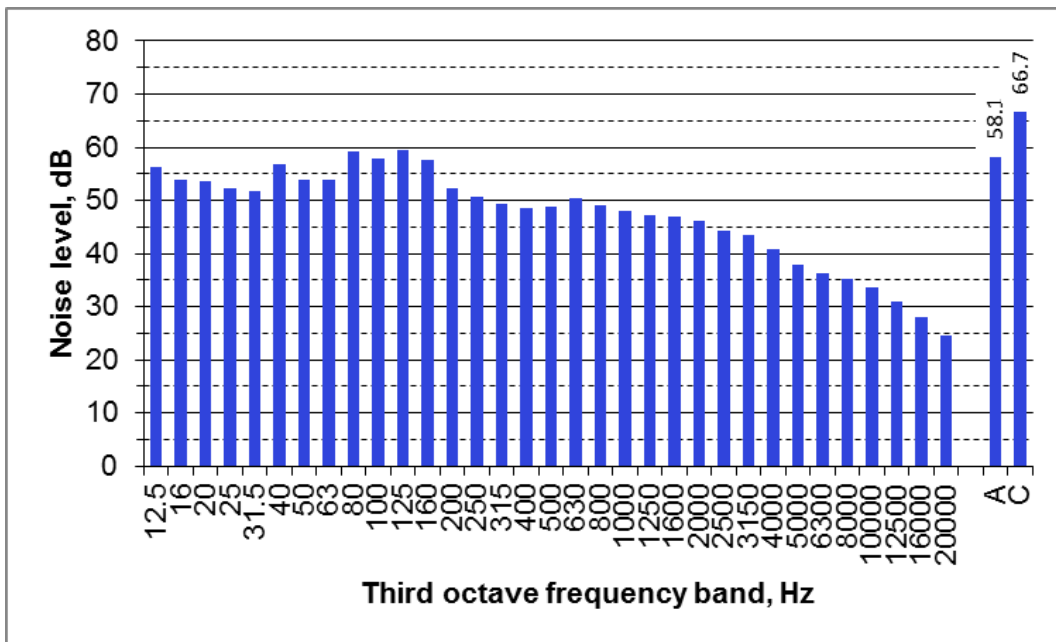


b)

Figure B-5: Ambient noise level measured at MP5 during the day: a) profile of the measurement and b) third octave band frequency spectrum.



a)

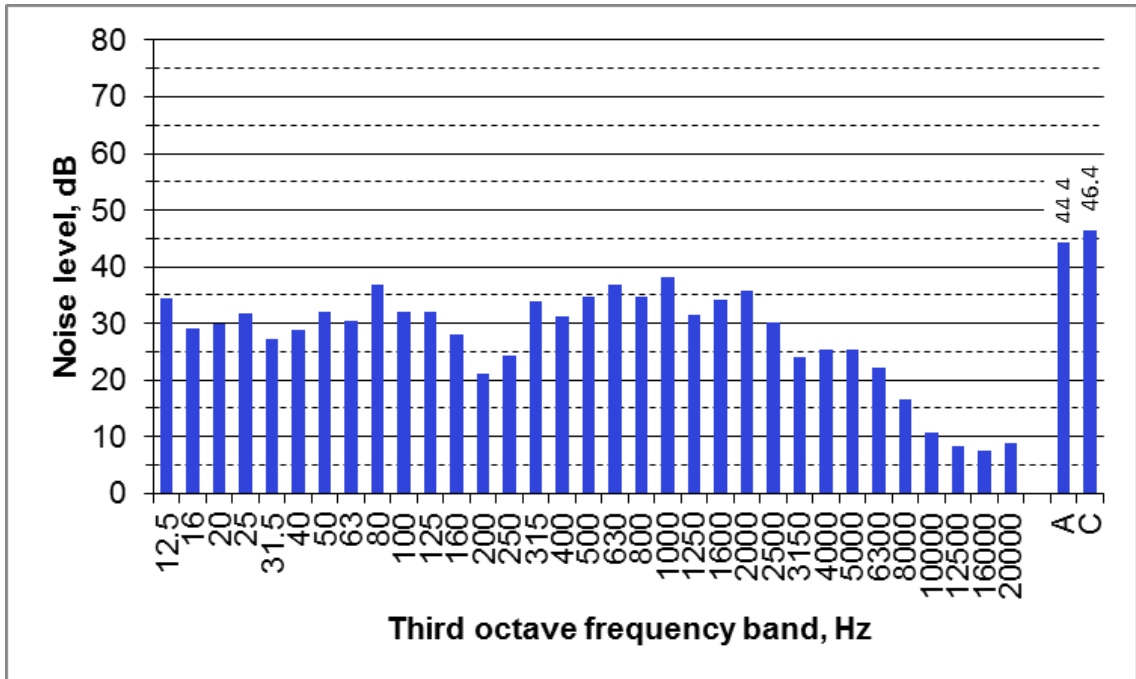


b)

Figure B-6: Ambient noise level measured at MP6 during the day: a) profile of the measurement and b) third octave band frequency spectrum.

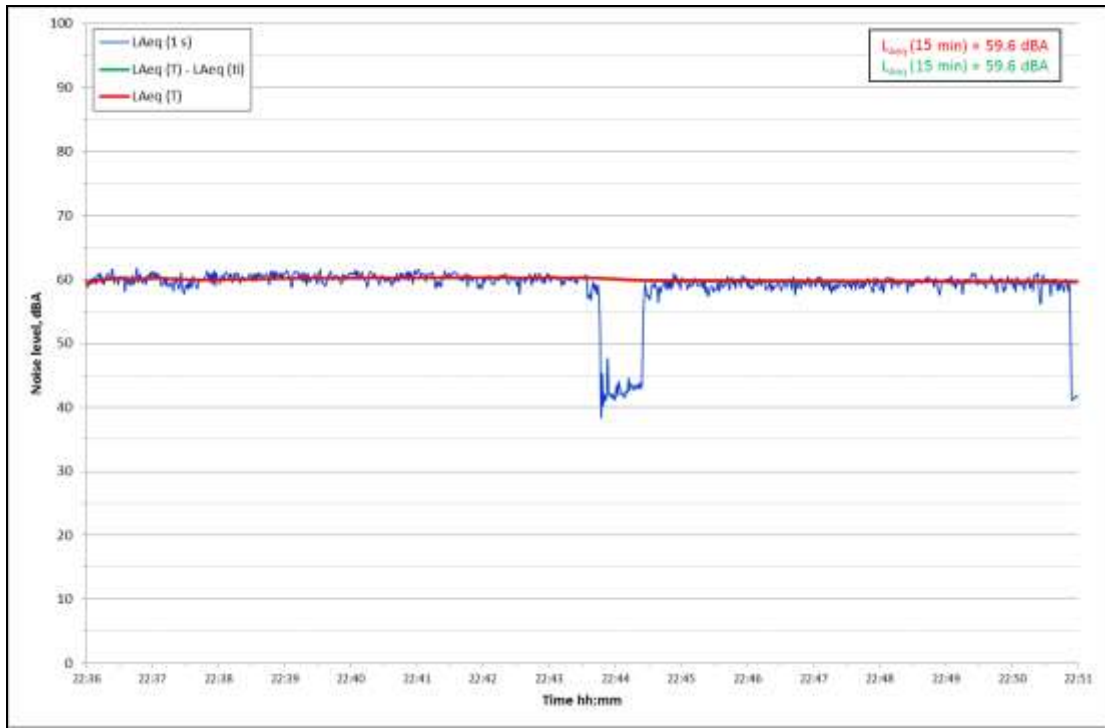


a)

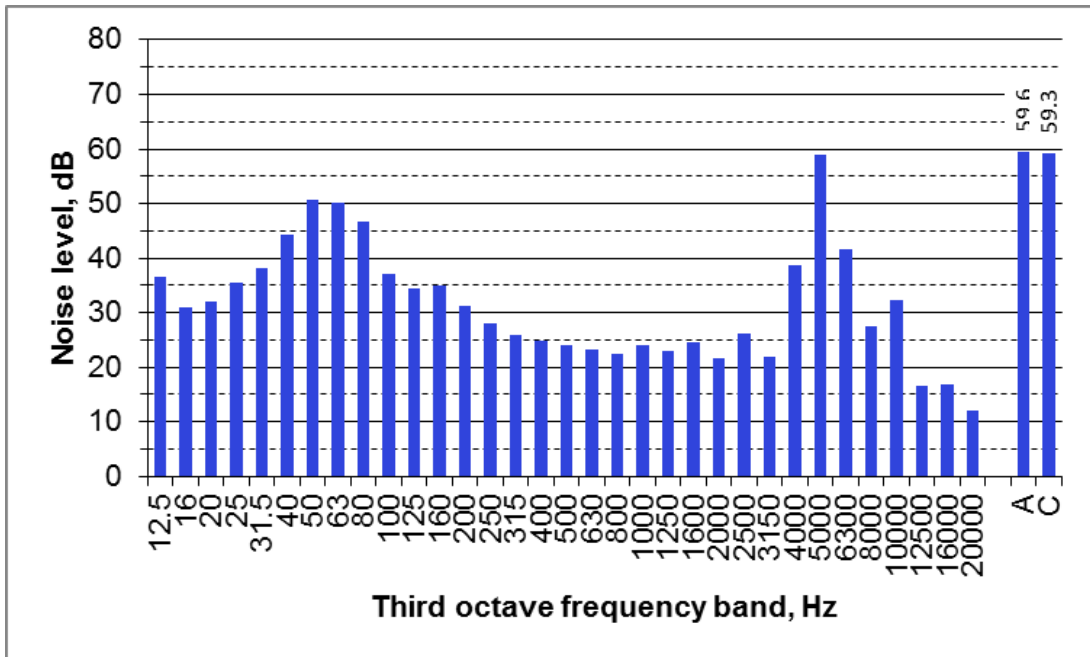


b)

Figure B-7: Ambient noise level measured at MP3 during the night: a) profile of the measurement and b) third octave band frequency spectrum.

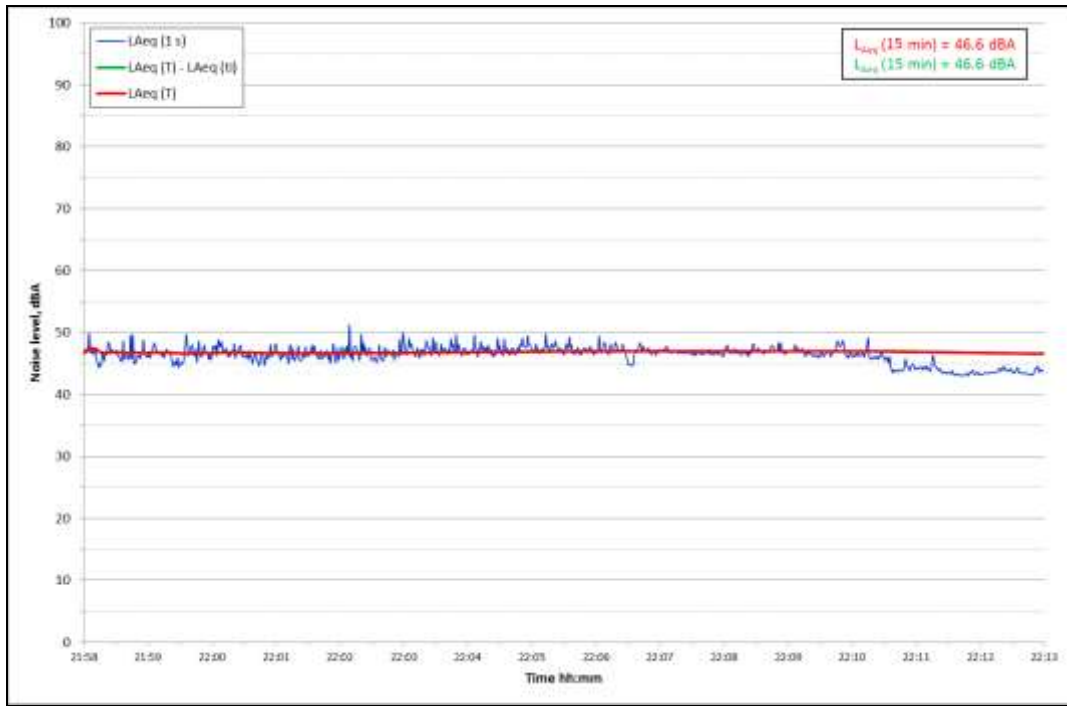


a)

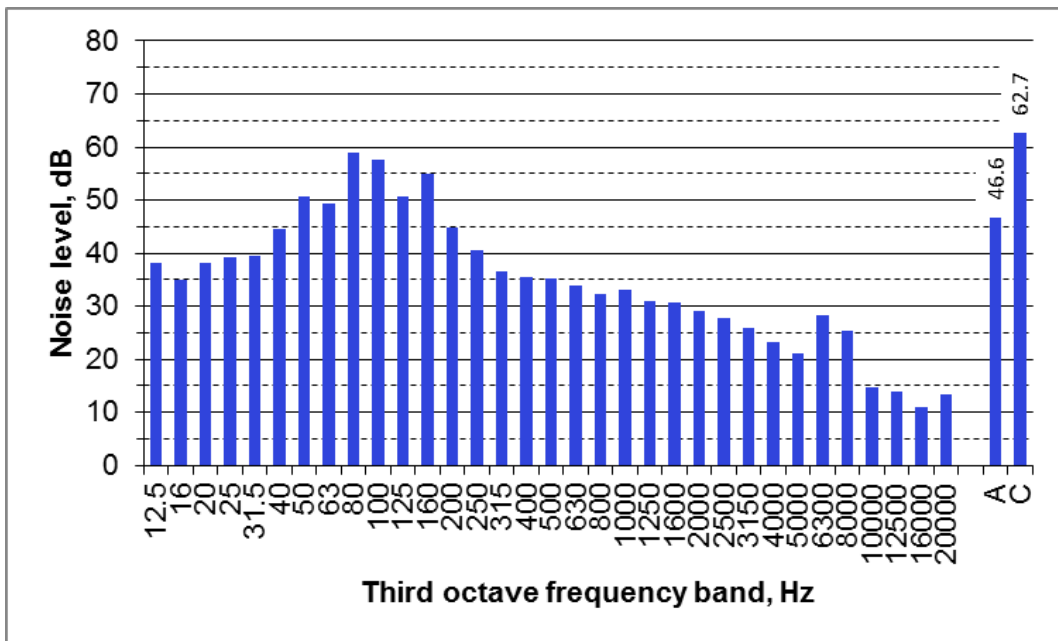


b)

Figure B-8: Ambient noise level measured at MP5 during the night: a) profile of the measurement and b) third octave band frequency spectrum.

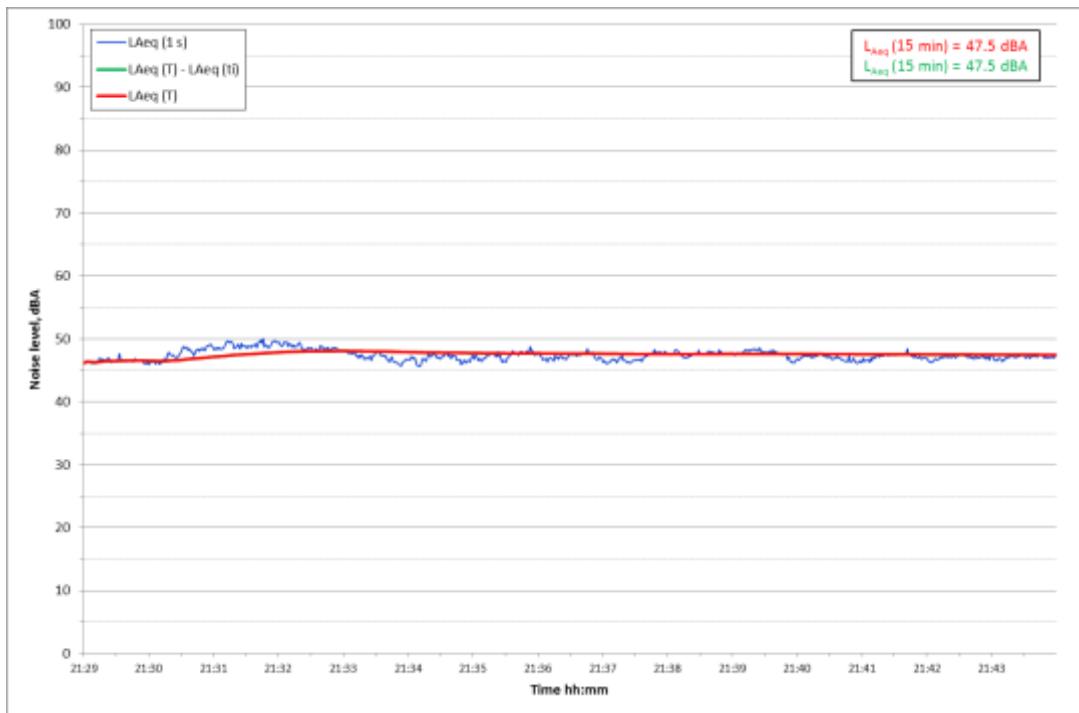


a)

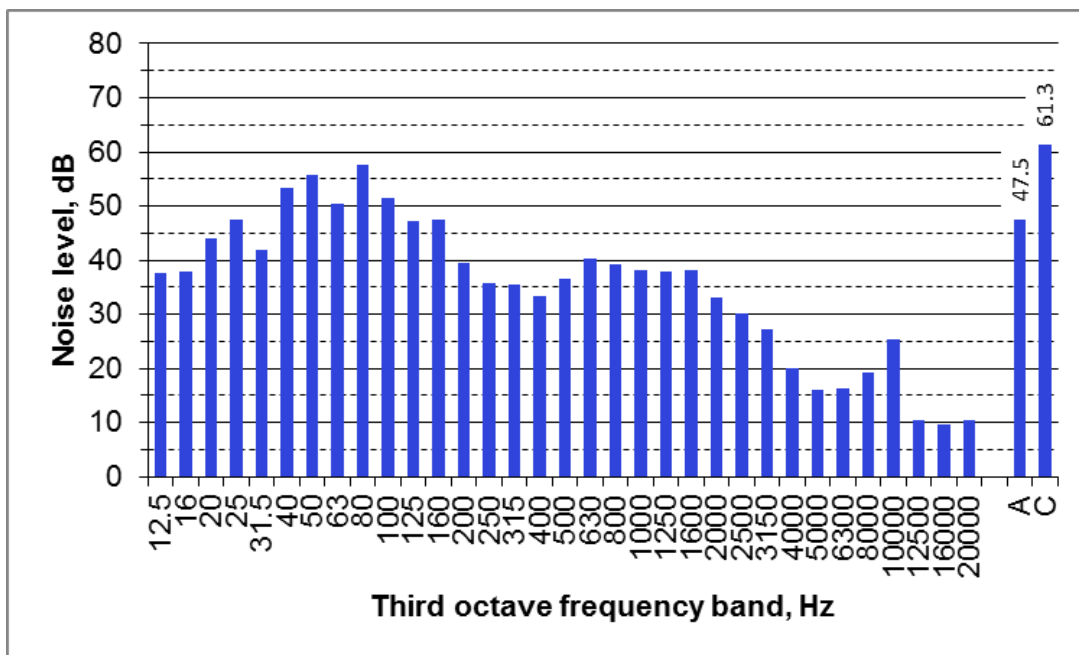


b)

Figure B-9: Ambient noise level measured at MP6 during the night: a) profile of the measurement and b) third octave band frequency spectrum.



a)



b)

Figure B-10: Ambient noise level measured at MP7 during the night: a) profile of the measurement and b) third octave band frequency spectrum.

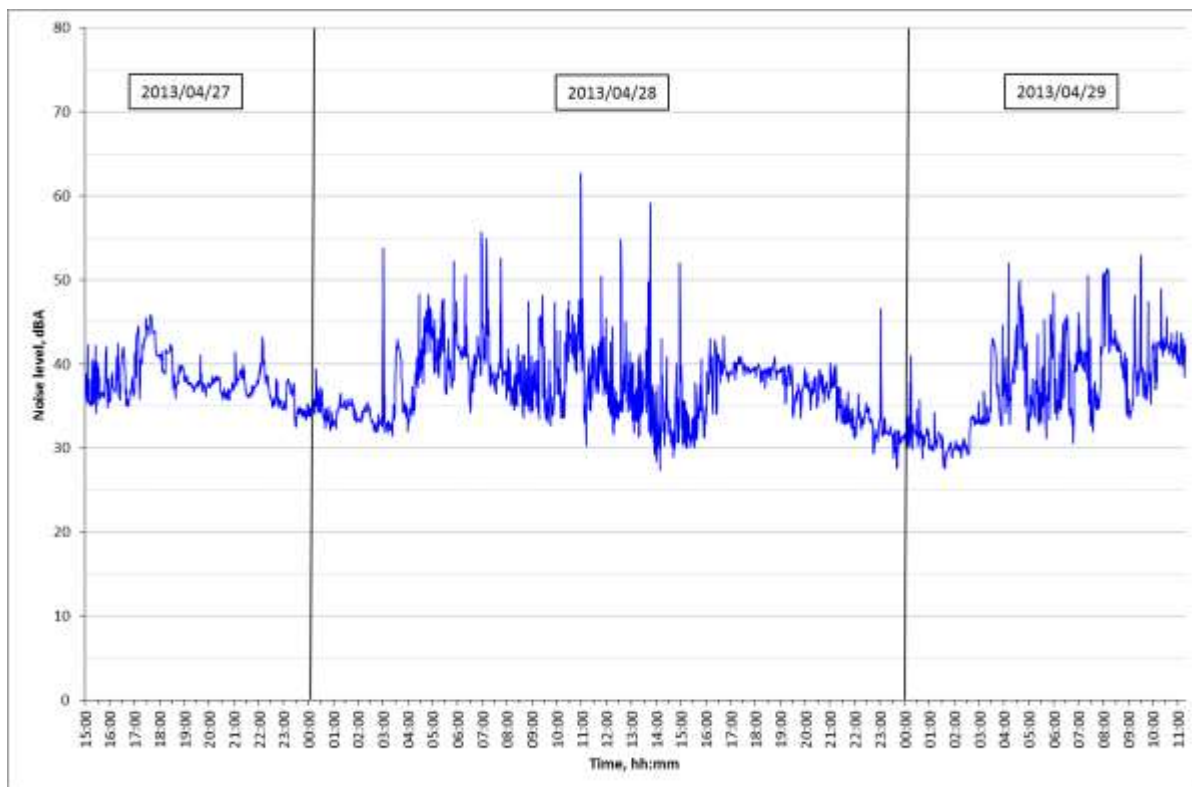


Figure B-11: Ambient noise level continuously measured at the Exploration Camp.

TABLE B-1

Measurement results at the Exploration Camp: 1 hour averages

1 hour Average								
Start	LAeq	LAFmax	LAFmin	L5	L10	L50	L90	L95
2013/04/27 17:03	37.6	65.1	30.3	39.6	38.4	35.8	34.4	34.2
2013/04/27 18:03	38.2	59.1	32.1	39.5	38.8	37.3	36.2	36.0
2013/04/27 19:03	43.0	64.3	32.4	44.2	43.8	42.2	40.6	40.2
2013/04/27 20:03	40.1	55.4	32.8	42.0	41.5	39.4	37.5	37.1
2013/04/27 21:03	37.7	59.6	32.3	39.4	39.0	37.4	35.9	35.5
2013/04/27 22:03	37.3	57.8	32.6	38.6	38.3	37.0	35.8	35.5
2013/04/27 23:03	37.8	51.2	32.8	39.3	38.9	37.5	36.2	36.0
2013/04/28 00:03	37.7	55.0	32.1	38.7	38.2	36.9	35.8	35.6
2013/04/28 01:03	35.6	46.9	30.0	36.9	36.6	35.1	33.9	33.7
2013/04/28 02:03	34.7	51.2	30.1	35.7	35.4	34.3	33.4	33.2
2013/04/28 03:03	34.7	46.8	30.2	36.2	35.8	34.4	33.2	32.9
2013/04/28 04:03	33.7	52.7	29.8	34.9	34.5	33.4	32.5	32.2
2013/04/28 05:03	40.3	68.2	29.4	38.1	37.4	35.6	34.5	34.3
2013/04/28 06:03	41.8	72.8	30.2	43.0	41.6	37.8	35.5	35.1
2013/04/28 07:03	43.0	66.6	32.5	44.9	43.4	39.5	37.4	37.0
2013/04/28 08:03	43.8	68.3	31.8	42.8	41.9	40.1	39.1	38.9
2013/04/28 09:03	44.1	64.5	32.7	43.4	42.3	39.6	38.0	37.7
2013/04/28 10:03	38.4	72.1	28.8	39.7	38.5	35.7	34.3	34.1
2013/04/28 11:03	40.1	66.2	28.6	40.1	39.1	36.5	35.0	34.8
2013/04/28 12:03	46.7	82.4	29.7	43.9	42.4	38.4	35.8	35.3
2013/04/28 13:03	40.6	66.5	26.9	42.4	40.5	35.7	32.7	32.2
2013/04/28 14:03	41.0	73.1	26.7	39.4	38.1	34.6	32.7	32.3
2013/04/28 15:03	43.2	75.4	23.8	38.9	37.2	32.6	30.4	30.0
2013/04/28 16:03	37.7	75.2	22.2	37.0	35.2	31.0	28.6	28.1

2013/04/28 17:03	34.0	55.3	24.7	36.6	35.1	31.1	29.1	28.7
2013/04/28 18:03	39.5	62.9	28.8	41.6	40.7	37.9	35.9	35.6
2013/04/28 19:03	39.6	53.1	33.3	41.2	40.9	39.4	37.8	37.5
2013/04/28 20:03	39.2	52.2	32.0	40.9	40.5	39.0	37.5	37.1
2013/04/28 21:03	37.6	46.4	27.3	39.2	38.8	37.0	35.3	34.9
2013/04/28 22:03	37.2	47.3	28.6	39.1	38.7	36.8	35.0	34.6
2013/04/28 23:03	35.7	55.0	26.6	36.8	36.4	34.8	33.2	32.7
2013/04/29 00:03	33.2	52.9	26.1	34.7	34.3	32.7	31.1	30.7
2013/04/29 01:03	33.6	67.2	24.8	33.5	33.0	31.2	29.5	29.2
2013/04/29 02:03	32.3	65.6	24.6	33.2	32.6	30.9	29.2	28.8
2013/04/29 03:03	30.3	55.2	24.6	31.8	31.3	29.9	28.5	28.2
2013/04/29 04:03	31.6	46.6	25.3	33.4	32.8	31.0	29.2	28.8
2013/04/29 05:03	38.0	60.1	25.5	38.7	38.0	35.5	33.6	33.2
2013/04/29 06:03	42.6	74.0	24.2	43.7	42.1	37.3	34.0	33.4
2013/04/29 07:03	38.7	68.3	23.8	40.9	39.2	34.1	30.8	30.2
2013/04/29 08:03	40.7	64.6	25.2	41.6	40.0	36.2	34.2	33.8
2013/04/29 09:03	41.6	68.8	26.1	41.7	40.4	37.0	35.3	34.9
2013/04/29 10:03	45.3	68.5	30.1	44.5	43.9	42.2	40.9	40.6
2013/04/29 11:03	41.7	70.9	30.5	40.7	39.5	36.9	35.8	35.5
2013/04/29 12:03	42.2	72.7	34.8	43.4	42.8	41.2	40.2	39.9
2013/04/29 13:03	41.0	62.4	34.3	43.2	42.2	39.8	38.4	38.1

APPENDIX 7 :

**CALCULATION OF HYDROGEOLOGICAL
CHARACTERISTICS**

Sub-watersheds:	3	4	5
Aspect of the hydrographic network:			
Area S (km ²) :	49.39	101.83	158.63
Length of the trough L _t (km) :	12.17	20.78	27.56
Total length of watercourses	12.17	20.78	27.56
L _{tce} (Km) :			
" Estimate longitudinal slope I (1/1000)" :			
(I = 0,26/S ^{1/2} in mm/m) :	0.0370	0.0258	0.0206
Drainage density Dd (Km/Km ²) :			
Dd =	0.246370761	0.204070397	0.173736213
L _{tce} /S :			
Perimeter (in km) :	28.78	48.52	68.14
P			
Compactness index :			
Ic			
Ic = 0.282*P/S ^{1/2}	1.15	1.36	1.53
Leq = Ic*(S ^{1/2} /1.128)*[1+(1-(1.128/Ic) ²) ^{1/2}]	8.74	18.86	28.51
Specific steepness DS			
Ds = Ig *S ^{0,5}	16.08323719	10.70114475	17.67260447
Maximum Altitude (in m) : Z _{max}	400	400	560
Minimum altitude (in m) : Z _{min}	260	260	291.4
Altitude at 5% of surface (en m) : Z _{5%}	280	300	320
Altitude at 95% of surface (in m) : Z _{95%}	260	280	280
Overall slope index: Ig			
Ig = (Z _{5%} -Z _{95%})/Leq	2.28851017	1.060476372	1.403179057

Determination of floods:	SBV 3	SBV 4	SBV 5
Calculation parameters			
Reduction coefficient A	0.79	0.75	0.73
A = 1-0,001*(9logT-0,042*Pan+152)*logS			
Pan = 869			
T = 10			

Hydrograph

$$Tb = 250 \cdot S^{0,35} + 300$$

Tb (mm)	1200	1550	3600
Tb (h)	20.00	25.83	60.00
Tm (mm)	450	600	650
Tb (mm)			
Tm (mm)			

ORSTOM Method

$$Q10 = a \times P10 \times Kr10 \times A \times S / Tb10 \quad 18.40 \quad 27.91 \quad 18.12$$

$$Qm10 = 16,7 \cdot P10 \cdot A \cdot Kr10 \cdot S / Tb \quad 15.36 \quad 23.30 \quad 15.13$$

(m3/S)

(Tb en mm)

Peak coefficient α

$$Qr10 = \alpha \cdot Qm10 \quad 39.94 \quad 60.58 \quad 39.34$$

$$Q10 = 1,03 \cdot Qr10 \quad 41.13 \quad 62.40 \quad 40.52$$

1,03*Qr10

CIEH Method Kr10

Estimation of Kr10 / Puech Formula

$$Kr10 = \text{Granite}$$

$$2300 \cdot Pan - 0,67$$

$$Kr10 = \text{Schist}$$

$$370 \cdot Pan - 0,375$$

Kr10 average

$$Q10 = 0,41 \cdot S^{0,425} \cdot Kr10^{100,923} \quad 45.01 \quad 61.21 \quad 73.90$$

$$Q10 = 0,254 \cdot S^{0,462} \cdot Ig^{0,101} \cdot Kr10^{100,976}$$

Q10 =

$$0,254 \cdot S^{0,462} \cdot Ig^{0,101} \cdot Kr10^{100,976}$$

Gradex Method

$$Q100 = C \cdot Q10 \text{ (m3/s)} \quad 45.63 \quad 62.08 \quad 75.07$$

$$C = 1 + (P100 - P10) / P10 \cdot (Tb/24)^{0,12} / Kr10 \quad 1.01 \quad 1.01 \quad 1.02$$

$$C = 1 + (P100 - P10) / P10 \cdot (Tb/24)^{0,12} / Kr10$$

APPENDIX 8

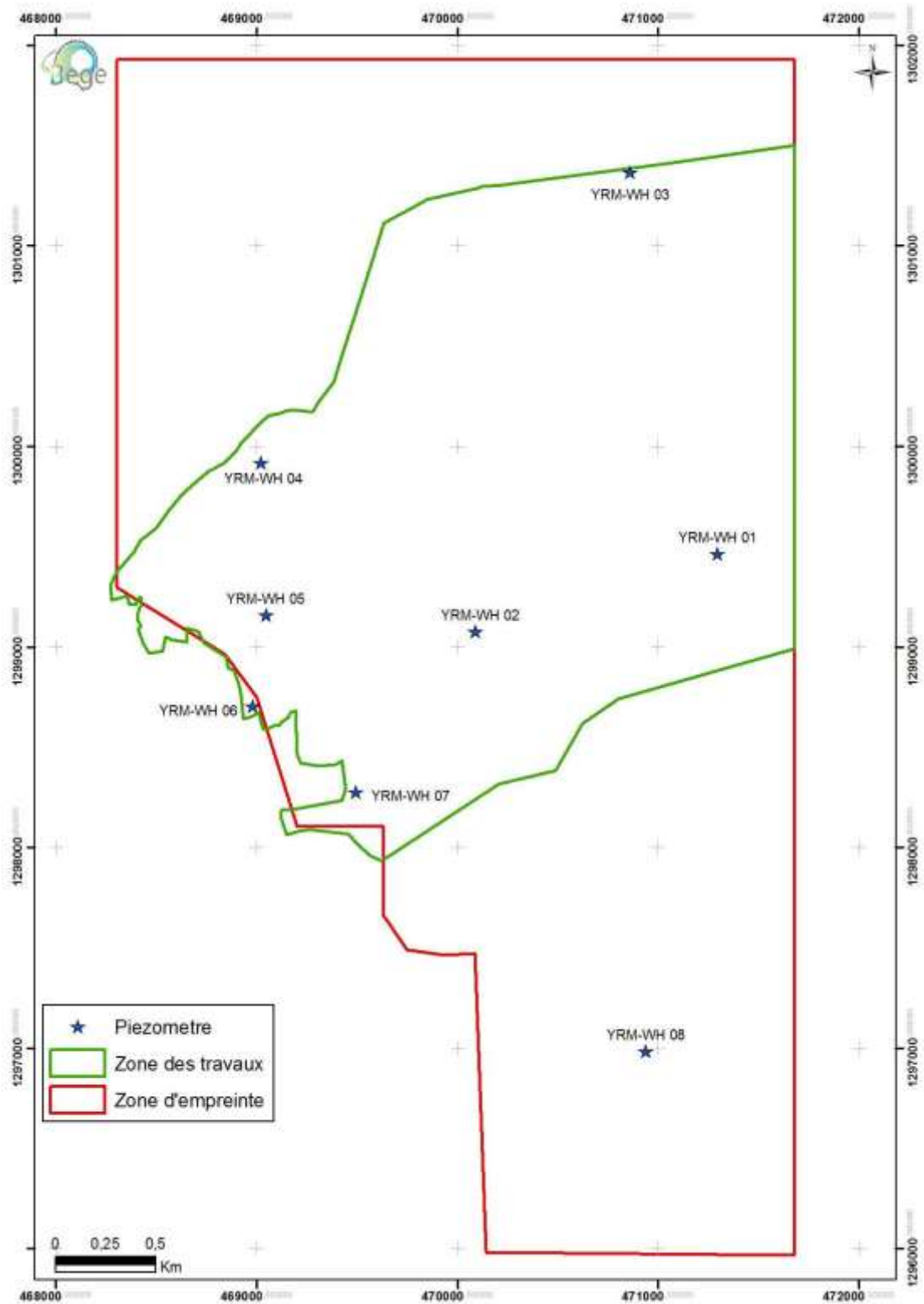
WATER MONITORING REPORT AND RESULTS OF WATER RESOURCE BASELINE LEVEL ANALYSES

GROUNDWATER MONITORING

Introduction

Roxgold completed in April 2013 a piezometric network made of 8 of piezometers; whose technical data do not help to determine the hydrodynamic parameters (flow, transmissivity, alteration thickness, etc.)

The following figure shows the implantation sites of the eight piezometers made by Roxgold in the footprint area of the project. Table II.26 shows the technical characteristics of these piezometers.



Source : BEGE, 2013

Location of piezometers in the Project Influence area

Technical data of piezometers

Description of piezometers	UTM Coordinates of the piezometers			Depth (m)	Drilling date
	X	Y	Z		
YRM-WH 01	471299.9	1299578	309	100	17/04/2013
YRM-WH 02	470091.2	1299191	334	150	15/04/2013
YRM-WH 03	470863.4	1301481.3	337	90	17 ÷ 19/04/2013
YRM-WH 04	469022.7	1300034	312	66	10 ÷ 13/04/2013
YRM-WH 05	469047.7	1299273	305	96	4 ÷ 8/4/2013
YRM-WH 06	468983.7	1298818	302	150	5 ÷ 7/4/2013
YRM-WH 07	469496.3	1298392	305	60	7 ÷ 9/4/2013
YRM-WH 08	470940.5	1297098	293	66	9 ÷ 10/4/2013

Source: Roxgold, 2013, amended by BEGE

Note: YRM means YARAMOKO; W=water; H=Hole, therefore YRM-WH 01=PIEZOMETER 01

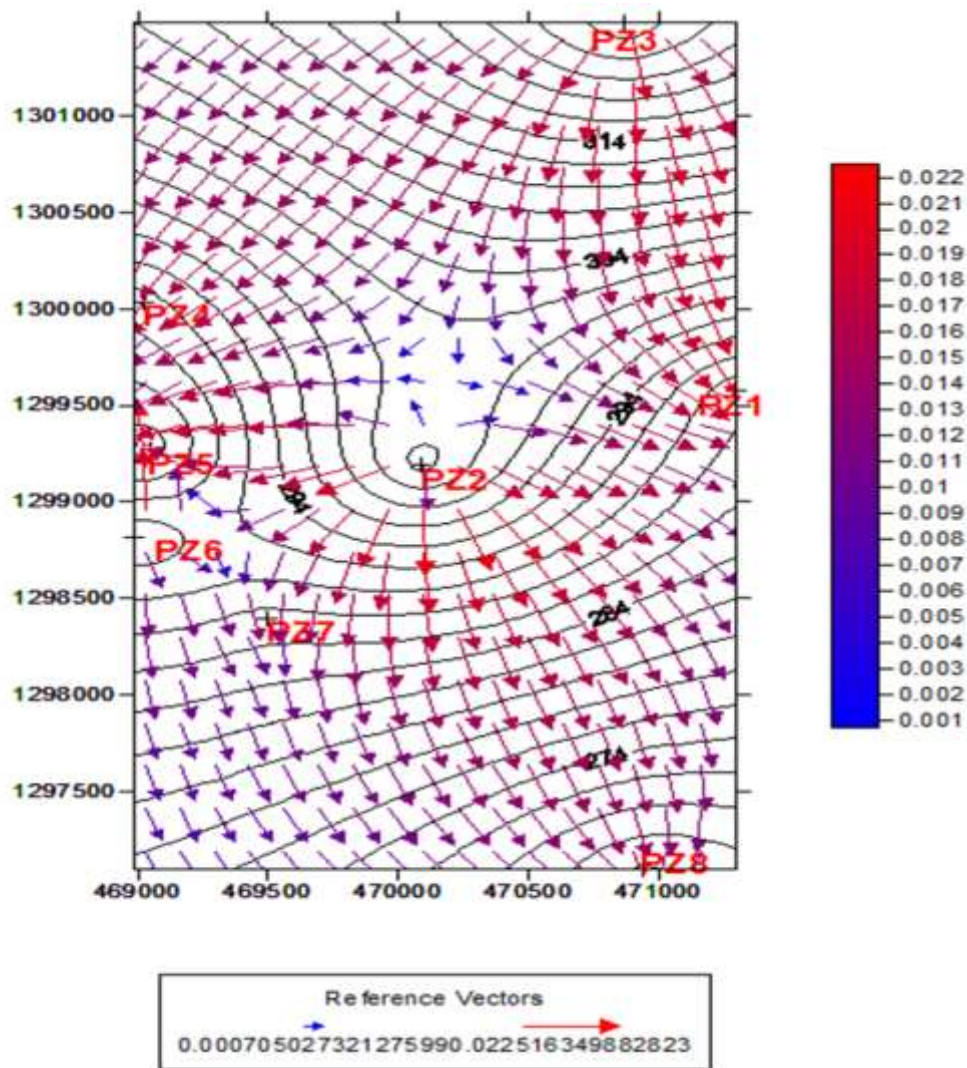
Static levels (NS) of piezometers recorded at the start of the network monitoring campaign are shown in the Table below.

Static Levels of piezometers on 5/15/2013

Description of piezometers	UTM Coordinates of the piezometers			Depth (m)	Static Level (m)	Measurement date
	X	Y	Z			
YRM-WH 01	471299.9	1299578	309	100	20.50	15/05/2013
YRM-WH 02	470091.2	1299191	334	150	31.21	
YRM-WH 03	470863.4	1301481.3	337	90	11.44	
YRM-WH 04	469022.7	1300034	312	66	20.90	
YRM-WH 05	469047.7	1299273	305	96	17.31	
YRM-WH 06	468983.7	1298818	302	150	8.33	
YRM-WH 07	469496.3	1298392	305	60	17.80	
YRM-WH 08	470940.5	1297098	293	66	27.30	

Source : Roxgold, 2013, amended by BEGE

The use of data on the static levels of piezometers helped to draw the isohypses below



Frequency of measurements on piezometers and water sampling were conducted on a monthly basis (from May 2013 to October 2013, 6 site visits).

Methodology and composition of the monitoring team

The material is composed of: a sound and light sensor and a Garmin GPS, a notepad and markers.

The team included: a senior hydrogeologist head of mission; a hydrogeologist; an assistant hydrogeologist; a driver; an officer from ROXGOLD accompanies the field team to avoid any conflict that may arise between stakeholders and populations on the land issues.

a) Piezometric Measurements

For measurements of piezometric level, we plunged the probe to reach the surface of the water; the benchmark of measurements is the ground and is marked at the bottom of PVC by a blue paint. All measurements are made relative to the ground.

The measurements results are recorded in the table below. Piezometric measurements began in May 2013, on the date indicated in the measurement table, i.e. at a point where we did not have information on the static level of the works at their completion. It is important to know that the execution of the works took place in April 2013, a month before. Thus, observations of discharges and recharges started from May 2013. In June, the levels decreased slightly compared to the previous ones.

Interpretation of contours (isohypses)

Based on the differences in levels, we can conclude that the waters rise or (recharge) usually in August on all facilities; level fluctuation does not reach 01m. This last hypothesis must be verified during the next campaigns.

b) Water Sampling

The material here is composed of a water sensor, two coolers, sterilized bottles, two 10 cc syringes, two reagents, nitric acid and sodium hydroxide, a gas heater for the standpost; gloves.

For the first sampling (May and June 2013), the sampling was conducted on 8 piezometers. On the request of the company, eleven (11) water samples were taken and distributed as follows:

- Eight (8) on all piezometers ;
- One (01) sample from the well of Bagasssi North ;
- One (01) on the Boutono well of Doussi ;
- One (01) on the standpost B 05 of Bagassi Centre.

Sampling technique

The sampling is done as follows: (i) with water sensor which is immersed in water for the case of piezometers (monitoring wells), (ii) using a ladle in the case of wells (iii) at the standpost the sampling is taken from the tap after heating the tap tip.

It should be noted that the bottles are rinsed three times before filling. The overall procedure that depends on the parameters to be tested is as follows: (i) for testing the heavy metals we add 1 ml of nitric acid in 0.5 l of water and 2 ml in 1 l of water (ii) for the physical and chemical parameters we add 5 ml of sodium hydroxide in 0.5 l of water or twice in 1 l (iii) at each facility, we always take a control sample (iv) for bacteriological analyses, the sample is put directly into sterilized bottles.

Sample Storage

On the ground, the team has two coolers: one to store empty bottle and the other to keep ice for storage of samples at a temperature below 40C. On each sample, the following details are mentioned: the identification number of the piezometer, the sampling date, the name of reagent added.

Results of the Analyzes

Based on test results, more than half of the water points that have been monitored are not safe because of their high conductivity and dissolved substances:

- Nitrate is detected in WH04 (May); WH 04, WH 07, wells of Bagassi south, Bagassi center standpost, Boutono well of Doussi (June); WH 07 wells of Bagassi and Boutono Doussi (July) ;
- The nitrite content is growing in certain works such as WH 02 (May); WH 02, WH 04 wells of Bagassi south (July); WH 02, WH 04 Bagassi south wells (August) WH 04, WH 07 Bagassi south wells (October);
- Magnesium is present in WH 04 (October)
- Arsenic is detected in WH 05 only;
- Cyanide was not detected in the works but they must be subjected to rigorous monitoring.

Conclusion/ recommendation

During the monitoring campaign, the following observations were made:

- (i) A lack of rigor in the technical implementation of piezometers resulting in leak due to the lack of packer, which favors contamination of surface water or groundwater (wells) and confined groundwater (piezometers);
- (ii) Minerals such as nitrate and nitrite, gradually affect piezometers downstream of WHO2; at early stage of sampling in May, the results of analyzes have helped to detect them in the piezometer WHO2 only; over months it turned out that the piezometers downstream were affected (by the same substances); we therefore believe that this progression could extend further in the long term, and could also affect operating facilities located in the direction of the vectors.
- (iii) Arsenic concentration is high enough in the WH 05;
- (iv) Based on observations made in (ii), we can conclude that the piezometer WHO2 could be close to the possible source of these substances.

Given the variation in results obtained, we find it necessary to conduct counterfactual analyzes, taking into account the fact that analyzes performed in the laboratory of BUMIGEB were using the multi-element method and ICP/MS; they shall be compared to those performed by multielement using atomic absorption or kits. Therefore, we recommend that Roxgold continues to monitor the piezometers to ensure predictable and reliable long-term data are guaranteed. We also recommend a review of the sampling and analysis procedures.

REMINDER OF THE ANSWERS

Minerals such as nitrate and nitrite, gradually affect piezometers downstream of WHO2; at early stage of sampling in May, the results of analyzes have helped to detect them in the piezometer WHO2 only; over months it turned out that the piezometers downstream were affected (by the same substances); we therefore believe that this progression could extend further in the long term, and could also affect operating facilities located in the direction of the vectors.

Based on observations, we can conclude that WHO2 is the starting point of these substances, and therefore we think this is the source.

PHYSICO-CHEMICAL ANALYSIS OF WATER, MAY 2013

MINISTRE DES MINES
ET DE L'ENERGIE

SECRETARIAT GENERAL
UREAU DES MINES ET DE LA
GEOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 7
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 013
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	27,70	18 - 40
pH			7,20	6,5 - 8,5
Conductivité		µS/cm	708,00	1000
Turbidité		NTU	2,00	5
Alcalinité (TA)			0,00	
Alcalinité complète (TAC)		mg/L de CaCO ₃	404,00	
Dureté totale (TH)			328,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	492,88	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		2,00	250
	Nitrate (NO ₃ ⁻) (N)		19,37	10
	Nitrite (NO ₂ ⁻) (N)		0,01	0,1
	Phosphate (PO ₄ ³⁻)		0,03	0,4
	Sulfate (SO ₄ ²⁻)		11,82	400
	Fluor (F ⁻)		0,03	1,5
Cations	Calcium (Ca ²⁺)	mg/L	69,74	
	Magnésium (Mg ²⁺)		37,36	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,00	0,3
	Manganèse (Mn ²⁺)		0,00	0,1
	Zinc (Zn ²⁺)		0,00	5
	Sodium (Na ⁺)		9,32	200
	Potassium (K ⁺)		0,02	12
	Ammonium (NH ₄ ⁺)		0,00	< 0,5
Solides dissous			428,86	1000
I.R			6,72	
Conclusion	Eau très dure; minéralisation importante; eau non entartante et non agressive. Excès des nitrates. Eau polluée par les nitrates, non potable.			

Le Chef du Service Analyses Chimiques



MINISTÈRE DES MINES
ET DE L'ÉNERGIE

SECRETARIAT GÉNÉRAL
BUREAU DES MINES ET DE LA
GÉOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 6
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 012
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	27,60	18 - 40
pH			7,30	6,5 - 8,5
Conductivité		µS/cm	351,00	1000
Turbidité		NTU	2,50	5
Alcalinité (TA)			0,00	
Alcalinité complète (TAC)		mg/L de CaCO ₃	160,00	
Dureté totale (TH)			168,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	195,20	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		1,00	250
	Nitrate (NO ₃ ⁻) (N)		5,69	10
	Nitrite (NO ₂ ⁻) (N)		0,02	0,1
	Phosphate (PO ₄ ³⁻)		0,03	0,4
	Sulfate (SO ₄ ²⁻)		9,63	400
	Fluor (F ⁻)		0,02	1,5
Cations	Calcium (Ca ²⁺)	mg/L	44,09	
	Magnésium (Mg ²⁺)		14,06	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,01	0,3
	Manganèse (Mn ²⁺)		0,00	0,1
	Zinc (Zn ²⁺)		0,00	5
	Sodium (Na ⁺)		7,48	200
	Potassium (K ⁺)		0,06	12
	Ammonium (NH ₄ ⁺)		0,00	< 0,5
Solides dissous			213,12	1000
I.R.			7,77	
Conclusion	Eau dure; minéralisation moyennement accentuée; eau agressive à chaud (T>65°C). Vus les paramètres analysés, eau chimiquement potable.			

Le Chef du Service Analyses Chimiques



Dieudonné M. WUNYI

MINISTÈRE DES MINES
ET DE L'ÉNERGIE

SECRETARIAT GÉNÉRAL
BUREAU DES MINES ET DE LA
GÉOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 5
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 011
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	27,50	18 - 40
pH			7,50	6,5 - 8,5
Conductivité		µS/cm	487,00	1000
Turbidité		NTU	3,50	5
Alcalinité (TA)			0,00	
Alcalinité complète (TAC)		mg/L de CaCO ₃	282,00	
Dureté totale (TH)			224,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	344,04	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		2,00	250
	Nitrate (NO ₃ ⁻) (N)		0,00	10
	Nitrite (NO ₂ ⁻) (N)		0,01	0,1
	Phosphate (PO ₄ ³⁻)		0,10	0,4
	Sulfate (SO ₄ ²⁻)		9,08	400
	Fluor (F)		0,03	1,5
Cations	Calcium (Ca ²⁺)	mg/L	40,08	
	Magnésium (Mg ²⁺)		30,09	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,00	0,3
	Manganèse (Mn ²⁺)		0,00	0,1
	Zinc (Zn ²⁺)		0,00	5
	Sodium (Na ⁺)		10,04	200
	Potassium (K ⁺)		1,69	12
	Ammonium (NH ₄ ⁺)		0,00	< 0,5
Solides dissous			296,39	1000
I.R.			7,19	
Conclusion	Eau dure; minéralisation moyennement accentuée; eau agressive à froid. Vus les paramètres analysés, eau chimiquement potable.			

Le Chef du Service Analyses Chimiques

Dieudonné MUVUNYI

MINISTÈRE DES MINES
ET DE L'ÉNERGIE

SECRETARIAT GÉNÉRAL
BUREAU DES MINES ET DE LA
GÉOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 4
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 010
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	27,40	18 - 40
pH			7,60	6,5 - 8,5
Conductivité		µS/cm	711,00	1000
Turbidité		NTU	2,10	5
Alcalinité (TA)			0,00	
Alcalinité complète (TAC)		mg/L de CaCO ₃	358,00	
Dureté totale (TH)			364,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	436,76	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		1,00	250
	Nitrate (NO ₃ ⁻) (N)		14,58	10
	Nitrite (NO ₂ ⁻) (N)		0,03	0,1
	Phosphate (PO ₄ ³⁻)		0,00	0,4
	Sulfate (SO ₄ ²⁻)		11,48	400
	Fluor (F ⁻)		0,03	1,5
Cations	Calcium (Ca ²⁺)	mg/L	73,75	
	Magnésium (Mg ²⁺)		43,67	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,00	0,3
	Manganèse (Mn ²⁺)		0,00	0,1
	Zinc (Zn ²⁺)		0,00	5
	Sodium (Na ⁺)		9,52	200
	Potassium (K ⁺)		0,16	12
	Ammonium (NH ₄ ⁺)		0,00	< 0,5
Solides dissous			433,73	1000
I.R			6,39	
Conclusion	Eau très dure; minéralisation importante; eau non entartrante et non agressive. Excès des nitrates. Eau polluée par les nitrates, non potable.			

Le Chef du Service Analyses Chimiques



Dieudonné MUVUNYI

**MINISTÈRE DES MINES
ET DE L'ÉNERGIE**

SECRETARIAT GÉNÉRAL
BUREAU DES MINES ET DE LA
GÉOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 3
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 009
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	27,60	18 - 40
pH			7,30	6,5 - 8,5
Conductivité		µS/cm	378,00	1000
Turbidité		NTU	2,10	5
Alcalinité (TA)			0,00	
Alcalinité complète (TAC)		mg/L de CaCO ₃	216,00	
Dureté totale (TH)			208,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	263,52	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		1,00	250
	Nitrate (NO ₃ ⁻) (N)		0,46	10
	Nitrite (NO ₂ ⁻) (N)		0,01	0,1
	Phosphate (PO ₄ ³⁻)		0,01	0,4
	Sulfate (SO ₄ ²⁻)		0,93	400
	Fluor (F ⁻)		0,01	1,5
Cations	Calcium (Ca ²⁺)	mg/L	52,90	
	Magnésium (Mg ²⁺)		18,43	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,00	0,3
	Manganèse (Mn ²⁺)		0,00	0,1
	Zinc (Zn ²⁺)		0,01	5
	Sodium (Na ⁺)		8,08	200
	Potassium (K ⁺)		1,84	12
	Ammonium (NH ₄ ⁺)		0,00	< 0,5
Solides dissous			229,51	1000
I.R			7,35	
Conclusion	Eau dure; minéralisation moyenne; eau agressive à chaud (T>65°C). Vus les paramètres analysés, eau chimiquement potable.			

Le Chef du Service Analyses Chimiques



Dieudonné MUYUNYI

**MINISTRE DES MINES
ET DE L'ENERGIE**

SECRETARIAT GENERAL
UREAU DES MINES ET DE LA
GEOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 2
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 008
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	27,60	18 - 40
pH			7,20	6,5 - 8,5
Conductivité		µS/cm	1550,00	1000
Turbidité		NTU	3,30	5
Alcalinité (TA)		mg/L de CaCO ₃	0,00	
Alcalinité complète (TAC)			80,00	
Dureté totale (TH)			812,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	97,60	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		3,49	250
	Nitrate (NO ₃ ⁻) (N)		0,00	10
	Nitrite (NO ₂ ⁻) (N)		0,35	0,1
	Phosphate (PO ₄ ³⁻)		0,02	0,4
	Sulfate (SO ₄ ²⁻)		19,30	400
	Fluor (F)		0,03	1,5
Cations	Calcium (Ca ²⁺)	mg/L	311,82	
	Magnésium (Mg ²⁺)		8,10	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,13	0,3
	Manganèse (Mn ²⁺)		0,00	0,1
	Zinc (Zn ²⁺)		0,00	5
	Sodium (Na ⁺)		8,84	200
	Potassium (K ⁺)		0,37	12
	Ammonium (NH ₄ ⁺)		0,14	< 0,5
Solides dissous			997,63	1000
I.R.			6,91	
Conclusion	Eau très dure; minéralisation élevée; eau non entartrante et non agressive. A réanalyser.			

Le Chef du Service Analyses Chimiques

Dieudonné MUVUNYI

MINISTRE DES MINES
ET DE L'ENERGIE

SECRETARIAT GENERAL
UREAU DES MINES ET DE LA
GEOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 1
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 007
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	28,10	18 - 40
pH			7,50	6,5 - 8,5
Conductivité		µS/cm	480,00	1000
Turbidité		NTU	2,80	5
Alcalinité (TA)		mg/L de CaCO ₃	0,00	
Alcalinité complète (TAC)			260,00	
Dureté totale (TH)			268,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	317,20	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		0,50	250
	Nitrate (NO ₃ ⁻) (N)		0,00	10
	Nitrite (NO ₂ ⁻) (N)		0,00	0,1
	Phosphate (PO ₄ ³⁻)		0,00	0,4
	Sulfate (SO ₄ ²⁻)		4,43	400
	Fluor (F ⁻)		0,01	1,5
Cations	Calcium (Ca ²⁺)	mg/L	47,29	
	Magnésium (Mg ²⁺)		36,41	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,14	0,3
	Manganèse (Mn ²⁺)		0,00	0,1
	Zinc (Zn ²⁺)		0,01	5
	Sodium (Na ⁺)		8,40	200
	Potassium (K ⁺)		0,22	12
	Ammonium (NH ₄ ⁺)		0,00	< 0,5
Solides dissous			288,00	1000
I.R			7,09	
Conclusion	Eau dure; minéralisation moyennement accentuée; eau agressive à froid. Vu les paramètres analysés, eau chimiquement potable.			

Le Chef du Service Analyses Chimiques

Dieudonné MOVUNYI

DM

BURKINA FASO
UNITE - PROGRES- JUSTICE

MINISTRE DES MINES ET DE
L'ENERGIE

SECRETARIAT GENERAL



GEOLOGIE, GEOCHIMIE, GEOPHYSIQUE,
TOPOGRAPHIE, SONDAGES CAROTTES,
FORAGES D'EAU, ANALYSE CHIMIQUE,
CONTROLE DE SECURITE INDUSTRIELLE
ET MINIERE.

BUREAU DES MINES ET DE LA GEOLOGIE DU BURKINA

01 BP 601 OUAGADOUGOU 01, Tél.:(226) 50 36 48 02 / 50 36 48 90 FAX : (266) 50 36 48 88-E-mail : bumigeb@censtrin.bf

BP 195 BOBO-DIOULASSO Tél.:(226) 20 97 17 71 / 20 97 14 33, FAX : (226) 20 97 27 19-E-mail : bumigeb.bobo@fasonet.bf

Comptes : Trésor : 450 0008/08 - BCB : 0121 500 / 700 15

BICIA-BF : 9053 0100 16 01 / 42 - BIB : 110 250 98201-27

Direction des Laboratoires

Ouagadougou le 04 Juin 2013

CLIENT : ROX/BEGE , 01 BP 931 01. tél 50 37 77 20
TYPE D'ECHANTILLON : Eaux
NOMBRE : huit (08)
ANALYSE DEMANDEE : Multiéléments
METHODE : ICP-MS, Titro

Projet N° 2013 E 18

n° Terrain	Éléments en ppb (µg/L)												CN- (mg/L)	
	As	Cd	Co	Cr	Cu	Hg	Mo	Ni	Pb	Sb	Se	Sn		Zn
PZ 01	1,94	0,04	0,12	6,66	3,02	0,13	9,79	1,29	2,74	0,18	0,79	0,06	5,94	0,00
PZ 02	0,25	0,02	0,06	2,76	0,96	0,10	8,29	0,00	0,58	0,03	0,00	0,05	1,77	0,00
PZ 03	0,41	0,19	0,28	2,40	1,70	0,10	157,40	0,00	3,71	0,14	0,00	0,04	11,03	0,00
PZ 04	0,19	0,07	0,08	2,27	1,07	0,09	52,07	0,00	1,02	0,02	0,02	0,04	2,64	0,00
PZ 05	0,09	0,01	0,00	1,64	0,05	0,07	0,63	0,00	0,07	0,00	0,00	0,01	0,27	0,00
PZ 06	0,11	0,01	0,03	1,84	0,34	0,07	5,74	0,00	0,16	0,01	0,09	0,02	0,75	0,00
PZ 07	0,63	0,02	0,04	2,15	0,45	0,08	3,86	0,00	0,73	0,02	0,02	0,02	1,62	0,00
PZ 08	0,92	0,01	0,02	1,69	0,06	0,07	0,52	0,00	0,94	0,01	0,00	0,01	0,25	0,00



Le Chef du Service des Analyses Chimiques,

Dieudonné MUVUNYI

**MINISTRE DES MINES
ET DE L'ENERGIE**

SECRETARIAT GENERAL
UREAU DES MINES ET DE LA
GEOLOGIE DU BURKINA
(BUMIGEB)

DIRECTION DES LABORATOIRES



BURKINA FASO

Unité - Progrès - Justice

Province	
Département / commune	
Village	YARAMOKO
Localisation	PZ 8
Nature de l'échantillon	eau

Numéro de l'échantillon	2013 E 18 - 014
Date de prélèvement	15/05/2013
Date de réception	20/05/2013
Adresse client	ROX/BEGE

RESULTATS D'ANALYSES PHYSICO-CHIMIQUES DES EAUX

PARAMETRES		UNITES	VALEURS	Recommandation OMS
Température		°C	27,90	18 - 40
pH			7,20	6,5 - 8,5
Conductivité		µS/cm	784,00	1000
Turbidité		NTU	2,20	5
Alcalinité (TA)			0,00	
Alcalinité complète (TAC)		mg/L de CaCO ₃	496,00	
Dureté totale (TH)			380,00	500
Anions	Bicarbonate (HCO ₃ ⁻)	mg/L	605,12	
	Carbonate (CO ₃ ²⁻)		0,00	
	Chlorure (Cl ⁻)		1,50	250
	Nitrate (NO ₃ ⁻) (N)		0,00	10
	Nitrite (NO ₂ ⁻) (N)		0,06	0,1
	Phosphate (PO ₄ ³⁻)		0,04	0,4
	Sulfate (SO ₄ ²⁻)		3,11	400
	Fluor (F ⁻)		0,00	1,5
Cations	Calcium (Ca ²⁺)	mg/L	83,37	
	Magnésium (Mg ²⁺)		41,72	50
	Fer total (Fe ²⁺ + Fe ³⁺)		0,03	0,3
	Manganèse (Mn ²⁺)		0,12	0,1
	Zinc (Zn ²⁺)		0,00	5
	Sodium (Na ⁺)		8,16	200
	Potassium (K ⁺)		0,00	12
	Ammonium (NH ₄ ⁺)		0,00	< 0,5
Solides dissous			472,65	1000
I.R.			6,39	
Conclusion		Eau très dure; minéralisation importante; eau non enartrante et non agressive. Vus les paramètres analysés, eau chimiquement potable.		



**BACTERIOLOGICAL ANALYSIS, MAY
20132013**



Laboratoire Central - Ouagadougou

RAPPORT D'ANALYSES

Identification de l'échantillon

Client: ROX et BEGE

Date de prélèvement: 15/05/2013

Lieu: Yaramoko/PZ 07

N°d'échantillon: 20130633

Résultats

Paramètre	Résultat	Unité	Normes
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	58	/100 mL	0
Coliformes fécaux	31	/100 mL	0
Strepto. fécaux	19	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluorure		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO2 agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations

YAMEOGO
Le chef du Laboratoire

PO

RAPPORT D'ANALYSES

Identification de l'échantillon

Client: ROX et BEGE

Date de prélèvement: 15/05/2013

Lieu: Yaramoko/PZ 06

N°d'échantillon: 20130632

Résultats

Paramètre	Résultat	Unité	Normes
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	34	/100 mL	0
Coliformes fécaux	08	/100 mL	0
Strepto. fécaux	139	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluorure		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO2 agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations

Office national de l'eau
 Rés. d'Analyses de l'eau
 Tél: 50 31 73 34
 ONEA
 Le chef du Laboratoire



Laboratoire Central - Ouagadougou

RAPPORT D'ANALYSES

Identification de l'échantillon

Client: **ROX et BEGE**

Date de prélèvement: 15/05/2013

Lieu: **Yaramoko/PZ 05**

N° d'échantillon: 20130631

Résultats

Paramètre	Résultat	Unité	Normes *
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	43	/100 mL	0
Coliformes fécaux	12	/100 mL	0
Strepto. fécaux	146	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluore		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes *
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO2 agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations



RAPPORT D'ANALYSES

Identification de l'échantillon

Client: ROX et BEGE

Date de prélèvement: 15/05/2013

Lieu: Yaramoko/PZ 04

N°d'échantillon: 20130630

Résultats

Paramètre	Résultat	Unité	Normes *
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	66	/100 mL	0
Coliformes fécaux	11	/100 mL	0
Strepto. fécaux	0	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluorure		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes *
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO2 agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations



Le chef du Laboratoire

PD

RAPPORT D'ANALYSES

Identification de l'échantillon

Client: ROX et BEGE

Date de prélèvement: 15/05/2013

Lieu: Yaramoko/PZ 03

N° d'échantillon: 20130629

Résultats

Paramètre	Résultat	Unité	Normes
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	107	/100 mL	0
Coliformes fécaux	69	/100 mL	0
Strepto. fécaux	0	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluorure		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO2 agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations



Le chef du Laboratoire PD



RAPPORT D'ANALYSES

Identification de l'échantillon

Client: **ROX et BEGE**

Date de prélèvement: 15/05/2013

Lieu: Yaramoko/PZ 02

N° d'échantillon: 20130628

Résultats

Paramètre	Résultat	Unité	Normes *
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	68	/100 mL	0
Coliformes fécaux	23	/100 mL	0
Strepto. fécaux	48	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluorure		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes *
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO2 agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations



Le chef du Laboratoire

PD



RAPPORT D'ANALYSES

Identification de l'échantillon

Client: **ROX et BEGE**

Date de prélèvement: 15/05/2013

Lieu: Yaramoko/PZ 01

N° d'échantillon: 20130627

Résultats

Paramètre	Résultat	Unité	Normes
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	11	/100 mL	0
Coliformes fécaux	01	/100 mL	0
Strepto. fécaux	172	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluorure		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO ₂ agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations



Le chef du Laboratoire

PO

RAPPORT D'ANALYSES
Identification de l'échantillon
Client: ROX et BEGE

Date de prélèvement: 15/05/2013

Lieu: Yaramoka/PZ 08

N°d'échantillon: 20130634

Résultats

Paramètre	Résultat	Unité	Normes *
Température		°C	
pH			
Chlore libre		mg/L	
TA		meq/L	
TAC		meq/L	
Turbidité		NTU	5,0
Conductivité		µS/cm	
Coliformes totaux	26	/100 mL	0
Coliformes fécaux	2	/100 mL	0
Strepto. fécaux	12	/100 mL	0
Teneur en chlore		%	-
Chlorure		mg/L	250
Fluorure		mg/L	1,5
Sulfate		mg/L	250
o-Phosphate		mg/L P	
Nitrite		mg/L N	0,9
Nitrate		mg/L N	11,4
Nitrite + nitrate		mg/L N	
Sodium (Na)		mg/L	200
Potassium (K)		mg/L	

Paramètre	Résultat	Unité	Normes *
Fer total		mg/L	0,3
DBO		mg/L	
DCO		mg/L	
Ammonium		mg/L N	
Calcium		mg/L	
Magnésium		mg/L	
Dureté total		mmol/L	
Azote Kjeldahl		mg/L N	
TP		µg/L P	
Chlorophylle A:		µg/LCHL	
M.E.S.		mg/L	
CO2 agressif		mg/L	
Oxygène dissout		mg/L	
Cyanures:		mg/L CN	
RCES:		mg/L	
Residu sec		mg/L	1000
Residu calciné		mg/L	
Couleur		Hazen	15
Carbonate		mg/l	
Bicarbonate		mg/l	

*Valeurs guides de l'eau de boisson, Directives de qualité pour l'eau de boisson, OMS 2004.

Observations


 Office national de l'eau et de l'électricité
 Résultats d'Analyses des Echantillons
 Tél: 50 31 74 31
 ONEA
 Laboratoire Central
Le chef du Laboratoire



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux: - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2491/2012

Date de prélèvement : 18/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLES Com. : Bagassi Vill. Bagassi

Qt : Yakoeyo / Puit à grand diamètre

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	26.1	
pH		7.37	6.5-9
Conductivité électrique à 20°C	µS/cm	1120	
Turbidité	NTU	10.9	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	38.7	
Dureté totale (TH)	°F	44.4	50
Dureté Calcique	°F	25.4	
Résidu Sec à 105°C	mg/L	849.56	1000
Calcium (Ca ²⁺)	mg/L	101.7	100
Magnésium (Mg ²⁺)	mg/L	45.9	50
Sodium (Na ⁺)	mg/L	83.10	200
Potassium (K ⁺)	mg/L	6.33	12
Fer total (Fe)	mg/L	0.03	0.3
Manganèse (Mn ²⁺)	mg/L	0.009	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.16	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	472.1	
Chlorures (Cl ⁻)	mg/L	7.65	250
Sulfates (SO ₄ ²⁻)	mg/L	68.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.083	3
Nitrates (NO ₃ ⁻)	mg/L	8.36	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.69	5
Phosphore (P)	mg/L	0.22	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.15	3

Conclusion : Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux: - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente: - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens: - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com

e-mail : labo.aina@fasonet.bf

Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2493/2012

Date de prélèvement : 18/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi VIII. Bagassi

Qt : Hinayou / Puit à grand diamètre

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	26.2	
pH		6.65	6.5-9
Conductivité électrique à 20°C	µS/cm	226	
Turbidité	NTU	8.24	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	12.0	
Dureté totale (TH)	°F	13.7	50
Dureté Calcique	°F	7.4	
Résidu Sec à 105°C	mg/L	173.92	1000
Calcium (Ca ²⁺)	mg/L	29.6	100
Magnésium (Mg ²⁺)	mg/L	15.2	50
Sodium (Na ⁺)	mg/L	12.06	200
Potassium (K ⁺)	mg/L	0.17	12
Fer total (Fe)	mg/L	0.05	0.3
Manganèse (Mn ²⁺)	mg/L	0.015	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.11	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	146.4	
Chlorures (Cl ⁻)	mg/L	1.83	250
Sulfates (SO ₄ ²⁻)	mg/L	8.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.003	3
Nitrates (NO ₃ ⁻)	mg/L	8.36	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.47	5
Phosphore (P)	mg/L	0.15	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.04	3

Conclusion : Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 BP 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.
Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels
Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le 22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2492/2012

Date de prélèvement : 18/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi Vill. Doussi

Qt : Doussi / Eau de marigot

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	26.2	
pH		7.46	6.5-9
Conductivité électrique à 20°C	µS/cm	103	
Turbidité	NTU	300	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	5.4	
Dureté totale (TH)	°F	6.0	50
Durété Calcique	°F	4.4	
Résidu Sec à 105°C	mg/L	97.60	1000
Calcium (Ca ²⁺)	mg/L	17.6	100
Magnésium (Mg ²⁺)	mg/L	3.9	50
Sodium (Na ⁺)	mg/L	6.35	200
Potassium (K ⁺)	mg/L	0.09	12
Fer total (Fe)	mg/L	2.41	0.3
Manganèse (Mn ²⁺)	mg/L	0.108	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.39	0.5
Arsenic As	µg/l	0	10
Carbonates (Co ₃ ²⁻)	mg/L	0	
Bicarbonates (HCo ₃ ⁻)	mg/L	65.4	
Chlorures (Cl ⁻)	mg/L	0.38	250
Sulfates (So ₄ ²⁻)	mg/L	2.0	250
Nitrites (No ₂ ⁻)	mg/L	0.003	3
Nitrates (No ₃ ⁻)	mg/L	1.32	50
Orthophosphates (Po ₄ ³⁻)	mg/L	0.56	5
Phosphore (P)	mg/L	0.18	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.16	3

Conclusion : Eau non conforme aux normes à cause de la turbidité, la teneur en fer et Manganèse sont très élevées.

LABORATOIRE AÏNA Suarl
LE CHEF DU LABORATOIRE
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2494/2012

Date de prélèvement : 18/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLES Com. : Bagassi Vill. Bagassi

Qt : Eglise de Bagassi / Borne fontaine

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	26.2	
pH		7.43	6.5-9
Conductivité électrique à 20°C	µS/cm	1271	
Turbidité	NTU	1.71	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	59.7	
Dureté totale (TH)	°F	70.1	50
Dureté Calcique	°F	34.0	
Résidu Sec à 105°C	mg/L	964.10	1000
Calcium (Ca ²⁺)	mg/L	135.8	100
Magnésium (Mg ²⁺)	mg/L	87.5	50
Sodium (Na ⁺)	mg/L	81.34	200
Potassium (K ⁺)	mg/L	3.46	12
Fer total (Fe)	mg/L	0.02	0.3
Manganèse (Mn ²⁺)	mg/L	0.066	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.09	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	728.3	
Chlorures (Cl ⁻)	mg/L	6.96	250
Sulfates (SO ₄ ²⁻)	mg/L	69.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.003	3
Nitrates (NO ₃ ⁻)	mg/L	15.40	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.46	5
Phosphore (P)	mg/L	0.15	2
Fluor	mg/l	0.50	1.5
Zinc (Zn)	mg/L	0.94	3

Conclusion : Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés, sauf TH, Calcium Magnésium sont élevées.

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cet: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com

e-mail : labo.aina@fasonet.bf

Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2495/2012

Date de prélèvement : 18/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLES Com. : Bagassi Vill. Bagassi

Qt : Eglise de Bagassi/ Eau de forage

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	26.2	
pH		7.36	6.5-9
Conductivité électrique à 20°C	µS/cm	319	
Turbidité	NTU	1.72	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	16.7	
Dureté totale (TH)	°F	16.9	50
Durété Calcique	°F	12.1	
Résidu Sec à 105°C	mg/L	245.49	1000
Calcium (Ca ²⁺)	mg/L	48.6	100
Magnésium (Mg ²⁺)	mg/L	11.5	50
Sodium (Na ⁺)	mg/L	18.41	200
Potassium (K ⁺)	mg/L	1.28	12
Fer total (Fe)	mg/L	0.02	0.3
Manganèse (Mn ²⁺)	mg/L	0.029	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.10	0.5
Arsenic As	µg/l	0	10
Carbonates (Co ₃ ²⁻)	mg/L	0	
Bicarbonates (HCo ₃ ⁻)	mg/L	203.3	
Chlorures (Cl)	mg/L	0.70	250
Sulfates (So ₄ ²⁻)	mg/L	2.0	250
Nitrites (No ₂)	mg/L	0.003	3
Nitrates (No ₃)	mg/L	3.96	50
Orthophosphates (Po ₄ ³⁻)	mg/L	0.59	5
Phosphore (P)	mg/L	0.19	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.18	3

Conclusion : Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2498/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi VIII. Haho

Qt : Haho / Puit à grande diamètre 1

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	26.3	
pH		7.25	6.5-9
Conductivité électrique à 20°C	µS/cm	274	
Turbidité	NTU	2.25	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	15.8	
Dureté totale (TH)	°F	14.3	50
Dureté Calcique	°F	7.6	
Résidu Sec à 105°C	mg/L	210.86	1000
Calcium (Ca ²⁺)	mg/L	30.5	100
Magnésium (Mg ²⁺)	mg/L	16.1	50
Sodium (Na ⁺)	mg/L	12.09	200
Potassium (K ⁺)	mg/L	0.49	12
Fer total (Fe)	mg/L	0.02	0.3
Manganèse (Mn ²⁺)	mg/L	0.017	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.08	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	192.8	
Chlorures (Cl ⁻)	mg/L	2.10	250
Sulfates (SO ₄ ²⁻)	mg/L	4.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.026	3
Nitrates (NO ₃ ⁻)	mg/L	12.76	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.23	5
Phosphore (P)	mg/L	0.07	2
Fluor	mg/l	0.03	1.5
Zinc (Zn)	mg/L	0.11	3

Conclusion : Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2499/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi Vill. Haho

Qt : Haho / Puit à grande diamètre II

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	26.3	
pH		6.77	6.5-9
Conductivité électrique à 20°C	µS/cm	541	
Turbidité	NTU	4.93	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	28.2	
Dureté totale (TH)	°F	29.5	50
Dureté Calcique	°F	15.6	
Résidu Sec à 105°C	mg/L	387.31	1000
Calcium (Ca ²⁺)	mg/L	62.4	100
Magnésium (Mg ²⁺)	mg/L	33.6	50
Sodium (Na ⁺)	mg/L	27.17	200
Potassium (K ⁺)	mg/L	2.56	12
Fer total (Fe)	mg/L	0.03	0.3
Manganèse (Mn ²⁺)	mg/L	0.022	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.11	0.5
Arsenic As	µg/l	0	10
Carbonates (Co ₃ ²⁻)	mg/L	0	
Bicarbonates (HCo ₃ ⁻)	mg/L	344.0	
Chlorures (Cl ⁻)	mg/L	2.84	250
Sulfates (So ₄ ²⁻)	mg/L	16.0	250
Nitrites (No ₂ ⁻)	mg/L	0.003	3
Nitrates (No ₃ ⁻)	mg/L	10.56	50
Orthophosphates (Po ₄ ³⁻)	mg/L	0.29	5
Phosphore (P)	mg/L	0.09	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.47	3

Conclusion : Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cet: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2500/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEES Com. : Bagassi Vill. Yaramoko

Qt : Yaro / Barrage eau de surface

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.8	
pH		7.07	6.5-9
Conductivité électrique à 20°C	µS/cm	160	
Turbidité	NTU	89.3	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	11.1	
Durété totale (TH)	°F	10.9	50
Durété Calcique	°F	7.0	
Résidu Sec à 105°C	mg/L	151.62	1000
Calcium (Ca ²⁺)	mg/L	27.9	100
Magnésium (Mg ²⁺)	mg/L	9.5	50
Sodium (Na ⁺)	mg/L	10.81	200
Potassium (K ⁺)	mg/L	0.63	12
Fer total (Fe)	mg/L	0.35	0.3
Manganèse (Mn ²⁺)	mg/L	0.029	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.44	0.5
Arsenic As	µg/l	0	10
Carbonates (Co ₃ ²⁻)	mg/L	0	
Bicarbonates (HCo ₃ ³⁻)	mg/L	135.4	
Chlorures (Cl ⁻)	mg/L	1.48	250
Sulfates (So ₄ ²⁻)	mg/L	5.0	250
Nitrites (No ₂ ⁻)	mg/L	0.003	3
Nitrates (No ₃ ⁻)	mg/L	0.88	50
Orthophosphates (Po ₄ ³⁻)	mg/L	0.30	5
Phosphore (P)	mg/L	0.10	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.05	3

Conclusion : Eau non conforme aux normes à cause de la turbidité très élevée.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cet: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2501/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi VIII. Bagassi

Qt : Biétoumanayé / Eau de forage

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.7	
pH		8.19	6.5-9
Conductivité électrique à 20°C	µS/cm	536	
Turbidité	NTU	0.35	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	29.3	
Dureté totale (TH)	°F	27.4	50
Dureté Calcique	°F	13.2	
Résidu Sec à 105°C	mg/L	383.73	1000
Calcium (Ca ²⁺)	mg/L	53.0	100
Magnésium (Mg ²⁺)	mg/L	34.3	50
Sodium (Na ⁺)	mg/L	30.36	200
Potassium (K ⁺)	mg/L	3.44	12
Fer total (Fe)	mg/L	0.02	0.3
Manganèse (Mn ²⁺)	mg/L	0.069	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.08	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	357.5	
Chlorures (Cl ⁻)	mg/L	1.42	250
Sulfates (SO ₄ ²⁻)	mg/L	11.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.003	3
Nitrates (NO ₃ ⁻)	mg/L	0.44	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.37	5
Phosphore (P)	mg/L	0.12	2
Fluor	mg/l	0.01	1.5
Zinc (Zn)	mg/L	0.08	3

Conclusion : Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux: - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente: - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens: - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2502/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu: Prov : BALLEs Com. : Bagassi Vill.

Kaho

Qt : Kaho / Cours d'eau

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.6	
pH		6.91	6.5-9
Conductivité électrique à 20°C	µS/cm	71	
Turbidité	NTU	433	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	4.8	
Dureté totale (TH)	°F	5.6	50
Durété Calcique	°F	2.8	
Résidu Sec à 105°C	mg/L	67.28	1000
Calcium (Ca ²⁺)	mg/L	11.1	100
Magnésium (Mg ²⁺)	mg/L	6.9	50
Sodium (Na ⁺)	mg/L	4.16	200
Potassium (K ⁺)	mg/L	0.09	12
Fer total (Fe)	mg/L	2.37	0.3
Manganèse (Mn ²⁺)	mg/L	0.076	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.32	0.5
Arsenic As	µg/l	0	10
Carbonates (Co ₃ ²⁻)	mg/L	0	
Bicarbonates (HCo ₃ ⁻)	mg/L	58.4	
Chlorures (Cl ⁻)	mg/L	0.73	250
Sulfates (So ₄ ²⁻)	mg/L	2.0	250
Nitrites (No ₂ ⁻)	mg/L	0.003	3
Nitrates (No ₃ ⁻)	mg/L	0.44	50
Orthophosphates (Po ₄ ³⁻)	mg/L	0.33	5
Phosphore (P)	mg/L	0.11	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.04	3

Conclusion : Eau non conforme aux normes à cause de la Turbidité, et de la teneur en fer très élevées.

LE CHEF DU LABORATOIRE
LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou-01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2503/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi Vill.

Kaho

Qt : Kaho / Puit à grand diamètre

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.7	
pH		6.13	6.5-9
Conductivité électrique à 20°C	µS/cm	65	
Turbidité	NTU	55.2	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	3.7	
Dureté totale (TH)	°F	4.5	50
Durété Calcique	°F	0.4	
Résidu Sec à 105°C	mg/L	61.59	1000
Calcium (Ca ²⁺)	mg/L	1.7	100
Magnésium (Mg ²⁺)	mg/L	9.8	50
Sodium (Na ⁺)	mg/L	5.18	200
Potassium (K ⁺)	mg/L	0.17	12
Fer total (Fe)	mg/L	0.76	0.3
Manganèse (Mn ²⁺)	mg/L	0.076	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.26	0.5
Arsenic As	µg/l	0	10
Carbonates (Co ₃ ²⁻)	mg/L	0	
Bicarbonates (HCo ₃ ⁻)	mg/L	45.1	
Chlorures (Cl ⁻)	mg/L	0.83	250
Sulfates (So ₄ ²⁻)	mg/L	6.0	250
Nitrites (No ₂ ⁻)	mg/L	0.003	3
Nitrates (No ₃ ⁻)	mg/L	0.88	50
Orthophosphates (Po ₄ ³⁻)	mg/L	0.30	5
Phosphore (P)	mg/L	0.10	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.07	3

Conclusion : Eau non conforme aux normes à cause de la Turbidité, et de la teneur en fer, Manganèse, élevées.

LE CHEF DU LABORATOIRE
LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cef: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com

e-mail : labo.aina@fasonet.bf

Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2504/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi Vill. Sipohin

Qt : Sipohin / Barrage de Bagassi

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.7	
pH		7.17	6.5-9
Conductivité électrique à 20°C	µS/cm	111	
Turbidité	NTU	48.3	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	6.4	
Dureté totale (TH)	°F	7.2	50
Durété Calcique	°F	3.6	
Résidu Sec à 105°C	mg/L	105.19	1000
Calcium (Ca ²⁺)	mg/L	14.5	100
Magnésium (Mg ²⁺)	mg/L	8.6	50
Sodium (Na ⁺)	mg/L	6.41	200
Potassium (K ⁺)	mg/L	0.26	12
Fer total (Fe)	mg/L	0.34	0.3
Manganèse (Mn ²⁺)	mg/L	0.170	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.24	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	78.1	
Chlorures (Cl ⁻)	mg/L	0.87	250
Sulfates (SO ₄ ²⁻)	mg/L	15.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.003	3
Nitrates (NO ₃ ⁻)	mg/L	0.44	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.20	5
Phosphore (P)	mg/L	0.07	2
Fluor	mg/l	0.04	1.5
Zinc (Zn)	mg/L	0.03	3

Conclusion : Eau non conforme aux normes à cause de la Turbidité, et de la teneur en Manganèse, élevées.

LE CHEF DU LABORATOIRE
LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux : - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente : - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens : - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2505/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi VIII. Sipohin

Qt : Sipohin / Puit à grand diamètre

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.9	
pH		6.89	6.5-9
Conductivité électrique à 20°C	µS/cm	262	
Turbidité	NTU	41.5	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	13.09	
Dureté totale (TH)	°F	12.44	50
Dureté Calcique	°F	6.22	
Résidu Sec à 105°C	mg/L	201.62	1000
Calcium (Ca ²⁺)	mg/L	24.9	100
Magnésium (Mg ²⁺)	mg/L	15.1	50
Sodium (Na ⁺)	mg/L	13.09	200
Potassium (K ⁺)	mg/L	0.73	12
Fer total (Fe)	mg/L	0.38	0.3
Manganèse (Mn ²⁺)	mg/L	0.121	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.26	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	159.7	
Chlorures (Cl ⁻)	mg/L	1.62	250
Sulfates (SO ₄ ²⁻)	mg/L	2	250
Nitrites (NO ₂ ⁻)	mg/L	0.043	3
Nitrates (NO ₃ ⁻)	mg/L	10.12	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.25	5
Phosphore (P)	mg/L	0.08	2
Fluor	mg/l	0	1.5
Zinc (Zn)	mg/L	0.20	3

Conclusion : Eau non conforme aux normes à cause de la Turbidité, et de la teneur en Manganèse, élevées.

LE CHEF DU LABORATOIRE
LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux: - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente: - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens: - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2506/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi Vill. Sipohin

Qt : Sipohin / Eau de forage

Identité du demandeur : Rox Gold

PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.9	
pH		6.48	6.5-9
Conductivité électrique à 20°C	µS/cm	154	
Turbidité	NTU	1.52	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	8.2	
Dureté totale (TH)	°F	8.7	50
Dureté Calcique	°F	3.5	
Résidu Sec à 105°C	mg/L	145.93	1000
Calcium (Ca ²⁺)	mg/L	14.1	100
Magnésium (Mg ²⁺)	mg/L	12.5	50
Sodium (Na ⁺)	mg/L	7.86	200
Potassium (K ⁺)	mg/L	0.59	12
Fer total (Fe)	mg/L	0.02	0.3
Manganèse (Mn ²⁺)	mg/L	0.005	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.06	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	100.4	
Chlorures (Cl ⁻)	mg/L	1.42	250
Sulfates (SO ₄ ²⁻)	mg/L	4.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.003	3
Nitrates (NO ₃ ⁻)	mg/L	0.44	50
Orthophosphates (PO ₄ ³⁻)	mg/L	1.13	5
Phosphore (P)	mg/L	0.37	2
Fluor	mg/l	0.09	1.5
Zinc (Zn)	mg/L	0.06	3

Conclusion: Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso



LABORATOIRE AÏNA Suarl

Laboratoire d'analyse des eaux: - Analyses physico-chimiques et bactériologiques - Etude sur l'eau, l'assainissement et la santé.

Société de vente: - Produits et appareils de laboratoire - Instrument, matériel et consommable de laboratoire - Produits chimiques industriels

Fabrication et de vente de produits d'entretiens: - Eau déminéralisée.

01 BP 558 Ouagadougou 01 Tél bureau : (226) 50 35 74 40 FAX : (226) 50 35 74 39 RC N° BF OUA 2009 M 1622

www.laboratoire-aina.com e-mail : labo.aina@fasonet.bf Compte BIB siège n° 012421109451020131

IFU N°00021261V Division fiscale: DME du centre Réel normal Situé sur la rue Boalboala Secteur 24 Ouagadougou

Ouagadougou le

22/08/2012

RESULTATS D'ANALYSE PHYSICO-CHIMIQUE D'EAU

Analyse n° 2507/2012

Date de prélèvement : 19/08/2012

Date de réception : 19/08/2012

Identité du préleveur : LABORATOIRE AÏNA Suarl

Lieu : Prov : BALLEs Com. : Bagassi Vill. Sipohin

Qt : Sipohin / Eau de forage

Identité du demandeur : Rox Gold

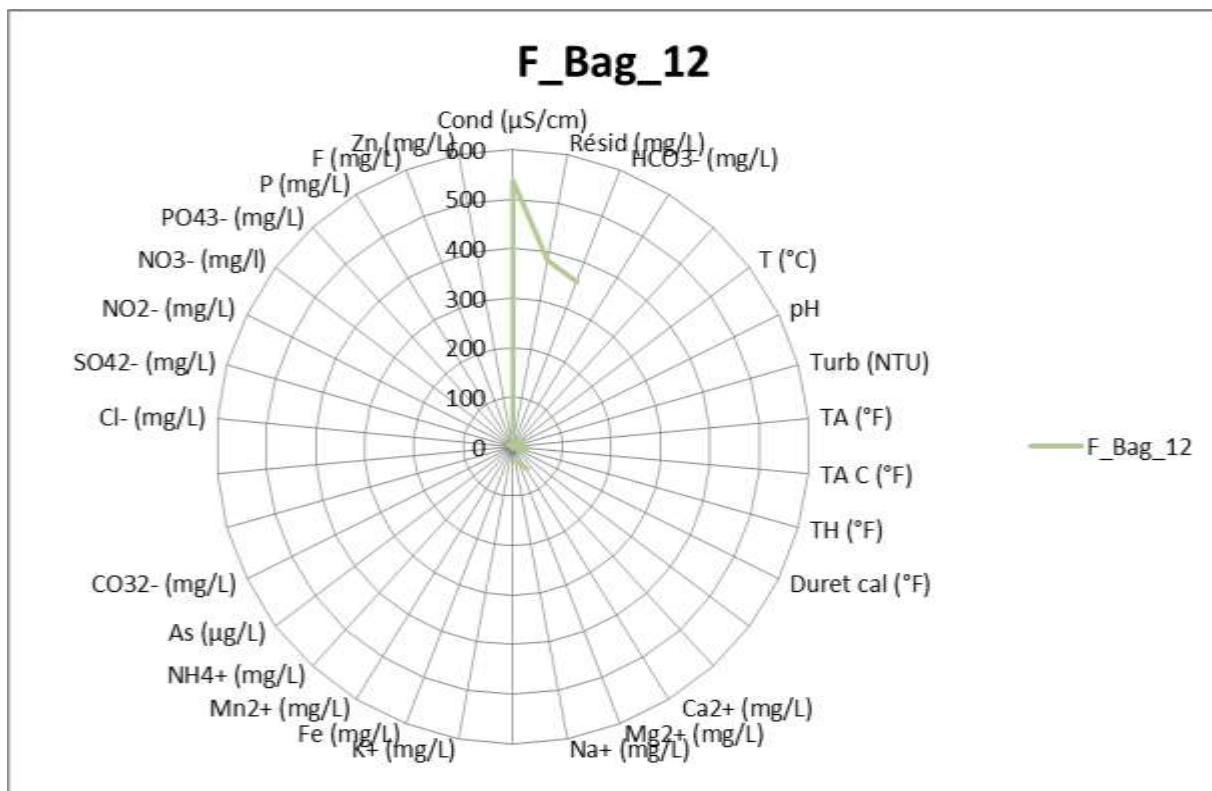
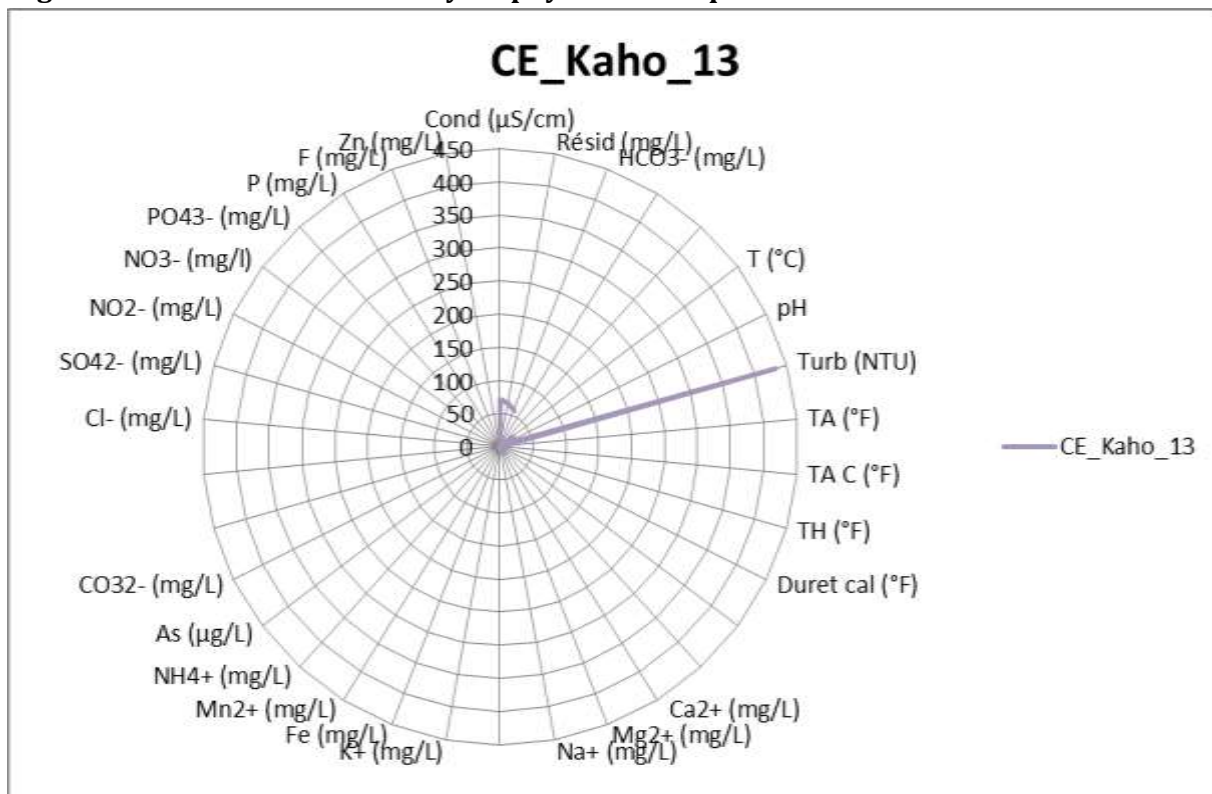
PARAMETRES	UNITES	VALEURS	Valeur inférieure ou égale recommandée par la CEE ou OMS
Température	°C	25.8	
pH		6.49	6.5-9
Conductivité électrique à 20°C	µS/cm	172	
Turbidité	NTU	3.57	5
Titre alcalimétrique (TA)	°F	0	
Titre alcalimétrique complet (TAC)	°F	10.1	
Dureté totale (TH)	°F	9.6	50
Dureté Calcique	°F	4.7	
Résidu Sec à 105°C	mg/L	132.36	1000
Calcium (Ca ²⁺)	mg/L	18.6	100
Magnésium (Mg ²⁺)	mg/L	12.0	50
Sodium (Na ⁺)	mg/L	8.49	200
Potassium (K ⁺)	mg/L	0.73	12
Fer total (Fe)	mg/L	0.02	0.3
Manganèse (Mn ²⁺)	mg/L	0.014	0.05
Ammonium (NH ₄ ⁺)	mg/L	0.10	0.5
Arsenic As	µg/l	0	10
Carbonates (CO ₃ ²⁻)	mg/L	0	
Bicarbonates (HCO ₃ ⁻)	mg/L	123.2	
Chlorures (Cl ⁻)	mg/L	1.20	250
Sulfates (SO ₄ ²⁻)	mg/L	2.0	250
Nitrites (NO ₂ ⁻)	mg/L	0.003	3
Nitrates (NO ₃ ⁻)	mg/L	0.44	50
Orthophosphates (PO ₄ ³⁻)	mg/L	0.76	5
Phosphore (P)	mg/L	0.25	2
Fluor	mg/l	0.09	1.5
Zinc (Zn)	mg/L	0.10	3

Conclusion: Eau conforme aux normes sur le plan physico-chimique pour les paramètres analysés.

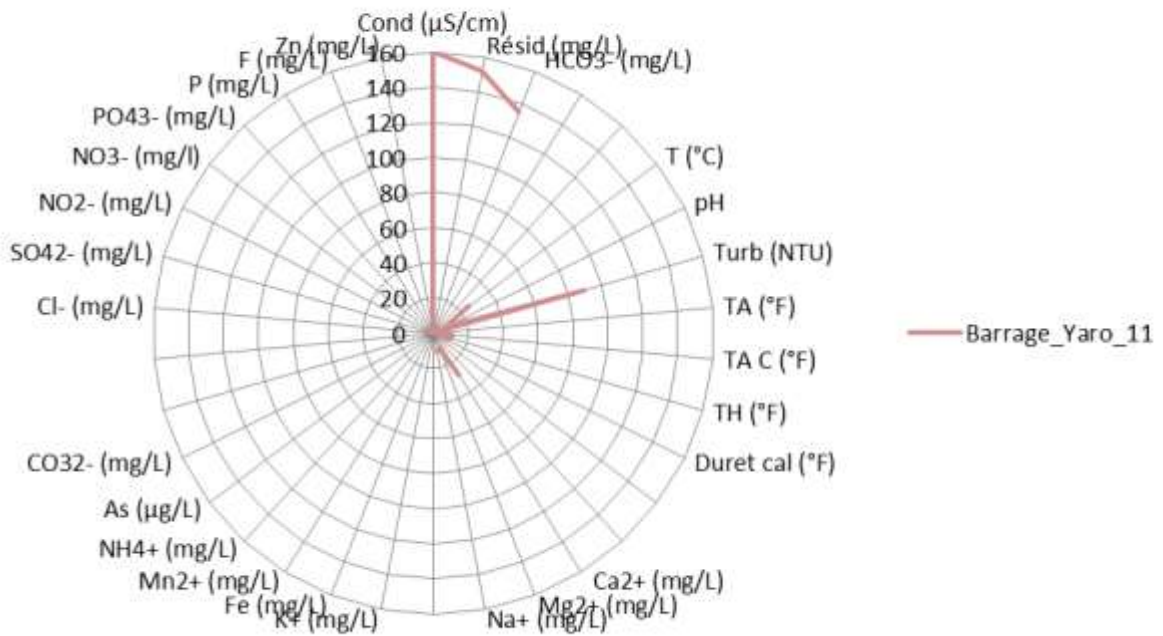
LE CHEF DU LABORATOIRE

LABORATOIRE AÏNA Suarl
01 B.P. 558 Ouagadougou 01
Tél: 50 35 74 40 - Fax: 50 35 74 39
Cel: 70 20 40 38 - Burkina Faso

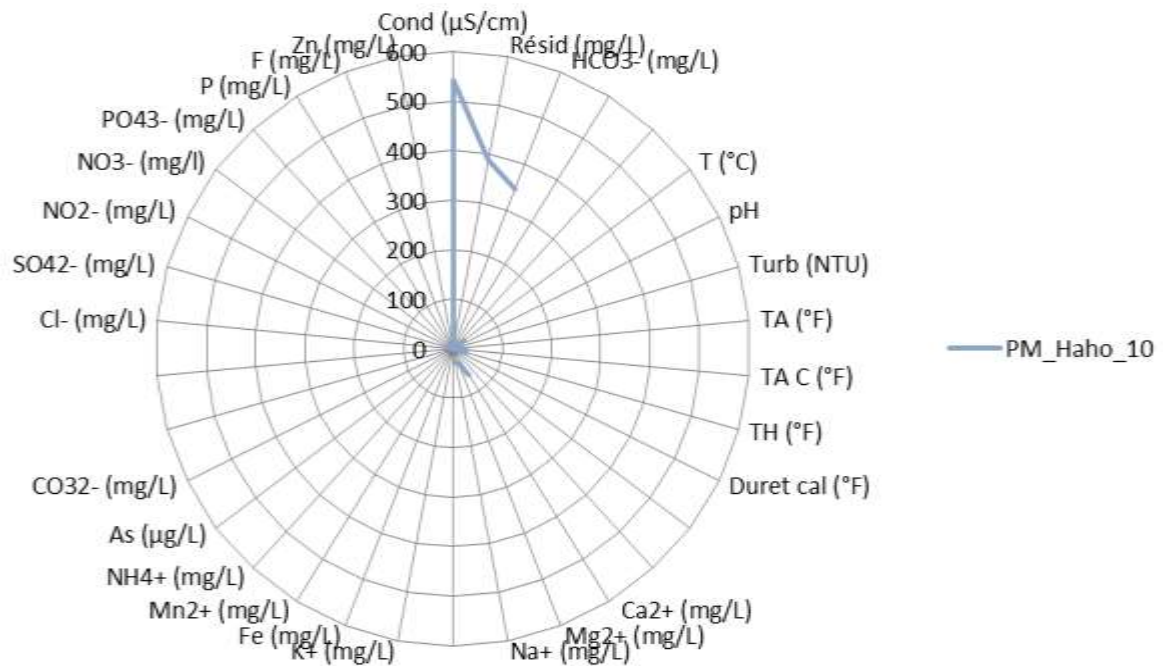
Digramme des résultats des analyses physico-chimiques des échantillons d'eau



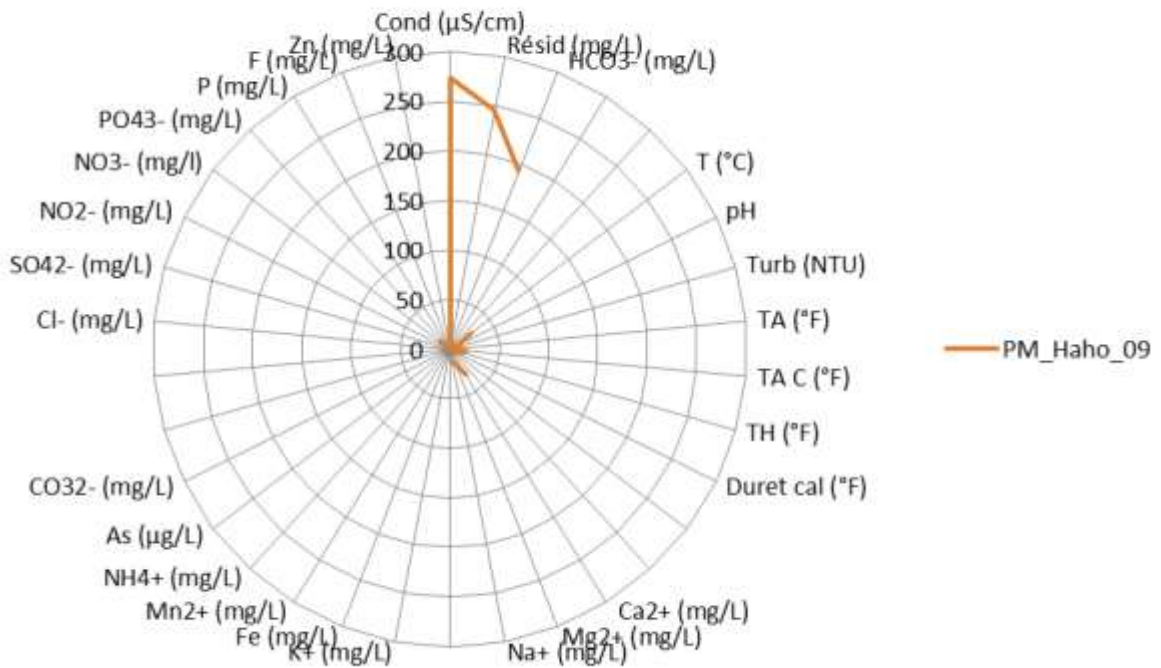
Barrage_Yaro_11



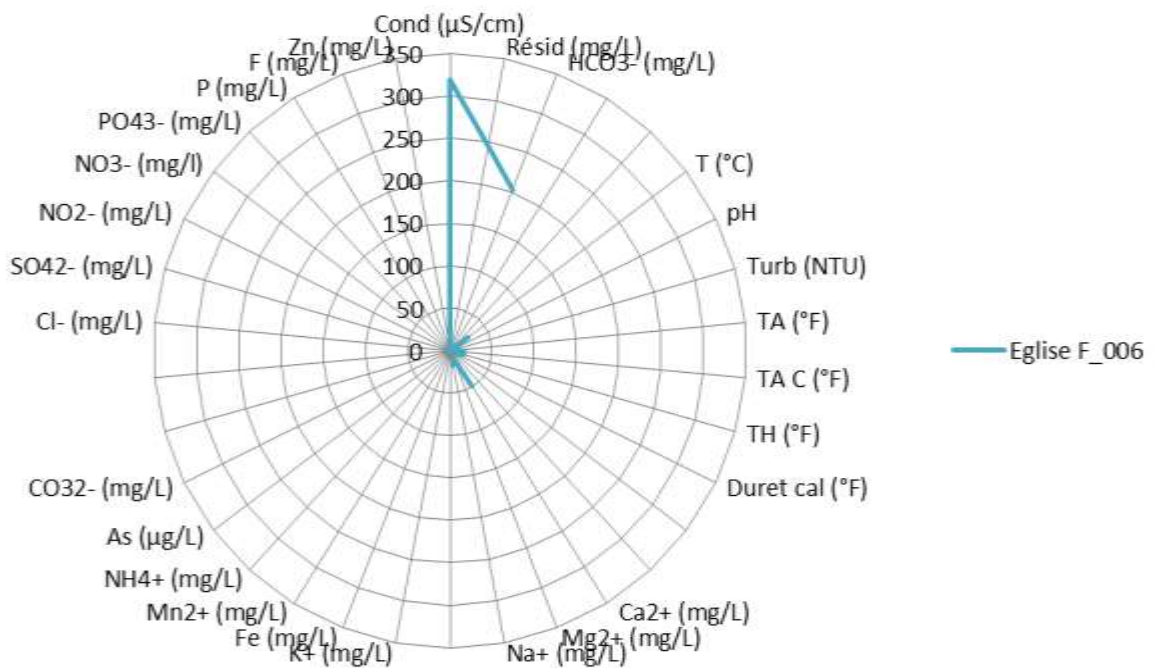
PM_Haho_10



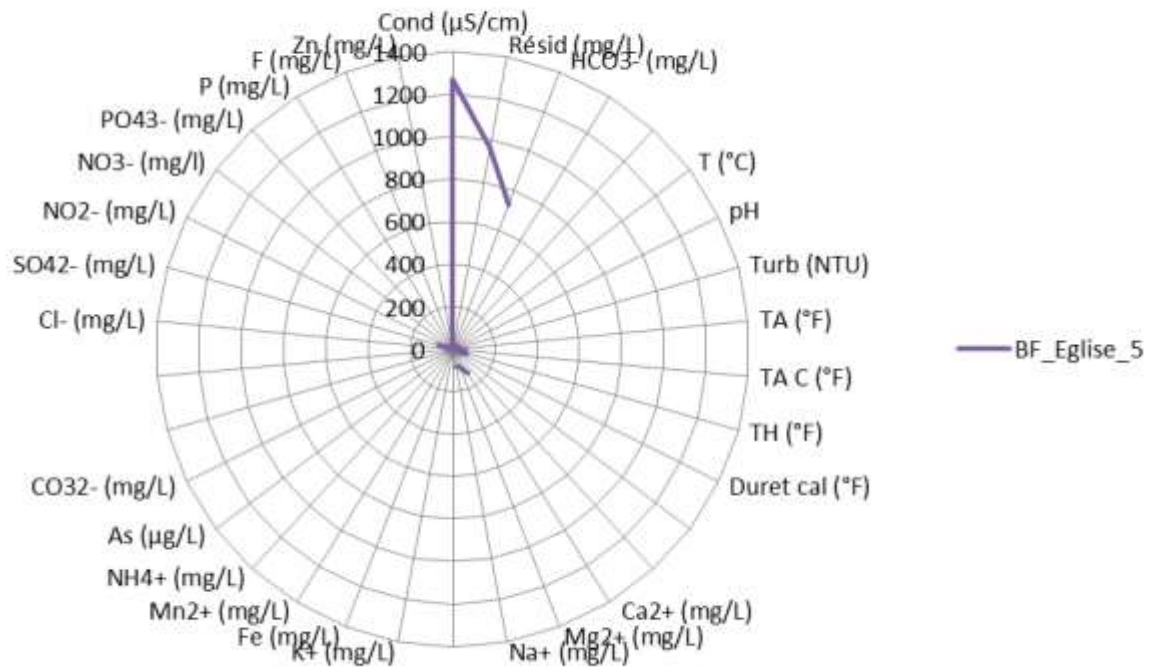
PM_Haho_09



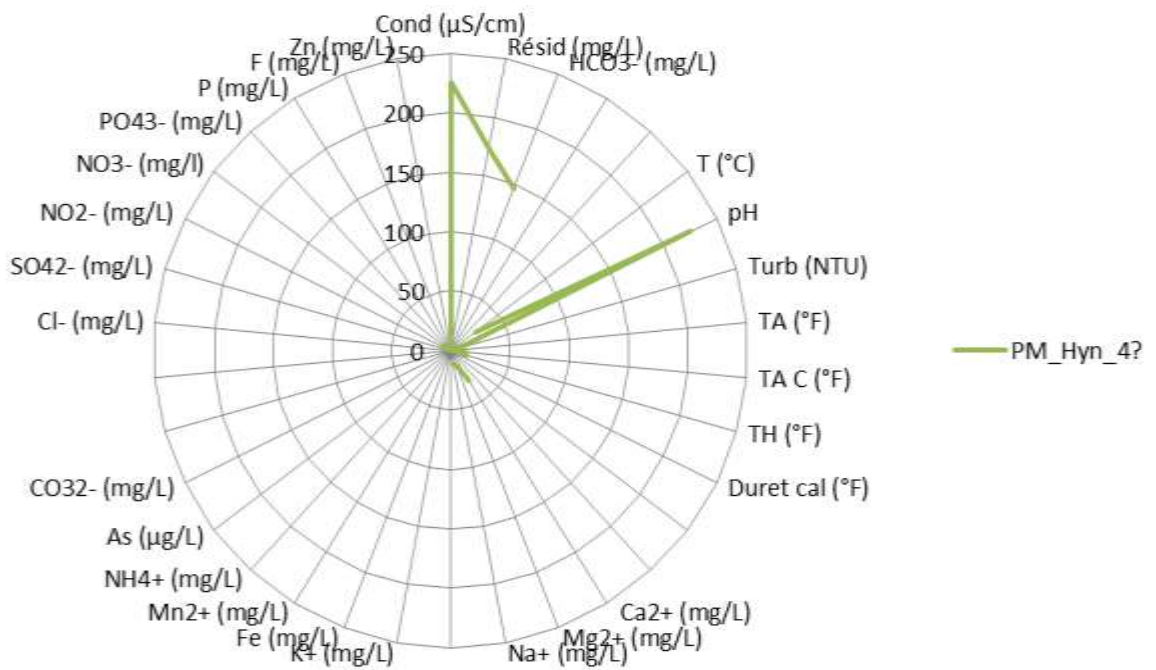
Eglise F_006



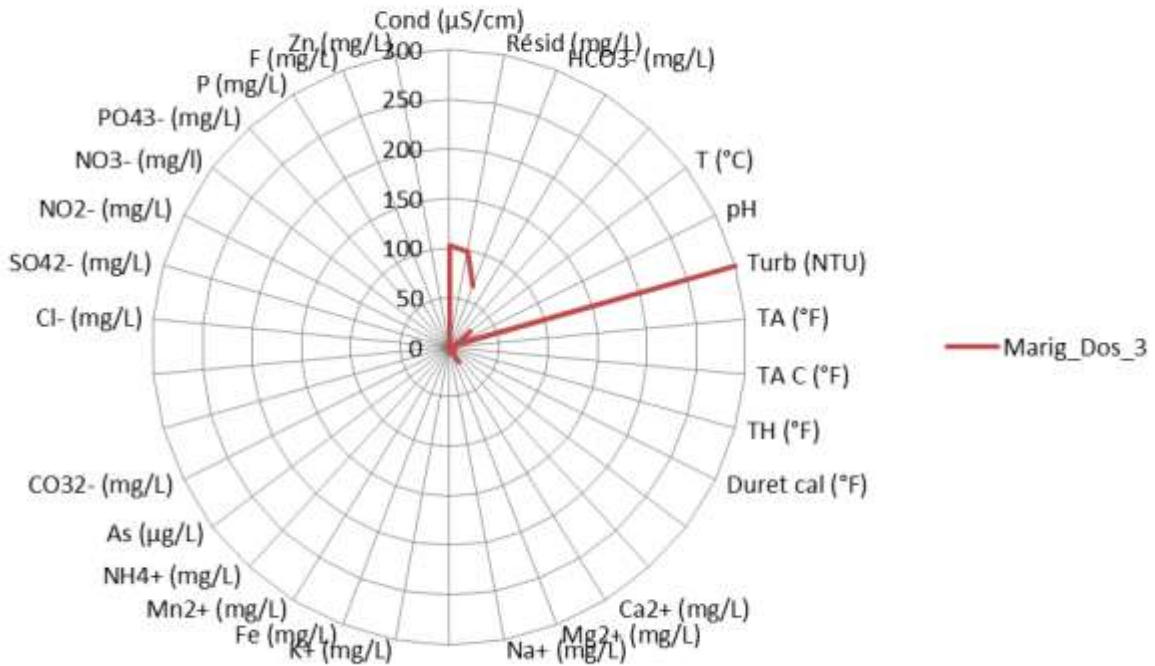
BF_Eglise_5



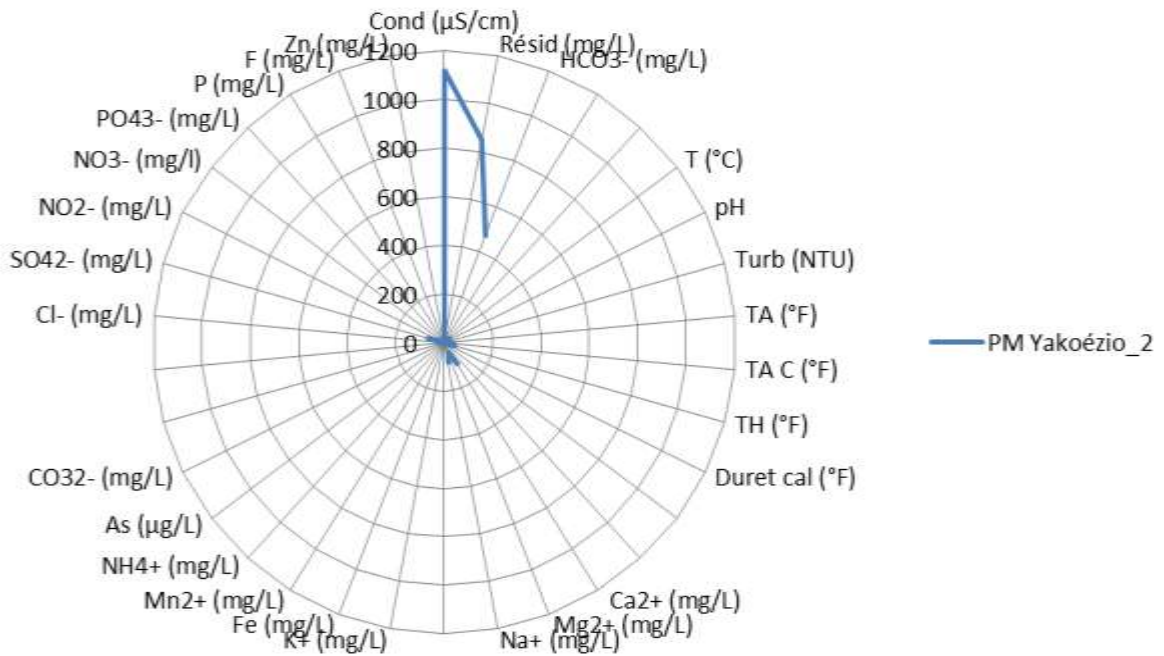
PM_Hyn_4?



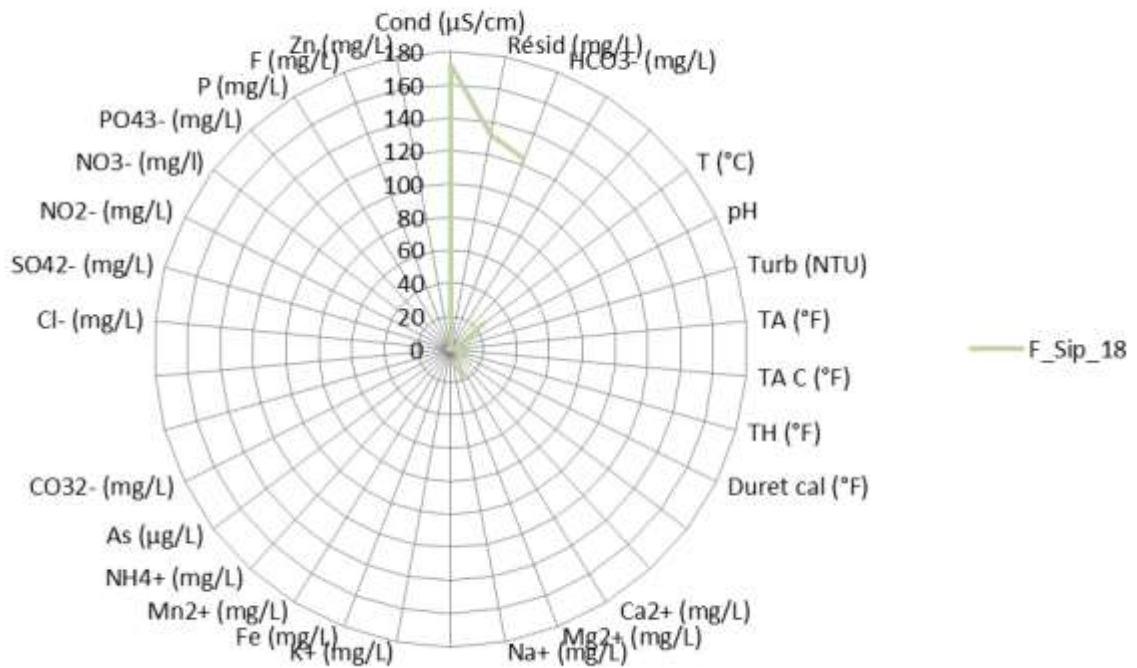
Marig_Dos_3



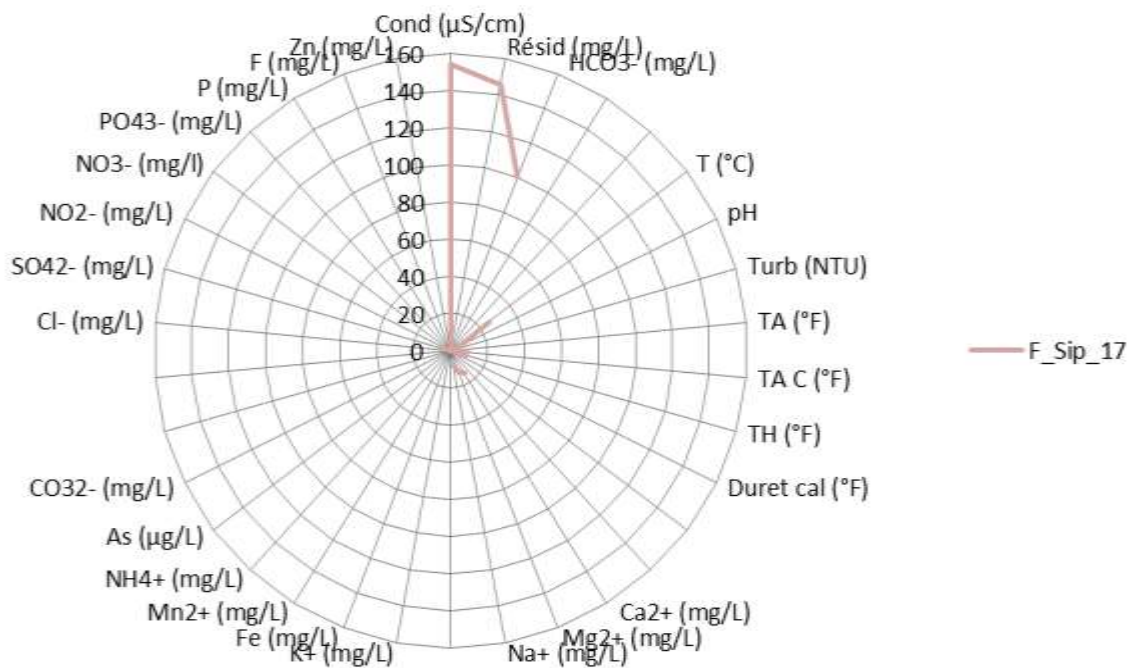
PM Yakoézio_2



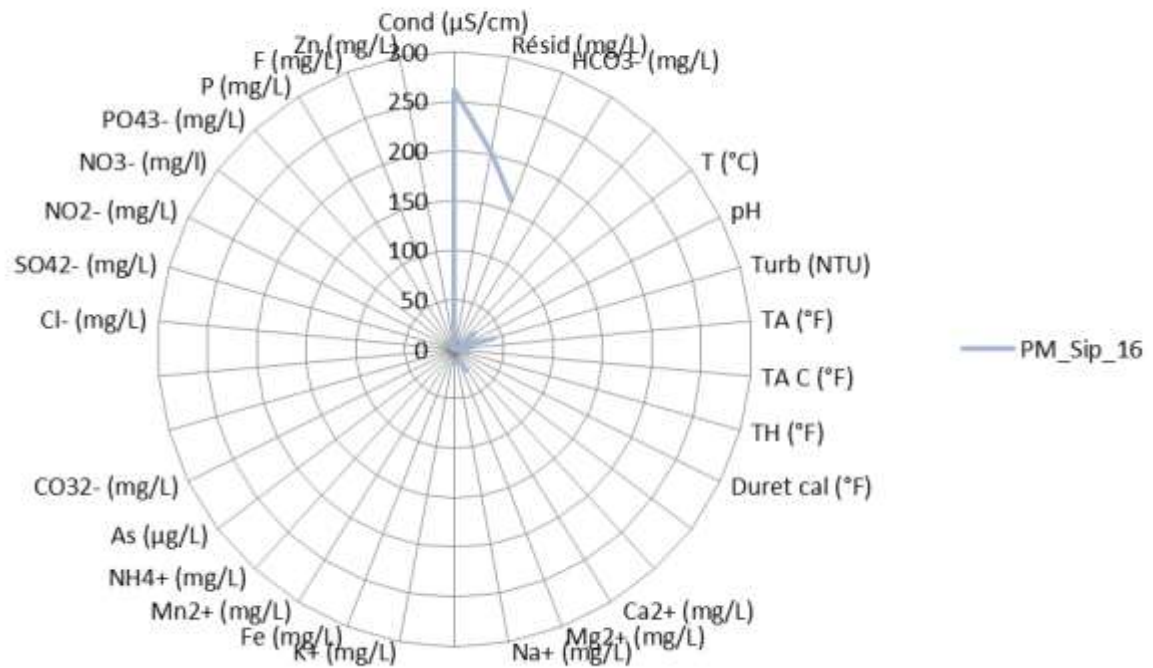
F_Sip_18



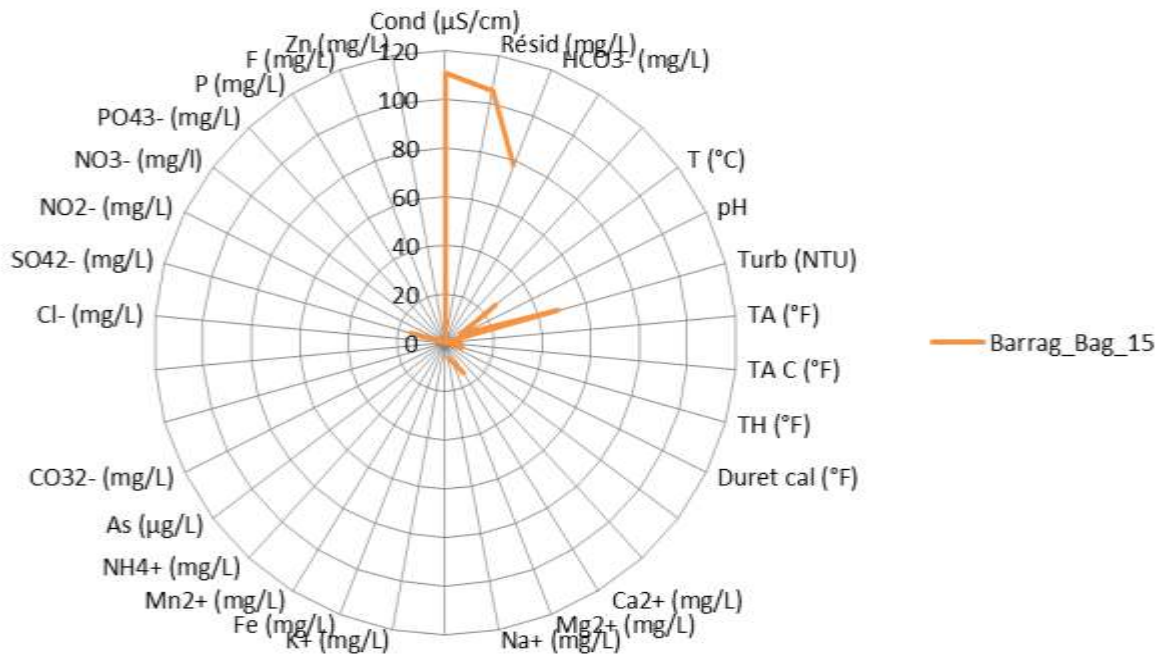
F_Sip_17



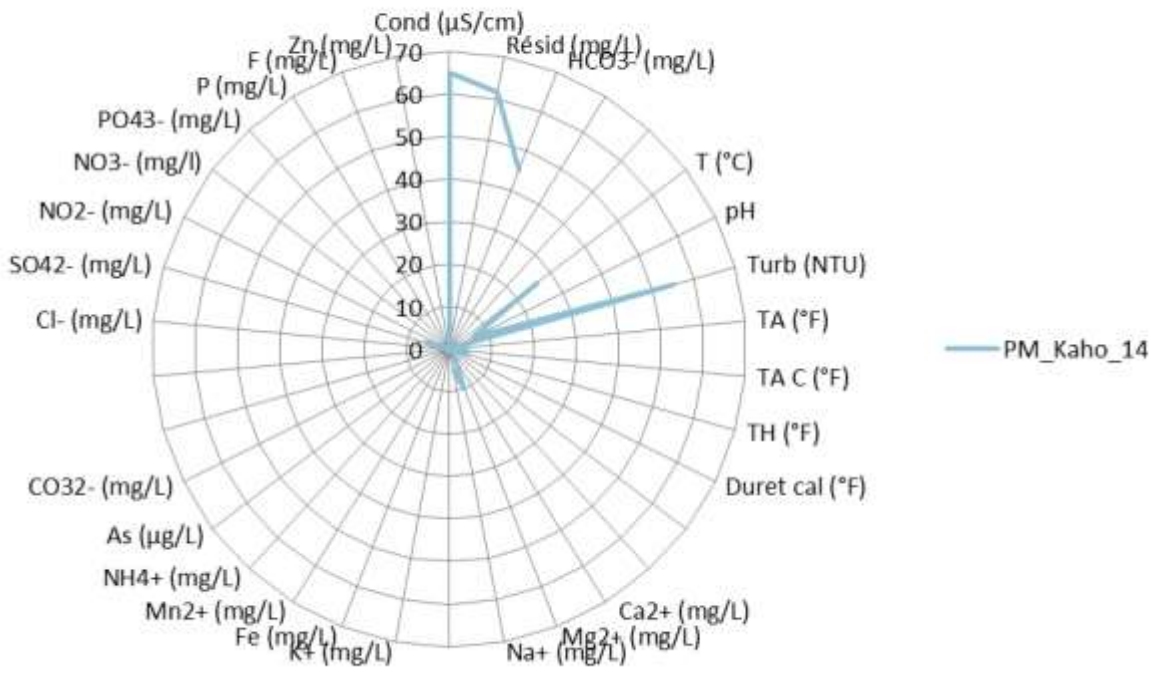
PM_Sip_16



Barrag_Bag_15



PM_Kaho_14



|

APPENDIX 9 :
LISTS OF NON GOVERNMENTAL ORGANIZATIONS AND
COMMUNITY-BASED ORGANIZATIONS

Non Governmental Organizations (NGOs) in the Yaramoko Concession

Name of the Organization	Description of activities/capacities	Intervention Area
Savings and Credit Union for Artisans and Producers (MECAP)	Microcredit NGO	Commune of Bagassi
Support to Rural Municipalities and Inter-Community Initiatives (ACRIC)	Capacity reinforcement in agriculture	Commune of Bagassi, village of San (Commune of Pompoi)
WaterAid	Constructed 3 latrines per school + 3-4 wells per village In 2012; project now complete, no more presence.	Commune of Bagassi
Permanent Fund for the Development of Territorial Collectivities (FPDCT)	State-run; have completed repair and development of market infrastructure	Commune of Bagassi
The National Project for Territory Management (PNGT)	Incoming 3 rd 5-yr phase; World Bank funded, state-run; capacity development, socio-economic infrastructure, reforestation, literacy, low-land development and agricultural land management	Commune of Bagassi
The Regional Development Project (PRD)	Austrian-financed; reforestation and low-land development for agriculture	Commune of Bagassi
Cooperative de Bagassi	Government institution; building financed by PRD; Microcredit for agricultural tools/equipment, supply of seeds (cereals, cotton), fertilizers	Commune of Bagassi
OCADES (with UNDP financing)	Multi-Functional Platform; associated technical support for processing, storage, hygiene, etc.	Bagassi, Bounou, Niankongo, San
Catholic Relief Services (CRS)	Microcredit	Bounou
FARWEST	Microcredit	Bounou
<i>Home Management of (Simple) Malaria/ Prise en Charge du Paludisme simple à Domicile (PECADO)</i>	Training on home-based malaria care/treatment; financing via the Global Fund	Haho
PAMAC - Programme d'Appui au Monde Communautaire et Associatif/ <i>Support Program to Community and Associated People (of the UNDP)</i>	HIV/AIDS, Tuberculosis & Malaria	Kahin
Winrock International	Equipment for farmers. Soil fertility management	Moko, Yaro
IFDC mil+	Millet, also support for cassava production and multi-functional platform	San
Youth Association for Solidarity & Progress (AJSP)	n/a – not fully established yet	Yaro

Community-Based Organizations (CBOs) that are active in the Yaramoko Concession

Organization Name	No. of Members	Description of Activities/Capacity	Area of Operation
Bagassi Cotton Producers Union	752 members / 86 CPGs	Support, advice, training, organization of all commune CPGs; herbicide provision; covers harvest fees; mediation between SOFITEX/banks.	Bagassi commune
Departmental Union of Livestock Breeding	140	Technical training, marketing/commerce related to breeding	Bagassi commune
Departmental Union of Rice Producers	36	Production & sales	Bagassi commune
Departmental Union of Seed Producers/ Providers	27	Production & sales	Bagassi commune
Benkadi Market Gardeners Departmental Union	22	Production & sales	Bagassi commune
CPG BENKADI	n/a	Cotton production; 105 Ha	Bagassi village
CPG KELENIA	n/a	Cotton production; 36 Ha	Bagassi village
CPG LOMINIEYIO	n/a	Cotton production	Bagassi village
CPG LANDINIEN	n/a	Cotton production	Bagassi village
CPG NPIEMOU	n/a	Cotton production	Bagassi village
CPG OUAMITE	n/a	Cotton production; 58 Ha	Bagassi village
CPG BAGASSI I	n/a	Cotton production; 64 Ha	Bagassi village
CPG YE DRISSA	n/a	Cotton production	Bagassi village
CPG YEREMAVOIN	n/a	Cotton production	Bagassi village
CPG DOFINIWIYAN	n/a	Cotton production; 23 Ha	Bagassi village
CPG OUOGAZOUNOU	n/a	Cotton production	Bagassi village
CPG TEMUSSAN	n/a	Cotton production	Bagassi village
CPG BAGASSI II	n/a	Cotton production	Bagassi village
CPG DABAM	n/a	Cotton production	Bagassi

			village
CPG WOUROUBIEYO	n/a	Cotton production	Bagassi village
Dofinsan Women's Group	25	Sensitization on STIs, HIV/AIDS, WASH, commune-interest activities, reforestation, funded by cleaning jobs, Town Hall & NGO partnership financial support	Bagassi village
Yimasso Women's Association for Development of Bagassi (AFDB)	60	Also known as Women's Centre; do work in traditional weaving, soap production, restoration	Bagassi village
Yimasso Traders Association	52	Sensitization, tax payment, consultation/promotion of traders' interests	Bagassi village
Youth Volunteers Organization of Bagassi	19 (9 women)	Meetings, sensitization, organization of volunteering	Bagassi village
Bagassi Youth Association for Development	31 (7 women)	Development of Bagassi, promotion of youth interests	Bagassi village
Bagassi Blacksmiths	7	Production & sales	Bagassi village
Bagassi Tailors	7	Production & sales	Bagassi village
Departmental Union of Fishermen	26	Production & sales	Bagassi village
Bagassi Mechanics	14	Production & sales	Bagassi village
Bagassi Carpenters	8	Production & sales	Bagassi village
Bagassi Dolo Group	60	Production & sales	Bagassi village
Bagassi Photographers	5	Production & sales	Bagassi village
Bagassi Butchers	6	Production & sales	Bagassi village
Bagassi Masons	22	Sensitization, promotion of interests	Bagassi village
Sesame Producers Union	43	Production & sales of sesame	Bagassi village
Bagassi Women's Agricultural Transformation Group	60	Production & sales of agricultural produce	Bagassi village
BENKADI (women)	110	Shea butter process and trading, harvesting cotton	Bounou
NONGTAABA	15	Agriculture, harvesting cotton	Bounou
PIEMOUSSAN	110	Agriculture, harvesting cotton	Bounou

SABABUYUMA	25	Handicrafts	Bounou
SINIASIGUI	41	Agriculture, cereal, rice, 100 ha	Bounou
CPG BADEYA	45	Cotton production ; 60 Ha	Bounou
CPG SINIYASIGUI	41	Cotton production ; 75 Ha	Bounou
CPG WAAOGTAABA	31	Cotton production ; 21 ha	Bounou
TAMUTI1	11	Seeds	Bounou
YELE	02	Cereal processing	Bounou
TAMUTI2	25	Group for harvesting	Bounou
Bounou Rice Producers Group	n/a	Paddy rice production an trading	Bounou
CPG Wolo Error! Bookmark not defined.	100	Production/sales of cotton; 66 Ha	Doussi
CPG Sinibambolo Error! Bookmark not defined.	80	Production/sales of cotton; 100 Ha	Doussi
CPG Gnimassan Error! Bookmark not defined.	100	Production/sales of cotton; 130 Ha	Doussi
CPG Tenegoté Error! Bookmark not defined.	60	Production/sales of cotton; 67 Ha	Doussi
CPG Nwalo Error! Bookmark not defined.	33	Production/sales of cotton; 250 Ha	Doussi
Sinimembolo (Women's Association of Doussi) Error! Bookmark not defined.	23	Microcredit for small trade	Doussi
Market gardening group of Doussi, Sipohin, Bagassi, Kaho	150	Market gardening	Doussi
Students Association of Doussi Error! Bookmark not defined.	All youth	Group to 'defend students interests' ; no clear # of members	Doussi
Nyagalo (Rice Production Association) Error! Bookmark not defined.	8 (office)	Production/sales of paddy rice; whole population participates	Doussi
CPG Wokahilo	40	Cotton production ; 100 Ha	Haho
Wogalo Association	10	Livestock breeding	Haho
Gnimassa Association	Whole village	Agriculture and communal activities	Haho
Botédesan Women's Group	n/a	n/a	Haho
Haho Seed Association	n/a	Collect and sell seeds to government & producers	Haho
Haho Students Association	n/a	Represent interests of students of Haho	Haho
CPG Lobassié	45	Cotton production ; 63Ha	Kahin
CPG Piényio	70	Cotton production ; 60Ha	Kahin
CPG Kohio	32	Cotton production ; 60Ha	Kahin
CPG Dounbatedaro	36	Cotton production ; 34Ha	Kahin
CPG Mounien	28	Cotton production ; 38Ha	Kahin
Kahin Citizens Association	n/a	n/a	Kahin

Gnimissan Women's Group	40	PAMAC (UNDP NGO project) work: Sensitization on maternal & infant health, HIV/AIDS, microfinance for small business	Kahin
CPG Horosan	50	69 Ha ; cotton production	Kaho
CPG Vanoussan	21	18 Ha ; cotton production	Kaho
CPG Gnibansan	25	60 Ha ; cotton production	Kaho
CPG Kani	22	35 Ha ; cotton production	Kaho
Dihayehio Association		Poultry breeding	Kaho
CPG Mendeba	3	30 Ha; cotton production	Moko
CPG Gnimassan	2	24 Ha; cotton production	Moko
CPG Botetesan	3	48 Ha; cotton production	Moko
CPG Tegeniyo	5	51 Ha; cotton production	Moko
CPG Botetessan	3	45 Ha; cotton production	Moko
CPG Bambakotin	3	30 Ha; cotton production	Moko
CPG Tamani	30	90 Ha ; cotton production	Moko
Gnimassan	Moko	Livestock breeding	Moko
Yimansan	n/a	Cattle breeding	Moko
Groupement La Grace	n/a	Poultry breeding	Moko
CPG Louma	70	Cotton production ; 118 Ha	Niankongo
CPG Dindébé	45	Cotton production ; 85 Ha	Niankongo
Women's Group Somila	30	Rice production, collective/community work	Niankongo
Sababu Yuma Group	70	Rice production/sales	Niankongo
CPG Wokazoumou	28	68 Ha; cotton production	San
CPG Gnoumounayo	57	129 Ha; cotton production	San
CPG Dalo	50	33 Ha; cotton production	San
CPG Koahonien	21	54 Ha; cotton production	San
Soumoukoté Group	n/a	Small livestock breeding	San
Association of Water Users (AUE)	n/a	Management of forages/water sources	San
San Development Association	n/a	Local development of San	San
Siniban Women's Group	n/a	Transformation process of cassava (i.e. manioc for attieke)	San
Gnibassan Women's Group	n/a	Microcredit	San
Manioc Market Gardeners Group	92	70 Ha of cassava production	San
CPG Bonfessan	25	Cotton production, 80Ha	Sipohin
CPG Npiébehi	15	Cotton production, 40Ha	Sipohin
CPG Dossan	15	Cotton production, 8Ha	Sipohin
CPG Tibako	20	Cotton production, 90Ha	Sipohin
Women's Dolo Group Bonfessan	22	Dolo preparation	Sipohin
Women's Dolo Group Npiébehi	18	Dolo preparation	Sipohin

Women's Dolo Group Gnimassan	21	Dolo preparation	Sipohin
Women's Dolo Group Girissan	24	Dolo preparation	Sipohin
Women's Dolo Group Nkésissan	20	Dolo preparation	Sipohin
Nképassan Seed Association		Conservation/recuperation/production of seeds to resell to community/govmt	Sipohin
Nyihne Market Gardeners Association	25	Market gardening	Sipohin
GPC Okawe	34	Cotton production; 42 Ha	Yaro
GPC Gnongodeme	n/a	Cotton production; 70 Ha	Yaro
GPC Benkadi	n/a	Cotton production; 42 Ha	Yaro
GPC Dofisini	n/a	Cotton production; 34 Ha	Yaro
GPC Doubayini	n/a	Cotton production; 80 Ha	Yaro
GPC Wokawe	n/a	Cotton production; 53 Ha	Yaro
Wogalo Women's Group	30	Microcredit, market gardening	Yaro
N'Siniban Women's Group	20	Microcredit; cereal transaction	Yaro
Zemaya	55	Market gardening	Yaro
Vouwenlo	60	Rice production	Yaro
Dofinsini	15	Niébé (beans) production	Yaro

APPENDIX 10 :
ARTISANAL MINING ACTION PLAN



ARTISANAL MINING ACTION PLAN OF THE YARAMOKO GOLD PROJECT

SECOND ÉDITION

Prepared by
Elizabeth Freele
CSR Manager

April 2014

Contents

1. INTRODUCTION **Error! Bookmark not defined.**
2. BURKINA FASO REGULATORY FRAMEWORK AND ASM IN THE YARAMOKO CONCESSION..... **Error! Bookmark not defined.**
3. THE DEVELOPMENT OF ASM IN BAGASSI..... **Error! Bookmark not defined.**
4. TYPES OF ASM IN THE YARAMOKO CONCESSION**Error! Bookmark not defined.**
 - 4.1 FORMALIZATION AND LEGALIT **Error! Bookmark not defined.**
 - 4.2 SCALE **Error! Bookmark not defined.**
 - 4.3 CATeGORIES..... **Error! Bookmark not defined.**
5. ASM ENGAGEMENT AND STAKEHOLDERS OF THE YARAMOKO GOLD PROJECT **Error! Bookmark not defined.**
6. KEY ASM ISSUES AT THE 55 ZONE **Error! Bookmark not defined.**
7. CURRENT STATUS OF ASM ACTIVITIES IN THE YARAMOKO CONCESSION**Error! Bookm**
8. ASM CHANGE MANAGEMENT AT THE 55 ZONE... **Error! Bookmark not defined.**
 - 8.1 SWOT ANALYSIS FOR 55 ZONE CHANGE MANAGEMENT.....**Error! Bookmark not defined.**
 - 8.2 STAKEHOLDER ENGAGEMENT STRATEGY AT THE 55 ZONE IN 2014**Error! Bookmark not defined.**
9. ACTION PLAN STEPS **Error! Bookmark not defined.**
10. OFF-SETTING LOCAL ECONOMIC DISPLACEMENT**Error! Bookmark not defined.**
11. CONTINUING ASM MANAGEMENT AT YARAMOKO**Error! Bookmark not defined.**

1. INTRODUCTION

Artisanal and Small-scale Mining (ASM) is an age-old, socio-economic phenomenon which is widely practiced by millions of people in resource-rich countries the world over. While Burkina Faso's mineral resources are relatively untapped, historical documentation of artisanal gold mining in the country goes back to the late 1800s³. It has become a particularly important part of the economy in the past three decades, following the devastating Sahel drought of the 1970s - 1980's and the sector today is well-established, with thousands of sites across the country. It is usually informal and unauthorized, characterized by hand tools, manual labour, rudimentary production and undeveloped processing techniques. Though a legitimate livelihood and an indispensable source of income for a significant share of the local labour market, the poverty-driven activity presents a wide-range of social and environmental problems, with many inter-related causes and effects. However, these remain generally overlooked due to limited state capacity and control mechanisms to enforce ASM-related laws. Meanwhile, increasingly, countless Burkinabe and their families expose themselves to harsh and dangerous working conditions for minimal income in a high risk anarchic context, depending on "*orpaillage sauvage*" to make a living, largely due to a lack of alternative revenue sources.

Oftentimes, the relationship between existing ASM populations and incoming Large Scale Mining (LSM) companies is fraught with misunderstanding, mistrust and a great lack of communication. In the absence of effective engagement to foster mutual understanding and targeted efforts to manage and harmonize expectations, companies in situations like Roxgold's in the Yaramoko concession can face a multitude of issues. These include problems such as project development delays, negative impacts on local livelihoods and violent confrontations related to competition for mineralization.

As the first step in our approach to ASM on the Yaramoko concession, Roxgold sought to deepen our understanding of the history, context and nature of ASM in the Bagassi area. The Burkina Faso Mining Code states that artisanal mining, while not requiring a mining title, does necessitate an official administrative authorization, bestowed on either an individual or legal entity. However, despite this sector formalization, the costs, time and resources necessary in the acquisition of such a short-term authorization make it tedious for often illiterate, itinerant or illegal miners to register.

Though the ASM activities in the Yaramoko concession are, like many in Burkina Faso, unauthorized, informal, illegal and unsustainable, the company acknowledges that this is an important livelihood source for the population of Bagassi commune. Using a multi-stakeholder approach and well-informed risk mitigation, Roxgold seeks to appropriately manage ASM relationships to achieve business and development goals, minimize broad-ranging negative impacts with targeted social development initiatives and create a secure environment for both company operations and surrounding ASM activities.

Understanding that the 55 Zone is a significant ASM site on the concession, Roxgold recognizes the importance of generating a comprehensive management strategy in advance of the development of the Yaramoko Gold Project at the 55 Zone. Guided by both Roxgold's own stakeholder engagement and philosophies from the International Council on Mining and Metals (ICMM), the IFC's CommDev and Communities and Small-Scale Mining (CASM), this document presents an update on the outline of the current state of activities and the company's related engagement strategies. The focus of this updated issue will continue to be on the 55 Zone. Roxgold's broader, future ASM management is beyond its scope and will be further elaborated in a later version.

³ Documented by L.G. BINGER on his French-mandated West African expedition in 1888

2. BURKINA FASO REGULATORY FRAMEWORK AND ASM IN THE YARAMOKO CONCESSION

The chief guiding regulatory reference for ASM in Burkina Faso is the Ministry of Mines' Mining Code (Law N° 031-2003/AN of the 8th of May 2003), which in Part 2, Article 6.6, defines traditional artisanal mining as:

“...using manual and traditional processes and methods...shall not use heavy equipment, is not mechanized and is not carried out with the intent of discovering sources or deposits.”

The code provides two distinct definitions for small-scale mining. Small-scale mining, according to Part 2, Article 6.8, is:

“all permanent, small-sized mining operations founded on the basis of the presence of a deposit, using semi-industrial or industrial processes according to industry standards, whose annual production shall not exceed tonnage of marketable products...as determined for each substance by the mining regulations.”

When specifically semi-mechanized, this small-scale mining is defined, as in Part 2, Article 6.7:

“Operations consisting in extracting or concentrating mineral substances and recovering their marketable products and disposing of the same in using some mechanical means in the line of operations.”

Importantly, Part 3, Article 7 states that with the exception of traditional artisanal mining, the exploration and exploitation of all mineral substances require the issuance of a mining title. A semi-mechanized mining permit is issued for an area of maximum 100 hectares, for five years, renewable for three years (Part 3, Article 26), and entails a number of health, safety and environmental directives.

3. THE DEVELOPMENT OF ASM IN BAGASSI

During the 1980's, in the wake of the Sahel drought's ensuing famine and poverty nationwide, rural populations such as that of Bagassi began to turn to artisanal gold exploitation as a means of survival. ASM was brought to the area by the Mossi from more northern areas of Burkina Faso, who continue to be the major operations leaders, managers and owners today. According to elders of the native Bwaba population, traditionally the Bwaba in fact had a purposefully dissociated relationship with gold. Cultural norms dictated that the agrarian Bwaba should not subsist on money which came from gold; though indeed used in certain rituals, it was generally not seen as something to make a profit from. In the late 1990's however, established *orpailleurs* arrived in the region, with a diverse, itinerant populace in tow, hiring local Bwa youth and teaching them about gold as a profitable revenue source.

With low levels of education and community development, few alternative income-generating opportunities existed for the local community and in 2002, sacrifices were done by the traditional Land Chief to permit the Bwaba to fully and freely benefit from the proceeds of artisanal gold mining. Since then, over time the population has become increasingly involved in *orpaillage* as a means to secure or supplement their livelihoods. Greater reliance on it was also fueled by the renewed unrest in the Ivory Coast in 2010, which has long been a popular seasonal work destination for unemployed Burkinabe youth.

Nowadays, artisanal mining has grown to be an entrenched revenue source, implicating local individuals at all levels (i.e. regardless of age, gender, social group/rank), either directly or indirectly. The current ASM community in the Yaramoko concession comprises predominantly migrant Mossi men with local Bwaba residents involved to varying degrees on a part-time basis. Though the direct mining work is exclusively carried out by men and adolescent boys, a considerable amount of ASM-related income generation benefits local women and children. There is also a significant proportion of ethnicities from elsewhere in the country and the region, including Mali, Ghana, Togo, Ivory Coast and Benin (including Bissa, Fulani, Dagara, Marka Dafing & other Mandé groups and ethnicities), each commonly fulfilling specific roles on the ASM sites in the region. These roles include, but are not limited to the following:

- Manual mining in the pits
- Manual rock-breaking
- Manual ore grinding (mortar and pestle)
- Ore powder washing
- Operating water pumps
- Operating crushers
- Operating grinding mills
- Pit guardians
- Production line guardians
- Dynamite expert
- Pit wood-framing expert
- Blacksmith
- Small commerce (e.g. clothing, mining equipment, toiletries, drugs, mercury, bars, videoclub, gambling games, foosball)
- Services provision (e.g. food, water, wood, clothes washing)
- Prostitution

4. TYPES OF ASM IN THE YARAMOKO CONCESSION

Roxgold's Community Relations department has identified and attempted to understand the nature of the various types of ASM being practiced within the Yaramoko exploration concession and their related drivers, with a particular focus around the 55 Zone operating area.

10.1 4.1 FORMALIZATION AND LEGALITY

All small-scale mining carried out within the Yaramoko exploration concession can be classified as *informal* or *illegal*, according to Burkina Faso legislation and designations of international bodies, such as the World Bank and ICMM. While some of the smaller-scale artisanal mining falls within the framework of informal mining, with its own system of extra-legal property rights, the vast majority in the future Yaramoko gold project area is explicitly illegal. No legal authorization has been granted to any individual, organization or other entity to carry out ASM activities in the area, therefore it is clearly understood as "*orpaillage sauvage*" ('sauvage' meaning wild, echoing the anarchic nature of the activities), rather than traditional artisanal mining, by nature of which it has no recognized legal status or power vis-à-vis Roxgold and the state.

10.2 4.2 SCALE

TRADITIONAL

This simple alluvial mining is present within the Yaramoko concession, largely practiced part-time and casually by women and children from local villages. However, it is important to note that in Burkina Faso’s legislation, ASM is classified as traditional only if it is “*not carried out with the intent of discovering deposits*”, a factor which arguably casts doubt on the pure classification of these alluvial activities as ‘traditional’.

SMALL-SCALE

The majority of the *orpaillage* within the Yaramoko concession is undoubtedly beyond the scope of traditional artisanal mining, easily fitting within the Burkina Faso mining legislation’s definition of small-scale mining.

SEMI-MECHANIZED

Much of the small-scale mining activities are indeed mechanized at the larger ASM sites in the concession, using machinery to crush and grind rocks. In fact, this is the form of ASM most prominent at the 55 Zone and Bagassi South, the two sites nearest to the proposed project’s direct impact area.

10.3 4.3 CATEGORIES

SEASONAL

ASM is used as a secondary means of livelihood support for an important share of both the local and non-local population. These seasonal miners largely rely on agriculture around the rainy season and identify primarily as cultivators. The majority of the local population from the Bagassi area practice *orpaillage* in this way and continue to earn a livelihood through their traditional income source, falling back on artisanal mining to supplement their income during the dryer months, anywhere from November through to June, as follows:

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
ASM												
Agriculture												

INFLUX

These itinerant *orpailleurs* come and go quickly and engage virtually exclusively in ASM or ASM-related livelihood generation, their movements fueled by mineral discoveries and their identities rooted therein. A small portion of them return to their place of origin during the rainy season, while plenty continue to work year-round, despite the elevated dangers of continued *orpaillage* during the wet months. This type of ASM is at the heart of the established site-side squatter camps around the Yaramoko concession and is chiefly represented by transient Mossi Burkinabé, with a sprinkling of other ethnicities and nationalities (Bissa, Marka/Dafing, Fulani, Dagara from Burkina; Ghana; Togo; Ivory Coast; Mali; Benin etc).

Much of the artisanal mining in the vicinity of the 55 Zone can be characterized in this way, the site lending itself to easy, small-scale excavation. An opportunistic and rapid in-migration occurred in 2010-2012, however in the past year the population is in a phase of decline, as ease of mineral access, productivity and profits are falling.

PERMANENT CO-HABITATION

Some of the original Mossi in-migrants (1999-2000) have developed a form of permanence in the area known as Bagassi South, naming their community *Bagassi Sanmatenga* (Sanmatenga meaning “zone of gold” in Mooré, named after a major Mossi gold producing province in the region of Kaya). The residents continue to work the original sites nearby, but with the advent of the 55 Zone influx ASM camp in 2010, these have become less frequented. Numerous residents also commute to other sites in the region, such as Pa (to a site known as V3). Living in harmony with the local citizens, the residents’ principle income source is year-round ASM. They have built up a community with many permanent structures south of the future project area and their current phase can be characterized as relatively steady-state operations.

TRADITIONAL ARTISANAL

Though artisanal mining has only existed in the Bagassi area for about 15 years, it has come to be practiced by a large portion of the local population in a way that is characteristic of long-standing traditional ASM populations, as learned from the migrant Mossis who have been practicing ASM for generations. Using basic panning techniques, a majority of the women, many children and even some older men from the villages within the Yaramoko concession have learned to practice this type of ASM to supplement household income.

5. ASM ENGAGEMENT AND STAKEHOLDERS OF THE YARAMOKO GOLD PROJECT

Many of the Yaramoko Gold Project stakeholders identified in Roxgold’s STAKEHOLDER ENGAGEMENT PLAN are equally critical stakeholders on the specific question of *orpillage* in the concession. During the initial period of exploration, from 2010-2012, interaction between the company and ASM stakeholders was minimal and exclusively needs-based. Formal stakeholder engagement commenced in January 2013, leading to extensive baseline environmental and socio-demographic data collection and stakeholder mapping, focused at the 55 Zone, covering aspects such as age, gender, origin, ethnicity, role, activity seasonality, secondary income sources, principal health issues, use of local social services and resources. Despite a number of constraints inherent in the illicit nature of the activities, this information served to be very useful in enhancing Roxgold’s understanding of the activities, processes, broader impacts and key individuals involved in artisanal mining in the area.

Through this process, relationships have been developed with several key stakeholders to form communication channels as the Yaramoko Gold Project evolves. The key stakeholder groups of the Yaramoko Gold Project associated with ASM can be summarized as follows:

NATIONAL, REGIONAL, PROVINCIAL AND LOCAL AUTHORITIES AND REGULATING AGENCIES that are responsible for law and order. This includes agents such as the Ministry of Mines (and especially the ASM division of the Cadaster of Mines), the Ministry of Environment, Bagassi Town Hall, Bagassi Prefecture, the Provincial Department of National Police (DPPN) in Boromo and its local counterpart, the Bagassi Police Department.

These actors have all been engaged at varying levels to date and have expressed support for the development of the Yaramoko Gold Project.

TRADITIONAL LAND OWNERS of the area in question. At the 55 Zone, there is one principal land owner for the site of the deposit. He has been thoroughly engaged since Roxgold's official stakeholder engagement program began and is supportive of facilitating project development. The company's engagement focus has been on relationship building, advance information disclosure and participatory project development.

GOLD BUYERS, including both individuals and established companies in the vicinity of the ASM workings, many of which extend to other regions of the country and beyond. Engagement and communication channels with the key stakeholders of the 55 Zone are strong. A cordial relationship has been pursued with the principal gold buyer at the 55 Zone to facilitate discussion and communication regarding project advancement; readiness for collaboration in project development has been expressed.

ITINERANT ARTISANAL MINERS who habitually follow the regional gold rush and collectively form an important stakeholder group. Though the *orpaillage* throughout the Yaramoko concession lacks any administrative authorization, there is a peaceable co-existence between Roxgold and most of these artisanal miners. Information disclosure is the top priority with this stakeholder group, largely utilizing relationships with the site's major players (i.e. the above-mentioned gold buyers, authorities and traditional land owners).

HOST COMMUNITIES are both affected by and intimately involved in *orpaillage*, and are the primary custodians of the Yaramoko Gold Project's Social License to Operate. Relationship building and information disclosure are the core engagement approaches used to facilitate smooth project advancement. An emphasis on LSM-related opportunities, benefits and related CSR initiatives for broad community development is also an important aspect of engagement.

6. KEY ASM ISSUES AT THE 55 ZONE

ASM has the potential to have a number of beneficial impacts on a region, frequently increasing local purchasing power and demand for local goods, combatting the issue of rural exodus and generally contributing to community development⁴. However, such positive impacts are greatly marred when legal, health, safety and environmental considerations are peripheral at best. This is the case with most concentrated ASM activities identified by Roxgold in the Yaramoko concession. The 55 Zone ASM is plagued by a number of critical social, environmental and financial challenges in particular and the gamut of related problems that Roxgold has noted through observation and stakeholder engagement can be summarized as follows:

POOR HEALTH AND SAFETY PRACTICES –The *orpailleurs* work in extremely unsafe working conditions with little to no safety equipment. The ventilation in the often deep pits is poor and there are high rates of associated respiratory (e.g. bronchopneumonia, nasopharyngitis, pneumonia, throat infections) and skin infections (e.g. prurigo, urticaria, eczema, ringworm, erysipelas, staph infections, scabies, nail fungus). The latter is worsened by the poor hygiene conditions, exemplified in the lack of sanitary infrastructure and widespread open defecation. Such communicable diseases, as well as sexually transmitted infections, run rampant in concentrated areas such as the 55 zone ASM camp. In addition, unsafe chemical use (e.g. mercury, cyanide) has been noted and merits serious attention given the impending negative impacts on both the natural and

⁴For details see ARTISANAL AND SMALL-SCALE GOLD MINES IN BURKINA FASO: TODAY AND TOMORROW. ERIC JAUQUES, BLAISE ZIDA, MARIO BILLA, CATHERINE GREFFIÉ AND JEAN-FRANÇOIS THOMASSIN. 2004

human environment. Exemplifying the lack of health and safety measures, in 2012, the Bagassi CSPA recorded 2088 occupational injuries from the 55 zone site.

POOR ENVIRONMENTAL PRACTICES LEADING TO ENVIRONMENTAL DEGRADATION – Beyond the major environmental issue of unsafe chemical use (in particular, mercury and cyanide), there are several other important environmental concerns. These include widespread garbage and effluent dumping, extensive deforestation for firewood, pit framing and shelter building and the use and improper disposal of oil in poorly-maintained mills used to grind ore.

SOCIAL PROBLEMS – Apprehension about the role of *orpaillage* role in the destruction of the local social fabric (i.e. linked to family, elders, culture etc) has been expressed on numerous occasions through local stakeholder consultation in the Bagassi area. There is real concern also for the well-being of a number of vulnerable groups who are exploited through the site, but in particular the youth. For example, child labour is a significant factor in the disturbingly elevated and rising primary school dropout rates and, linked to this, the semi-commercialized sexual exploitation of young girls causes problems such as STI transmission and unwanted pregnancy in the area. Further, there is a general issue with the range of problems associated with unregulated prostitution in the zone. Crime levels are high and substance abuse (e.g. marijuana, alcohol, M10 and other amphetamines) especially is a weighty issue, most notably amongst the male youth involved on the site. The influx of foreigners at the site has also put a noticeable strain on social services, such as the already overburdened and undersupplied local CSPA clinic (*Centre de Sante et de Promotion Sociale*, Health and Social Promotion Centre). The community also puts increased pressure on local water access points, mostly from Doussi and Bagassi. Finally, *orpaillage* is connected with a reticence of the local youth to continue with or return to agriculture in this traditionally agrarian zone, thus further contributing to existing local food security challenges.

FINANCE AND LEGALITY – Given the lack of authorization for the activity, the ASM practiced throughout the concession is classified as illegal. It is unregulated, so the Burkina Faso government fails to benefit in the form of taxes and royalties that could be used to boost national development, further hampering its ability to provide communal services. This also allows for arbitrary, fluctuating and usually depressed gold prices for miners on the ground, as well as an inequitable distribution of benefits in the local community. Moreover, it means pit operators have no liability or responsibility regarding miner health and safety or the environment. The overall context of the activity fosters generalized economic insecurity for all individuals involved.

THREAT TO INDUSTRIAL MINE DEVELOPMENT – Widespread engagement in ASM has the potential to threaten community support for the development of LSM activities such as those pursued by Roxgold. A potential preference of ASM over LSM at the local level jeopardizes mining-associated employment, capacity-building, training and a host of other significant benefits and long term community development through taxes and royalties on Burkina Faso's most important export. In the context of Roxgold's formal engagement process and commitment to providing opportunities in the local community, this risk is considered manageable.

7. CURRENT STATUS OF ASM ACTIVITIES IN THE YARAMOKO CONCESSION

While there are only a few established artisanal mining sites throughout the Yaramoko concession, there are remnants of ASM activity and isolated pits scattered throughout the area, as shown in the following graphic. Roxgold has inventoried a total of about 3000 pits across the exploration permit, over 80% of which are non-active, varying between 50 centimeters and 30 metres in depth.

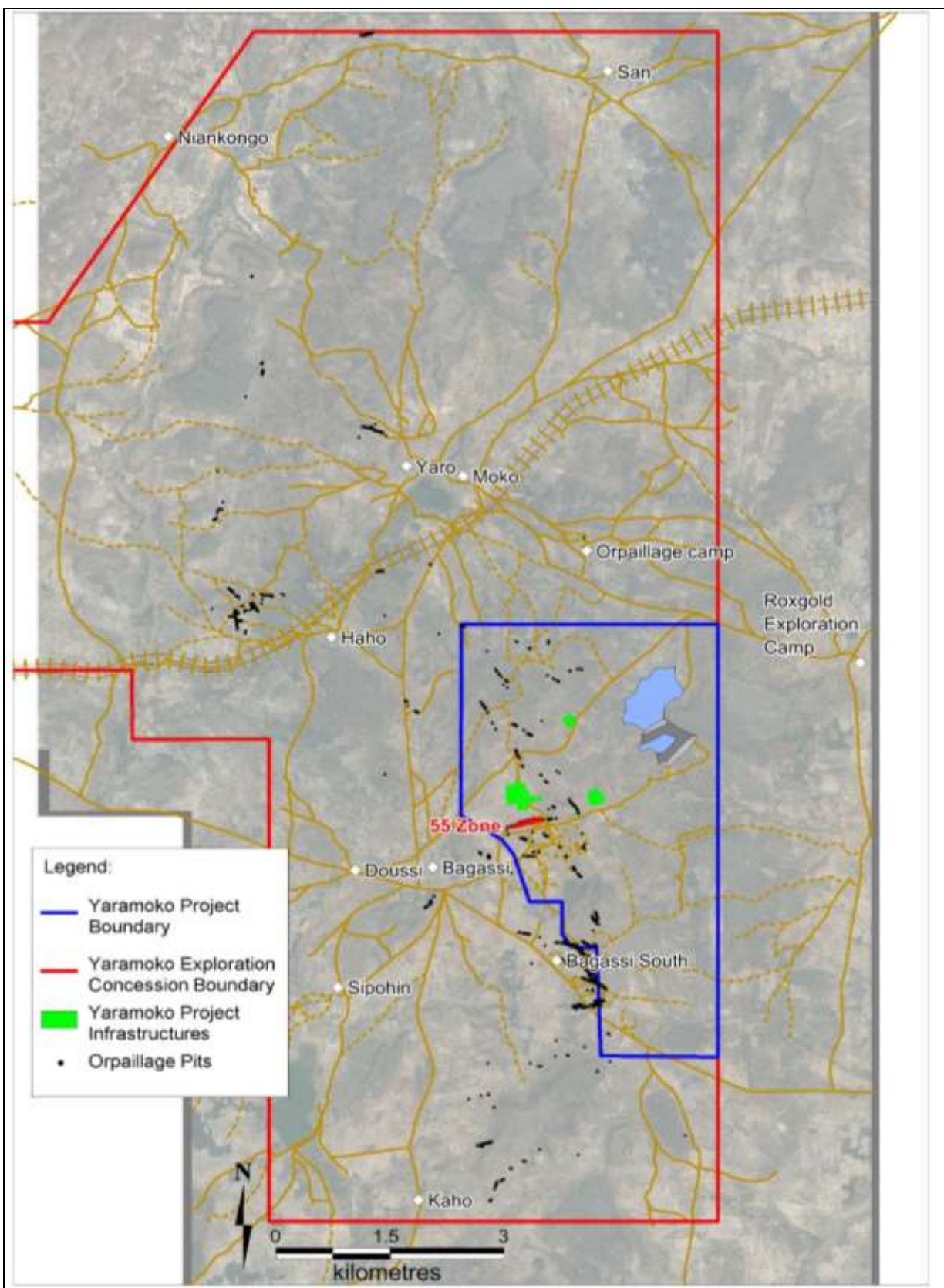


Figure 4 Inventory of ASM pits in the Yaramoko concession

The 55 Zone area is the focal point of this action plan, given it is the proposed location for the development of the Yaramoko Gold Project. The 55 Zone has been an important *orpillage* site in the area since 2010, following a Roxgold RC drilling program in the zone, and has visibly provided important revenue to both the

migrant community and the local population. Site organization has been quite lacking throughout but since early 2012, Roxgold has funded a permanent National Guard (Burkina Faso CRS) peace-keeping presence in the artisanal camp. In recent months, enumeration and control of work teams and shaft technical inspection at the site have increased, following pressure from Roxgold to do so.

The figure below shows in greater detail the principal ASM workings inventoried in the 55 zone area, with relation to the location of future project infrastructure.

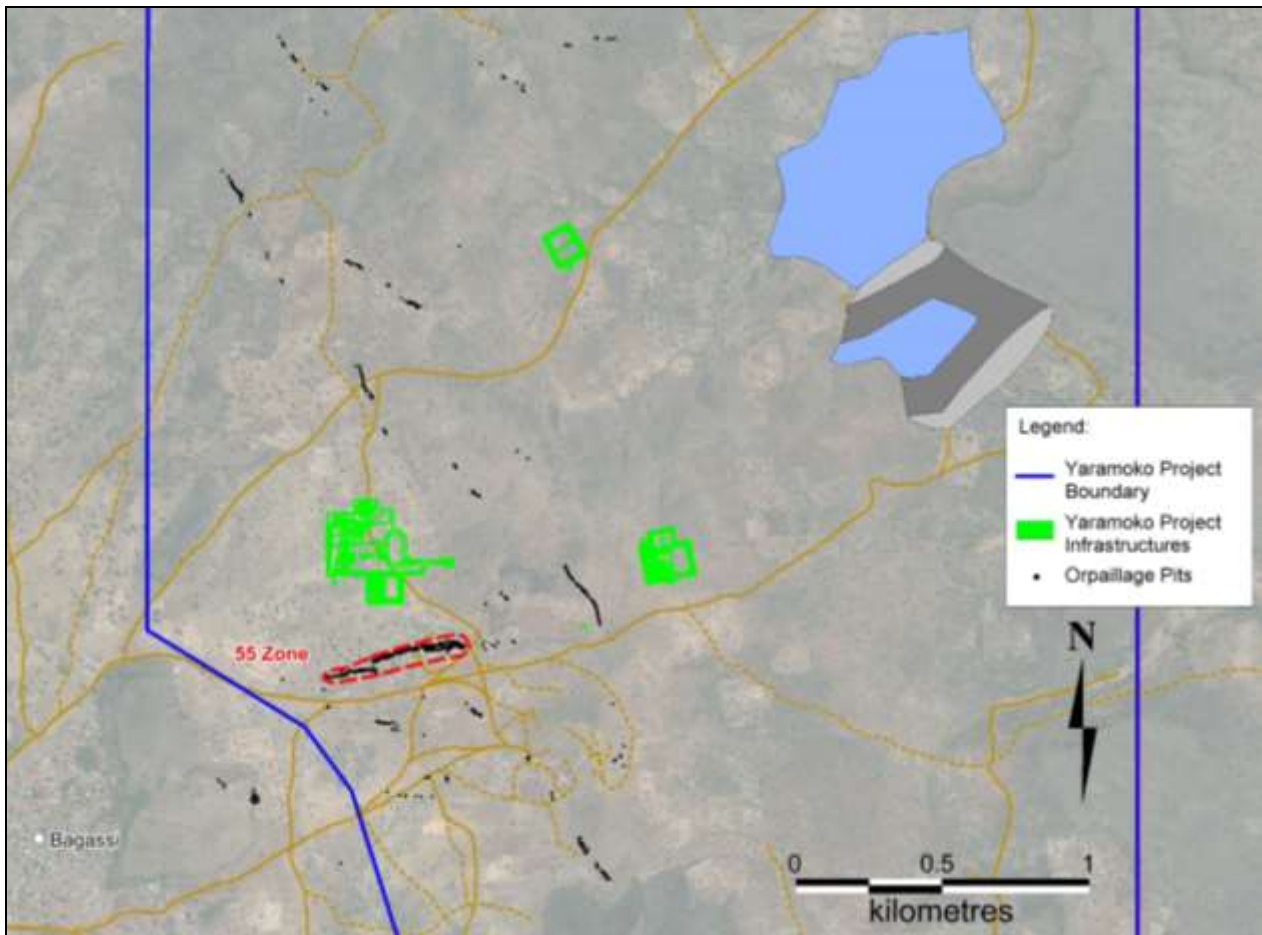


Figure 5 Principal ASM workings at the 55 Zone with superimposed project infrastructure

Notably, in the past year, work is becoming more challenging for the *orpailleurs* in this location, as they are encountering harder rock at greater depth, profits are declining and interest is overall lessening in this particular location, with the widespread knowledge that a LSM project will shortly be implemented. The resulting organic decrease in population coincides well with Roxgold's upcoming development plans. Nevertheless, the requisite change management to facilitate project advancement is being carefully and thoughtfully planned, clearly communicated and meticulously implemented so as to minimize any negative fallouts in this phase of project advancement. Given that the nearby artisanal settlement is impermanent, the expectation based on extensive consultations with the site leadership is that it will continue to organically decrease as Roxgold approaches development and the *orpailleurs* cease their activities at the 55 Zone itself.

8. ASM CHANGE MANAGEMENT AT THE 55 ZONE

10.4

10.5 8.1 SWOT ANALYSIS FOR 55 ZONE CHANGE MANAGEMENT

10.5.1

STRENGTHS

- Numerous violations of the Burkina Faso Mining Code that confirm illegal status of activities
 - The 55 Zone meets the threshold of semi-mechanized small-scale mining and thus requires a basic administrative authorization, following a mandatory public survey (Part 2, Article 4 and Article 24); No such document exists;
 - The site does not observe standards of or provide official rules and regulations for public health, workers safety, environmental conservation or commerce regulation (Article 49, 73, 74);
 - No environmental conservation efforts are made and no environmental impact assessment was carried out (Article 76);
 - No annual surface-based tax has been paid, nor has the mandatory 20% thereof been sent to commune (Article 82);
 - The activities are not officially declared to the Ministry of Mines (Article 94 - regular and repeated operations of purchase, sale, transport, storage, export or importation of mineral substances; Article 102 – any workings exceeding 20m depth);
 - Lack of mining authorization indicates eligibility for a fine of 10-50 million FCFA and 5-10 years imprisonment (Article 108);
- Despite the acknowledged financial benefits, stakeholder consultations with the community indicate a perception of the 55 zone as harmful (environment, children, youth, family, culture);
- 55 zone revenues are dropping; organic emigration is already occurring since early 2012;
- Roxgold has a strong understanding and profile of 55 Zone ASM activity, strengthening its capacity in risk mitigation and minimization of negative impacts in the ASM to LSM transitional period;
- Stakeholder consultation has indicated a very strong enthusiasm for the development of industrial mining;
- The main land owner of the 55 Zone area is supportive of LSM development and already has a developed relationship with Roxgold;
- Open communication exists with the principle gold buyer at the 55 Zone and he has shown willingness for peaceful cooperation and liberation of the site when the time comes.

WEAKNESSES

- Based on consultations, community sees the 55 Zone orpillage as a benefit from a financial point of view because it is a viable livelihood source for many local people.

10.5.2

OPPORTUNITIES

- Openness to alternative livelihoods expressed by members of the local community is concurrent with Roxgold's intention to facilitate community development initiatives;
- Interest in employment expressed in the community is concurrent with Roxgold's ability to offer it;
- Continued apparent support from the main local land owner who can influence public perception;
- Support for an ASM to LSM transition at the 55 Zone has been expressed from relevant regulatory, administrative and security authorities.

THREATS

- Roxgold has no knowledge of any Mining Code enforcement at the 55 Zone thus far, which is indicative of weak government capacity to enforce ASM laws in place;

- Labour and equipment from 55 zone will likely end up on nearby ASM sites in the permit area and could potentially augment and/or mechanize under-developed or new locations.

10.6 8.2 STAKEHOLDER ENGAGEMENT STRATEGY AT THE 55 ZONE IN 2014

Since Roxgold commenced exploration, the company has always ensured clear information disclosure with artisanal miners relevant to their community (e.g. regarding exploration activity near ASM works, to ensure the safety of *orpailleurs*). Since the official stakeholder engagement process began in January 2013, the community relations team's organized, conscious and articulated efforts have successfully developed a two-way dialogue and an open relationship with the key stakeholders of the 55 Zone. The focus has been on transparent communication regarding project planning timelines and informing stakeholders of company intentions, with a view of easing the future mobilization of artisanal miners to advance construction of the Yaramoko Gold Project.

While regional and industry norms often take interventionist, confrontational approaches, at the heart of Roxgold's strategy lays a firm belief in the value of communication through established channels and existing stakeholder relationships. In the first instance, the key stakeholders we plan to involve directly and actively in facilitating the change management at the 55 Zone are:

ROLE	NAME
Traditional Bagassi commune leaders <ul style="list-style-type: none"> • Village Chief • Land Chief 	YE Digobienou (and representatives, elders etc) YE Yakuyo (and representatives, elders etc)
Administrative and governing authorities of Bagassi commune <ul style="list-style-type: none"> • Prefect • Mayor • Village Development Committee (CVD) 	ZOUNDI Tingande Nehemie YE/GNOUMOU Nibatan YE Joseph (President)
Provincial and Regional level authorities <ul style="list-style-type: none"> • High Commissioner of Bale province • Governor of region of Boucle du Mouhoun • President of Regional Council 	BAMOUNI/TRAORÉ Abibata DABIRE Victor KONE Maxime
Local, provincial and regional level security forces <ul style="list-style-type: none"> • District Police (Commissariat) Officer • Provincial Directorate of National Police • Regional Director of National Police 	BASSOLET Daouda <i>OUEDRAOGO Innocent</i>

	<i>COULIBALY Modibo</i>
Director of the Cadastre of Mines (sub-section of Burkina Faso Ministry of Mines)	COULIBALY Felix
Land owner of the 55 Zone	YE Boughin
ASM leadership of the 55 zone (orpailleurs syndicate)	SAWADOGO Sidimadi

Since conscientiously developing a relationship with the 55 Zone *orpillage* site's leadership and land owners, the request has always been to provide an advance 3-month warning for site liberation, an appeal with which Roxgold plans to comply – current estimates see a full liberation of the zone during the 2014 rainy season. In addition, clear and widespread information disclosure will be critical with larger groups of representatives of the *orpailleurs* on the 55 Zone site and with the general public throughout the concession. Roxgold's official Grievance Resolution Mechanism is in place, should this be necessary in supplementing problem-solving via direct dialogue with Roxgold's Community Relations department.

Roxgold has every intention of avoiding security measures in its change management of the 55 Zone and foremost will continue to uphold a transparent dialogue between all pertinent stakeholders. The company expects a smooth transition based on its community relationships but will ensure that any security activities deemed necessary as a last recourse in the halt of ASM activities on site are carried out in accordance with established international human rights norms (e.g. the Universal Declaration of Human Rights, the UN Global Compact and the Voluntary Principles on Security and Human Rights) and with the collaboration of local authorities.

9. ACTION PLAN STEPS

As previously stated, at the core of Roxgold's 55 Zone action plan lays a resolve to utilize a collaborative, participatory approach in executing the transition of the site towards industrial mine development. Following are the exact steps Roxgold expects to take in the process:

1. **ESIA approval and granting of exploitation permit** enables Roxgold to begin process of development for the Yaramoko Gold Project;
2. **Compensation** negotiated and carried out for land owners and cultivators in the area, in line with norms from similar projects in the region and international recommendations;
3. **Key stakeholders involved as change agents** to eliminate artisanal mining at the project site, in particular the land owner and primary gold buyer, with a fair, 3-month advance warning of the deadline to allow a final cycle of operations, thereby minimizing negative impacts to the itinerant population; Note that there is ongoing stakeholder involvement from Step 1 onwards;
4. **Community development programming** and alternative livelihood strategies executed prior to and concurrent with vacating of site (elaborated below), with a goal of maximizing the mitigation of negative effects caused by the removal of ASM as a livelihood generating activity;
5. **Local labour hired** upon release of the site to start the cleanup of the remnants of the *orpillage* camp and clear the tailings dam area for LSM development; an estimated 100 labour jobs will be made immediately available and as the project evolves into early construction, these numbers will increase; Priority will be given to local citizens who suffer economic loss due to land loss and the end of ASM activity on the site.

10. OFF-SETTING LOCAL ECONOMIC DISPLACEMENT

Artisanal mining in the Yaramoko concession is undeniably a notable driver of the local economy. Roxgold is committed to contributing to the socio-economic and institutional development of this community and as such, recognizes that ASM engagement is an important aspect of the company's community development strategy. *Orpaillage* must end at the 55 Zone in order for the Yaramoko Gold Project to advance into the development phase and bring with it the plethora of socio-economic advantages related to the advent of a large industrial employer in a rural underdeveloped area. While many of the *orpailleurs* are part of an itinerant population that will organically migrate upon closure of the site, an important portion belong to Roxgold's Project Affected Population and may suffer a loss of revenue in the process. Therefore, Roxgold believes that this transition must be synchronized with the development of alternative livelihood strategies for those individuals hailing from the project's host communities. Indeed, this is consistent with the openness to alternative livelihood generation expressed on numerous occasions by local community members. However, it is important to note that Roxgold will not prevent local community members from continuing traditional artisanal mining in the area if they so wish, as this informal activity is authorized under the Burkina Faso mining code.

Roxgold aims to conduct community development activities using a participatory planning method, in order to ensure that initiatives are targeted to the needs and interests of the local population. Based on thorough stakeholder engagement and asset and skills registration processes, the company is already identifying alternative livelihood opportunities which seek to mitigate any revenue loss resulting from the transition to an industrial mining project.

The targeted community development projects that Roxgold proposes are based on key understandings but foremost is the fact that ASM in the area is largely poverty-driven and the result of there being few alternatives for income generation. This being the case, there is great potential for a wide variety of development initiatives, so long as they are directed towards employment and income generation to address the poverty factors.

Community consultation has shown that the number one interest of the population with regards to Roxgold's presence in the zone is employment prospects. Whenever possible, Roxgold will strive to identify such opportunities to offer different employment options that can offer a respectable, productive and safe way of life for members of our host community. In fact, once the site is cleared of *orpaillage* activity, the direct and immediate labour needs of the company as it enters into the construction phase will be significant. Further, a substantial amount of the wages from this employment will be spent in the local economy, thus in turn supporting a wide range of economic activity in the community.

The area has long been agrarian and the Bwaba have traditionally engaged in subsistence farming, but today it suffers from a notable food security issue, exacerbated by *orpaillage*. Roxgold plans to address this in providing alternative livelihood opportunities by investing in diverse projects in the domain of agricultural development, as identified by Bagassi's Commune Development Plan (2014-2018), ranging from rice cultivation and market gardening to animal husbandry and household composting. Moreover, the company will endeavor to develop and increase local procurement to meet its own food and construction needs.

Roxgold has recently implemented a 2-year pilot vocational training program, which will significantly build the capacity of 20 local youth in its first round. The graduation of these individuals will coincide with Roxgold's desire to guarantee skilled local employment with the mine even once construction is completed.

This is an initial step and other apprenticeship prospects will surely surface, which can translate into skilled job opportunities, while building local human capital for the long term benefit of the host community.

As the project develops, further opportunities that support the principles of economic security and sustainable community development will undoubtedly arise as the company becomes better positioned to support broad entrepreneurial business development in the zone once production begins.

11 11. CONTINUING ASM MANAGEMENT AT YARAMOKO

Roxgold will facilitate and maximize a transition to alternative sustainable livelihoods wherever possible, including to mining-related and agricultural sectors, in concert with Roxgold's community development initiatives. However, the company will remain committed to enhancing its understanding of artisanal mining and addressing ASM-related issues affecting the project and our host communities. Acknowledging that ASM will remain ongoing in the area and is a valuable livelihood source, Roxgold seeks to continue to co-exist side by side in harmony with the existing community, working at arms-length but addressing the concerns, needs and interests of this stakeholder group. This responsibility will rest largely in the hands of the Community Relations Department, under the supervision of the Corporate Social Responsibility Manager, with collaboration from the Environmental Manager and General Manager. Further, the team will continue to strategize and seek guidance based on philosophies and case studies of respected international bodies, including the International Council on Mining and Metals (ICMM) and the IFC's CommDev.

Interest has been expressed by some ASM stakeholders in obtaining legal authorization for small-scale mining within the Yaramoko concession. If possible in the future, the company may look into a collaborative framing of the activity, if there is genuine interest in evolving it to a status which respects Burkina Faso's regulatory requirements for official authorizations. In this vein, the company's future community development initiatives could certainly involve accompanying technical training programs and socio-environmental sensitization to improve productivity, sustainability, workers' well-being, and the safeguarding of the social and natural environment (e.g. water sources, deforestation, mercury and other toxic substances, health care, safer working conditions).

APPENDIX 11 :
BOUNDARY POINTS OF THE LAND OF VILLAGES
WITHIN THE PROJECT AREA

HAHO

Names	X	Y	Boundary points	Description of the place
HAHO1	466066	1300340	Boundary with Doussi	Plateau of crust
HAHO2	463452	1300145	Boundary with Bonou	Plateau of crust
HAHO3	462997	1301662	Boundary with Bonou	Plain (fields)
HAHO4	462995	1303053	Boundary with Kahin	Plain (fields)
HAHO5	463811	1305215	Boundary with Kahin	Plain (fields)
HAHO6	467024	1302723	Boundary with Yaro	Lowland
HAHO7	467650	1302318	Boundary with Moko	Plain (fields)
HAHO8	467596	1301018	Boundary with Bagassi	Plateau of crust

YARO

Names	X	Y	Boundary Points	Description of the place
Yaro1	468309	1304145	Boundary with Moko	Village
Yaro2	469787	1305070	Boundary with Moko	Village
Yaro3	471653	1307357	Boundary with Pompoye	Plateau
Yaro4	469685	1307351	Boundary with San	Hill
Yaro5	466456	1307418	Boundary with Nainkongo	Hill
Yaro6	463811	1305215	Boundary with Kahin	Lowland
Yaro7	467024	1302723	Boundary with Haho	Lowland
Yaro8	467650	1302318	Boundary with Haho	Lowland
Yaro9	469957	1302646	Boundary with Koussaro	Plateau
Yaro10	468542	1303594	Boundary with Moko	Plateau
Yaro11	468231	1304001	Boundary with Moko	Bottom of a hill

KAHO

Kaho1	465127	1291106	Boundary with Voho	Balé River
Kaho2	468615	1292030	Boundary with Badier	Plateau (fields)
Kaho3	469878	1294143	Boundary with Badier	Hill
Kaho4	470322	1294684	Boundary with Badier	Hill
Kaho5	470637	1295431	Boundary with Bagassi	Hill
Kaho6	467897	1295669	Boundary with Bagassi	Plateau (road)
Kaho7	466824	1295277	Boundary with Sipohin	Hill
Kaho8	465540	1293427	Boundary with Sipohin	Water dam

MOKO

Names	X	Y	Boundary Points	Description of the place
MOKO1	470713	1302304	Boundary with Bagassi	Plateau (fields)
MOKO2	471345	1302214	Boundary with Bagassi and Koussaro	Plateau (fields)
MOKO3	471541	1303507	Boundary with Koussaro	Plateau (fields)
MOKO4	472132	1306184	Boundary with Pompoye	Lowland
MOKO5	471653	1307357	Boundary with Pompoye and Yaro	Plateau (fields)

Names	X	Y	Boundary points	Description of the place
MOKO6	469787	1305070	Boundary with Yaro	Bottom of a hill
MOKO7	468309	1304145	Boundary with Yaro	village
MOKO8	468231	1304001	Boundary with Yaro	village
MOKO9	468542	1303594	Boundary with Yaro	Plateau (road)
MOKO10	469957	1302646	Boundary with Yaro and Koussaro	Plateau (fields)

DOUSSI

Names	X	Y	Boundary Points	Description of the place
Doussi1	455490	1295458	Boundary with Sipohin	Lowland
Doussi2	457228	1301262	Boundary with Yaho	Balé River
Doussi3	461674	1301434	Boundary with Kahin	Forest reserve
Doussi4	466066	1300340	Boundary with Haho	Plateau
Doussi5	466567	1298716	Boundary with Bagassi	Plateau
Doussi6	466699	1297863	Boundary with Bagassi	Plateau
Doussi7	466243	1297167	Boundary with Bagassi	Plateau
Doussi8	463461	1296358	Boundary with Sipohin	Lowland

SIPOHIN

Names	X	Y	Boundary Points	Description of the place
Sipohin1	466824	1295277	Boundary with Doussi	Balé River
Sipohin2	465540	1293427	Boundary with Doussi	Lowland
Sipohin3	467897	1295669	Boundary with Kaho	Hill
Sipohin4	467811	1 297 215	Boundary with Bagassi	plateau
Sipohin5	466 653	1297430	Boundary with Bagassi	plateau
Sipohin6	455490	1295458	Boundary with Doussi	Lowland
Sipohin7	457031	1293323	Boundary with Voho	Balé River
Sipohin8	462065	1292278	Boundary with Voho	Balé River

BAGASSI

Names	X	Y	Boundary Points	Description of the place
Bag1	467596	1301018	Boundary with Haho	Plateau
Bag2	466066	1300340	Boundary with Doussi and Haho	Plateau of crust
Bag3	466356	1298852	Boundary with Doussi	Plateau
Bag4	466699	1297863	Boundary with Doussi	Plateau
Bag5	466243	1297167	Boundary with Doussi	Plateau
Bag6	466653	1297430	Boundary with Sipohin	Hill
Bag7	467811	1297215	Boundary with Sipohin	Plateau
Bag8	467897	1295669	Boundary with Kaho	Plateau
Bag9	470637	1295431	Boundary with Badier and Kaho	Hill
Bag10	473585	1295604	Boundary with Pahin	Hill
Bag11	473160	1295750	Boundary with Banou	Plain
Bag12	470713	1302304	Boundary with Moko et Koussaro	Plateau
Bag13	471345	1302214	Boundary with moko	Plateau

Source: Survey BEGE, 2012

APPENDIX 12 :
COORDINATES OF THE PLOTS

ID	X	Y
L1P1	472 000	1 301 600
L1P2	471 400	1 301 600
L1P3	470 800	1 301 600
L1P4	470 200	1 301 600
L1P5	469 600	1 301 600
L1P6	469 000	1 301 600
L1P7	468 400	1 301 600
L2P1	472 000	1 300 800
L2P2	471 400	1 300 800
L2P3	470 800	1 300 800
L2P4	470 200	1 300 800
L2P5	469 600	1 300 800
L2P6	469 000	1 300 800
L2P7	468 400	1 300 800
L3P1	472 000	1 300 000
L3P2	471 400	1 300 000
L3P3	470 800	1 300 000
L3P4	470 200	1 300 000
L3P5	469 600	1 300 000
L3P6	469 000	1 300 000
L3P7	468 400	1 300 000
L4P1	472 000	1 299 200
L4P2	471 400	1 299 200
L4P3	470 800	1 299 200
L4P4	470 200	1 299 200
L4P5	469 600	1 299 200
L4P6	469 000	1 299 200
L4P7	468 400	1 299 200
L5P1	472 000	1 298 400
L5P2	471 400	1 298 400
L5P3	470 800	1 298 400
L5P4	470 200	1 298 400
L5P5	469 600	1 298 400
L5P6	469 000	1 298 400
L5P7	468 400	1 298 400
L6P1	472 000	1 297 600
L6P2	471 400	1 297 600
L6P3	470 800	1 297 600
L6P4	470 200	1 297 600
L6P5	469 600	1 297 600
L6P6	469 000	1 297 600
L6P7	468 400	1 297 600

L7P1	472 000	1 296 800
L7P2	471 400	1 296 800
L7P3	470 800	1 296 800
L7P4	470 200	1 296 800
L7P5	469 600	1 296 800
L7P6	469 000	1 296 800
L7P7	468 400	1 296 800
L8P1	472 000	1 296 000
L8P2	471 400	1 296 000
L8P3	470 800	1 296 000
L8P4	470 200	1 296 000
L8P5	469 600	1 296 000
L8P6	469 000	1 296 000
L8P7	468 400	1 296 000

APPENDIX 13 :

STAKEHOLDER ENGAGEMENT PLAN



STAKEHOLDER ENGAGEMENT PLAN OF THE YARAMOKO GOLD PROJECT

Prepared by

Elizabeth Freele

CSR Coordinator

January 2014

Contents

1. INTRODUCTION.....	26
1.1 PROJECT DESCRIPTION AND CONTEXT	26
1.2 SEP GOALS AND OBJECTIVES.....	27
1.3 SEP STRUCTURE.....	27
2. REQUIREMENTS AND STANDARDS FOR STAKEHOLDER ENGAGEMENT	28
2.1 NATIONAL REQUIREMENTS FOR STAKEHOLDER ENGAGEMENT.....	28
2.1.1 GENERAL STAKEHOLDER ENGAGEMENT REQUIREMENTS	28
2.1.2 STAKEHOLDER ENGAGEMENT REQUIREMENTS FOR ESIA PROCESS	28
2.1.3 STAKEHOLDER ENGAGEMENT REQUIREMENTS FOR LAND ACQUISITION.....	28
2.2 INTERNATIONAL REQUIREMENTS FOR STAKEHOLDER ENGAGEMENT	29
2.3 ROXGOLD'S STAKEHOLDER ENGAGEMENT PHILOSOPHY	29
3 ENGAGEMENT PHASES.....	30
3.1 INTRODUCTION.....	30
3.2 ENGAGEMENT THROUGH LIFE OF MINE	30
3.2.1 EXPLORATION AND PRE-FEASIBILITY	30
3.2.2 FEASIBILITY, ESIA AND EMPP STUDIES.....	30
3.2.3 CONSTRUCTION	31
3.2.4 OPERATIONS	31
3.2.5 CLOSURE.....	31
3.3 NO-DEVELOPMENT ALTERNATIVE.....	31
4 STAKEHOLDER ENGAGEMENT	32
4.1 APPROACH TO IDENTIFYING STAKEHOLDERS	32
4.2 OVERVIEW OF ENGAGEMENT TO DATE	32
4.2.1 PRE-ESIA CONSULTATION.....	32
4.2.3 ESIA ENGAGEMENT.....	33
4.3 STAKEHOLDER GROUPS	34
4.3.1 BURKINA FASO GOVERNMENT AUTHORITIES.....	34
4.3.2 TRADITIONAL AND VILLAGE-LEVEL GOVERNANCE OF COMMUNITIES OF INTEREST (COIs).....	36
4.3.3 PROJECT AFFECTED POPULATIONS	38
4.3.4 ARTISANAL MINERS	42
4.3.5 VULNERABLE GROUPS.....	42
4.3.6 CIVIL SOCIETY AND NON-GOVERNMENTAL ORGANISATIONS.....	42

4.3.7 OTHER ADVISORY AND PUBLIC BODIES	43
4.3.8 COMMERCE AND INDUSTRY	44
4.3.9 PROJECT EMPLOYEES, CONSULTANTS AND CONTRACTORS	44
4.3.10 SHAREHOLDERS & INVESTORS	44
5 STAKEHOLDER ANALYSIS	45
5.1. STAKEHOLDER INFORMATION MANAGEMENT SYSTEM	45
5.1.1 REGISTRIES	45
5.1.2 COMMUNITY PROFILING	45
5.2 ANALYSIS SUMMARY	45
5.2.1 STAKEHOLDER MATRIX	45
5.2.2 KEY ISSUES IDENTIFIED TO DATE.....	46
6 FUTURE STAKEHOLDER ENGAGEMENT	48
6.1 DISCLOSURE & RESTITUTION OF ESIA.....	48
6.2 FUTURE ENGAGEMENT PENDING PROJECT AUTHORIZATION	49
7 RESOURCES AND RESPONSIBILITIES	50
8 GRIEVANCE MANAGEMENT	51
8.1 INTRODUCTION.....	51
8.2 GRIEVANCE MECHANISM PROCESS	52
8.2.1 RECEIVING AND RECORDING.....	52
8.2.2 INVESTIGATION	53
8.2.3 RESOLUTION	54
8.2.4 MONITORING & EVALUATION	54
9 MONITORING AND REPORTING STAKEHOLDER ENGAGEMENT ACTIVITIES	56
10 CONCLUSION	56
APPENDIX 1: INITIAL INFORMATION DISCLOSURE WITH LOCAL COMMUNITIES.....	Error! Bookmark not defined.
APPENDIX 2: BAGASSI COMMUNE GOVERNANCE STRUCTURE.....	Error! Bookmark not defined.
APPENDIX 3: YARAMOKO CONCESSION NGOS & CBOS.....	57

Table of Figures

FIGURE 1 YARAMOKO PROJECT SITE RELATIVE TO SURROUNDING VILLAGES AND COMMUNES ..	26
FIGURE 2 YARAMOKO CONCESSION AND ALL COMMUNITY LOCATIONS	39
FIGURE 3 STAKEHOLDER MATRIX	46
FIGURE 4 ROXGOLD ORGANOGRAM OF POSITIONS INVOLVING STAKEHOLDER ENGAGEMENT ROLES.....	51
FIGURE 5 ROXGOLD COMMUNITY GRIEVANCE REGISTRY FORM.....	53
FIGURE 6 ROXGOLD INTERNAL GRIEVANCE RESOLUTION FLOWCHART	55

Acronyms & Abbreviations

AA1000SES	AccountAbility 1000 Stakeholder Engagement Standard
ASM	Artisanal and Small-Scale Mining
BEGE	Bureau d'Etudes des Géosciences et Environnement (Geosciences and Environmental Consultancy)
BUNEE	Bureau National des Evaluations Environnementales (National Bureau for Environmental Evaluations)
CBO	Community-Based Organization
CDP	Community Development Plan
CEB	Circonscription d'Education de Base District (Primary Education Inspection)
COI	Communities of Interest
COTEVE	Comité Technique sur les Evaluations Environnementales (Technical Committee on Environmental Evaluations)
CLC	Community Liaison Committee
CLO	Community Liaison Officer
CVD	Conseil Villageois de Développement (Village Development Committee)
CSR	Corporate Social Responsibility
DPPN	Direction Provinciale de la Police Nationale (Provincial Directorate of National Police)
e3 PLUS	Environmental Excellence in Exploration Plus
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GRI	Global Reporting Initiative
ICMM	International Council on Mining and Metals
IFC	International Finance Corporation

ISO	International Organization for Standardization
LOM	Life Of Mine
NGO	Non-Governmental Organization
NI 43-101	National Instrument 43-101 Standards of Disclosure for Mineral Projects
PDAC	Prospectors and Developers Association of Canada
PRA	Participatory Rural Appraisal
PS	Performance Standard
SARL	Société à Responsabilité Limitée (Equivalent to Private Company Limited by Shares "Pvt. Ltd." or Limited Liability Partnership "LLP")
SDEDD	Service Départemental de l'Environnement et du Développement Durable (Departmental Environmental and Sustainable Development Service)
SEDAR	System for Electronic Document Analysis and Retrieval
SEP	Stakeholder Engagement Plan
SLO	Social License to Operate
SNA	Social Network Analysis
TSM	Towards Sustainable Mining
UN	United Nations
ZATA	Zone d'Appui Technique de l'Agriculture (Departmental Agricultural Service)
ZATE	Zone d'Appui Technique de l'Elevage (Departmental Animal Husbandry Service)

12 1. INTRODUCTION

12.1 1.1 PROJECT DESCRIPTION AND CONTEXT

Roxgold Inc. is a Canadian mineral exploration and development company listed on the Toronto Stock Exchange, with a branch in Burkina Faso, ROXGOLD SARL. Currently the company focuses on its Yaramoko permit, particularly the area known as the 55 Zone, where it wishes to develop a significant gold deposit of nearly 2.4 million tons of ore, containing about 1 million ounces of gold. The 167km² permit is located in Burkina Faso's south-central province of Balé, situated in the Boucle du Mouhoun region. It predominantly includes villages of the rural commune of Bagassi, but also touches the communes of Yaho and Pompoi. The setting for Roxgold's proposed development of an underground mining operation, processing plant, tailings storage facility, accommodation camp and related infrastructure to mine and process ore for the Yaramoko Gold Project is a 16km² project area. Less than 1km north-east of the commune capital, Bagassi, the site is nestled around the 55 Zone and its development will entail no resettlement and minimal field displacement. Following is a map delineating the project area.

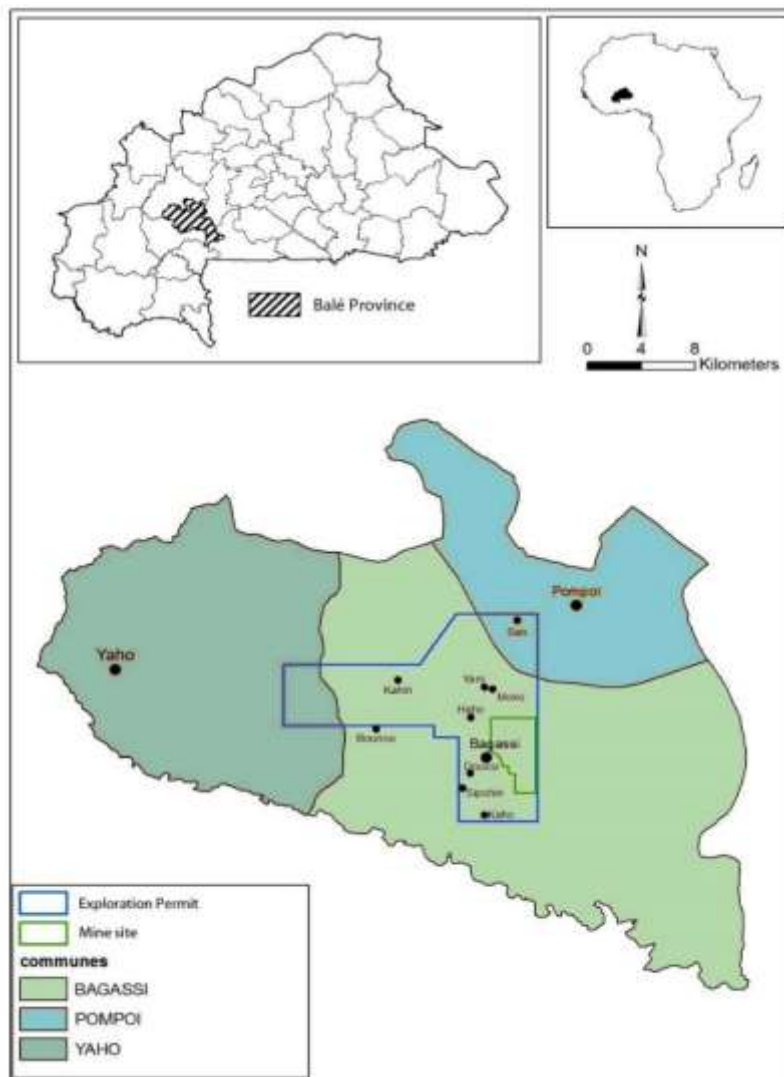


FIGURE 6 YARAMOKO PROJECT SITE RELATIVE TO SURROUNDING VILLAGES AND COMMUNES

Since its inception in 2011, Roxgold has performed exploration activities on its properties utilizing the skills of its geological team. However, in late 2012, activities shifted to include the definition of a development project at the 55 Zone, accompanied by the recruitment of a group of high level executives, with varying skills in the field of mine project implementation across Africa. Concurrently, the company recognized the mounting importance of early stakeholder engagement and formed a Community Relations team to begin driving this process. Accordingly, taking its corporate, social and environmental responsibilities seriously, Roxgold publishes this document to present the preliminary issue of its Stakeholder Engagement Plan (SEP) for the Yaramoko Gold Project.

12.2 1.2 SEP GOALS AND OBJECTIVES

The SEP document sets out the approach that the company will employ to interact with project stakeholders, building on existing consultation practices and guided by Burkina Faso legislation, Roxgold internal policy and international best practice standards. Specifically, this covers information disclosure, official and unofficial consultation, negotiations, relationship building, grievance resolution, monitoring and reporting.

Roxgold is committed to comprehensive life-of-mine engagement and via this document seeks to ensure all related plans are clearly communicated throughout. Accordingly, the SEP exists as a living document, to be evaluated and refined progressively, responding to changes in the project and engagement context. Updates will be issued at regular intervals to ensure the document remains relevant to the needs of both the company and stakeholders.

The fundamental goals of the Stakeholder Engagement Plan are to:

- Define the scope of who and how we engage throughout the different project phases;
- Delineate a framework of communication channels through which to manage the ongoing flow of information between Roxgold and project stakeholders;
- Ensure clear, transparent and timely information disclosure regarding project policies and activities during the various phases of project development;
- Facilitate Free (of intimidation and coercion), Prior (timely and relevant disclosure) and Informed Consultation (relevant, understandable and accessible) with stakeholders to ascertain opinions, interests and concerns and to involve them in participative project design and monitoring;
- Build and enhance healthy, respectful relationships with interested stakeholders to strengthen and maintain the company's Social License to Operate (SLO) and secure Broad Community Support;
- Communicate risk mitigation and management processes to diminish potential negative impacts and enhance potential benefits;
- Institute an accessible and effective grievance resolution system for both Roxgold employees and the general community;

12.3 1.3 SEP STRUCTURE

The sections of this SEP are structured as follows:

- REQUIREMENTS AND STANDARDS FOR STAKEHOLDER ENGAGEMENT – Outline of pertinent national and international standards, as well as Roxgold's engagement philosophy.
- ENGAGEMENT PHASES – Description of stakeholder engagement throughout all life-of-mine scenarios.
- STAKEHOLDER ENGAGEMENT – Roxgold's approach to identification, synopses of engagement to date with all identified stakeholder groups, and a clarification of existing communication channels.
- STAKEHOLDER ANALYSIS – Summary of stakeholder information management system developed through engagement to date, and a synopsis of the preliminary analysis.
- FUTURE STAKEHOLDER ENGAGEMENT – Planned disclosure and feedback management following the Environmental and Social Impact Assessment (ESIA) process and further engagement strategies, pending project authorization.

- RESOURCES AND RESPONSIBILITIES – Details ongoing and Life-of-mine (LOM) human resources and management arrangements for implementing, monitoring, advising and supporting various aspects of stakeholder engagement.
- GRIEVANCE MANAGEMENT – Outline of principles and established grievance mechanism process.
- MONITORING AND REPORTING STAKEHOLDER ENGAGEMENT ACTIVITIES – Envisioned framework for ongoing monitoring and evaluation of stakeholder engagement and KPI-based reporting.

13 2. REQUIREMENTS AND STANDARDS FOR STAKEHOLDER ENGAGEMENT

13.1 2.1 NATIONAL REQUIREMENTS FOR STAKEHOLDER ENGAGEMENT

13.1.1 2.1.1 GENERAL STAKEHOLDER ENGAGEMENT REQUIREMENTS

In terms of stakeholder engagement, the Burkina Faso Mining Code (Law n°031- 2003/AN of May 8,2003) requires the following of all mining companies:

- Consent (of owners or holders) is required for prospecting, research, or operating activities conducted within 100 metres of any buildings, dwellings, wells, religious buildings and burial or sacred places;
- State authorization is required under the same conditions regarding any outbuildings in the public domain;
- With regards to the occupation of land for prospecting, research, or operating activities, the landowner or traditional or customary occupant is entitled to compensation for damages;
- All registers, mining plans and charts shall be made available to the public and their contents communicated to any applicant proving his identity;
- A public investigation must be conducted, to accompany the ESIA, as part of any application for an industrial operating permit.

13.1.2

13.1.3 2.1.2 STAKEHOLDER ENGAGEMENT REQUIREMENTS FORESIA PROCESS

Burkina Faso law requires an Environmental and Social Impact Assessment (ESIA) in the application for a mining exploitation authorization. The various project stakeholders, roles and expectations presented in the ESIA include the ‘Project Promoter’ (Roxgold), the ‘Relevant Authority’ (Ministry of Environment), the ‘Decision Makers’ (the technically relevant ministry, in this case the Ministry of Mines) and the General Public.

The first stakeholder engagement requirement in the process is the collection of ‘public information’ by an independent consultancy firm, which informs the study and report. Roxgold has retained the services of an independent consultancy firm, BEGE (Geosciences and Environmental Consultancy), to direct this process. Copies of the resulting report are then disseminated to local stakeholders and other interested parties, followed by a COTEVE Session (session of the Technical Committee on Environmental Evaluations) to discuss and question the document.

Once the report passes this phase, it is subjected to a full public inquiry, undertaken by surveyors appointed by the Ministry of Environment, to independently assess the opinions of the population affected by the project. The Public Inquiry Report accompanies the ESIA submission, a favourable notice of which facilitates the granting of an industrial operating permit from the Ministry of Mines.

13.1.4 2.1.3 STAKEHOLDER ENGAGEMENT REQUIREMENTS FOR LAND ACQUISITION

Burkina’s constitution guarantees basic property rights, but most land officially belongs to the government and the state reserves the right to expropriate land at any time for public use. A2007 national land reform policy has led to the recognition and protection of the rights of rural stakeholders to land and natural resources. Since, a rural land management law followed in 2009 (034/2009/AN) that enables legal recognition of land rights anchored in customary rules and practices. In rural areas

such as the Yaramoko concession, customary land tenure rules have long governed land transactions and indeed these are the type of land rights to be taken into account in the development of the Yaramoko Gold Project. Though the texts are vague on the explicit mention of stakeholder engagement, it is clear that the law requires Roxgold to ensure advance compensation in any case of future land expropriation for project advancement.

13.2 2.2 INTERNATIONAL REQUIREMENTS FOR STAKEHOLDER ENGAGEMENT

Roxgold seeks to implement international best practice in stakeholder engagement and corporate social responsibility in general whenever possible. The company draws guidance from a number of sources, including the PDAC's e3 Plus framework, ISO 26000, GRI, UN Global Compact, the Mining Association of Canada's TSM, AA1000SES and the ICMM's Sustainable Development Framework. However, its engagement philosophy largely uses the IFC's Sustainability Framework as its benchmark, with special attention given to the framework's Performance Standards.

The Performance Standards are:

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

At the time of writing, the main guiding standards of the current phase are Performance Standards 1 and 5, which are especially pertinent in addressing expectations regarding stakeholder engagement during the ESIA process.

In addition, Roxgold takes direction from the IFC's 2007 publication *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets* as well as the 2013 IFC guide, *A Strategic Approach to Early Stakeholder Engagement: Good Practice Handbook for Junior Companies in the Extractive Industries*.

13.3 2.3 ROXGOLD'S STAKEHOLDER ENGAGEMENT PHILOSOPHY

Stakeholders are any individuals or groups of people that are directly or indirectly affected by the project, have interests in the project and its activities, or have influence on the project and its planned outcome. While obligatory stakeholder engagement in a context such as the Yaramoko concession would typically be limited to regulatory requirements of the ESIA, Roxgold recognizes it as a prerequisite for acquiring and maintaining its Social License to Operate (SLO) and as the foundation for good risk management. The company therefore sees stakeholder engagement as a broader, more inclusive, and continuous process that should span the entire life of the project.

Roxgold embraces the following principles in its pursuit to exhibit exemplary corporate citizenship and maintain ongoing, inclusive dialogue with its stakeholders:

- Utilize early, proactive, transparent and mutually acceptable consultation procedures that include opportunities for discussion in advance of any action;

- Engage in consultation that is always Free (of intimidation and coercion), Prior (timely information disclosure) and Informed (relevant, understandable and accessible);
- Ensure respect for human rights, cultures, customs and values of those affected by the company's activities in all stakeholder engagement;
- Facilitate two-way dialogue that affords all interested parties the opportunity to exchange opinions and information and to have any issues heard and addressed;
- Ensure meaningful information disclosure in an appropriate language or format, that is readily understandable and accessible to the target stakeholder groups;
- Ensure inclusiveness in representation and communication, including the breadth of stakeholders (i.e. age, gender, ethnicity, vulnerable/minority groups)
- Respect for local conventions, languages, time-frames and decision-making processes and protocols;
- Assume accountability rooted in clear recording of all official and unofficial community engagement;
- Participatory project planning and development with stakeholders, which mitigates negative impacts and emphasizes benefit enhancement;
- Maintain a regular presence in local communities to develop and sustain personal company relationships and engender trust;
- Implementation of context-specific risk management strategies, based on analysis of sound data and sourced from stakeholder engagement;
- Establish, propagate and evolve clear mechanisms for responding to concerns and suggestions, incorporating feedback into the project and reporting back to stakeholders.

Consultation records and a stakeholder database will be maintained by the Community Relations Department of Roxgold Inc. Key information exchange and engagement activities will be recorded and updated on an ongoing basis.

14 3 ENGAGEMENT PHASES

14.1 3.1 INTRODUCTION

This section outlines how Roxgold envisions stakeholder engagement should work in the different phases throughout the life of the project. Different engagement contexts will be encountered, wherein stakeholders interact with a variety of Roxgold representatives and different tools and approaches are required. It is essential that the diverse engagement activities be well coordinated and underpinned by clear standards and procedures. Engagement during the project life cycle is further defined below.

14.2 3.2 ENGAGEMENT THROUGH LIFE OF MINE

14.2.1 3.2.1 EXPLORATION AND PRE-FEASIBILITY

During this phase of the Project, the priority is to identify select stakeholders and assess key risks that could affect the viability of the project. Stakeholders throughout the exploration permit are engaged with a focus on information disclosure and registration of concerns and feedback. Results are fed back into decision-making processes.

14.2.2 3.2.2 FEASIBILITY, ESIA AND EMPP STUDIES

Engagement during the feasibility phase is more intensive, going beyond basic information disclosure to more meaningful two-way dialogue focused on relationship building. A system for stakeholder tracking is established and a wider variety of local stakeholders are engaged. The approach evolves towards a more participatory project development, whereby stakeholders influence the proposed project in advance of the ESIA and in-depth design. As studies are undertaken to establish technical feasibility, financial viability, socio-environmental sustainability and to develop engineering and operational designs, a greater emphasis is placed on targeted consultation with communities in the

immediate vicinity of the proposed mine site, while information disclosure continues to be the guiding principle of consultation in the rest of the concession. A Community Liaison Committee (CLC) is established to create an official forum for two-way dialogue and the grievance mechanism is developed in concert with the community, in anticipation of the upcoming development phase.

14.2.3 3.2.3 CONSTRUCTION

During the construction phase, stakeholder engagement relates to all activities leading up to and including the building of project facilities, roads, infrastructure, and buildings. Previous stakeholder engagement has left the company better equipped to facilitate efficient management of adverse impacts in this phase (e.g. address economic displacement in land acquisition with particular respect to customary and usufruct use of land and resources in the local context). A priority is to maintain links with stakeholders to ensure impact mitigation is being implemented as planned so once construction starts, affected stakeholders must be closely involved in a proactive and timely manner, in monitoring both anticipated and unanticipated impacts, as well as evaluating the effectiveness of risk mitigation measures (e.g. the grievance mechanism). The CLC can prove to be a strong tool in this sense. An emphasis will also be placed on community inclusion via employment and need-based community development activities. This critical phase will set the tone for continued stakeholder engagement during the life-of-mine operations, thus a great emphasis should be put on enhancing relationships with local stakeholders.

14.2.4 3.2.4 OPERATIONS

The transition to operations usually leads to fewer negative impacts and grievances, resulting in a decreased need for engagement with local stakeholders. However, with the end of construction will also come decreased labour and employment needs, a reality which will need to be communicated well in advance, so as to carefully manage community expectations. Stakeholder engagement procedures will be more deeply integrated into a broad range of operations management systems, such as health & safety, social development, environmental management, procurement, logistics and overall project risk management. Also, the focus will be on maintaining constructive, long-term relationships to ensure a constant two-way dialogue with stakeholders. Further details for this phase will be added to the SEP in an updated version as the project evolves.

14.2.5 3.2.5 CLOSURE

The closure phase will include a number of negative impacts, including the loss of local employment, a decline in regional economic activity and a reduction of community programs, project and services previously provided by the company. Once again, engagement on these realities will have to be undertaken well in advance of the transition to manage stakeholder expectations. Community involvement can play an important role in rehabilitating the natural environment and integrating operational infrastructure into public services, as well as establishing management structures for long-term asset management. Further details for this phase will be added to the SEP in an updated version as the project evolves.

14.3 3.3 NO-DEVELOPMENT ALTERNATIVE

A number of social, political, economic or technical situations may lead to a decision not to initiate or continue mine development. Under such no-go circumstances, stakeholders must be informed to ensure mitigation of negative feelings, as well as the alleviation and management of stakeholder expectations.

15 4 STAKEHOLDER ENGAGEMENT

15.1 4.1 APPROACH TO IDENTIFYING STAKEHOLDERS

The objective of stakeholder identification is to establish who may be directly or indirectly affected (both positively and negatively), or have an interest in or influence on the project. It also enables the company to discuss the forms of involvement that stakeholders can have in project development. The ongoing process requires regular review and updates and the principle questions asked in identification are:

- Who does Roxgold influence? Who is dependent on our operations? With whom does Roxgold interact the most?
- Who influences Roxgold?
- To whom is Roxgold responsible?

To date, much identification has been informed by:

- Attention to the project's Area of Influence as it has currently been defined;
- Contacts already made with communities and authorities as part of initial public consultation, information disclosure and government relations activities;
- Contacts made through the first round of local stakeholder consultation in each of the villages within the exploration permit;
- Unsolicited contacts with the project made by external interested parties.

To develop an effective SEP with unique, personalized strategies, it is necessary to understand the needs and expectations for engagement from each stakeholder or stakeholder group, as well as their priorities in relation to the project. This information enables the company to tailor engagement to each stakeholder and ensure effective and appropriate communication and relationship building.

15.2 4.2 OVERVIEW OF ENGAGEMENT TO DATE

15.2.1

15.2.2 4.2.1 PRE-ESIA CONSULTATION

As is typical in many junior companies beginning exploration, stakeholder engagement was tasked to Roxgold's exploration mining staff on site at first and was for the most parts *ad hoc* and uncoordinated. However, in late 2012, an extensive stakeholder consultation process commenced, including both group consultations within the communities and in-depth one-on-one consultations with key stakeholders. Leading up to the ESIA, stakeholders at the local level have become a top priority and are now engaged in detailed and regular communication. Below is a summary of recorded consultations with the local communities of the Yaramoko concession since formal documentation of stakeholder engagement began:

Quarter	# of Consultations	Objectives of Engagement
Q1 2013	56	Stakeholder identification, information disclosure, social baseline data collection

Q2 2013	20	Stakeholder identification, information disclosure, social baseline data collection and consolidation
Q3 2013	38	Relationship building, CLC formation, identification of social investment opportunities, crop compensation negotiations (exploration)
Q4 2013	n/a	Relationship building, ESIA information disclosure

15.2.3

The primary aim was building an understanding of the local context and ensuring thorough information disclosure about the concession and scope of company exploration activities (a copy of the information disclosed is available in Annex 1). However, the consultation program also provided stakeholders an opportunity to express views and concerns about potential impacts and suggested mitigation measures related to the Yaramoko Gold Project. This has enabled the company to register and respond to any existing concerns, and subsequently, to consider and integrate stakeholder interests as project design has evolved, concomitantly developing an Environmental and Social Management Plan.

Further, these pre-ESIA engagement activities enabled Roxgold to clearly assess who the project stakeholders are, how they influence or are influenced by the Yaramoko Gold Project, and the nature of attitudes and priorities in relation to the project. An engagement priority throughout was the development of communication channels and comfortable access for local stakeholders to the new community relations staff. A comprehensive social baseline study was performed to inform the ESIA process, rooted in a philosophy of Participatory Rural Appraisal (PRA), which established a new foundation for the community-company relationship, based on inclusion and empowerment. Key community stakeholders and local knowledge were incorporated throughout the data-gathering and scoping phase of the ESIA studies conducted by BEGE, particularly with regard to the mapping of sacred animist sites and others with cultural, ethnographic or archaeological significance.

Stakeholder engagement at other levels, particularly with government authorities, has been largely needs-based thus far and is at a relatively early stage at this point.

15.2.4 4.2.3 ESIA ENGAGEMENT

As the ESIA process rolls out, contact is being maintained with local stakeholders and national regulatory authorities alike. The Community Relations department is continuing information disclosure to address the aspects of the ESIA report and project design most pertinent to the local stakeholders. This is largely through the use of visual materials and face-to-face communication at the village level, with a view to enhancing local understanding of what the project will look like and ensuring input of key stakeholders who will be affected by project development. Following the pre-ESIA engagement activities, the emphasis has moved toward:

- Establishing a consistency in stakeholder engagement and communication

- Preparing community for what the ESIA regulatory procedure and public inquiry will entail
- Building relationships of trust and transparency, to pave the way for a participative path forward
- Establishing an early, accessible and responsive grievance mechanism
- Expectation management
- Continuing identification of risk mitigation measures
- Identification of win-win scenarios and ways to create value and enhance project benefits for the host community

15.3 4.3STAKEHOLDER GROUPS

15.3.1 4.3.1 BURKINA FASO GOVERNMENT AUTHORITIES

This group includes the agents within the Burkina Faso government who have the power to regulate or otherwise influence the project in terms of establishing policy, granting permits or other approvals, as well as monitoring and enforcing compliance with Burkinabe law throughout the project's lifecycle. It is essential to establish an early and continuing dialogue with these authorities.

The government ministries identified as currently most relevant to the project are the Ministry of Mines, Energy and Quarries, the Ministry of Finance, the Ministry of Environment and Sustainable Development (including BUNEE, the National Bureau for Environmental Evaluations) and the Ministry of Agriculture and Food Security. In addition, the Ministry of Labour, the Ministry of Water, Hydraulic Works and Sanitation and the Ministry of Interior will become important stakeholders in the future.

Most importantly at this stage, relationship building with the Ministry of Mines is ongoing, with Roxgold meeting regularly with its Director, as well as with the Director of the Cadastre of Mines. Meetings are also relatively frequent with the Ministry of Environment's BUNEE during the ongoing ESIA process.

The regional, provincial and departmental governing and administrative authorities pertaining to the Bagassi area extend from the Ministry of Territorial Administration, Decentralization and Security. A basic, explanatory organogram of the structure can be found in Annex 2, but the principal details follow.

At the regional level, the main decentralized and devolved authorities include:

Legislative	Regional Council	
Executive	President of the Regional Council (Elected Administrative Head)	Maxime Lomboza Kone 1stVP : Kondé Ismaël 2ndVP: Sanfo/Yé Hélène
Permanent Commissions	General, Social & Cultural Economic & Financial Environment &	President : Souabo Hamidou President: Diallo Mamadou President : Dioma Soumabéré

	Development	
--	--------------------	--

At the commune level, the main decentralized and devolved authorities include:

Legislative	Municipal Council	
Executive	Town Hall, Mayor of Bagassi (Elected Administrative Head)	Gnoumou/Yé Nibatan 1st Deputy: Yé Nestor 2nd Deputy: Zongo Yira Halimata
Permanent Commissions	General, Social & Cultural Economic & Financial Environment & Local Development Planning & Land Management	

The State-appointed administrative civil servants of the zone are:

Regional	Governor of the Region of Boucle de Mouhoun	Victor Dabiré
Provincial	High Commissioner of the Province of Bale	Diallo/Aouba Henriette Lydie
Departmental (Commune)	Prefect of the Department of Bagassi	Nehemie Tingande Zoundi

Regional authorities have mostly not been engaged to date and only basic contact has been made with the provincial authorities. However, at the commune level, efforts have been made to more deeply engage the local leadership of the Prefecture and Town Hall, the institutions around which all modern administration of the villages revolves. The Mayor, an elected, civil officer, drives all affairs within the commune with the objective of defending the population's interests, supported by 2 elected councilors per village. The appointed Prefect represents the authority of the State and is an important mediator, particularly through the judicial role of presiding over the County Court. The Prefect is also responsible for supervising the Decentralized Technical Services of the commune. The Decentralized Technical Services at the local level are:

1. Departmental Agricultural Service (*ZATA, Zone d'Appui Technique de l'Agriculture*), reporting to the Provincial Directorate for Agriculture and Food Security;
2. Departmental Animal Husbandry Service (*ZATE, Zone d'Appui Technique de l'Elevage*), reporting to the Provincial Directorate for Animal Resources;
3. Departmental Environmental and Sustainable Development Service (*SDEDD, Service Départemental de l'Environnement et du Développement Durable*), reporting to Provincial Directorate for Environment and Sustainable Development

4. District Primary Education Inspection (*CEB, Circonscription d'Education de Base*), reporting to the Provincial Inspection for Education
5. Departmental Tax Service (*La Perception de Bagassi*), reporting to the Regional Directorate for Economy and Finance.
6. Departmental Police Service, reporting to the Provincial Directorate of National Police (*DPPN, Direction Provinciale de la Police Nationale*).

Relationships are being built with the leaders within these two core administrative institutions, whose roles will remain important throughout the duration of the project and who have the potential to be helpful change agents. The representatives of the various Decentralized Technical Services have also all been engaged to varying extents.

15.3.2 4.3.2 TRADITIONAL AND VILLAGE-LEVEL GOVERNANCE OF COMMUNITIES OF INTEREST (COIs)

The traditional Village & Land Chiefs represent the most long-standing local leadership of Burkinabe villages. They continue to exercise significant power today and therefore have a direct, strong influence on the company's Social License to Operate (SLO). The Chiefs also represent the leadership of the animist belief system, a critical socio-cultural aspect of the project's context.

The two roles can be played by one person or by two different individuals from distinct indigenous lineages, each with a few notable elders to assist and advise them. Also, in some cases, where a village has multiple ethnicities, each group identifies their own Chief. Cultural norms dictate that one usually accesses the Chiefs via the elected Village Development Committee (CVD), which is the effective 'front door' to the village and is also accountable to the Mayor.

Meetings regarding decision-making and other important topics are held with this stakeholder group, following local practices, prior to any wider communication within the local Communities of Interest (COIs), in order to respect the political and social structures. Roxgold's ongoing relationship building with both the Chiefs and leaders of the Village Development Committees is of central importance in LOM stakeholder engagement activities, as these customary leaders are vital stakeholders.

The main traditional and village-level leaders (of the dominant Bwaba ethnic group) in the Yaramoko concession COIs include:

Bagassi	Village Chief	YE Digobienou
	Land Chief	YE Yakuyo
	CVD President	YE Joseph
Bounou	Village Chief	GNOUMOU Koumayihou
	Land Chief	GNOUMOU Anmi
	CVD President	GNOUMOU Bawiye
Doussi	Village Chief	GNOUMOU Kani
	Land Chief	LAMIEN Nikievo
	CVD President	GNOUMOU Pangabomi

Haho	Village Chief	KASSA Dofinwiya
	Land Chief	KASSA Dofinwiya
	CVD President	GNOUMOU Wokaere
Kahin	Village Chief	SIEZA Oumar
	Land Chief	SIEZA Oumar
	CVD President	SIEZA Bonou
Kaho	Village Chief	GNOUMOU Sinne
	Land Chief	GNOUMOU Sinne
	CVD President	GNOUMOU Pissizounou
Moko	Village Chief	GNOUMOU Bognessan
	Land Chief	GNOUMOU Bognessan
	CVD President	GNOUMOU Bognessan
Niankongo	Village Chief	TAMBOURA Mamadou
	Land Chief	TAMBOURA Mamadou
	CVD President	TAMBOURA Siaka
San	Village Chief	MANDI Francois
	Land Chief	GNOUMOU Zounouti
	CVD President	MANDI Foban
Sipohin	Village Chief	BAHOUE Donou
	Land Chief	GNOUMOU Sieyounou
	CVD President	GNOUMOU Bienvenu
Yaro	Village Chief	GNOUMOU Milotin
	Land Chief	GNOUMOU Zounoupawiyen

	CVD President	GNOUMOU Yenki
--	--------------------------	----------------------

15.3.3 4.3.3 PROJECT AFFECTED POPULATIONS

This stakeholder group is the most paramount custodian of Roxgold's Social License to Operate (SLO). Therefore, this is the stakeholder group on which the Community Relations team have concentrated with regard to identifying stakeholder interests, influences and project support levels, engaging 660 local stakeholders to date.

The Yaramoko concession includes the following Communities of Interest (COIs):

COMMUNITY	POPULATION	NATURE OF COMMUNITY
Bagassi	4 706	Village, Commune Capital
Bounou	3 112	Village
Doussi	1 309	Village
Haho	452	Village
Kahin	1 379	Village
Kaho	883	Village
Moko	1 197	Village
Niankongo	1 163	Village
San	1 728	Village
Sipohin	783	Village
Yaro	1 674	Village
SUB-TOTAL	18 386	
Bagassi South	≈ 1000	ASM migratory population
55 Zone	≈ 1200	ASM migratory population
TOTAL	≈20 586	

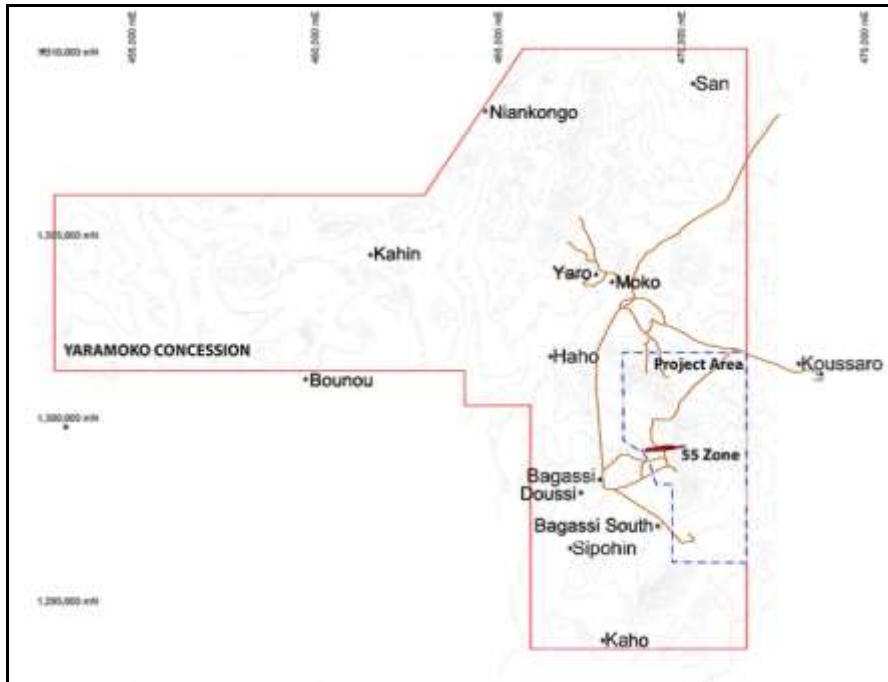


FIGURE 7 YARAMOKO CONCESSION AND ALL COMMUNITY LOCATIONS

Though detailed data on the communities can be found in the ESIA and Roxgold’s social baseline study summary document, for the purposes of this stand-alone document, a brief description of the local population follows:

Citizens of the area are chiefly subsistence farmers, with a significant percentage of people also cultivating cotton and other cash crops. Both commerce and animal husbandry are fairly popular income-generating activities. In addition, artisanal mining has been popularized since the 1990’s as a supplementary income source for many and has grown in popularity in the past few years as greater numbers of farmers abandon cotton farming. Literacy levels are low and unemployment high.

The foremost local ethnicity are the Bwaba, an animist group with autonomous, patrilineal village structures. Living in harmony with the Bwaba, there is also a significant representation of Marka, Mossi and Fulani ethnicities. Though largely an animist populace, Islam and Christianity are widely practiced.

Overall, the population is largely characterized by its youth, with the <20 age group representing 58.5% of the total population and meriting particular attention in engagement activities. While the population has experienced a notable in-migration linked to artisanal mining in recent years, there continues to be a rural exodus to urban centres and cocoa/coffee fields in Ivory Coast and Ghana, where youth seek remunerative work not found at home.

The SEP presents an initial prioritization of the communities within the Yaramoko concession as Levels 1 and 2, based on likelihood of impact.

Level 1 Project-Affected Communities

This group has a high impact and interest categorization and includes the villages of Bagassi and Doussi, as well as the artisanal mining settlements of Bagassi South and the 55 Zone. Of these, the commune capital, Bagassi, and the village fused to it, Doussi, are the nearest villages to the project. These residents are the individuals most likely to be affected by a host of both positive and negative socio-economic and environmental project-related impacts. In the upcoming transition towards

construction, the greatest impacts will most likely centre around employment and land acquisition. To date, Roxgold has already liaised closely with local landowners and has established a compensation procedure for exploration activities, based on national compensation norms for any lost crops in the case of temporary access to agricultural areas. When areas are identified, negotiations are undertaken and compensation is paid prior to drill site preparation and activities. The Community Relations department closely monitors the work throughout. This procedure will be reviewed and improved for the case of mine development, to ensure maximized compensation above local norms, with a view of ensuring minimal negative impacts.

A Community Liaison Committee (CLC) has also been formed with the leadership of Bagassi and Doussi, to provide a forum for ongoing disclosure, future grievance management and informed participation in project development.

The high classification of individuals working and living informally at Bagassi South and the 55 Zone is due to the fact that this population has a notable effect on the project's advancement and that these are the stakeholders most likely to suffer a loss of illicit income as the project advances.

The main leadership figures of these communities are listed below:

COMMUNITY	KEY STAKEHOLDERS	
	TITLE	NAME
Bagassi	Prefect	ZOUNDI Tingande
	Mayor	GNOUMOU (YE) Nibatán
	1 st Deputy Mayor	YE Nestor
	2 nd Deputy Mayor	ZONGO Yira Halimata
	CVD President	YE Joseph
	Village Chief	YE Digobienou
	Land Chief	YE Yakuyo
Doussi	CVD President	GNOUMOU Pangabomi
	Village Chief	GNOUMOU Kani
	Land Chief	LAMIEN Nikiévo
55 Zone	Principal Land Owner	YE Bouyen
	Principal Land	YE Doutien SAWADOGO

	Owner	Sidi
	ASM Leader 55 Zone	
Bagassi South	Community Delegate Deputy Delegate Representative of Delegate	El Hadj ZOURE Amado OUEDRAOGO Moussa SAWADOGO Isaka

Level 2 Project-Affected Communities

This low to medium level impact group includes the other villages of the exploration concession that are not in the immediate vicinity of the currently proposed Yaramoko Gold Project's exploitation of the 55 Zone.

The Level 2A extent of impact will largely be limited to ongoing exploration activities in the near future (exploration permit valid until 2016) and potential employment or business development opportunities. These are villages within the Yaramoko concession that are anywhere from 2 – 8 kilometres away from the mine project site boundary. The CVD and traditional leaders of these villages have all been engaged on a basic level (through the 2012-2013 round of information disclosure and baseline data collection), as have a variety of community groups and representatives, including women, youth, religious, health and education actors. The villages are:

- Sipohin
- Haho
- Yaro
- Moko
- Kaho
- Kahin
- Bounou
- Niankongo
- San

In addition to these, the Level 2B impact group will eventually include a number of other villages that are outside the concession but that ought to be engaged, as they are within a certain distance of the mine or they may be affected by mine traffic, according to the currently proposed access route. These will be engaged as necessary once access route plans are confirmed. These villages include:

- Ouahabou
- Koussaro
- Koho
- Bandhio
- Pahin
- Banou

15.3.4 4.3.4 ARTISANAL MINERS

Though much of the Artisanal and Small-scale Mining (ASM) on the concession is not carried out by residents of the area, Roxgold recognizes the importance of taking into account these individuals. In addition to the itinerant gold-rush population, many of the Bagassi commune residents incorporated in Level 1 or 2 of the Project Affected Population stakeholder classification are also reliant on artisanal mining as an income source, particularly at the 55 Zone.

Since Roxgold's exploration activities began, the company has co-existed harmoniously with this stakeholder group. Interaction with the sites has primarily entailed advance information disclosure in the case of any nearby exploration activities, to ensure artisanal mining ceases within 100 metres of any drilling, to avoid the risks associated with ground disturbance through vibration.

As the official consultation schedule throughout the permit area rolled out in 2013, the company shifted to an approach which sought to enhance the understanding of the site's functioning and develop relationships with key stakeholders involved. Given that this is an important Corporate Social Responsibility issue, Roxgold addresses the artisanal mining stakeholder group in more detail in the ARTISANAL MINING ACTION PLAN OF THE YARAMOKO GOLD PROJECT. The company is of the view that challenges presented by ASM will be best addressed through a multi stakeholder-approach. Ultimately, Roxgold seeks to develop and implement a strategy that supports co-existence while reducing the negative socio-environmental impacts associated with ASM.

15.3.5 4.3.5 VULNERABLE GROUPS

These are the stakeholders that may have a high level of interest but are typically disempowered. Conscious steps must be taken to ensure these groups are included in engagement activities. The vulnerable groups identified in the Yaramoko context include:

- Women;
- Children;
- In-migrants;
- The elderly;
- The disabled;
- Minority ethnic groups or lineages (e.g. the nomadic Fulani ethnic group, who are typically landless herders and therefore may be at risk for losing access to grazing land for their cattle, thus also more prone to experiencing the notorious cultivator-herder conflicts common in the region);
- Land users (cultivators) of the proposed mine site area, who could be at risk for economic displacement without their share of compensation from land owners, linked to potential discord between traditional and modern land management and ownership systems.

15.3.6 4.3.6 CIVIL SOCIETY AND NON-GOVERNMENTAL ORGANISATIONS

This stakeholder group includes members of the wider general public, civil society organizations such as religious groups, cooperatives, cultural groups and citizens associations. For many, the interest in the project is linked to their pursuit for socio-economic investment and support. Roxgold's engagement has touched on all these main groups to date, especially the more organized and influential of the zone's community-based organizations (CBOs) that collectively have a great impact on Broad Community Support and Roxgold's SLO.

Opportunities for participation and further engagement will continue through the diffusion of the stakeholder engagement plan and the constant availability of the Community Relations team on the ground. A complete list of concession-wide active NGOs and CBOs is available in Annex 3. In addition to these, the religions identified and engaged include:

- Animism
- Islam

- Catholicism
- Protestantism
 - Assemblies of God (Pentecostal)
 - Christian Alliance (Evangelical)
 - Adventism

15.3.7 4.3.7 OTHER ADVISORY AND PUBLIC BODIES

The recently established Roxgold Restricted Committee creates an important forum for communication with representatives of the Level 1 local communities. At this time, plans are being developed to also establish a larger Roxgold Exploration Committee, to include representation from all the villages of the exploration concession.

Plans are in place at the regional level to soon form a mining sector committee, to be named the Committee of Actors in the Mining Sector of the Region of Boucle du Mouhoun, once again to create an important forum for communication. Roxgold has already submitted its application and is awaiting the committee's formation.

Security forces in the local area are also a significant public body. Within Bagassi commune, this is limited to the Police Commission of Bagassi, with 3 full-time employees. This office reports to the Provincial Police Department of Bale, in Boromo. Security forces also include Roxgold's private hired security at the exploration camp. Together, these stakeholders are charged with the task of maintaining peace and order in the area.

Engagement with local media thus far has been minimal, though this stakeholder group can play an important role in public perception of the company's activities and by extension Roxgold's SLO. These include, but are not limited to:

- Television: Canal 3, BF1 and RTB
- National newspapers: Sidwaya (Le Quotidien) and l'Observateur, Le Pays, l'Independent, San Finna and the web-based Le Faso.net
- Radio: The Voice of Bale (103.6), RTB Burkina

Similarly, engagement with Canadian media has also been minimal; outlets such as The Northern Miner newspaper, the Gold Report and Mine web currently cover Roxgold's developments and occasionally request management interviews. Response to the company and the project as a whole has been positive to date. In addition, the company has active relationships with a number of analysts who are associated with local media and whose reports are distributed to an extensive client network. These analysts include:

- Cormark Securities Ltd. - Tyron Breytenbach
- GMP Securities - Brock Salier
- Jennings Capital Inc. - Dan Hrushewsky
- Macquarie Capital Markets Canada Ltd. - Pierre Vaillancourt
- Raymond James Ltd. - David Sadowski

At the Canadian and corporate level, there are a number of notable advisory and public bodies too, such as the Canadian Securities Administrators. As a Canadian mining and mineral exploration company, Roxgold engages at this level by following their specific guidelines for disclosure, such as National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101). This instrument governs a company's public disclosure of scientific and technical information about its mineral projects. As a public company, Roxgold is also required to abide by the rules set out by the British Columbia Securities Commission, the independent provincial government agency responsible for regulating securities trading in British Columbia through the administration of the Securities Act.

Another important form of engagement with this stakeholder group is the filing of all material information regarding the company's activities, including permitting, with SEDAR (the System for Electronic Document Analysis and Retrieval), a Canadian mandatory document filing and retrieval system for all Canadian public companies.

Requests for information submitted by the British Columbia Securities Commission must also be addressed expeditiously.

In the future, this stakeholder group will also include relevant international watchdog organizations, such as MiningWatch Canada, for whom engagement will be predominantly information disclosure based on requirements, when necessary.

15.3.8 4.3.8 COMMERCE AND INDUSTRY

A range of commercial agents will certainly have a great interest in project development. These may include:

- Local entrepreneurs, though typically having limited influence, may have supply chain potential (e.g. small businesses, farmers, traders, merchants etc) and will be contacted through the company, its contractors, or other related business, with follow up with individual entrepreneurs where appropriate;
- National-level businesses or goods and services providers who may gain by providing a variety of larger-scale goods and services to the project, with whom direct contact will be undertaken as part of the normal business of the project;
- Other mining companies working in the area.

As the project needs develop and new contractors and service providers are identified, it is likely that such businesses will become more important stakeholders as they establish contractual relationships with the company.

Engagement with the broader mining industry is largely carried out through the Burkina Faso Chamber of Mines, with which Roxgold is involved in through weekly discussions.

15.3.9 4.3.9 PROJECT EMPLOYEES, CONSULTANTS AND CONTRACTORS

Engagement between the company and local employees is accomplished via two elected Employee Delegates. The recent incorporation of a Human Resources Manager looks to formalize this engagement and strengthen cross-hierarchy communications, to further benefit both employees and the company management team. The local management team holds daily meetings in the exploration camp to ensure broad, ongoing communication with the leadership of the employee base, contractors and consultants on site. An induction package is also provided to every new employee, consultant or contractor entering the project. Employees and contractors will continue to be informed on the project's development via these existing mechanisms and with the introduction of new tools as necessary, on a regular basis.

A weekly and monthly report is compiled to communicate between the various branches of company activity and Roxgold senior management. As well, there is a weekly conference call between supervisory and management groups to discuss operations in all aspects of the business.

15.3.10 4.3.10 SHAREHOLDERS & INVESTORS

As a public company Roxgold is accountable to its investors and shareholders. The majority of shareholders are institutional and supportive of company management. Interests of this stakeholder group are generally exercised through existing company governance structures, such as the Board of Directors. The company discloses significant information to the public in widely disseminated news

releases and communications vehicles such as the company's website, corporate presentations and other marketing materials.

Shareholders and investors are routinely engaged at functions such as industry conferences and conventions, meetings with management and the company's Annual General Meeting. The interests of shareholders are protected through corporate governance oversight mechanisms and the Board of Directors. The company's investor relations department is responsible for overall engagement with existing and potential shareholders and manages the dissemination of significant company developments through news releases and associated communications.

16 5STAKEHOLDER ANALYSIS

16.1 5.1.STAKEHOLDER INFORMATION MANAGEMENT SYSTEM

16.1.1 5.1.1 REGISTRIES

Identification and initial engagement has resulted in the creation of living stakeholder and consultation record registries for the project's local stakeholders. The stakeholder registry informs the company's stakeholder analysis, describing the various stakeholders in terms of their level of influence, level of support for the project and how impacted they are by the project activities. Meetings archived in the consultation registry cover a variety of these stakeholders within the exploration concession communities, such as vulnerable groups, artisanal miners, civil society, NGOs, CBOs, and leadership from the traditional to commune administration levels. A database of consultation reports exists for all baseline consultations, as well as for any non-simple subsequent consultations to date. The consultation registry enables the Community Relations department to identify the interests and impacts most discussed in consultation over any given period of time and the ensuing analysis results continually enhance the effectiveness of engagement in informing the choice of engagement approaches, focus topics and tools.

For non-local stakeholders, meetings have been more infrequent and thus are not logged in the same way at this time. However, reports are created for such consultations if deemed necessary.

16.1.2 5.1.2COMMUNITYPROFILING

The social baseline study culminated in the production of profiles for each community in the Yaramoko concession, serving as socio-economic fact sheets that outline such domains as religion, ethnicity, economy and livelihood, health, water, education, key stakeholders and general demographics. The profiles also include a Social Network Analysis (SNA), represented by relationship maps in the form of cluster diagrams that identify key actors, their support, relationships, interconnections and community flows of influence. Descriptor documents have been created to accompany these maps. In addition, a governance organogram has been elaborated, representing the area's official governance structures.

16.2 5.2ANALYSIS SUMMARY

16.2.1 5.2.1 STAKEHOLDER MATRIX

The purpose of the stakeholder analysis is to identify key social risks and provide a reference for the levels and methods of engagement appropriate to the diverse stakeholders and stakeholder groups

surveyed. For example, some stakeholders only require simple information disclosure, while others are key figures to be integrated into joint decision-making. The method used to date involves placing stakeholders in a matrix with two axes, giving equal weight to each parameter:

- The degree of influence the individual can have on the project and project stakeholders
- The level of support the individual has expressed for the project

This analysis can be carried out at any impact level for stakeholders whose influence and project support have already been evaluated. To date, it has been executed for both the full database of Yaramoko stakeholders and for the smaller Level 1 impacted communities that are in the immediate vicinity of the proposed mine site (constituting 33% of the database). The matrix indicates how engagement should be carried out for different stakeholders by quadrant:

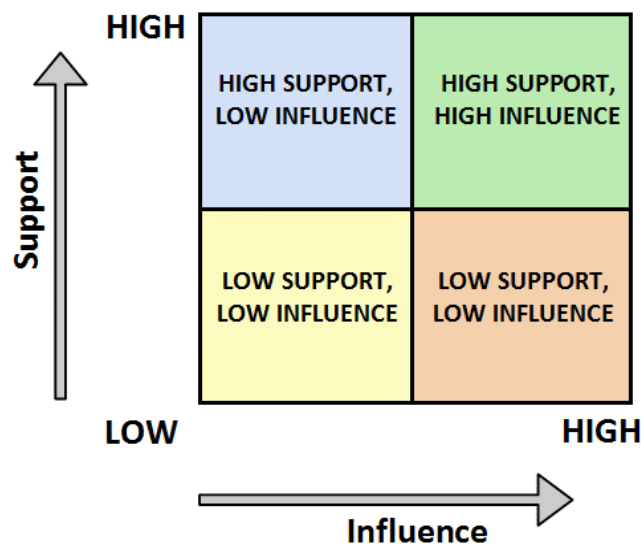


FIGURE 8 STAKEHOLDER MATRIX

- **HIGH SUPPORT, HIGH INFLUENCE** – These are key stakeholders, usually with a certain level of authority, requiring in-depth and regular consultation, as well as involvement in decision-making. As project allies, they are excellent change agents with regard to other stakeholders and merit strong relationship-building efforts.
- **HIGH SUPPORT, LOW INFLUENCE** – Also advocates of the project, but unless *en masse* these individuals have little influence on the project or other stakeholders. The quadrant often includes vulnerable members of the community and weak local interest groups that are supportive of the project. They must be kept satisfied via consultation and disclosure, with particular regard for their interests.
- **LOW SUPPORT, LOW INFLUENCE** – Information disclosure will be the priority and monitoring should be ongoing, but generally engagement needs are minimal. This quadrant may include vulnerable members of the community and weak local interest groups that do not support the project. Efforts should be made where possible to elevate support levels for the project.
- **LOW SUPPORT, HIGH INFLUENCE** – These stakeholders typically have decision-making power that could adversely affect the project and must be closely monitored. Engagement could be intensified and efforts made to elevate support levels for the project whenever possible.

16.2.2 5.2.2 KEY ISSUES IDENTIFIED TO DATE

While no means exhaustive, the list below describes the most frequently mentioned project-related issues from pre-ESIA consultations:

Issue	Nature of Issue	Response Provided
Employment & Recruitment	Desired impact	- Roxgold intends to prioritize local employment whenever possible, depending on available local capacities and the project's technical needs; Definite is unskilled labour
Community Investment & Economic Development (inc. agriculture, infrastructure, education, health, water)	Desired impact	- Roxgold hopes to increase its involvement with community social development in the future if a project is developed
Resettlement of villages	Concern	- There is no intention to resettle any population with the development of the project
Land – Adequate compensation for economic displacement resulting from project acquisition of agricultural land	Concern	- Any compensation will be objectively fair, as well as equal to or above state & industry norms, and guided by international standards
Land – Impact on and respect for sacred sites and sacrifices	Concern	- Every effort will be made to respect and avoid impact on sacred animist sites, as evidenced in the BEGE census of existing sites already carried out
Water – in particular, agro-pastoral use + potable	Concern & Desired impact	- Detailed hydrological and hydrogeological investigations have been carried out, Roxgold intends to create its own fresh water resource so as not to harm the community's supply
LSM over ASM – Desire for elimination of ASM as a negative activity, in favour of a larger project with greater potential for broad-	Desired Impact	- Indeed, Roxgold aspires to ensure broad-ranging benefits to the community if a mine is developed

ranging benefits		
LSM over ASM – Significantly relied on by community as supplementary livelihood; what will happen to it?	Concern	<ul style="list-style-type: none"> - ASM in the vicinity of a future chosen project will end, but Roxgold does not seek to eradicate this income source across the exploration concession. - Direct employment, local procurement, indirect support to local economy will all accompany LSM - Needs-based community development initiatives will accompany LSM
Advance, honest information disclosure and general company integrity	Desired impact	- Roxgold will always strive to ensure advance information disclosure and to keep its word
Road infrastructure	Interest	- It is unclear at this time what kind of road development would accompany mine development

17 6 FUTURE STAKEHOLDER ENGAGEMENT

17.1 6.1DISCLOSURE &RESTITUTIONOF ESIA

Throughout the ESIA process, the Community Relations department will continue stakeholder tracking and relationship building. The team will be in place to accompany the public inquiry phase on the ground if invited to do so by the investigating team that is appointed by the Ministry of Environment. While the interested parties formally have the opportunity to digest and comment on the detailed proposals and envisioned impacts, Roxgold hopes to operate an internal comment and feedback system, so as to ensure voices are heard and concerns are registered and responded to. Roxgold will systematically log issues brought up and following the study and inquiry, a report on the outcome of this phase of the engagement process will be prepared if necessary. The findings of the process will be disseminated through the channels deemed appropriate at the time by local authorities in conjunction with the Community Relations department, including options as varied as:

- A direct round of consultations in the form of general assemblies facilitated by the Community Relations department to communicate outcomes orally (especially given the very low literacy rates of the local population)
- Information booth at the market place
- Roxgold Restricted Committee
- Local radio (La Voix de Bale)
- Local press
- Roxgold corporate press release
- Roxgold website

17.2 6.2 FUTURE ENGAGEMENT PENDING PROJECT AUTHORIZATION

Upon successful completion of the ESIA regulatory requirement, the Yaramoko Gold Project will move forward into the implementation phase. The company will assure ongoing liaising with the relevant regulatory authorities, in particular those concerned with socio-environmental issues. A full stakeholder engagement program will continue, expanding in scope and deepening the company's relationships with interested and affected parties at the local level. It is expected that in the near future, many discussions at this level will centre on anticipated construction timelines and activities, as well as related employment, land acquisition and community development initiatives. This will also be an excellent time to further explore the developing role of the Roxgold Restricted Committee.

Throughout the life of the project, Roxgold will track stakeholders and record issues discussed in a methodical way within its established yet ever-evolving Stakeholder Information Management System. Matters raised that require consideration are brought to the attention of the appropriate member of the project team if and when necessary and issues classified as grievances will be addressed via the Grievance Resolution Mechanism outlined later in this document. Given local stakeholders' clear interest in employment and income generation, moving forward an emphasis will also be placed on advance communication of the type and extent of opportunities through the different life-of-mine phases, as a critical aspect of expectation management.

Other future goals will include increasing awareness within the broader employee base with regard to socio-environmental and other community issues and further developing formal Community Relations and Corporate Social Responsibility policies. As it grows, the Community Relations department will have more frequent briefings and updates to ensure the consultation team on the ground is well-informed. The team also seeks to enhance transparency and accountability, with regards to both themselves and local stakeholders, hence a priority is also to continue direct engagement and not overly rely on authorities, in order to ensure the message is sent that the company does value the input of communities and to foster a shared sense of ownership over the engagement process. Further, additional action plans will be developed, based on the needs identified in the outcome of the ESIA process. Regular updates of the Stakeholder Engagement Plan and these other action plans will be produced as necessary and reviewed quarterly by the Community Relations department to ensure they are in tune with the day to day realities of the project, as well as the needs and feedback of the community.

Roxgold believes that a direct focus on enhancing natural, human and social capital holds the greatest promise for sustainable community development resulting from mining activities. Through increased engagement with the community and the CLC and further participatory assessment of community assets and needs, the Community Relations department will seek to identify and maximize more ways to support this philosophy as time goes on, always with a Participatory Rural Appraisal (PRA) approach that empowers the host community in planning and monitoring. The company will strive to positively benefit local standards of living through internal alignment of functions to support community investment, through mitigation of potential adverse impacts and through multi-stakeholder development of sustainable and needs-based community projects. For example, Roxgold is already

piloting a 2-year vocational training package, in response to a widespread documented desire for employment, recruitment and training. In addition, the company started a primary school scholarship program in 2013 to support education for more vulnerable children in the villages. Such community investment and socio-economic benefit optimization initiatives will be further outlined in Roxgold’s Community Development Plan (CDP).

If you are a stakeholder reading this document that has not been adequately taken into account in Section 4, please advise the Roxgold team about your desire to be kept informed about the project in the future:

<p>Burkina Faso</p> <p>Contact Person(s):</p> <p>NACOULMA Jean-Didier, jdnacoulma@roxgold.com</p> <p>Elizabeth Freele, efreele@roxgold.com</p> <p>Pierre Matte, pmatte@roxgold.com</p> <p>Tel : +226 50 36 13 57</p>	<p>Canada</p> <p>Contact Person:</p> <p>Annelise Burke, aburke@roxgold.com</p> <p>Tel: +1 416203 6401 x240</p>
---	--

18 7 RESOURCES AND RESPONSIBILITIES

This section describes the human resources and responsibilities for implementing, monitoring and evaluating Roxgold’s stakeholder engagement throughout the life of the project.

The components of this plan will require management from various areas and on a number of levels through the project’s various phases. Currently, the company has developed an internal Community Relations department to manage the majority of stakeholder engagement activities at the Yaramoko Gold Project, described below, all of whom are accessible to stakeholders:

- Elizabeth Freele, Corporate Social Responsibility Coordinator
- Jean-Didier Nacoulma, Community Relations Coordinator
- Charles Gnoumou, Community Liaison Officer

The Community Liaison Officer is a member of the local project affected population, playing the important role of resource person, interpreter and general cross-cultural facilitator. The Community Relations Coordinator manages all direct engagement with local stakeholders and is their primary contact in the company. He is the chief stakeholder identifier and facilitator of relationship-building. The Corporate Social Responsibility Coordinator consolidates the data of the Stakeholder Information Management System, directs evolving engagement priorities in parallel with project development and ensures corporate monitoring and reporting of stakeholder engagement matters. All team members are directly involved in village consultation, identification of risk mitigation strategies and social investment opportunities, as well as the upcoming implementation and management of the Grievance Resolution Mechanism.

The Community Relations department reports directly to the Chief Operating Officer, who holds ultimate accountability for social and environmental performance of project operations and who devolves the main tasks and responsibilities of the local stakeholder engagement process to the appropriate employees through the General Manager. With regard to impacts of ongoing exploration activities, the team frequently consults with the Exploration Manager and Senior Manager of Geology. They also work closely with the General Manager, who directs stakeholder engagement regarding inter-mine cooperation, contractors, commerce and Burkina government and regulatory bodies. Engagement with employees is directed by the Human Resources Manager and at the corporate level, engagement with shareholders, investors and North American advisory and public bodies is handled by the Department of Investor Relations & Corporate Communications. Notable local engagement roles related to local employment and value chains are also played by the Project Engineer, Exploration Camp Manager and the Procurement/Logistics Coordinator. Below is an organogram highlighting these roles as they currently exist within the company structure:

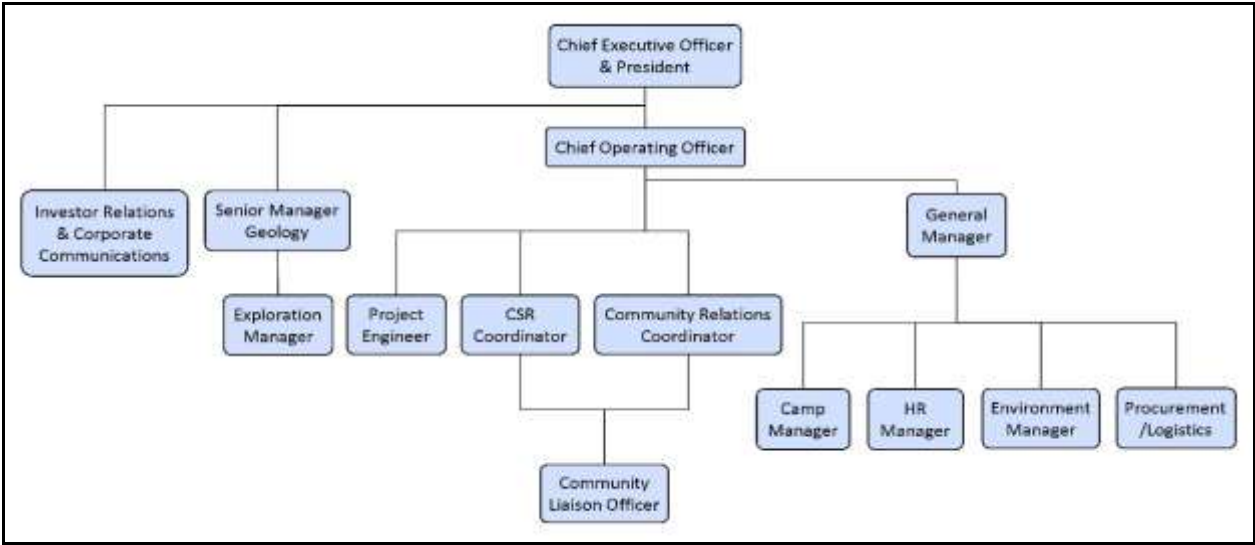


FIGURE 9 ROXGOLD ORGANOGAM OF POSITIONS INVOLVING STAKEHOLDER ENGAGEMENT ROLES

In order to fulfil the requirements of the evolving SEP, it is likely that Roxgold will provide and employ additional resources. The existing core Community Relations department will remain the primary point of contact for stakeholders and hold responsibility for the day to day processes of project area stakeholder engagement. During the transition through feasibility and development phases, the company envisions expanding the responsibilities of the existing structure shortly to include a Health & Safety Officer, an Environmental Manager, as well as an additional Community Relations Coordinator and Community Liaison Officer.

19 8 GRIEVANCE MANAGEMENT

19.1 8.1 INTRODUCTION

A grievance is an issue, concern, problem or claim (real or perceived) that an individual or group wants the company to address and resolve. A formal grievance mechanism provides the project with a way to reduce risk, offers communities an effective avenue for expressing concerns and attaining resolutions, and promotes mutually constructive relationships.

Internally, the process for grievance resolution is via the Human Resources department, elected Employee Delegates and direct contact with the General Manager. Roxgold’s grievance mechanism,

as outlined below, was developed to receive and facilitate resolution of any community concerns regarding the project's social and environmental performance at a local level. The purpose of the grievance mechanism is to develop a structured, credible process that ensures transparent reporting, official recording and fair consideration of all project-related grievances. It has been designed, in collaboration with the community, to be accessible to stakeholders and to address concerns promptly, in a culturally sensitive way that considers customary methods of dispute resolution.

The grievance mechanism is currently being put in place through the Roxgold Restricted Committee. The committee members represent the leadership of the Level 1 impact-interest communities and these individuals will be charged with disseminating the mechanism in the first instance, through customary village-level communication channels. Following this, an additional round of consultations will be held by Roxgold's Community Relations department to inform all communities potentially affected by the project. As the mechanism is formally implemented, Roxgold will ensure it is continually monitored and improved as necessary to ensure its efficacy.

19.2 8.2 GRIEVANCE MECHANISM PROCESS

19.2.1

19.2.2 8.2.1 RECEIVING AND RECORDING

When an individual or group have a grievance to report to the company, they will first decide whether to go to the President of the relevant CVD, as is customary, or to bring the grievance directly to the attention of the Prefecture themselves. Should they choose to go to the CVD President, he will report the issue to the Prefecture, where it will be officially logged in the departmental (communal) records. The involvement of the Prefecture at this first level ensures transparency and participation of one of the commune's existing governing and mediating structures.

The Prefect will then inform the company via the Community Relations department and internally, Roxgold will also log the grievance, assigning it a unique number. The Community Relations department will begin investigating immediately, beginning by meeting with the citizen and filling out the following grievance form.



Community Grievance Registry

Reference: PL0000_dd-mm-yyyy

1. Date of Reception: / /

2. Grievance Location:

COMMUNE:	
VILLAGE:	
OTHER LOCATION DETAIL :	

3. Identity of Complainant:

Name, SURNAME	Title/Role	Contact Details	Signatures/ Fingerprint

4. Concern/ Grievance – Classification(s):

<input type="checkbox"/> Recruitment/Employment	<input type="checkbox"/> Provision of goods/services and revenue generation at local level	<input type="checkbox"/> Economic Displacement
<input type="checkbox"/> Resettlement (Physical Displacement)	<input type="checkbox"/> Sites with cultural/ heritage / religious importance	<input type="checkbox"/> Compensation
<input type="checkbox"/> Environment (water/air/land)	<input type="checkbox"/> Dust	<input type="checkbox"/> Noise
<input type="checkbox"/> Traffic	<input type="checkbox"/> Water usage	<input type="checkbox"/> Behaviour of ROX personnel/ contractors/ suppliers/ security
<input type="checkbox"/> Human Rights	<input type="checkbox"/> Community health & safety	<input type="checkbox"/> Security personnel
<input type="checkbox"/> Road damages	<input type="checkbox"/> Community investment	<input type="checkbox"/> Community involvement
<input type="checkbox"/> Mine infrastructure	<input type="checkbox"/> Other (specify):	

5. Description of Grievance:

What? Where? Who? Outcome/problem?

6. Grievance Date:

<input type="checkbox"/> One time – Date? :	<input type="checkbox"/> Several times – How many? :	<input type="checkbox"/> Ongoing – Since? :

7. Resolution Suggestions:

8. Resolution Method Envisioned:

<input type="checkbox"/> Community Relations Team	<input type="checkbox"/> Internal (cross-departmental) Roxgold Team	<input type="checkbox"/> External Investigation
---	---	---

9. Recorded by :

Name and Surname of Roxgold Receiver:	Signature :

FIGURE 10 ROXGOLD COMMUNITY GRIEVANCE REGISTRY FORM

19.2.3 8.2.2 INVESTIGATION

During Roxgold’s meeting with the complainant, the appropriate investigative method for the severity of the concern is determined. Should there be any discord between the parties in this decision, the Prefect’s mediation skills will be referred to. The methods to choose from are as follows:

- Basic investigation and corrective action can be managed internally by Roxgold's Community Relations department;
- Establishment of a Roxgold cross-departmental internal team, which includes Community Relations employees;
- External investigator(s) identified to address the grievance.

A thorough investigation will be completed accordingly by the chosen group.

19.2.4 8.2.3 RESOLUTION

Following investigation, a solution is proposed to the individual or group in question, if relevant. Should the remedy be satisfactory to all parties, the corrective action is managed and a Grievance Resolution report is filed by the Community Relations department, with copies sent to the Roxgold Restricted Committee (via Town Hall), the General Manager of Roxgold and the Prefect.

Should the grievance not be resolved, it will be brought to the next level of resolution; a failed attempt to resolve within the Community Relations department will lead to the formation of an internal team and a failed attempt by an internal team will lead to external investigation. In the event that this last form of investigation fails, a Grievance Investigation report will be filed and the grievance will be brought to the Restricted Committee for arbitration. The committee will meet to discuss and propose a solution. If this resolves the matter, the committee will file a Grievance Resolution report to the Prefect and Roxgold's Community Relations department and General Manager.

In the case where none of these existing instruments succeed, the complainant is free to pursue legal recourse outside of Roxgold's grievance mechanism.

19.2.5 8.2.4 MONITORING & EVALUATION

For all grievances resolved within the grievance mechanism, two to three weeks following the resolution of the complaint, a Community Relations representative will visit the individual or group to ensure ongoing satisfaction with the outcome of the resolution process. Feedback regarding the process will be registered in the Stakeholder Information Management System and if relevant, be used to improve the grievance mechanism.

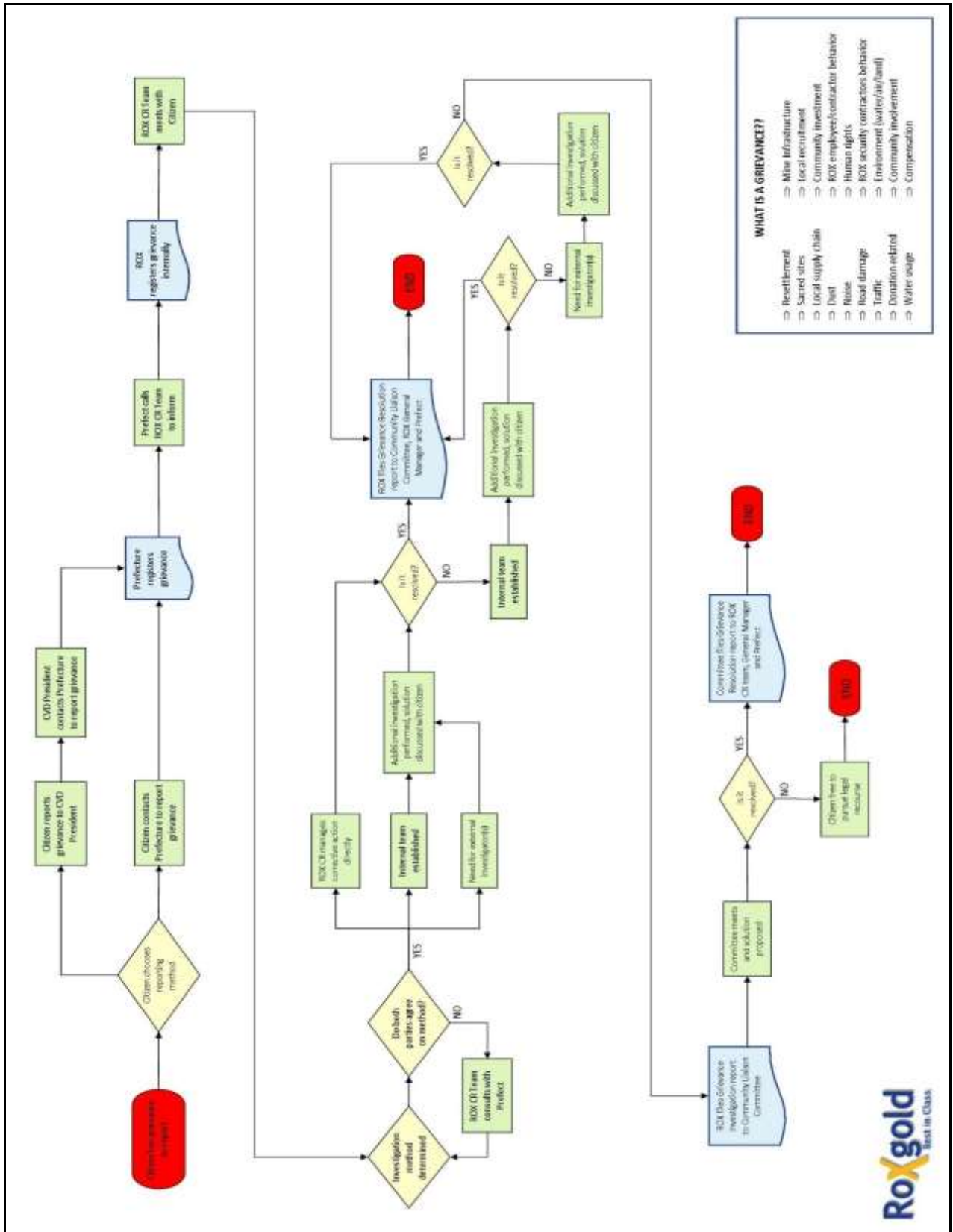


FIGURE 11 ROXGOLD INTERNAL GRIEVANCE RESOLUTION FLOWCHART

20 9 MONITORING AND REPORTING STAKEHOLDER ENGAGEMENT ACTIVITIES

Monitoring of engagement activities will be ongoing throughout the lifecycle of the project, to ensure consultation efforts are effective and meaningful and that the SEP remains relevant and updated. Periodic evaluations will include internal auditing of the implementation of the SEP, studying records of consultation activities conducted, assessing the effectiveness of engagement processes and reviewing grievances. This will include self-evaluations but will also be rooted in a participative process that involves stakeholders, in the interest of continually improving Roxgold's engagement procedures for company and stakeholders alike. Important indicators will include evaluating the level of understanding of the project by stakeholders, their level of involvement in the project and grievances received, as well as how they have been addressed.

Reporting to stakeholders at the local level will include a minimum update at the quarterly meetings of the Roxgold Restricted Committee. Further, continuing consultation and the general availability of community relations staff on the ground will ensure that reporting is an ongoing process with the community.

Internal monthly reporting to present a summary of all activity is already ongoing as part of established corporate communication procedures. This includes general community activities conducted, progress on partnerships, stakeholders consulted and risk analysis developments (including interests and concerns discussed, project support levels, etc). In the future, this will grow to include grievances registered as well as resolution details. An external corporate summary report will be produced annually, beginning in 2014, for which the company will seek to uphold international standards whenever possible.

21 10 CONCLUSION

Roxgold's activities bring the company in contact with an enormous variety of stakeholders. Many of the relationships established to date are fruitful, friendly and collaborative, fostering clear and frequent two-way dialogue, thereby bringing benefits to both the company and stakeholders in forging a smooth path forward for the future. Nevertheless, there are certainly relationships that need still to be cultivated and others to be further nurtured and developed. Roxgold is committed to stakeholder engagement as an ongoing process and strives to listen and respond effectively to stakeholders, in order to build constructive, healthy and mutually beneficial relationships of confidence and trust with its host community. The company seeks to create strong and effective for a for communication, negotiation and grievance resolution within this engagement framework, believing that such is the best course of action to achieve a win-win development of the Yaramoko Gold Project.

APPENDIX 14

ROXGOLD ENVIRONMENTAL AND SOCIAL MONITORING PLAN

A PLEMININARY ENVIRONMENTAL AND SOCIAL MONITORING PLAN FOR THE YARAMOKO GOLD PROJECT IN BURKINA FASO

Prepared For
SRK Consulting (Canada) Inc.

Report Prepared by



SRK Consulting (UK) Limited

UK5629

COPYRIGHT AND DISCLAIMER

Copyright (and any other applicable intellectual property rights) in this document and any accompanying data or models which are created by SRK Consulting (UK) Limited ("SRK") is reserved by SRK and is protected by international copyright and other laws. Copyright in any component parts of this document such as images is owned and reserved by the copyright owner so noted within the document.

This document may not be utilised or relied upon for any purpose other than that for which it is stated within and SRK shall not be liable for any loss or damage caused by such use or reliance. In the event that the recipient of this document wishes to use the content of this document in support of any purpose beyond or outside that which it is expressly stated or for the raising of any finance from a third party where the document is not being utilised in its full form for this purpose, the recipient shall, prior to such use, present a draft of any report or document produced by it that may incorporate any of the content of this document to SRK for review so that SRK may ensure that this is presented in a manner which accurately and reasonably reflects any results or conclusions produced by SRK.

The use of this document is strictly subject to terms licensed by SRK to its Client as the recipient of this document and unless otherwise agreed by SRK, this does not grant rights to any third party. This document shall only be distributed to any third party in full as provided by SRK and may not be reproduced or circulated in the public domain (in whole or in part) or in any edited, abridged or otherwise amended form unless expressly agreed in writing by SRK. Any other copyright owner's work may not be separated from this document, used or reproduced for any other purpose other than with the document in full as licensed by SRK. In the event that this document is disclosed or distributed to any third party, no such third party shall be entitled to place reliance upon any information, warranties or representations which may be contained within this document and the recipient of this document shall indemnify SRK against all and any claims, losses and costs which may be incurred by SRK relating to such third parties.

© SRK Consulting (UK) Limited 2013

Table of Contents

1	INTRODUCTION.....	1
1.1	BACKGROUND.....	1
2	Brief project description	1
3	Legal requirements and obligations.....	3
3.1	Burkina Faso requirements.....	3
3.2	International good practice.....	4
3.3	Corporate standards	5
4	Monitoring activities.....	5
5	Data analysis.....	6
6	Review and reporting	6
7	Responsible persons	7
8	Estimated monitoring costs.....	7

List of tables

Table 3-1: Analysis of the monitoring program	Error! Bookmark not defined.
Table 3-2: Environmental Oversight Program.....	Error! Bookmark not defined.
Table 8-1: Preliminary Environmental Monitoring Plan.....	9
Table 8-3: List of Water Quality Parameters (Actlabs)	22
Table 8-4: Preliminary Socio-economic Monitoring Plan	30

List figures

Figure 8-1: Air Quality Monitoring Location Map.....	24
Figure 8-2: Noise Monitoring Location Map	26
Figure 8-3: Groundwater Monitoring Location Map	28

Introduction

1.1 Background

SRK Consulting (UK) Limited (“SRK”) is an associate company of the international group holding company, SRK Consulting (Global) Limited (the “SRK Group”). SRK has been requested by Roxgold Inc., (“Roxgold”, hereinafter also referred to as the “Company” or the “Client”) to prepare an Environmental and Social Monitoring Plan (hereinafter referred to as the Monitoring Plan for the Yaramoko Gold Project (“the Project”) located in Burkina Faso.

Roxgold commissioned the Bureau d’Etudes des Géosciences des Energies et de l’Environnement (BEGE) to produce an Environmental and Social Impact Assessment (ESIA) for submission to the Ministry of Environment and Sustainable Development (Ministred’Environnement et Development Durable – MEDD). The ESIA includes an Environmental and Social Management Plan (ESMP) which takes into consideration the impacts identified for each environmental or social component and which require ongoing monitoring throughout the life of the project to quantify and understand the effects of the project on the biophysical and social environment.

Since SRK was responsible for baseline data collection for some of the specialist studies such as air quality, ground water and oversight of the noise study it is well placed to identify the specific parameters that need to be monitored on an on-going basis and provide recommendations of where the monitoring points should be located, as well as how frequently the monitoring needs to take place. The Monitoring Plan produced by SRK will form part of the ESMP prepared by BEGE.

2 BRIEF PROJECT DESCRIPTION

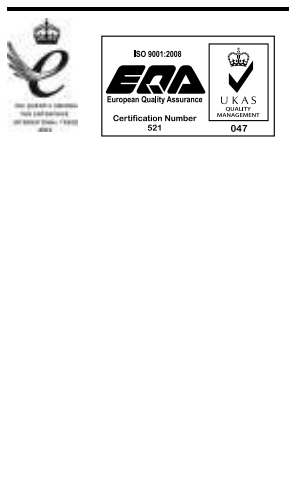
The Yaramoko Project is located 1 km north east of the town of Bagassi, in the Balé province of south-central Burkina Faso. The project resource is estimated at 2.4 million tonnes of ore containing 1 million ounces of gold.

The deposit will be exploited using underground mining methods such as inclined long-hole blast drilling and long-hole open stoping extraction, with backfilling as required. The ore extraction rate is expected to be approximately 270,000 tonnes per year with an annual gold production of 100,000 ounces. The Life of Mine is estimated at 10 years and may be extended depending on exploration results.

The processing plant will involve crushing, gravity concentration and carbon in leach. The plant will

	<p>Registered Address: 21 Gold Tops, City and County of Newport, NP20 4PG, Wales, United Kingdom.</p>	<p>Group Offices: Africa</p>
	<p>SRK Consulting (UK) Limited Reg No 01575403 (England and Wales)</p>	<p>Asia Australia</p>
<p>Page 1</p>		<p>Europe North America</p>
		<p>South America</p>

operate 24 hours a day and 365 days per year. Water for the operation will be supplied with water from a storage dam (WSD) built in the northeast of the deposit, Electricity supply to the mine will be through the use of an oil-fired power plant. A Tailings Storage Facility (TSF) will be located to the northeast of the plant. Accommodation for 300 people will also be constructed at the site.

	<p>Registered Address: 21 Gold Tops, City and County of Newport, NP20 4PG, Wales, United Kingdom.</p> <p>SRK Consulting (UK) Limited Reg No 01575403 (England and Wales)</p> <p>Page 2</p>	<p>Group Offices:</p> <ul style="list-style-type: none"> Africa Asia Australia Europe North America South America
---	--	---

A small quarry may be operated above the underground mine to rehabilitate artisanal mining sites, produce materials for the construction of different structures as well as for underground backfill.

3. LEGAL REQUIREMENTS AND OBLIGATIONS

The Monitoring Plan has been developed to address the requirements of Burkina Faso legislation as well as the requirements of monitoring plans developed to meet good international industry practice and Roxgold's corporate social responsibility policy.

3.1 BURKINA FASO REQUIREMENTS

Article 76 of the Mining Code (L031-2003/AN) states that activities governed by the Mining Code shall be conducted so as to ensure environment conservation, management, and restoration of mining sites following standards, conditions and methods set by the regulation in force.

According to the EIA Decree (Decret N°2001-342/PRES/PM/MEE):

Article 30: "Environmental monitoring is to verify the effectiveness of the implementation of the measures detailed in the environmental management plan and the compliance with the recommendations of the Minister in charge of the environment on the one hand and the pertinence of the impacts identified on the other hand."

Article 31: "The Minister in charge of the environment in collaboration with the relevant ministries is responsible for environmental monitoring. Other people from other ministerial departments can be involved in monitoring as and when needed."

According to the Mining Act (Law N°031-2003/AN):

Article 17: "Applications for an Industrial operating permit for a mine shall be accompanied by a case file containing, among others, an environmental monitoring plan."

Although the legislation does not specify exactly what is required for a monitoring plan BUNEEI have developed sectorial guidance of what the monitoring plan should contain and this has been included in the ESIA terms of reference (Section 4.2.10.2) submitted to government in June 2013. Only the specific information requirements from the terms of reference that are relevant to the environmental and social monitoring plan have been included hereunder for ease of reference.

4.2.10.2. ENVIRONMENTAL MONITORING AND OVERSIGHT PROGRAM

Article 76 of the Mining Code (L031-2003/AN) states that activities governed by the Mining Code shall be conducted so as to ensure environment conservation, management, and restoration of mining sites following standards, conditions and methods set by the regulation in force.

According to the EIA Decree (Decret N°2001-342/PRES/PM/MEE):

Article 30: "Environmental monitoring is to verify the effectiveness of the implementation of the measures detailed in the environmental management plan and the compliance with the recommendations of the Minister in charge of the environment on the one hand and the pertinence of the impacts identified on the other hand."

Novembre 2013

Article 31: "The Minister in charge of the environment in collaboration with the relevant ministries is responsible for environmental monitoring. Other people from other ministerial departments can be involved in monitoring as and when needed."

According to the Mining Act (Law N°031-2003/AN):

Article 17: "Applications for an Industrial operating permit for a mine shall be accompanied by a case file containing, among others, an environmental monitoring plan."

Although the legislation does not specify exactly what is required for a monitoring plan BUNEEI have developed sectorial guidance of what the monitoring plan should contain and this has been included in the ESIA terms of reference (Section 4.2.10.2) submitted to government in June 2013. Only the specific information requirements from the terms of reference that are relevant to the environmental and social monitoring plan have been included hereunder for ease of reference.

4.2.10.2.2. ENVIRONMENTAL OVERSIGHT

The 'environmental oversight program' describes the means and mechanisms used by the project proponent to ensure compliance with legal and environmental requirements. The oversight program includes as a minimum:

A description of the means provided for the proper functioning of equipment and facilities and measures in case of occurrence of problems;

Mechanisms and frequency of submission of periodic reports on the results of the oversight programs to the competent authorities.

4.2.10.2 3. INDICATORS OF ENVIRONMENTAL MONITORING AND OVERSIGHT

The Consultant has taken into account the following key elements in the environmental monitoring and oversight programme development:

Water quality ;

Air quality ;

Level of noise ;

Soil and vegetation; their degradation levels;

Status of evolution: plant cover, wildlife habitats, landscape, respiratory diseases and STI/AIDS;

Conditions and livelihoods of communities."

3.2 INTERNATIONAL GOOD PRACTICE

The World Bank Group Environmental, Health, and Safety Guidelines (known as the "EHS Guidelines") are technical reference documents which contain general and industry-specific examples of Good International Industry Practice (GIIP), as defined in IFC's Performance Standard 3: Resource Efficiency and Pollution Prevention. The International Finance Corporation (IFC, the private

Novembre 2013

lending arm of The World Bank) uses the EHS Guidelines as a technical source of information during project appraisal activities, as described in IFC's Environmental and Social Review Procedures Manual. All Equator Banks also use these technical reference documents for their project appraisals. (www.ifc.org/ehsguidelines)

The EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology. For IFC-financed projects, application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets with an appropriate timetable for achieving them. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to IFC, become project- or site-specific requirements.

When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent. If less stringent levels or measures than those provided in the EHS Guidelines are appropriate in view of specific project circumstances, a full and detailed justification must be provided for any proposed alternatives through the environmental and social risks and impacts identification and assessment process. This justification must demonstrate that the choice for any alternate performance levels is consistent with the objectives of Performance Standard 3.

3.3 CORPORATE STANDARDS

Roxgold is committed to conducting its mineral exploration and development activities in a manner consistent with internationally recognized guidelines and principles for Sustainable Development and Corporate Social Responsibility. Community engagement and environmental stewardship are important cornerstones of this commitment, along with a duty to promote a safe and healthy working environment.

4. MONITORING ACTIVITIES

The preliminary Monitoring Plan is summarised in Table below. The table outlines:

the relevant environmental/social discipline to be monitored,

the activity and/or component needing to be monitored,

the units needing to be measured,

the frequency of the monitoring activity and the implementation period over which these needs to take place,

the location of the monitoring site(s),

how the data will be recorded,

the type of internal reporting needing to take place, and

the criteria against which the data collected would be interpreted.

The air quality, noise and ground water specialists were consulted for their recommendations on activities to be undertaken as part of the monitoring plan..

5. DATA ANALYSIS

The data collected for each environmental and social discipline will be recorded either into a Log or a Database and this information will then be used to compile monthly, quarterly or annual reports as specified in T Tableau. Where data collection has already started as part of the baseline studies (such as in the case of air quality, water, noise) the existing monitoring programs will be continued (with adjustments made as recommended by the specialists) to track and quantify seasonal trends for the specific component being monitored. The records will also enable the significance and extent of impacts associated with construction and operational activities to be assessed and compared with the relevant baseline conditions described in the ESIA.

If construction or operational activities impact on any of the specified sampling locations these would need to be adjusted accordingly, for example the installation of a substitute monitoring point in the vicinity of the existing location. Once the sequence of specific activities for construction and operations activities are available the monitoring sites could be reassessed. In some instances, such as noise monitoring, an external specialist may need to assist with the analysis of the monitoring data.

Environmental and social monitoring is an ongoing iterative process which requires adaptive management and enables the company to identify non-conformances quickly and respond to these in a proactive manner. Monitoring data collected will be used to evaluate trends in the project environment and assess whether any significant changes are caused by the project development which may have reputational, regulatory and/or financial implications for the company. Any significant changes detected would need to be reported to management immediately so that proactive management can address these changes.

Regular internal reporting to management will further ensure non-conformances are addressed in a timely manner, keep the company informed on compliance, trends in data collected and assist with keeping track of the company's performance.

Monitoring of activities post closure are covered in Section 4 of the Preliminary Closure Cost Plan. This includes water quality (particularly with respect to seepage from the tailings facility) and the success of re-vegetation activities.

REVIEW AND REPORTING

Monthly, quarterly and annual reports will be prepared for management as outlined in Table T Tableau and Table 8-.

The Monitoring Plan will need to be reviewed and, if necessary updated, on a regular basis (at least annually) and any changes incorporated in a systematic way using the company's document control system.

Environmental reports outlining the results of monitoring and any suggested changes to the existing Monitoring Plan will be submitted to the environmental authorities on an annual basis.

Consideration will also be given to preparing a summary annual monitoring report showing the company's performance over the year, which can be made available to stakeholders.

7 RESPONSIBLE PERSONS

Roxgold has employed a full-time Corporate Social Responsibility (CSR) Coordinator and is in the process of recruiting additional staff. The company intends to establish a five person team to address environmental and social issues related to the project. It is anticipated this team would include a Sustainability Manager who would report to Roxgold's CEO. The CSR Coordinator would be joined by an Environmental Manager and both of these positions would report to the Sustainability Manager.

The Environmental Manager would have an additional team member who would assist with on-going monitoring activities. There may be the necessity for training to take place regarding the specific use of monitoring equipment, capture of data, evaluation of data and reporting. The initial training and ongoing career development needs will be evaluated once the team is in place. The Process Manager would be responsible for recording and reporting upset conditions linked to the process plant.

The following third parties may need to be involved in the review of the Monitoring Plan:

verification of the appropriateness and effectiveness of the monitoring plan using external audits;

annual tailings audit by an external specialist;

external review of the social management plan - this would probably be annually in the first three years, followed by biennial review for rest of the Project life.

Verification of the annual compliance by BUNEE, in compliance with Roxgold ESMP suggested in the ESIA.

8 ESTIMATED MONITORING COST

The lump sum cost provided is indicative and will be updated following the commencement of the mining operations. The overall cost of the monitoring programme is expected to be approximately USD 109,500.

The annual costs provided are based on 2013 rates and exclude labour costs. Details on what is included in the costs for each of the disciplines are as follows, and are summed up in table 8-1:

Climate: only general monthly maintenance of the existing weather station is required therefore no additional costs are anticipated;

Ambient air quality: Monitoring of PM10 and PM2.5 requires monthly maintenance of equipment and data downloading;

Dust monitoring and gas sampling: requires that samples are sent for analysis to a laboratory and an expert interprets the results obtained, this would cost approximately USD17,000 per year;

Noise: an external specialist will undertake noise monitoring during one week in the field and analyse annual data collected at 8 monitoring sites and report results; estimated to cost USD8,000 per year excluding his/her travel to flight and on-site expenses), Roxgold may also need to undertake internal monitoring if any complaints are received;

Traffic monitoring would require the purchase of a speed camera of USD10,000;

Ground water quality: purchase of sampling equipment, sampling by a local consultant and management of the local consultant, database management and monthly interim reporting all undertaken by an external consultant, lab costs would still need to be included USD 47,000 per year, if Roxgold undertakes all labour associated with this activity internally this cost would decline;

Ground water level monitoring: purchase of ground water loggers at USD3,500, database management and annual reporting by an external consultant or Roxgold USD 7,500;

Ecological: may require some training by an in-country specialist botanist/ecologist for a week (costs not included) and also training by a revegetation expert (costs not included);

The other environmental disciplines being monitored including land disturbance, vehicles and equipment maintenance and hazardous materials and waste only require labour costs.

The internal social monitoring would be undertaken by Roxgold's CSR team which would not require any additional cost. For the external monitoring an additional amount of USD 20,000 per review is proposed. This will be conducted by a BUNEE and BEGE approved consultant.

Tableau0-1: synthesis of the Monitoring Costs

Monitoring Activity	Cost (per year)
Dust monitoring and gaz sampling	USD 17,000
Noise monitoring	USD 8,000
Traffic monitoring	USD 10,000
Monitoring of the underground water quality	USD 47,000
Monitoring of the level of the underground water	USD 7,500
Social Monitoring	USD 20,000
Total	USD 109,500

T Tableau8-1:Preliminary Environmental Monitoring Plan

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
Climate (from a meteorological station at site)	Temperatures	°C	Start April 2013	Roxgold exploration Camp (Figure 5.1)	Database	Quarterly reports of results and long term trends	Comparison to historical record
	Humidity	%	Measurement Frequency:				
	Dew point	°C	Hourly averaging periods				
	Wind speed	m/s	Downloaded by Roxgold staff:				
	Wind direction	-	Monthly				
	Wind chill	°C	Period:				
	Pressure	Bar	Continuous basis LoM				
	Rainfall	mm					

Novembre 2013

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria	
Ambient air quality	PM10 & PM2.5	µg/m ³	Monthly	Roxgold exploration Camp (1 point each) (Figure 5.1)	Database	Quarterly reports of results and long term trends	Burkina Faso Limit: Total Suspended Particulates 200-300 µg/m ³ (max. 24-h)	IFC level guideline: PM10:20 µg/m ³ (annual mean) and 50 µg/m ³ (max. 24-h) PM2.5:µg/m ³ (annual mean) and 25 µg/m ³ (max. 24-h)

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
	<p>Dust deposition (directional dust gauges for continuous monthly monitoring –filters collected and replaced once a month)</p> <p>The filtratesent to an external lab for analysis.</p>	mg/m ² /day	Monthly	Monitoring stations as shown inFigure 5.18 points (Yaro, Haho, Doussi, Kaho, Siphohin, Bagassi, Bagassi 55 Zone, Roxgold exploration camp)	Database	Monthly report of results and long term trends	<p>SANS 1929:2011 dust fallout standards (no national standards):</p> <p>Residential Level of 600 mg/m²/day;</p> <p>Industrial of 1200 mg/m²/day</p> <p>Alert Threshold of 2400 mg/m²/day</p>

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria	
	Gas: Ambient SO ₂ & NO ₂ concentrations (using passive samplers)	µg/m ³	Once over a 24-hour period monthly	Monitoring stations as shown in Figure 8-1 4 points (Siphohin, Bagassi, Bagassi 55 Zone, Roxgold exploration camp)	Database	Quarterly report of results and long term trends	Burkina Faso Limit: SO ₂ :200-300 µg/m ³ (max. 1-h) NO ₂ :70 µg/m ³ (max. 24-h) and 100 µg/m ³ (max. 1-h)	IFC level guideline: SO ₂ :20 µg/m ³ (max. 24-h) NO ₂ :40 µg/m ³ (annual mean) and 200 µg/m ³ (max. 1-h)

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
Noise	Monitor ambient noise levels LAeq (15 min) & LA90	dB(A)	Day-time 15-min period; Night-time 15-min period (once at 4 points); Day-time 16-hr period (twice at exploration camp) Annually or upon receipt of complaint	Monitoring stations as shown in Figure 8-2 - 8 points (Yaro, Haho, Doussi, Kaho, Siphohin, Bagassi, Bagassi 55 Zone, Roxgold exploration camp) or At location of complaint	Database	Annual Report on findings and any identified remedial measures	IFC level guideline: Day-time: 55 LAeq(dBA)(Residential areas) 70 LAeq(dBA)(Industrial areas) Night-time: 45 LAeq(dBA)(Residential areas) 70 LAeq(dBA)(Industrial areas)

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
Traffic	Random speed checks	km/hr	Once a month at different times of day and different days of week	Random locations within project area and on main access road to site	Log	Monthlyreport	National or site specific speed limit in force for particular road in question
	Records of vehicle and equipment maintenance	None	As per manufacturer's instructions	Maintenance workshop	Log	Available for inspection as and when required	
Groundwater	Monitor water quality (Parameters measured see Table 8-)		Monthly	Monitoring stations as shown in Figure 8-3 8 holes (YRM-WH-01 to 08)	Database	Monthly	WHO (2006) DWG

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
	Monitor groundwater levels	m below ground level (mbgl)	Weekly during wet season. Fortnightly during dry season. Installation of continuous data loggers in selected boreholes.	Monitoring stations as shown in Figure 8-3 16 holes	Database	Annual Report	Compare against long term pre-project baseline
Surface water	Surface water quality	Field parameters such as	Weekly	To be identified	Database	Monthly report	Site specific water quality standards to be developed using baseline data (these will be re-evaluated every year as more data becomes available)
		Comprehensive suite of parameters (see Table 4.2)	Once a month (possibly dropping to quarterly at a later stage)	To be identified	Database	Monthly report	

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
	Monitor surface water levels in key surface water features	m3/s	Continuous	(for example surface water users by communities)	Database	Monthly report	Compare against long term pre-project baseline
Ecological	Visual inspections by ecologist to verify presence or absence of species of conservation importance and habitat integrity (such as level of disturbance outside construction and operation sites)	None	Once, at least one month prior to construction commencing, quarterly thereafter	Areas to be utilised for construction or waste deposition	Log	Quarterly report during construction of results and conservation measures applied and thereafter annual report on findings and remedial measures	Compare against pre-project baseline

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
	Visual inspections for the presence of invasive species	None	Quarterly	Disturbed and rehabilitated areas, and adjacent areas	Log	Annual report on findings and remedial measures	Compare against pre-project baseline
	Records of animal and bird kills	None	On occurrence	Within or near Project areas and along access routes	Log	Monthly report on fatalities and remedial measures	Compare against pre-project baseline
	Records of major wildlife sightings	None	On occurrence	Within or near Project area	Log	Annual report on observations	Compare against pre-project baseline

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
	Record of footprint area disturbed and/or rehabilitated	m2	Monthly during construction and then as needed when land disturbed or rehabilitated	As per ESIA baseline study area, subject to amendment based on annual findings and analysis or ongoing stakeholder engagement	Database of footprint areas disturbed and/or rehabilitated	Monthly report during construction, annual reports during operation	Site specific targets to be set each year for the following year
Land disturbance	Visual inspection of road condition	None	Quarterly or on receipt of complaint	Access roads	Log	Annual report (highlighting non-conformances and how addressed)	N/A

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
	Visual inspection for signs of erosion or deposition	None	At least monthly during construction (particularly after major storm events) and then at least quarterly during operations	Disturbed or rehabilitated areas, Stormwater diversions, Major facilities, access roads. Major natural drainage pathways downstream of the site	Log	Monthly report during construction Annual report during operation	N/A
Vehicles and equipment	Baseline noise emissions of new equipment	dB	On commissioning of new equipment	Within 100m of equipment	Log	Available for inspection	N/A

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
Hazardous materials	Records of hazardous materials used	m3 or kg of each type of material	On arrival at site	Warehouse or storage facility	Log	Monthly report of material used	Site specific targets set each year
	Inspections of hazardous substances containment facilities, instrumentation and detection systems.	None	At least monthly for containment facilities with instrumentation as per manufacturers' instructions	Hazardous material containment facilities	Log	Annual report	No visible signs of leakage or contamination of external environment
Waste	Volume of different wastes types disposed of to landfill or incineration	kg or tonnes	Continuous	Prior to transport to waste disposal sites	Database	Quarterly report	Site specific targets set each year
	Volume of different waste types recycled or reused	kg or tonnes	Continuous	Prior to transport to waste disposal sites	Database	Quarterly report	Site specific targets set each year

Environmental discipline	Type of monitoring (activity and components/parameters to be monitored)	Units	Frequency & Implementation Period	Location/s	Records	Internal reporting	Assessment Criteria
	Volume of soil bio-remediated	kg or tonnes	Continuous	Prior to transport to waste management site at mine	Database	Quarterly report	Site specific targets set each year

The list of parameters given is provisional to enable comparisons with baseline data collection to be made and to fill identified gaps in the current knowledge base. This list of parameters will be reviewed by the Environmental team on a routine basis to determine if parameters analysed for are appropriate and provide meaningful information.

The Environment team will investigate the suitability of easily maintained continuous monitors for SO_x and NO_x where continuous power supply is available to run the monitoring equipment

Table 8-2: LIST OF WATER QUALITY PARAMETRES (Actlabs)

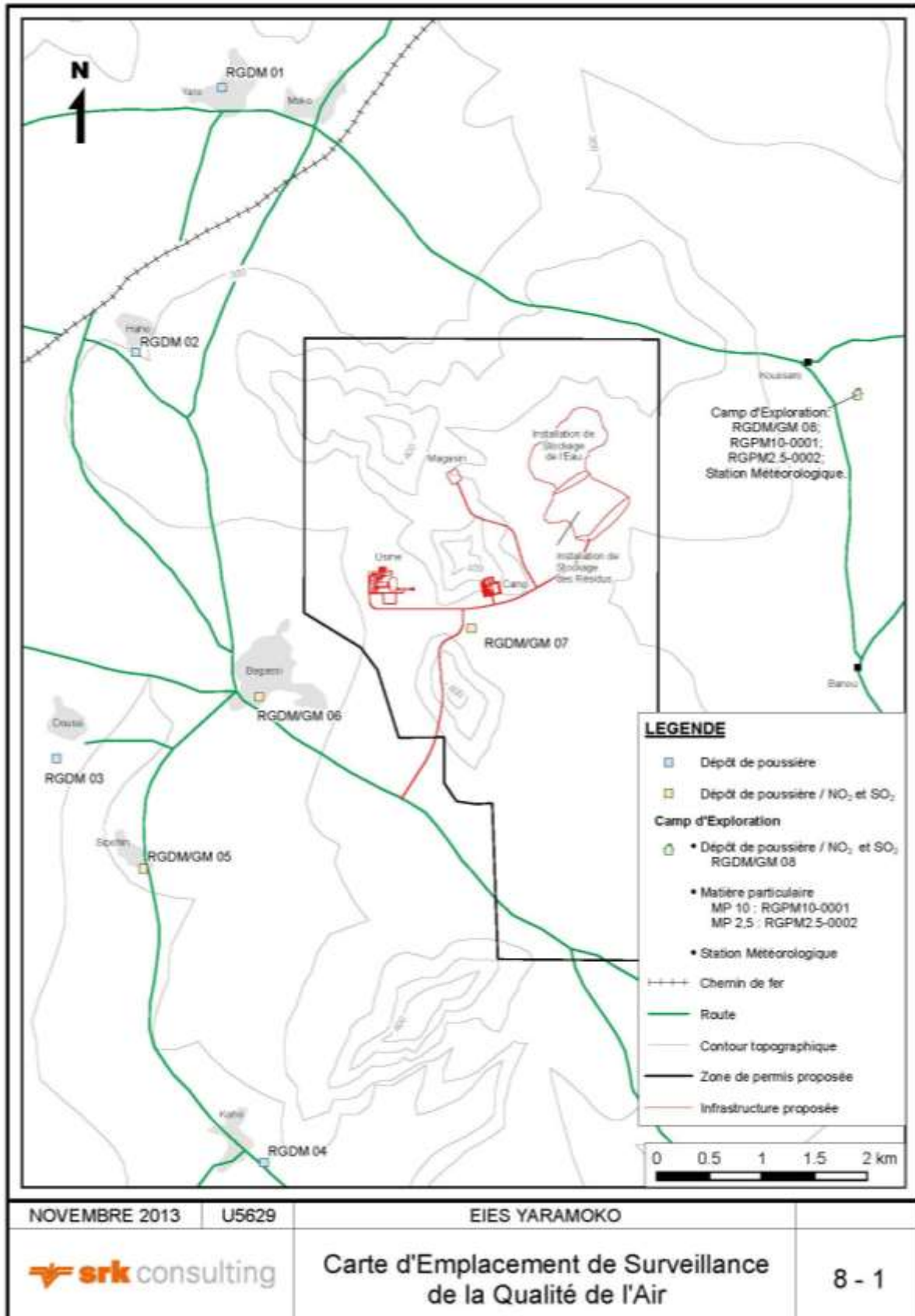
Parameter	Unit	WHO (2006)	Parameter	Unit	WHO (2006)
Field Parameters			Metals		
pH	pH Units	6.5 – 8.5	Aluminium	mg/l	
Temperature	°C		Antimony	mg/l	0.02
Turbidity	NTU		Arsenic	mg/l	0.01
Conductivity	mS/cm		Barium	mg/l	0.7
Dissolved oxygen	mg/l		Beryllium	mg/l	
Conventional Parameters			Boron	mg/l	0.5
total alkalinity	mg/l		Cadmium	mg/l	0.003
total dissolved solids	mg/l		Chromium	mg/l	0.05
total suspended solids	mg/l		Cobalt	mg/l	
total organic carbon	mg/l		Copper	mg/l	2
chemical oxygen demand	mg/l		Iron	mg/l	
Hardness	mg/l		Lead	mg/l	0.01
Organics			Manganese	mg/l	0.4
Phenolic	µg/l		Molybdenum	mg/l	0.07
Pentachlorophenol	µg/l		Nickel	mg/l	0.02
Oil and grease	mg/l		Selenium	mg/l	0.01
TPH (C10-C44)	mg/l		Silver	mg/l	
Major Ions			Strontium	mg/l	
Ammonium (NH ₄ + NH ₃)	mg/l		Thallium	mg/l	
Bicarbonate	mg/l		Thorium	mg/l	
Calcium	mg/l		Tin	mg/l	
Magnesium	mg/l		Titanium	mg/l	

Novembre 2013

Parameter	Unit	WHO (2006)
Potassium	mg/l	
Sodium	mg/l	
Chloride	mg/l	
Fluoride	mg/l	1.5
Sulphate	mg/l	
hydrogen sulphide	mg/l	
Nitrate (NO3)	mg/l	11.3
Nitrite (NO2)	mg/l	0.06
Phosphate (PO4)	mg/l	

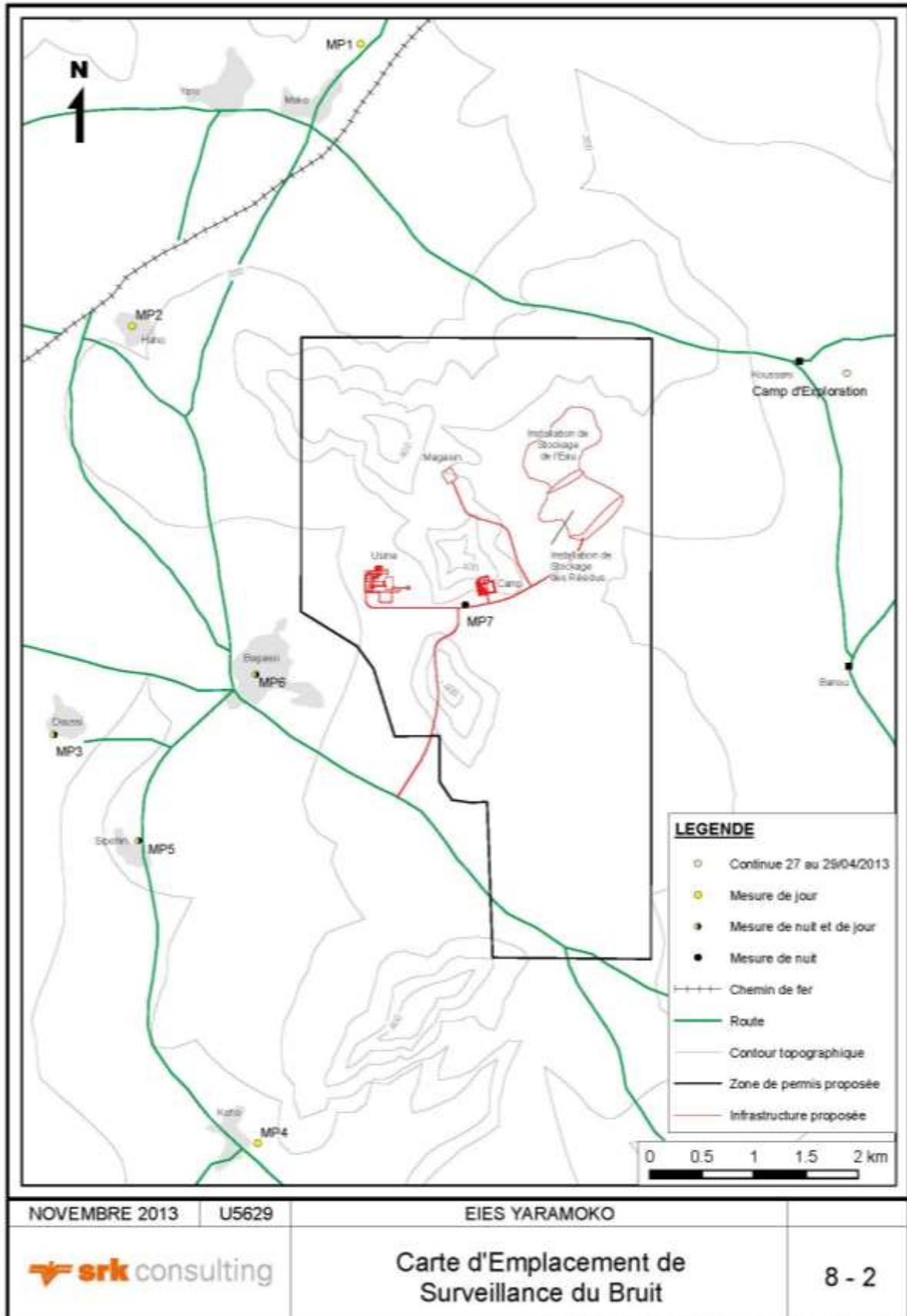
Parameter	Unit	WHO (2006)
Uranium	mg/l	0.015
Vanadium	mg/l	
Zinc	mg/l	
Mercury	mg/l	0.001
Chromium VI	mg/l	
WAD Cyanide	mg/l	
Cyanide total	mg/l	0.07
Free Cyanide	mg/l	

Figure 8-1: AIR QUALITY MONITORING LOCATION MAP



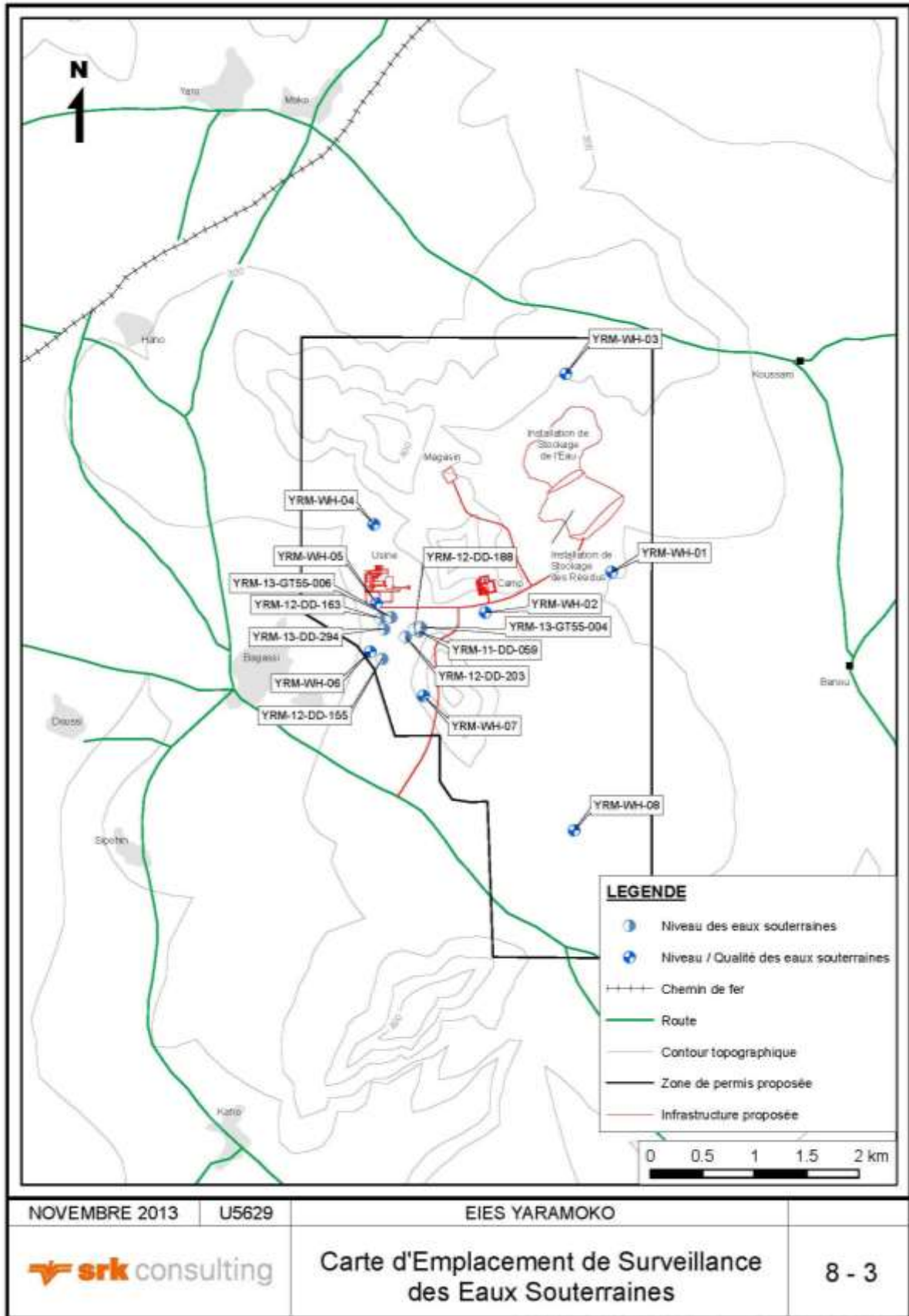
Novembre 2013

Figure 8-2: NOISE MONITORING LOCATION MAP



Novembre 2013

Figure 8-3: GOUND WATER MONITORING LOCATION MAP



P:\U5629\Yaramoko\PEP\Project\CAD\Figures for report\05_novembre_Monitoring_Fr.mxd

Novembre 2013

Table 8-3: PRELIMINARY SOCIO-ECONOMIC MONITORING PLAN

Type of monitoring (activity and components to be monitored)	Units	Frequency & implementation period	Location/s	Sources of data	Reporting format	Assessment criteria
<p>Details of employees (for Roxgold and its contractors) categorised by:</p> <p>skill level;</p> <p>whether they are local, prefecture, national or international;</p> <p>ethnicity;</p> <p>gender;</p> <p>from a vulnerable group (for example disabled).</p>	Number and percentage of employees in each category	<p>Set up in in the first quarter and updated as when a new employee is hired.</p> <p>Ongoing throughout the life of the Project</p>	Project facilities	Roxgold employee database	Quarterly human resources report	<p>100% of the unskilled workers hired from project affected villages;</p> <p>At least 15% of the workforce comprises of women</p>
<p>Employees trained, categorised by:</p> <p>skill level;</p> <p>type of training received;</p> <p>whether they are local, provincial, national and/or international;</p> <p>ethnicity;</p>	Number of employees trained from each category	Quarterly	Project training facilities	Continual professional development records for each employee	Quarterly human resources report	<p>100% of the workers provided H&S induction and training;</p> <p>X% of the local workers provided</p>

Novembre 2013

Type of monitoring (activity and components to be monitored)	Units	Frequency & implementation period	Location/s	Sources of data	Reporting format	Assessment criteria
gender; from a vulnerable group (for example disabled).						training on life skills for better management of financial resources;
Number of trained employees transferred from the construction teams to the operation team, categorised by their place of origin, residence, and gender.	Number of employees by place of origin, residence and gender Percentage of workforce	One off study during change over from construction to operation	Project facilities	Employee database	Annual social performance report	At least 50% of the local workers from the construction phase re-employed in the construction phase.
Origin of contractors and suppliers (Local, provincial, national and/or international)	Percentage in each category	Yearly	Project facilities	Supplier and contractor database	Annual report from contractors/suppliers	x% of goods procured locally
New skills among the community members	Number of people with new skills	Once in two years	Project affected communities	Skills survey	Survey reports	Number and types of skills built

Type of monitoring (activity and components to be monitored)	Units	Frequency & implementation period	Location/s	Sources of data	Reporting format	Assessment criteria
Support to local entrepreneurs to set up small businesses (particularly vulnerable groups)	Number and type of entrepreneurs/ventures	Yearly	Project affected communities	Skills Survey	Annual social performance report	Site specific target to be set each year
Engagement of vulnerable groups in income generation/ small businesses	Increase in number	Quarterly	Project affected communities	Primary sample survey; Community meetings	Annual social performance report	Site specific target to be set each year
Initiatives and ventures for promotion of alternative livelihoods (including participation of vulnerable groups and artisanal miners)	Number and type of initiatives	Yearly	Project affected communities	Reports on initiatives; observations, Skills survey, community development survey	Quarterly social performance report	At least one initiative supported each year
Population in the Project affected area	Population; Rate of growth	Every three to five years	Project affected communities	Primary sample survey; Government statistics	Annual social performance report	Compare against pre-project baseline
Prevalence of informal settlements	Population;	Quarterly (during	Project affected	Primary sample survey;	Quarterly social performance report	Compare against pre-

Novembre 2013

Type of monitoring (activity and components to be monitored)	Units	Frequency & implementation period	Location/s	Sources of data	Reporting format	Assessment criteria
in the Project affected area	Number of dwellings Existence of new communities	construction) Yearly (during operation with frequency dropping if no settlement occurring)	communities	Government statistics; Observation; Media reports	(construction); Yearly social performance report (operation)	project baseline
Community grievances or complaints, categorised by type (for example: access to opportunities; community health and safety; compensation; presence of migrant job seekers etc.	Number and type of complaints	Monthly	Project affected communities	Grievance mechanism register	Quarterly social performance report	80% of the grievances resolved within 15 days
Prevalence of communicable diseases, including: Malaria Skin infections Diarrhoea	Incidence of diseases	Yearly	Project affected communities	Reports from health centres; Government statistics; Employee health screening records	Annual social performance report	Set site specific targets that align with national health targets and the millennium development goals

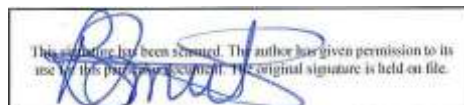
Novembre 2013

Type of monitoring (activity and components to be monitored)	Units	Frequency & implementation period	Location/s	Sources of data	Reporting format	Assessment criteria
STIs Tuberculosis and respiratory infections						
Civil society initiatives supported by Roxgold including CBOs and Networks	Number and type of initiatives	Yearly	Project affected communities	Community development survey	Annual social performance report	At least one CBO supported from the local area

For and on behalf of SRK Consulting (UK) Limited



This signature has been scanned. The author has given permission to its use for this particular document. The original signature is held on file.



This signature has been scanned. The author has given permission to its use for this particular document. The original signature is held on file.

Fiona Cessford
Corporate consultant (Environment)
SRK Consulting (UK) Limited

Rowena Smuts,
Senior Consultant (Environment)
SRK Consulting (UK) Limited

Novembre 2013

APPENDIX 15 :

**TECHNICAL SPECIFICATION OF ENVIRONMENTAL
CLAUSES**

I. GENERAL INFORMATION

Purpose of this document

This document is the Specification of environmental technical clauses (CCTE) for the proposed construction of the Yaramoko gold mine in the province of Balé.

The specification of environmental technical clauses is part of the contract documents

The construction work can actually start only after approval of the EIA report by the Ministry of Environment.

II- COMMON REQUIREMENTS TO ALL IMPACT SOURCES

2.1. Provisions related to awareness for site personnel on project environmental issues, the risk of accidents and possible transmission of STIs and HIV/AIDS

1. The Control Mission and the successful Company in charge of the work are required before starting work together to conduct an awareness campaign for residents and site personnel on project environmental issues and especially the potential risks of accidents and transmission of STIs and HIV/AIDS.
2. This campaign shall continue throughout the construction period.
3. Any accident caused to wildlife by the successful company or its personnel shall be immediately reported to the nearest environment department: otherwise, this is considered as an act of deliberate illegal hunting (poaching) and shall be punished as such.

To minimize the risk of accidents and various nuisances for people and wildlife, the following will be prohibited:

- Night work in urban areas ;
- The movement of heavy vehicles (trucks, bulldozers, etc.) at night in urban areas ;
- The use of toxic chemicals in urban areas.

2.2. Provisions relating to hygiene and cleanliness of workplaces and base camps

1. Provisions on hygiene and cleanliness of the site and base camps shall be included in the company house rules now.
2. Solid and liquid waste from construction and base camp shall be regularly collected and disposed of by appropriate methods agreed by the parties.

2.3. Provisions relating to the supply of workers in food (meat, fish), wood and drinking water

1. To fight against poaching, workers food shall include meat (other than wild meat) and fish.

2. Similarly, to fight against excessive cutting of firewood, the base camp shall be supplied in firewood and charcoal.
3. Arrangements shall also be made for supplying the base camp and sites with drinking water.

III - ENVIRONMENTAL REQUIREMENTS

The opening and the use of access tracks to borrow materials areas shall comply with the following aspects in both opening and closing phases:

- Sensitive areas,
 - Areas of particular landscapes
 - Speed limits which are: on construction and quarrying sites 20 km/h and 35 km/h in temporary deviations
 - Speed limit in other cases to 80 km/h in the open field and maximum 40 km/h in urban areas.)
- a. Site Installation
 - i. Installation of the base camp and equipment park
 1. To install the base camp and parking, the choice shall be on areas with no vegetation (including glades). In any case, the base camp must be installed outside the classified forests or reserves. As for equipment, they will be arranged in alignment in the area already cleared for work
 2. To this end, flood areas shall be avoided as they generally contain a significant biodiversity.
 3. The base camp shall be installed at more than 200 m of surface water bodies to counter the pollution thereof.
 4. The base camp and parking shall be placed away from towns to avoid nuisances such as oil smells, noise, etc.
 - ii. Opening tracks various
 1. The choice of access tracks to borrow materials and water stations for works, must carefully avoid biodiversity areas (flood areas, cemeteries, historic sites, cultural and worship sites (places of sacrifice, prayer, etc.)
 2. Uncontrolled track opening for the supply of materials (multiplication tracks) shall be avoided when a track can be used for many purposes.
 3. Trees on these tracks (influence parts of access tracks) shall be pre-marked. Thereafter, the cutting shall be selective and focusing on those which are marked.

The contractor shall avoid as far as possible rare woody species identified in the EIS. To do this, a cutting plan and intended use of felled trees must be prepared by the contractor and approved by the Control Mission and the Monitoring Committee.

4. The tracks shall be watered frequently at least twice a day to avoid dust takeoffs.

During construction, the contractor shall avoid the destruction of boundary markers and other items planted by the Land Registry (cadastre).

3.1.3. Clearing

1. Concerning the clearing of the influence area of small dams, provision 3 of subsection 3.1.2. Is applied here again.
2. As far as possible, rare woody species (and/or protected) recognized by the monograph of the plant species of Burkina Faso must be avoided.
3. At the time of clearing, the influence area shall be watered to prevent the takeoffs of dust.
4. Stumping shall be done manually to avoid excessive soil disturbance and give employment to local residents.
5. Topographic markers and other structures set up by the cadastre service shall also be avoided.

3.1.4. Earthwork

1. The use of earthmoving equipment shall be limited strictly to the space provided for this purpose; as much as possible, access tracks shall be used to avoid damage to additional spaces.
2. It is mandatory to water earthmoving areas. Areas shall be watered as much as the Control Mission requires, especially in sites close to urban areas.

3.1.5. Selection of crushed rock piles areas

1. Areas with no vegetation shall be selected (including glades).
2. Flood areas shall be avoided as they generally contain a significant biodiversity (plant and wildlife). Stockpiles shall be arranged to avoid destroying woody plant areas. The cottages of rodent and termite mounds shall be carefully avoided.
3. The piles shall be contained by walls to prevent their transport by runoff.
4. No deposit shall be created within an area of high plant density or with customary, religious importance or recognized as being of public utility.
5. At the end of the work, these storage areas shall be rehabilitated. The topsoil piled, shall be spread so that the soil can turn back to its original profile.
6. This topsoil could also be used in the rehabilitation of borrow areas and in tree planting (if it has good soil qualities.).

3.1.6. Provisions relating to the opening of borrow areas

1. Any borrow of materials shall be subject to a prior authorization from the land chief and the village chief.

2. No borrow area shall be created within an area of high plant density or with customary, religious importance, or recognized as having a public utility.

Borrow areas located in villages must be scrupulously rehabilitated.

New borrow areas cannot be created near the following:

- Residential areas and public places (markets and place of worship) and wherever excavations may constitute a danger to the people;
- Main roads, so as not to alter the landscape (at least 30 m from the road) ;
- Areas of ecological, tourist, landscape and cultural interest: wood, panoramic site, etc.

Before any removal, topsoil shall be carefully removed to a depth of 30 cm and placed in reserve for possible restoration of the site. This could be used in the rehabilitation of borrows areas.

Borrow areas could also be developed (keeping them as small reservoirs for watering livestock.)

3. In this situation, you must ensure that this option is accepted by the populations concerned and ensure that the borrow areas are located far from the residential areas to minimize nuisances (odors, mosquitoes, waterborne diseases, etc.), planting bordering trees.

3.1.7. Using (borrow) water for the work

1 - In order to prevent conflicts, taking water from water points for multiple uses (consumption of humans, domestic animals and wildlife, socio-economic uses such as making bricks ...) shall be subject to consultation between the various users and the company prior to the work, in order to determine the appropriate periods when water can be used for the mine work.

- The motor-pumps used to take water for the mine work shall be in good working condition to prevent leakage of diesel and engine oil that can pollute the water for human and animal consumption.
 - These pumps shall be at a distance of at least 30 m from the water taking point and they shall be placed in a platform (embankments) to contain the oil discharge (accidental or not) and all sources of water pollution shall be curbed.
 - All spillage or discharges of sewage, mud, oil and pollutants of all kinds into surface water, wells, boreholes and soil are strictly prohibited.
- Construction of drainage structures
 1. The destruction of some trees within the influence area of these structures shall be limited to a strict minimum.
 2. Soil from the excavation works shall be removed to ensure cleanliness and proper functioning of the latter.
 3. Drainage structures routes shall avoid populated areas, sites of ecological, socio-economic and cultural interest.

4. The people and animals access shall be established by appropriate structures (culverts, gutters, etc.)

3.1.9. Site cleaning up and equipment removal

1. The soil of the base camp and parking shall be rehabilitated at the end of the cleanup of solid waste (used filters, tires, rubble and domestic waste ...) and liquids.
2. The soil shall be free from all oil spots.
3. The barracks shall be carefully removed unless there is a specific request by the administrative authority or the village chief to keep them for future use.
4. After cleaning the site, it shall be revegetated (case of clearings).

IV. VARIOUS PROVISIONS

4.1. Obstacle to traffic

The contractor shall at all times avoid hindering the traffic (between the villages) and access of residents to their homes, fields and places of economic activity during construction.

4.2. **Fuel, oil and lubricants depots**

Fuel, lubricants and oil depots, as well as facilities for the maintenance of the company equipment must comply with the requirements for such types of facilities. These facilities shall be located at more than 500 m from waterways; otherwise, precautions will be taken for waterproofing the site and containment of facilities within a bund thus preventing the discharge of products to surface water.

4.3. Safety Measures

1. Security measures shall be taken for local populations near the sites: construction sites shall be marked and identified by a sign in the quarries and access is strictly forbidden to visitors.
2. In towns, barriers shall be erected to prevent public and foreign people from entering the sites.
3. Measures for worker safety shall be taken: use of anti-dust masks, gloves and safety shoes, etc.
4. Measures for speed limiting in both towns shall be taken
5. The lighting in the base camp and parking shall be effective at night

4.3. Requirements regarding noise

The company working in inhabited areas shall avoid as far as possible, noise generation during hours of rest, especially at night. To do this, it shall comply with the instructions given above, on the machines and equipment settings, etc.

4.5. Improvement of the environmental context

1. To protect the environment and achieve a sustainable project, the company shall take all appropriate steps in accordance with the Contractor, the Control Mission and Monitoring Committee to improve the environmental context.
2. Upon work completion, the company shall draw the diagram with all the indications of environmental improvements it has made.

APPENDIX 16 :
REHABILITATION AND CLOSURE PLAN

A CONCEPTUAL CLOSURE PLAN FOR THE YARAMOKO PROJECT, BURKINA FASO

Prepared For
Roxgold Inc.

Report Prepared by



SRK Consulting (UK) Limited

UK5629

COPYRIGHT AND DISCLAIMER

Copyright (and any other applicable intellectual property rights) in this document and any accompanying data or models which are created by SRK Consulting (UK) Limited ("SRK") is reserved by SRK and is protected by international copyright and other laws. Copyright in any component parts of this document such as images is owned and reserved by the copyright owner so noted within the document.

This document may not be utilised or relied upon for any purpose other than that for which it is stated within and SRK shall not be liable for any loss or damage caused by such use or reliance. In the event that the recipient of this document wishes to use the content of this document in support of any purpose beyond or outside that which it is expressly stated or for the raising of any finance from a third party where the document is not being utilised in its full form for this purpose, the recipient shall, prior to such use, present a draft of any report or document produced by it that may incorporate any of the content of this document to SRK for review so that SRK may ensure that this is presented in a manner which accurately and reasonably reflects any results or conclusions produced by SRK.

The use of this document is strictly subject to terms licensed by SRK to its Client as the recipient of this document and unless otherwise agreed by SRK, this does not grant rights to any third party. This document shall only be distributed to any third party in full as provided by SRK and may not be reproduced or circulated in the public domain (in whole or in part) or in any edited, abridged or otherwise amended form unless expressly agreed in writing by SRK. Any other copyright owner's work may not be separated from this document, used or reproduced for any other purpose other than with the document in full as licensed by SRK. In the event that this document is disclosed or distributed to any third party, no such third party shall be entitled to place reliance upon any information, warranties or representations which may be contained within this document and the recipient of this document shall indemnify SRK against all and any claims, losses and costs which may be incurred by SRK relating to such third parties.

© SRK Consulting (UK) Limited 2013

SRK Legal Entity:

SRK Consulting (UK) Limited

SRK Address:

5th Floor Churchill House
17 Churchill Way
City and County of Cardiff, CF10 2HH
Wales, United Kingdom.

Table of Contents

INTRODUCTION	1
BRIEF PROJECT DESCRIPTION	1
LEGAL REQUIREMENTS AND OBLIGATIONS	3
CLOSURE OBJECTIVES	4
CLOSURE ASSUMPTIONS	5
CLOSURE ACTIONS	6
MONITORING	107
COST ESTIMATE	8

List of tables

Table 8-1: Closure Cost Summary.....	11
--------------------------------------	----

Liste des figures

<u>Figure 2-1: Site Layout Overview.....</u>	<u>23</u>
--	-----------

1. Introduction

SRK Consulting (UK) Limited (“SRK”) is an associate company of the international group holding company, SRK Consulting (Global) Limited (the “SRK Group”). SRK has been requested by RoxgoldInc. (“Roxgold”, hereinafter also referred to as the “Company” or the “Client”) to prepare a Conceptual Closure Plan (CCP) for the Yaramoko Project (“the Project”) located in Burkina Faso.

The CCP will be incorporated into an Environmental and Social Impact Assessment (ESIA), being prepared by **Bureau d’Etudes des Géosciences des Energies et de l’Environnement (BEGE)** and submitted to the Ministry of Environment and Sustainable Development (Ministre de l’Environnement et du Développement Durable – MEDD). According to the Terms of Reference for the ESIA, the preliminary/conceptual plan will describe the main activities of rehabilitation and closure and estimates of the costs of rehabilitation and closure.

2. BRIEF PROJECT DESCRIPTION

The Yaramoko Project is located 1 km north east of the town of Bagassi, in the Balé province of south-central Burkina Faso. The project resource is estimated at 2.4 million tonnes of ore containing 1 million ounces of gold. Figure 10 presents the general site layout.

The deposit will be exploited using underground mining methods such as inclined long-hole blast drilling and long-hole open stoping extraction, with backfilling as required. The ore extraction rate is expected to be approximately 270,000 tons per year with an annual gold production of 100,000 ounces. The Life of Mine is estimated at 10 years and may be extended depending on exploration results. The processing plant will involve crushing, gravity concentration and carbon in leach. The plant will operate 24 hours a day and 365 days per year. Water for the operation will be supplied with water from a storage dam (WSD) built in the northeast of the deposit, Electricity supply to the mine will be through the use of an oil-fired power plant. A Tailings Storage Facility (TSF) will be located to the northeast of the plant. Accommodation for 300 people will also be constructed at the site.

A small quarry may be operated above the underground mine in order to rehabilitate artisanal mining sites, produce materials for the construction of different structures as well as for underground backfill.

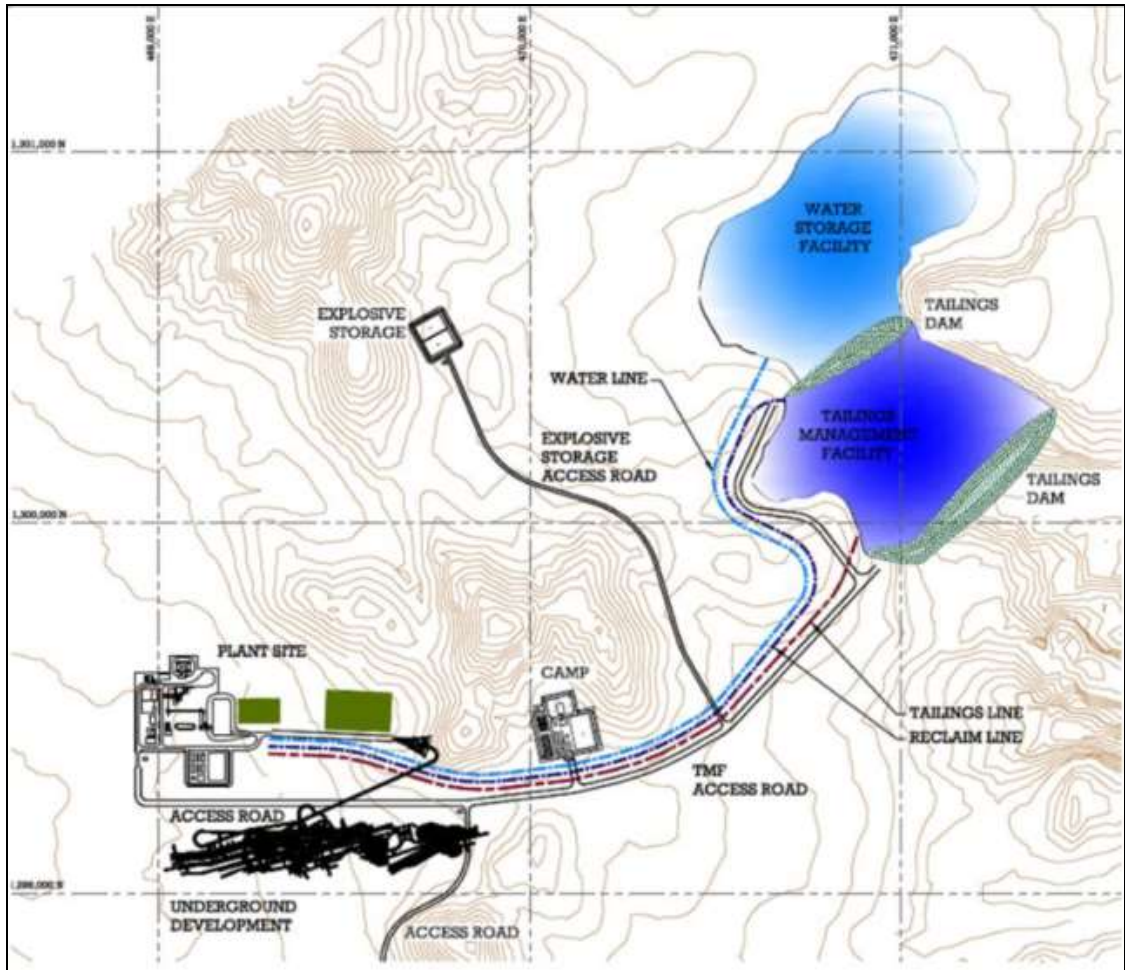


Figure 2-1: Présentation du plan du site

3. LEGAL REQUIREMENTS AND OBLIGATIONS

3.1. BURKINA FASO REQUIREMENTS

Article 76 of the Mining Code (L031-2003/AN) states that activities governed by the Mining Code shall be conducted so as to ensure environment conservation, management, and restoration of mining sites following standards, conditions and methods set by the regulation in force.

The Mining Code also specifies that with regards to financial provisioning for closure “holders of a mining title ... shall be bound to open and make deposits in a fiduciary account with the Central Bank of West African States (BCEAO) or a commercial bank in Burkina Faso. Such account shall serve as capital to cover the costs of implementation of environment conservation and restoration” (Article 78).

There are no specific references to rehabilitation or mine closure in the Environmental Code (L005/97/ADP) or the ESIA Decree (D2001-342/PRES/PM/MEE). However, the ESIA guideline for Mining (Guide Sectorial D’Etude et de la Notice D’Impact Sur L’Environnement des Projets Miniers) refers to the need to develop a Rehabilitation and Closure Plan as part of the Environmental and Social Management Plan for the project. The Rehabilitation and Closure Plan should include a list of management measures, costs, responsibilities and schedule for implementation of the actions.

3.2. INTERNATIONAL GOOD PRACTICE

International perspectives on good practice with respect to mine rehabilitation and closure emphasise that mine closure planning should:

- present a vision for closure, with clearly defined closure outcomes and completion criteria;
- be an integral part of a project life cycle;
- be undertaken early in the process of mine development, and in consultation with the regulating authority, local communities and other stakeholders;
- include social and economic considerations to minimise adverse socio-economic impacts and maximise socio-economic benefits;
- include financial provisions to ensure that there are sufficient funds available to complete the prescribed closure activities;
- be regularly updated and refined to reflect changes in mine development and operational planning, as well as the environmental and social conditions and circumstances, and
- include adjustments to closure funding arrangements to reflect any changes in mine closure requirements.

3.3. CORPORATE STANDARDS

Roxgold is committed to conducting its mineral exploration and development activities in a manner consistent with internationally recognized guidelines and principles for Sustainable Development and Corporate Social Responsibility. Community engagement and environmental stewardship are important cornerstones of this commitment, along with a duty to promote a safe and healthy working environment.

3.4. OBLIGATIONS TO STAKEHOLDERS

No closure-specific commitments have been made to stakeholders to date. As recommended by international good practice, project stakeholders will be involved in the closure planning

process throughout the mine life.

4. CLOSURE OBJECTIVES

At the time of final closure of the Project, the mine areas should be reclaimed to a safe and environmentally sound condition consistent with closure commitments developed during the life of the project. Specific closure objectives may be tied to the final land use for the Project area which should be determined in collaboration with local communities and other Project stakeholders in the area. In the absence of stakeholder input at this stage of the project, SRK has assumed the preferred final post-closure land use will be a savannah landscape commensurate with the surrounding land uses, which are currently small-scale agriculture and livestock grazing.

Until such time as specific closure objectives are defined, general objectives will be to:

- maintain worker health and safety throughout closure activities, including concurrent closure;
- protect public health and safety;
- demonstrate chemical stability compatible with site conditions;
- demonstrate physical stability compatible with site conditions;
- create self-sustaining ecosystem compatible with site conditions;
- minimise need for reclamation maintenance;
- minimise negative impact on retrenched employees and local economy;
- maintain community relations; and
- reduce closure liability during operations through an aggressive concurrent closure program.

During operations, closure criteria will be developed in communication with the regulatory authority to define specific end-points that demonstrate the closure objectives have been met.

5. CLOSURE ASSUMPTIONS

The following assumptions are made for the development of the Conceptual Closure Plan at this stage of the Project.

- Runoff water quality from the industrial site will be acceptable according to Burkinabe legislation and will not require any further treatment.
- Runoff water quality from the surface of the rehabilitated TSF will be acceptable according to Burkinabe legislation and will not require any further treatment.
- Seepage water quality from the TSF will be acceptable according to Burkinabe legislation and will not require any further treatment.
- Groundwater will not be negatively impacted by the underground mine workings.
- The Closure Actions presented in the Tailings Storage Facility and Water Storage Dam Design Report (Knight Piesold, 2013) will be accepted as appropriate by the Burkinabe authorities.
- The modular Processing Plant will be in an acceptable condition to be sold off to a third party. Decontamination, dismantling and removal costs of the equipment will be offset by the sale price.
- Modular buildings (offices, workshops, accommodation, etc) will be in an acceptable condition to be sold off to a third party. Dismantling and removal costs will be offset by sale price.
- An allowance of USD 1M is allocated for general site clean-up, material and equipment pick-up, dismantling of permanent electrical and piping connections to modular buildings, etc.
- Reagents and explosives manufacturers will accept returned product at the end of the mine life.
- Soil contamination is assumed to not be an issue for the stockpile foundations. An allowance of \$50,000⁵ is assumed for the treatment of hydrocarbon contamination at surface.
- Topsoil will be stripped from infrastructure and operational areas and stockpiled for use during closure activities. The volume of topsoil stockpiled will be sufficient for closure activities

Assumptions should be reviewed during operations and any required technical work conducted in order to reduce information gaps prior to mine closure.

⁵Included in the nominal USD 1M allowance for general site clean-up.

6. CLOSURE ACTIONS

The following section outlines the proposed actions for closure of the Yaramoko Project.

6.1. Mine Infrastructure

The 5 m x 4 m underground access portal will be sealed with reinforced concrete, following any underground disposal of demolition debris as required. Underground equipment will be left in place.

Ventilation fans and equipment at surface will be dismantled. The two 3.5 m – diameter ventilation raises will be sealed with reinforced concrete.

6.2. Quarry

No specific design is currently available for quarrying activities within the boundaries of the historical mine workings. Material from the quarry may be used for construction purposes and for underground backfill. Historical spoils may be re-processed. Should it be required, a bund will be constructed around the quarry excavation. A 2000 m bund is included in the cost estimate.

6.3. Run-of-Mine Stockpile and Crushed Material Stockpile

Once the ROM material has been processed, the stockpile's foundation will be tested for contamination. The closure cost estimate assumes that no contamination is found. The pad area will be scarified, covered with 0.20 m of growth media and seeded for re-vegetation.

The crushed material stockpile will be rehabilitated the same way.

6.4. Processing Plant

The processing plant will be modular and include:

- Primary and Secondary crushing
- Reclaim, single-stage milling and classification
- Gravity concentration and intensive leach recovery
- Carbon in Leach (CIL) leaching and gold recovery via carbon elution
- Gold room
- Tailings transportation and storage
- Reagents storage
- Conveyors, pipelines, etc.

The plant will be decontaminated, dismantled and sold off to a third party. The sale price is expected to offset dismantling costs. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation. The plant covers an estimated area of 3,225 m². Hazardous waste and contaminated components will be disposed of in an approved facility as required.

6.5. Pipelines

The tailings and TSF return water pipelines will be placed in a containment trench for operations. For closure, the pipelines will be decontaminated, cut to transport length and sold as scrap or salvage material.

6.6. Mining Contractor Infrastructure

The contractor area, located south of the main plant area consists of eight buildings, including light and heavy vehicles maintenance workshops, and offices. A laydown pad is also part of the contractor area.

The modular buildings will be dismantled and sold off to a third party. The sale price is expected to offset dismantling costs. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation.

Hazardous waste and contaminated components will be disposed of in an approved facility as required.

6.7. Diesel Power Plant and Fuel Storage

The power plant consists of six generators with a total installed capacity of 5 MW. Four fuel tanks with a total storage capacity of 2,000 m³ allow for three months of operation. The vehicle fuelling stations consist of two modular buildings in close proximity to the fuel storage facility.

The generators will be dismantled and sold to a third party. Fuel tanks will be emptied, decontaminated and sold to a third party. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation.

Hazardous waste and contaminated components will be disposed of in an approved facility as required. Ground will be tested for soil contamination, removed and hauled to an approved facility as required.

6.8. Sewage Treatment Plants

Modular sewage treatment plants are located at the processing plant and at the accommodation camp. Equipment will be decontaminated, dismantled and sold to a third party. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation.

Hazardous waste and contaminated components will be disposed of in an approved facility as required.

6.9. Process Water Pond

The process water pond is located to the north of the processing facilities. Infrastructure consists of the pond, a pumping station and the raw water tank.

The pond's embankment will be breached and the liner removed (if any). The surface area will be scarified, 0.20 m of topsoil placed and the area will be seeded for re-vegetation. The pumping station and tank will be dismantled and equipment sold to a third party. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation.

6.10. Other Plant Area Infrastructure

Various other buildings and infrastructure are part of the processing facility area and are part of the closure plan. They include:

- Security Building;
- Laboratory facilities;
- Administration building;
- Amenity buildings (cafeteria and mess, offices, etc);

- Reagents store and yard; and
- Workshop and yard.

Equipment is to be decontaminated, dismantled and sold to a third party. Buildings will be dismantled and sold to a third party. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation.

6.11. Explosive Magazines

The explosive magazines area is located 1 km to the northeast of the main processing facilities and consists of two main explosive storage buildings (powder and cap magazines) and a security gate building. The area is surrounded by a fence.

Modular buildings will be dismantled and sold to a third party. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation.

Remaining explosive material will be returned to manufacturer for disposal. If earth bunds are included in the design, they will be levelled following explosive and building removal. The fence will be dismantled and the material sold to a third party.

6.12. Accommodation Camp

The camp is designed to accommodate 300 people and is located to the east of the processing facilities. All buildings are modular and the camp is surrounded by a fence. The camp consists of:

- Security gate building
- Sport field
- Recreational facility
- Kitchen and cafeteria
- Laundry buildings
- Main dormitories
- 4-room dormitory units
- 2-room dormitory units
- General Manager's house

Modular buildings will be dismantled and sold to a third party. Concrete footings over ground will be broken and transported underground for disposal. Concrete slabs will be broken in place over 20% of their surface, covered with 0.20 m of topsoil and seeded for re-vegetation.

6.13. Yards and Internal Roads

Yards and internal roads at all project sites, including the main processing facilities area, the accommodation camp and the explosive magazines will be scarified and trimmed, covered with 0.2 m of topsoil and seeded for re-vegetation. Roads required for post-closure monitoring will be maintained until no longer required.

Contamination testing may take place in specific areas (such as maintenance shop yards) and contaminated soils will be removed and treated in appropriate facilities.

The modular security building on the main road from Bagassi will be dismantled and sold to a third party. Concrete footings will be removed and placed underground.

6.14. Tailings Storage Facility

The final TSF will cover an area of 29.0 ha (KP TSF Design Report, 2013) and is designed to

accommodate 3.0 Mt of tailings. The final downstream faces of embankments will have overall slopes of 3.5H:1V slopes and a maximum gradient of 3H:1V. No re-grading of the embankment is expected for closure. Embankments will be covered with 0.2 m of topsoil and seeded for re-vegetation.

A closure spillway will be excavated from the remaining supernatant pond to the water storage dam. The spillway will be excavated in natural ground to the west of the TSF, directing discharge to the north.

The tailings surface will be graded to shed water towards the closure spillway. The TSF surface will be covered with 0.3 m of low permeability material (10^{-8} m/s) and 0.2 m of topsoil as growth medium. The finished surface will be seeded with shrubs and grasses. The final cover configuration will be determined during operations.

6.15. Water Storage Dam

The water storage dam is designed to accumulate water during the rainy season and is used as a water supply through the year. The infrastructure will be maintained at closure for use by the local population. The closure spillway from the TSF will discharge to the WSD. It is expected that water volume in the WSD will peak at 64,000 m³ during the wet season.

6.16. Sediment Control

The sediment control infrastructure located downstream of the TSF will be breached once acceptable seepage water quality is achieved.

7. MONITORING

The monitoring program developed for the post-closure period will be designed to track progress of the site rehabilitation activities to reach the defined closure criteria.

7.1. Water Quality

Seepage water quality from the TSF will be monitored for a minimum period of 5 years following closure of the facility. If water quality does not meet discharge regulations after this period, monitoring will continue for a further period until acceptable water quality is achieved.

7.2. Infrastructure Stability

Monitoring of the TSF embankments will continue after closure, following cover construction. The existing monitoring equipment installed during construction of the infrastructure will be used and maintained for a minimum period of 5 years following closure of the facility.

The area over underground workings should be monitored for signs of subsidence.

7.3. Vegetation

The success of the re-vegetation activities will be monitored to ensure viable, self-sustaining vegetation growth over the rehabilitated areas and to determine if further vegetation support activities are warranted.

8. Cost estimate

The closure cost estimate takes into account the closure activities described above and the assumptions presented. It is based on information available at this stage of the Project and is to be updated as new information becomes available as Project design progresses.

Unit rates were derived from the cost estimate for the construction of the TSF and WSD facilities by Knight Pie sold. Where closure activities were the same as construction activities, the same unit rates were used. Further closure unit rates were developed based on the KP cost estimate and experience. Detailed Unit Rates are available in Appendix **Error! Reference source not found.**. A nominal sum of USD 1.0 M is estimated for general clean-up of the site and dismantling of electrical and piping connections for modular buildings. The sale price of process equipment, modular buildings and any salvageable assets is assumed to offset the dismantling and removal costs.

Areas and volumes were derived from available CAD drawings. Infrastructure dimensions used in the cost estimate are presented in Appendix **Error! Reference source not found.**.

The estimated cost of closure for the Yaramoko Project is USD 2.78 M. This includes an estimated 10% of the total for management overhead and 20% contingency. Table 8-1 presents a summary of the closure costs. The detailed cost estimate is included in Appendix **Error! Reference source not found.**.

Table 8-1: Closure Cost Summa

Project Area	Estimated closure costs, USD	Estimated closure costs, CFA	%
General cleaning	1340000	670 000 000	26,75
Underground Infrastructure	50000	25 000 000	1,00
Quarry	20000	10 000 000	0,40
Processing Facilities Area	650000	325 000 000	12,97
Accommodation Area	420000	210 000 000	8,38
Magazine Area	250000	125 000 000	4,99
TSF	1220000	610 000 000	24,35
Post-Closure Monitoring	200000	100 000 000	3,99
Management Fees (10%)	210000	105 000 000	4,19
Contingencies (20%)	650000	325 000 000	12,97
TOTAL	5010000	2 505 000 000	100,00

It should be noted that if the potential sale of buildings and process equipment was to be ignored and dismantling and demolition of these assets included in the cost estimate, this would have a significant impact on the cost estimate.

APPENDIX 17:

**SUMMARY AND LISTS OF ATTENDANCE AND
RESOURCE PERSONS MET AS PART OF THE ESIA**

VILLAGES	DATE	NO. OF PERSONS	POSITION	PURPOSE OF THE MEETING	INITIATORS FOR ROXGOLD
Bagassi	26-01-2013	8	Leaders and major land owners in Bagassi	Updated on Roxgold project and on BEGE work	GNOUMOU Charles, Community Facilitator
Bagassi	28-01-2013	8	Leaders and major land owners in Bagassi	Updated on Roxgold project and on BEGE work	KINANE Nestor, KOUSSE Raymond, GNOUMOU Charles
Bagassi	10-02-2013	6	Leaders and major land owners in Bagassi	Updated on Roxgold project and on BEGE work	NACOULMA Jean Didier, GNOUMOU Charles
Boromo	04-2013	1	CISSE Officer	Collection of administrative data on health	BEGE
Bagassi	04-2013	2	Officers of the CSPS and drugs Depot in Bagassi	Collection of administrative data on health	BEGE
Pompoi	04-2013	4	Health workers at the CSPS of	Collection of administrative data on health	BEGE
Kahin	04-2013	3	Health workers at the CSPS of Kahin	Collection of administrative data on health	BEGE
Boromo	06/07-2013	1	CISSE Officer	Collection of data on health in relation to artisanal gold mining	BEGE

VILLAGES	DATE	NO. OF PERSONS	POSITION	PURPOSE OF THE MEETING	INITIATORS FOR ROXGOLD
Bagassi	06/07-2013	2	Officers of the CSPS and drugs Depot in Bagassi	Collection of data on health in relation to artisanal gold mining	BEGE
Pompoi	06/07-2013	4	Health workers at the CSPS of Pompoi	Collection of data on health in relation to artisanal gold mining	BEGE
Kahin	06/07-2013	3	Health workers at the CSPS of Kahin	Collection of data on health in relation to artisanal gold mining	BEGE
Doussi	18-03-2013	23	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Bagassi	18-03-2013	1	Chief	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Bagassi	19-03-2013	9	CVD	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
San	19-03-2013	32	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Kaho	21-03-2013	12	Chiefs, Notables and CVD	Exchanges on the archaeological and/or ethnological aspects of the	BEGE

VILLAGES	DATE	NO. OF PERSONS	POSITION	PURPOSE OF THE MEETING	INITIATORS FOR ROXGOLD
				area	
Niankongo	22-03-2013	88	Community and farmers' Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Kahin	24-03-2013	28	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Bounou	24-03-2013	22	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Sipohin	25-03-2013	20	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Haho	26-03-2013	24	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Yaro	27-03-2013	25	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Moko	27-03-2013	18	Community Leaders	Exchanges on the archaeological and/or ethnological aspects of the	BEGE

VILLAGES	DATE	NO. OF PERSONS	POSITION	PURPOSE OF THE MEETING	INITIATORS FOR ROXGOLD
				area	
Bagassi	28-03-2013	13	Chiefs and notables	Exchanges on the archaeological and/or ethnological aspects of the area	BEGE
Kaho	13-06-2012	10	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE
Sipohin	15-06-2012	18	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE
Haho	16-06-2012	17	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE
Yaro	04-07-2012	18	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE
Doussi	05-07-2012	32	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE
Moko	07-07-2012	23	Community Leaders	Exchange on socio-economic aspects of the village to determine	BEGE

VILLAGES	DATE	NO. OF PERSONS	POSITION	PURPOSE OF THE MEETING	INITIATORS FOR ROXGOLD
				its the profile	
Bagassi	08-07-2012	24	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE
Kahin	17-11-2012	-	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE
San	19-11-2012	-	Community Leaders	Exchange on socio-economic aspects of the village to determine its the profile	BEGE

People met as part of surveys on the health situation

As part of the ESIA, data on health have been collected through two field visits; the first one took place from 11 to 13 April 2013 (administrative visit) and the second visit was held from 19 June to 12 July 2013 (further health aspects related to artisanal gold mining). Resource-persons involved in those consultations were as follows:

	N°	Village	Full Name	Position held
Admin. Visit (April 2013)	1	Boromo	Mr. SOMDA	Responsible for the health statistics information and epidemiological surveillance center (CISSE)
	2	Bagassi	Mrs. SINKONDO Alice	Head Nurse (ICP) CSPS of Bagassi
			Mr. TRAORE Kadari	Manager of a private drug depot in Bagassi
	3	Pompoi	Mr. OUATTARA Adama	Head Nurse (ICP) CSPS of Pompoi
				Other health workers in the CSPS of Pompoi (1 AIS, 1 AA, 1 drug manager)
	4	Kahin	Mrs. PARE Fatimata	Head Nurse (ICP) CSPS of Kahin
				Other health workers in the CSPS of Kahin (1 AIS, 1 drug manager)
	Health data related to artisanal gold mining (June-July 2013)	5	Boromo	Mr. SOMDA
6		Bagassi	Mrs. SINKONDO Alice	Head Nurse (ICP) CSPS of Bagassi
			Mr. TRAORE Kadari	Manager of a private drug depot in Bagassi
7		Pompoi	Mr. OUATTARA Adama	Head Nurse (ICP) CSPS of Pompoi
				Other health workers in the CSPS of Pompoi (1 AIS, 1 AA, 1 drug Manager)
8		Kahin	Mrs. PARE Fatimata	Head Nurse (ICP) CSPS of Kahin
				Other health workers in the CSPS of Kahin (1 AIS, 1 drug manager)

Issues discussed included:

- Existing infrastructure and equipment
- Existing staff

- Services provided by health facilities
- Availability of drugs
- Use of services by the population
- Epidemiological profile
- Hygiene and sanitation
- Communication for behavior change;
- Perception of population about certain health issues
- Way forward (development of infrastructure, equipment, staff)
- Assessment of needs expressed
- Assessment of priorities

8.1. Bagassi

Bagassi on 26 January 2013

N	Full Name	Structure and responsibility
1	YE Amo	Leader of Bagassi, resource-person
2	YE Doutien	Son of one of the major landowners
3	YE Bouyen	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
4	YE Binibio	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
5	BONOU Peré	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
6	YE Siwiya	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
7	YE Siénmi	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
8	YE Yazon	Resident in the <i>Sinyiio</i> neighborhood, Bagassi

Bagassi on 28 January 2013

N	Full Name	Structure and responsibility
1	YE Amo	Leader of Bagassi, resource-person
2	YE Doutien	Son of one of the major landowners
3	YE Bouyen	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
4	YE Binibio	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
5	BONOU Peré	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
6	YE Siwiya	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
7	YE Siénmi	Resident in the <i>Sinyiio</i> neighborhood, Bagassi
8	YE Yazon	Resident in the <i>Sinyiio</i> neighborhood, Bagassi

Bagassi on 10 February 2013

N	Full Name	Structure and responsibility
1	YE Bouyen	Resident in the <i>Sinyio</i> neighborhood, Bagassi
2	YE Binibio	Resident in the <i>Sinyio</i> neighborhood, Bagassi
3	BONOU Peré	Resident in the <i>Sinyio</i> neighborhood, Bagassi
4	YE Siwiya	Resident in the <i>Sinyio</i> neighborhood, Bagassi
5	YE Siénmi	Resident in the <i>Sinyio</i> neighborhood, Bagassi
6	YE Yazon	Resident in the <i>Sinyio</i> neighborhood, Bagassi

Termes de références pour la réalisation d'une étude d'impact socioculturel dans le département de Bagassi

Liste de présence Date 17/03/2013

Village BAGASSI Département BAGASSI

N°	Nom et prénoms	Occupations	Contacts	Signatures
01	YE Digbiencou	chef	77060614	

8.2.

17/03/15

Rencontre avec la COJ de Bagassi

Nom et Prénom(s)	Village	Numero Telephone	Signature
BAZI Joel	BAGASSI	7624-89-36	
Dakoué François	Sipohin	75-63-58-94	
Abiliter Doumato	KHO	76-11-1065	
Gnacoué Bissizou-nou	KALO	77-53-1565	+
≡ YE Sofinia	KALO	76-59-1941	
≡ Gnacoué Yinké	YORO	76-66-02-82	
" Yanzon	YORO	76-11-1378	
Tanboué Siaka	Niakongé	75-11-77-36	
Siéza Niéssan	Kahin	76-40-37-06	ttt L

Bagassi on 8 July 2012

N	Full Name	Structure and responsibility
1	TOURE Souleymane	Mayor, focal point
2	YE Dofinimitén	Land Chief (Tel :75 14 10 99)
3	YE Digabièmou	Village Chief
4	YE Siègnounou	Neighborhood Head
5	YE Zounoumadou	Neighborhood Head
6	YE Zounounaman	Neighborhood Head
7	YE Mamadou	Neighborhood Head
8	YE Siédouma	Neighborhood Head
9	YE Hambo	Neighborhood Head
10	YE Christophe	Artisanal gold miner
11	YE Wokènè	Neighborhood Head
12	TUINA G. Jean-Paul	Retired Forester
13	COMPAORE Yembi	Forestry offier
14	YE Noël	Traditional Healer

Liste des participants de Bagassi
08/07/2012

- Maire de Bagassi (yazon gustavo ye) ~~_____~~
- Yé Siegnounou ~~_____~~
- Yé Yazon ~~_____~~
- Yé Douche ~~_____~~
- Yé Bougnétéhencou ~~_____~~
- Yé Goussan ~~_____~~
- Yé Safif ~~_____~~
- Yé Djoumiten ~~_____~~
- Yé Sihin ~~_____~~
- Yé Namadou ~~_____~~
- " Siédouba ~~_____~~
- " Zoumouhadoun ~~_____~~
- " Zounouraman ~~_____~~
- Kohio Pandoabatan- ~~_____~~
- Bonou fic ~~_____~~
- Lamien Nsaani ~~_____~~
- Lamien Rankahan ~~_____~~
- Maba Fougriéhan ~~_____~~
- Groumou Angeline ~~_____~~
- Groumou Bayriwe' ~~_____~~
- Bambo Mikiehan ~~_____~~
- Kohio Mikiehan ~~_____~~
- Yé Kouho ~~_____~~
- Yé Yé Arouna ~~_____~~

Doussi on 5 July 2012

N	Full Name	Structure and responsibility
1	LAMIEN Pindaba	Teacher
2	GNOUMOU Doubanou	CVD Member
3	SIEZA Hekohoun	CVD Member
4	KOHIO Milotien	Farmer
5	GNOUMOU Nientien	Farmer
6	DIALLO Boukary	Livestock Breeder
7	GNOUMOU Lamoussa	Farmer
8	GNOUMOU Lodami	Traditional leader
9	GNOUMOU Dotien	CVD President /Craftsman
10	GNOUMOU Lodoubo	CVD Member
11	GNOUMOU Siédoubè	Farmer
12	GNOUMOU Sawari	Farmer
13	SIEZA Doutien	Farmer
14	LAMIEN Sibada	CVD Member
15	KOHIO Lodami	Farmer
16	NABA Kaki	Farmer
17	BONDE Delphine	AUE Member
18	GNOUMOU V. Zounoussan	Councilor
19	LAMIEN Nikièvo	Land Chief
20	KOHIO Nikièvo	Fetish-priest of the Land Chief
21	GNOUMOU Dofinissan	Neighborhood Head
22	GNOUMOU Gnimaté	Member of the Neighborhood of the Land Chief
23	GNOUMOU Niassan	Farmer invited
24	SIEZA Kani	Farmer invited

N	Full Name	Structure and responsibility
25	SIEZA Zamatéma	Farmer invited
26	KOHIO Mitian	GPC President
27	KASSA Hiniènou	Farmer invited
28	KOHIO Konlô	Neighborhood Head
29	GNOUMOU Kani	Neighborhood Head
30	GNOUMOU Yéréssan	Neighborhood Head
31	GNOUMOU Douwèrè	GPC President
32	KOHIO Wénababéni	Farmer invited

Liste de présence du village de Doussi

05/0

- | | | | |
|-----|---------|---------------|---|
| 1. | Groumon | Kani | ✓ |
| 2. | " | Zimkabate | ✓ |
| 3. | " | Lodami | ✓ |
| 4. | " | V. Zounoussan | ✓ |
| 5. | " | Dotin | ✓ |
| 6. | " | Sewijan | ✓ |
| 7. | " | Jnibaté | ✓ |
| 8. | " | Biéssaan | ✓ |
| 9. | LARIEN | Sickaniénon | ✓ |
| 10. | " | Yictan | ✓ |
| 11. | KOHIO | Wenababéni | 2 |
| 12. | " | Zounouwe | ✓ |
| 13. | " | Nikiéwo | ✓ |
| 14. | " | Labalen | ✓ |
| 15. | Sieza | Deubayaho | ✓ |
| 16. | " | Zabatemaan | ✓ |
| 17. | KANI | KANI | ✓ |
| 18. | ✓ | Hekohoun | ✓ |

8.4. Haho

Termes de références pour la réalisation d'une étude d'impact socioculturel dans le département de Bagassi

Liste de présence

Date 26/03/12

Village Haho Département Bagassi

N°	Nom et prénoms	Occupations	Contacts	Signatures
01	Kaba Payiri	cultivateur		
02	Kaba TIEDIGA	"	/	
03	Kaba SIENIMI	"	66-51-52-88	
04	Kaba TAN KOSI	"	/	
05	Kaba KOSSI	"	/	
06	Kaba BOZOMANOU	"	66-12-62-08	
07	Kaba HEMANOU	"	77-35-76-22	
08	Kaba LAZOUSSA	"	/	
09	Kaba SIGUIZOU	"	75-51-57-58	
10	Kaba SULOU	"	75-76-77-34	
11	Kaba DANIEL	élève	77-93-3-165	
12	Kaba KAMBIE	cultivateur	/	
13	Kaba WIZOUOU	"	/	
14	Kaba ZOUZOU	"	75-19-69-36	
15	Gnoumou SABIÉ	chef du village	72-57-01-63	
16	Gnoumou YIYIYI	cultivateur	70-23-09-56	
17	Gnoumou ZOUZOU	"	76-29-17-53	
18	Gnoumou KOFFI	"	/	
19	Gnoumou PAUL	élève	74-58-72-99	
20	Gnoumou YIYIYI	cultivateur	66-52-42-77	
21	Gnoumou YIYIYI	cultivateur	75-16-00-05	
22	Gnoumou TIEMBO	"	76-21-67-06	
23	Kaba ADOUKI	"	/	
24	Gnoumou COTA	"	/	

Haho on 16 June 2012

N	Full Name	Structure and responsibility
1	GNOUMOU Yérédi	Councilor
2	KASSA Ziniban	Farmer (public crier)
3	KASSA Pagniri	Farmer
4	KASSA Lamoussa	Farmer
5	KASSA Kassiéno	Farmer
6	KASSA Yaho Alain	CVD Member
7	KASSA Alphonse	CVD Assistant Secretary
8	GNOUMOU Siéti	Farmer
9	KASSA Kansikopè	CVD Assistant Secretary
10	GNOUMOU Yentinoumi	Farmer
11	KASSA Bernard	Vice President of the Water point Committee
12	GNOUMOU Yirissan	President of the Water point Committee
13	GNOUMOU Marcel	CVD Treasurer
14	YE Kassiéno Marcel	Teacher
15	GNOUMOU Dofiniwiyen	Land and Village Chief
16	KASSA Tankossi	Neighborhood Head
17	KASSA Benkimi	Neighborhood Head

Notes des présences de HAHO

- | | | | |
|----|---------|--------------|--------------|
| 1 | KASSA | Tamakassi | ○ |
| 2 | GNOUROU | Dofinirian | ○ |
| 3 | GNOUROU | Yentimien | ○ |
| 4 | KASSA | Tiethiou | - |
| 5 | KASSA | Koffi | ○ |
| 6 | GNOUROU | Darcel | ○ |
| 7 | KASSA | Kansikopé | ○ |
| 8 | GNOUROU | Yéréban | ○ |
| 9 | KASSA | Houilo | ○ |
| 10 | GNOUROU | Yérédi | ○ |
| 11 | KASSA | B. Alphonse | - |
| 12 | KASSA | Hékohoun | - |
| 13 | GNOUROU | Zanou Jomian | ○ |
| 14 | KASSA | Noé | ○ |
| 15 | GNOUROU | Lawa | x |

8.5. Kaho

Termes de références pour la réalisation d'une étude d'impact socioculturel dans le département de Bagassi

Liste de présence Date Jeudi - 21 Mars 2013.

Village Kaho Département Bagassi

01	Gnoumou Sinlé	chef du village	76.72.64.65	
02	Gnoumou Simplec	Président	-	X
03	Gnoumou Bissizounou	Producteur	76.33.14.74	
04	Gnoumou Bissizounou	P/CVD	77.53.15.65	X
05	YE Hankani	chef de famille	-	
06	YE Dofinia	CVD/SG	76.59.69.64	
07	Kotonou Nikiègnoumou	chef de famille	-	X
08	Mitikoé Sahbi	chef de famille	-	
09	Mitikoé Niki	Producteur	76.15.24.02	
10	Mitikoé Kambou	vp/CVD	76.62.17.86	
11	Mitikoé Zambou	Producteur	-	NI -
12	Mitikoé D. Edouard	vp/CVD	76.64.36.12	

Kaho on 13 June 2012

N	Full Name	Structure et responsibility
1	YE Dofinia	CVD Secretary General
2	GNOUMOU Bissizounou	CVD President
3	MITIKOE Datien	Artisanal gold miner
4	GNOUMOU Sinlé	Land Chief and Traditional healer
5	MITIKOE Niki	Councilor
6	KOTONOU Nikiègnoumou	N'Banouyio Neighborhood Head
7	COULIBALY AWA	Councilor and member of AUE
8	YE Hankani	Women's Leader
9	LAMIEN Mariam	CVD Board member
10	MITIKOE Nouibahièho	AUE Treasurer

8.6.

Liste des présences de Kaho

1.	Gnaouma Sinlé	+
2.	Gnaouma Birzouma	+
3.	Gnaouma Bazouma	+
4.	Jé Dofinian	+
5.	Jé Hékouma	0
6.	Kotouma Nikié	+
7.	Nitkoué Niki	+
8.	Nitkoué Datien	+

8.7.

8.8. Sipohin

8.9.

Termes de références pour la réalisation d'une étude d'impact socio-culturel dans le département de Rapreni

Liste de présence Date 25/03/13

Village Sipohin Département Bogassi

		Coordonnées	
01	Bani François	collimateur	7563 58 34
02	Groumou Biocoume	"	
03	Bani Droumou	"	77 336 887
04	Groumou Koutoum	"	65 45 4088
05	Bani Droumou	"	77 3692 37
06	Bani Zoumoumou	"	76 32 30 69
07	Groumou Timbo	"	
08	Bani N'Groumou	"	
09	Groumou Siguemou	"	
10	Kotoum Koutoum	"	744790 38
11	Bani Oufimouli	"	
12	Koti Kani	"	
13	Groumou watacou	"	76 11 62 32
14	Groumou Lotou	"	
15	Bani wazoumou	"	
16	Groumou Djoumou	"	
17	Groumou Zoumoumou	"	76 10 82 37
18	Groumou Doh	"	76 65 93 97
19	Bani Zoumoumou	"	
20	Bani Droumou	"	

8.10.

Sipohin on 15 June 2012

N	Full Name	Structure and responsibility
1	GNOUMOU Tinbio	AUE President
2	KOTONOU Pénou	AUE Treasurer
3	BAWE Zounoumité	AUE Secretary
4	GNOUMOU Haïdo	AUE President
5	GNOUMOU N'Lemi	AUE Secretary
6	BAWE Dohan	AUE Treasurer
7	BAHOUE François	Councilor
8	BAHOUE Madou	CVD Member
9	BAHOUE Dazounou	Fisherman
10	GNOUMOU Kansikopè	Fisherman
11	KOTONOU Martin	Artisanal gold miner
12	BAWE Nikèssan	Artisanal gold miner
13	GNOUMOU Bienvenu	CVD President
14	BAWE Donou	Land Chief
15	GNOUMOU Wattamou	Councilor
16	BAWE Lowiho	Traditional Healer

Liste des présences de SIPOHIN

1	GNOUNOU	Bienvenu	Yaga
2	KOHIO	Jéniman	Yaga
3	GNOUNOU	Niniéro	Y
4	BAWE	Daga boué'	Y
5	KOTONOU	Péneu	Yaga
6	GNOUNOU	Ya chémi	Yaga
7	GNOUNOU	Dounca	Yaga
8	GNOUNOU	Donou	Yaga
9	Bawé'	Gerard	Yaga
10	GNOUNOU	Doubalo	Y
11	GNOUNOU	Datin	Yaga
12	BAWE	Bizoussi	Yaga
13	BAWE	Zou nou mte'	Yaga
14	BAWE	François	Yaga
15	BAWE	Doubassan	Yaga
16	GNOUNOU	Wakamou	Yaga
17	GNOUNOU	Tinhio	Yaga
18	KOTONOU	Kankan baté'	Yaga

Moko on 7 July 2012

N	Full Name	Structure and responsibility
1	GNOUMOU Adama	AUE
2	GNOUMOU Massan	Farmer
3	GNOUMOU Massan	AUE
4	GNOUMOU Zounoupawiyen	Farmer
5	GNOUMOU Yétan	Farmer
6	GNOUMOU Bonyéssan	CVD
7	GNOUMOU Panka	Breeder/Farmer
8	GNOUMOU Loyazo	Breeder/Farmer
9	GNOUMOU Lamoussa	Farmer
10	GNOUMOU Zounouhiè	Farmer
11	GNOUMOU Nazoumou	Farmer
12	YIE Siétien	Traditional healer

Liste des présence de POKO

• GNOUPOU	Boquessan 9 = B
• "	Nazounou n° 2 2
• "	Nimbano A
• "	Loyayso 2
• "	Poussa 2
• LATIEN	Bobassi Vay
• "	Houibate 2
• GNOUPOU	Nazounou n° 1 2
• "	Bagesse 2
• "	Bagnamou n° 2 2
• "	Adama 2
• "	Zounouye n° 1 2
• "	Yéréwidan 2
• "	Yéremitim 2
• "	Sita 2
• "	Zounoustan 2
• LATIEN	François 2
• GNOUPOU	Passan 2
• "	Dénis 2
• "	Yéréyave 2
• "	Bagnamou n° 1 2
• "	Yistan 2
• "	Zounoubié 2

Yaro on 4 July 2012

N	Full Name	Structure and responsibility
1	GNOUMOU Zéphirin	CVD Secretary
2	GNOUMOU Yarobiè	GPC (President)
3	GNOUMOU Sintié	Market Gardener (President of the market gardeners Group)
4	GNOUMOU Yirissan	GPC (President)
5	GNOUMOU Sanhari	GPC (Secretary)
6	GNOUMOU Sindouba	GPC (President)
7	GNOUMOU Lonko Emmanuel	GPC (President)
8	GNOUMOU Doubéssan	Farmer
9	GNOUMOU T. Jean	AUE (President)
10	GNOUMOU Y. Fidèle	CVD President
11	GNOUMOU Yanzo	Councilor & Neighborhood Head
12	GNOUMOU Biènouyiti	Neighborhood Head
13	GNOUMOU Kassiéanou	AUE Member
14	GNOUMOU Milloti	Neighborhood Head
15	GNOUMOU Zounoupowian	Land Chief
16	GNOUMOU Bernard	CVD Member
17	GNOUMOU Joseph	Representative of the Neighborhood Head
18	GNOUMOU Siéwiyan	Representative of the Neighborhood Head

Liste des présences du village de Jaro

- Groumou Lounoufamin ~~son~~
- Groumou Yobatin = JS
- Groumou Jazon ~~JS~~
- Groumou Sounwagnan
- Groumou Jirkin ~~JS~~
- Groumou Nathien ~~JS~~
- Groumou Anche' ~~JS~~
- Ye Doumbo ~~JS~~
- Groumou Radou ~~JS~~
- Groumou siaka ~~JS~~
- Groumou JEFIRIN ~~JS~~
- Groumou Pereki ~~JS~~
- Groumou Zounouyidouba ~~JS~~

8.14. San

Termes de références pour la réalisation d'une étude d'impact socioculturel dans le département de Bagassi

Liste de présence

Date 19/03/13

Village de San Département Pampoi

N°	Nom et prénoms	Occupations	Contacts	Signatures
01	MANDE BRUNO	chauffeur	71 99 0031	
02	MAFENO VISEFARA	Cultivateur	76 50 9366	
03	KOUASSI ZOUSSOU	Cultivateur		
04	Mandi BOUÉ	Cultivateur	77 04 30 20	
05	MANDE ZSWEBAH	Cultivateur		
06	MANDE FORAN	Président CVO	75 31 32 62	
07	Soumarou Tchélele	" CVO	75 12 11 92	
08	Mandi Kani	Cultivateur		
09	KOUASSI Sani	Cultivateur		
10	KOUASSI Balyia	Cultivateur		
11	MANDE Tichil	Cultivateur		
12	Mandi VANOUPE	conseiller		
13	Mandi FANGALO	Cultivateur		
14	Mandi OUDOU	Cultivateur	25 78 21 30	
15	Mandi Talaï	Cultivateur		
16	Mandi DORON	Cultivateur		
17	Mandi HILAN	Cultivateur	76 9 15 2 27	
18	MANDE Tchélele	Cultivateur	76 19 49 52	
19	Soumarou Tchélele	Cultivateur	97 98 26 98	
20	Mandi LORON	Cultivateur		
21	Mandi RICHARD	Cultivateur	75 35 35 82	
22	Mandi ANDRI	Cultivateur	75 45 72 85	
23	MANDE FIRO	Cultivateur		
24	Mandi ABDOU	Cultivateur	75 02 32 62	
25	Mandi ADAMA	Cultivateur	65 60 05 07	
26	Mandi SOUBATEL	Cultivateur		
27	Mandi NAGOUNA	Cultivateur	72 35 42 19	
28	Mandi ZOUSSOU	Cultivateur	75 93 19 22	
29	MANDE ANTOINE	Cultivateur	76 31 05 01	
30	MANDE ZOUSSOU	Cultivateur	75 20 22 28	
31	MANDE BELLI	Cultivateur		
32	MANDE ZOUSSOU	Cultivateur		

Niankongo

Termes de références pour la réalisation d'une étude d'impact socioculturel
dans le département de Bagassi

Liste de présence

Date 22/03/13

Village NIANKONGO Département Bagassi

N°	Nom et prénoms	Occupations	Contacts	Signatures
1	Tamboussa Nabaou	cultivateur		
2	Tamboussa Loukoko	cultivateur	74-688193	
3	Tamboussa Sika	cultivateur		
4	Tamboussa Nabaou	cultivateur	76-59-4806	
5	Tamboussa Lassim	cultivateur	95-05-3638	
6	Tamboussa Sidiki	cultivateur	41-1658-30	
7	Tamboussa Nabaou	cultivateur		
8	Tamboussa Tchoumou	cultivateur		
9	Tamboussa M. Sotoko	cultivateur		
10	Tamboussa Tadjou	cultivateur		
11	Tamboussa Samba	cultivateur		
12	Tamboussa Sika	cultivateur	75-11-72-96	
13	Tamboussa Yankou	cultivateur	62-223-673	
14	Tamboussa Yankou	cultivateur	95-56-23-48	
15	Tamboussa Tadjou	cultivateur	74-03-78-23	
16	Tamboussa Nabaou	cultivateur		
17	Tamboussa Sika	cultivateur		
18	Tamboussa Samba	cultivateur	74-31-35-33	
19	Tamboussa Tadjou	cultivateur	66-11-430-21	
20	Tamboussa Nabaou	cultivateur		
21	Tamboussa Samba		76-41-57-76	
22	Tamboussa Fadiou	cultivateur	74-40-35-11	
23	Tamboussa Samba	Épaveur	26-12-37-30	
24	Tamboussa Samba	cultivateur	74-10-49-35	
25	Tamboussa Samba	cultivateur	75-14-25-25	
26	Tamboussa Samba	cultivateur	75-72-70-63	
27	Tamboussa Samba	cultivateur		
28	Tamboussa Kossou	Eleve	74-44-15-11	
29	M. N. Kassou	cultivateur		
30	Tamboussa Samba	cultivateur		
31	Tamboussa Hamali	cultivateur		
32	Tamboussa Samba	Épaveur	77-57-07-11	

Village/suite

ATHANINGO

33	Tamboua Taltat	cultivatus		
34	Tamboua Sanna	cultivatus		
35	Tamboua Gantika	cultivatus		*
36	Tamboua Kambika	cultivatus		*
37	Tamboua Bawana	cultivatus	75.34.51.08	0.20
38	Tamboua faga	cultivatus		+
39	Tamboua Duruana	cultivatus	97.23.75.71	+
40	Tamboua Samba	cultivatus	75.10.11.06	+
41	Tamboua Canda	cultivatus		
42	Dit Akana	cultivatus		
43	Tamboua Dassa	cultivatus	75.70.40.75	+
44	Tamboua M	cultivatus	74.22.23.12	+
45	Cantibaly Bantika	cultivatus		
46	Tamboua Gamba	cultivatus	75.75.73.48	
47	Duo Gumbau	cultivatus	65.29.06.67	+
48	Tamboua Kaba	cultivatus	70.95.62.52	+
49	Duo Kambau	cultivatus		
50	De Danda	cultivatus	74.2.60.24	+
51	Tamboua Zikha	cultivatus		
52	Cantibaly Waka	cultivatus		
53	Tamboua La Sana	cultivatus		
54	Duo Sanyana	cultivatus		
55	Tamboua Daba	cultivatus		
56	Tamboua gaga	cultivatus		
57	Tamboua Daba	cultivatus		
58	Tambou Saba	cultivatus	75.01.16.7	
59	Samba Gikha	cultivatus	66.70.60.72	
60	Tamboua Samba	cultivatus	75.13.65.20	
61	Kaba Thaba	cultivatus	92.38.11.75	
62	Tamboua Gamba	cultivatus	75.35.1.34	
63	Tamboua Samba	cultivatus	94.11.22.15	
64	Tamboua Samba	cultivatus	74.33.76.17	
65	Tamboua Bamba	cultivatus	72.82.81.60	
66	Tamboua Bamba	cultivatus	76.42.01.52	
67	Tamboua Samba	cultivatus		
68	Tamboua Kaba	cultivatus		
69	Duo Samba	cultivatus	77.72.16.33	
70	Tambou Dassa	cultivatus		

Kahin

Termes de références pour la réalisation d'une étude d'impact socioculturel dans le département de Bagassi

Liste de présence

Date 24/03/13

Village Kahin Département Bagassi

N°	Nom et prénoms	Occupations	Contacts	Signatures
01	Kohie Z. Joseph	cult	76/22/22/82	
02	Siezo Lotiolié	"		
03	" Lamoussa	"	66/53/83/90	
04	" Dambla	"	76/36/63/76	
05	" Karfei	"	75/1/83/30	
06	" Roger	"	74/10/16	
07	Gnaouma Yacoubé	"	75/14/16/19	
08	Kiam Haritah	"	77/79/77/66	
09	Siezo Lotiolié	"	74/07/10/85	
10	Gnaouma Doukhan	"	71/11/65/25	
11	Siezo Sami	"	75/85/20/08	
12	" Mitiani	"	76/32/64/65	
13	" Doufinkoubé	"	73/10/46/33	
14	" Teyé	"	75/17/67/81	
15	Kohie Wanki	"		
16	" Takafani	"		
17	Gnaouma Sipami	"		
18	Siezo Koumassou	"	74/54/36/48	
19	" Niessou	"	71/60/27/08	
20	Bambie Yitaouami	"		
21	Siezo Tipalié	"	76/18/64/59	
22	Bambie Biyou	"		
23	Dassouma Doudie	"	76/32/37/37	
24	Gnaouma Fieze	"	75/27/67/59	
25	Bambie Fkikié	"	75/26/77/15	
26	Bambie Baki	"	75/32/68/33	
27	Bambie Lohami	"	75/28/21/35	
28	Famien Khouman	"		

8.16. Bounou

Termes de références pour la réalisation d'une étude d'impact socioculturel dans le département de Bagassi

Liste de présence

Date 24-03-13

Village Bounou Département Bagassi

N°	Nom et prénoms	Occupations	Contacts	Signatures
1	Kouma Mikizant	Cultivateur		
2	Goussou Toukoto	"	76 56 38 70	
3	" Dabou non	"	76 10 61 55	
4	Toumani Mondou	"	76 26 18 03	
5	Doua Louani	"	76 01 38 11	
6	Compassi Albert	"	77 55 46 30	
7	Goussou Sakou	"	76 36 30 24	
8	Siga Da Kouma	"		
9	Nyénéké Doumane	"	76 17 58 03	
10	Guillain Bagui	"		
11	Konak Sangé	"		
12	Toumani Adama	"	76 85 10 65	
13	Sigé Sakou	"	76 17 13 38	
14	Boussou Sakou	"	76 61 47 55	
15	Doumane Sakou	"		
16	Saké Kouma	illegible	75 36 77 06	
17	Goussou Kouma	illegible		
18	Miké Saké	"	76 03 43 10	
19	Louani Sakou	"		
20	Kouma Sakou	"		
21	Goussou Kouma	"	76 85 16 82	
22	Goussou Kouma	"	76 63 02 01	

APPENDIX 18

**MEMO OF MEETINGS WITH COMMUNITIES LIVING
WITHIN THE PROJECT AREA**

MEMO of the meeting held at KAHO

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Kaho on Wednesday 13 June 2012 at 7:30 in the courtyard of Mr. Gnomou Bissizounou, President of the CVD. This meeting brought together around the team of BEGE, the President of the CVD, Mr. Mitikoé Niki the village councilor, few households heads and the notables of the various neighborhoods that make up the village of Kaho.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After discussions that lasted 2 hours, the consultant conducted a survey of the coordinates of sacred sites and places of worship in the village as well as on the outskirts of the village.

After visiting those places, the meeting ended at 11:30 a.m.

MEMO of the meeting held at SIPOHIN

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Sipohin on Friday 15 June 2012 at 8:00 in the courtyard of Mr. Gnomou Bienvenu, President of the CVD. This meeting brought together around the team of BEGE, the President of the CVD, Mr. Bawe François the village councilor, few households heads and the notables of the various neighborhoods that make up the village of Sipohin.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After discussions that lasted 2 hours and 30 mn, the consultant conducted a survey of the coordinates of sacred sites and places of worship in the village as well as on the outskirts of the village.

After visiting those places, the meeting ended at 11:30 a.m.

MEMO of the meeting held at HAHO

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Haho on Friday 16 June 2012 at 4:30 p.m. in the courtyard of Mr. Gnoumou Yeredi the village councilor. This meeting brought together around the team of BEGE, the village councilor, the President of the CVD, few households heads and the notables of the various neighborhoods that make up the village of Haho.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

A l'issue des discussions qui ont duré 1h30, le consultant a procédé au recensement des participants en établissant la liste des participants. La visite des lieux sacrés et lieux culte a été reporté au lendemain matin. Aussi le chef de mission a procédé à la levée de séance à 18h30mn.

After discussions that lasted 1 hour and 30mn, the consultant conducted a census of participants by establishing the list of participants. The visit of sacred sites and worship places has been postponed to the next morning. The Head of Mission ended the meeting at 6:30 p.m.

MEMO of the meeting held at YARO

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Yaro on Wednesday 4 July 2012 at 9:00 in the courtyard of Mr. Gnomou Zounoupowiyen, the Land Chief. This meeting brought together around the team of BEGE, Mr. Gnomou Yenkin the village councilor, few household heads and the notables of the various neighborhoods that make up the village of Yaro.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After discussions that lasted 1 hour and 30 mn, the consultant ended the meeting and postponed the visit of sacred sites and places of worship because of a thunderstorm.

MEMO of the meeting held at DOUSSI

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Doussi on Thursday 5 June 2012 at 8:00 a.m. in the courtyard of the village Chief, Mr. Lamien Sekaniennou. This meeting brought together around the team of BEGE, the Village Chief, Mr. Gnomou Dotini the President of the CVD, Mr. Gnomou Zounoussan the village councilor, household heads and the notables of the various neighborhoods that make up the village of Doussi.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After discussions that lasted 1 hour and 30 minutes, the consultant conducted a survey of the coordinates of facilities, sacred sites and places of worship in the village as well as on the outskirts of the village.

After visiting those places, the meeting ended at 10:30 a.m.

MEMO of the meeting held at MOKO

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project (the social and economic component), a meeting was held at Moko on Saturday 7 July 2012 at 8:30 a.m. in the courtyard of the Village Chief Mr. GNOUMOU Bougnèsan. It was reported that the village Councilor lives in Ouagadougou. This meeting brought together around the team of BEGE, the Village Chief, few household heads and the notables of the various neighborhoods that make up the village of Moko.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After discussions that lasted 2 hours and 30 minutes, the consultant conducted a survey of the coordinates of sacred sites and places of worship in the village as well as on the outskirts of the village.

After visiting those places, the meeting ended at 12:30 a.m.

MEMO of the meeting held at BAGASSI

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Bagassi on Sunday 8 June 2012 at 8:00 a.m. in the courtyard of the President of the CVD. This meeting brought together around the team of BEGE, Mrs Yé Yazon the Mayor the municipality of Bagassi, representatives of women's associations, the chairmen of village cotton producers groups and the notables of the various neighborhoods that make up the village of Bagassi.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After the discussions that lasted 2 hours and 45 minutes, the consultant conducted a survey of the coordinates of sacred sites and places of worship in the village as well as on the outskirts of the village.

MEMO of the meeting held at KAHIN

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Kahin on Saturday 17 November 2012 at 7:30 in the courtyard of Mr. Sieza Donou, the President of the CVD. This meeting brought together around the team of BEGE, the President of the CVD, Mr. Sieza Gnessan, household heads and the notables of the various neighborhoods that make up the village of Kahin.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After the discussions that lasted 2 hours, the consultant conducted a survey of the coordinates of sacred sites and places of worship in the village as well as on the outskirts of the village.

After visiting those places, the meeting ended at 11:45 a.m.

MEMO of the meeting held at NIAKONGO

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at Niakongo on Sunday 18 July 2012 at 8:00 a.m. in the courtyard of Mr. Tamboura Mamadou, the Village Chief. This meeting brought together around the team of BEGE, the Village Chief; Mr. Tamboura Souleymane, the President of the CVD, Mr. Tamboura Lassina the village councilor, household heads and the notables of the various neighborhoods that make up the village of Niakongo.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After the discussions that lasted 1 hour and 30 minutes, the consultant conducted a survey of the coordinates of sacred sites and places of worship in the village as well as on the outskirts of the village.

After visiting those places, the meeting ended at 11:00 a.m.

MEMO of the meeting held at SAN

As part of the Environmental and Social Impact Assessment for the Yaramoko mining project, a meeting was held at San on Monday 19 November 2012 at 8:30 in the courtyard of Mr. Mandi Vanoussan, the Village Councilor. This meeting brought together around the team of BEGE, Mr. Mandi Lombo François the Village Chief; the village councilor, household heads and the notables of the various neighborhoods that make up the village of San.

The meeting began with the usual greetings and the presentation of the mission. Following the presentations, the Head of Mission explained the purpose of the visit. He stressed that within the framework of the Yaramoko Mining Project, an Environmental and Social Impact Assessment was commissioned to enable the project to have what follows:

- A full description of the human frame of the villages concerned
- The demographic and cultural characteristics
- The underlying factors of population change
- The ethnic groups and religions
- The customs and traditions

Participants were informed that this study is conducted in all villages within the Yaramoko permit, namely Bagassi, Doussi, Haho, Kahin, Niakongo, San, Sipohin and Yaramoko.

The mission ensured the representativeness of the population through a presentation of the notables and heads of families present.

Before starting the discussion, the consultant from BEGE outlined the items on the agenda, namely:

- The demographic and cultural characteristics
- The ethnic configuration and religions (customs and traditions)
- The production sectors
- The social sectors
- Sports and Recreation
- The development stakeholders

After these prerequisites, the interview guide was used to conduct the data collection.

After discussions that lasted 2 hours, the consultant conducted a survey of the coordinates of sacred sites and places of worship in the village as well as on the outskirts of the village.

After visiting those places, the meeting ended at 11:45 a.m.

INTERVIEW GUIDE USED FOR DATA COLLECTION

Date/Start Time:

Village:

1. History of settlement

- Ethnic groups present in the village : history of the facility
- Origin of the various lineages that constitute the village
- History of the facility in the village
- The various decision centers / local authorities

2. Land tenure : forms of land management

- Land access and land management modes
- Existence of land disputes : reasons of land conflicts; and the actors involved ;
- Modes of land conflict settlement

3. The social organization of the village (roles of the various age classes)

- Existence of customary chiefs : mode of legitimization; mode of transmission of traditional political power; functions and role in the village
- Existence of other customary authorities : functions and role in the village
- Existence of caste : types, functions and role in the village

4. Migration

- Reasons for emigration in the village / stakeholders (estimated number) / duration of the migration
- Existence of other forms of population movement

5. Places of worship and sacred places (inventory and description)

- Existence of Places of Worship : types of worship, periodicity
- Existence of other sacred places : place and functions in the local cosmology

6. The place and role of the various social groups :

- Roles and status of women, youth , the elderly
- Types and number of associations and specific groups
- Functions of each association and group
- References the leaders of the associations and groups

7. Education :

- Access to education services : the existence of a school, reasons for non-enrollment / dropout of children in the village; modes of participation in the management of school infrastructure; difficulties encountered in the education of children;

8. Health

- Access to health services: existence of a reference health center / distance between the village and health facility; mode of participation in the management of the health facility; difficulties in access to the health facility.

9. Water and Sanitation

- Access to safe water: number of functional boreholes; number of boreholes that are down; support partners for access to drinking water; problems related to access to safe drinking water.
- Access to Sanitation : number of household latrines constructed; number of functional household latrines ; support partners for access to household latrines; difficulties in access to sanitation ;

10. Sports and Recreation

- Existence of sport and recreation facilities / types of sport and recreation practiced in the village

11. Production activities

- Agriculture: existence of farmers' organizations; types of crops; the specific challenges related to agriculture
- Breeding: existence of breeders' organizations; livestock, specific problems related to breeding
- Fishing: existence of fishers' organizations; fishing places; specific difficulties related to fishing
- Handicrafts : existence of artisans' organizations, types of arts, specific difficulties related to handicrafts

12. Development actors

13. Presence of artisanal mining sites

End time

ANNEXE 19
COMPREHENSIVE LIST OF LAND USERS WITHIN THE
MINING PERMIT

N°	Full Name	ID card details	Crops	Area cultivated (ha)
1	NAZOUDOUBA François Javier	0689993 du 19 06 08	Corn Millet	1.68
2	GNAMEOU Botipbé Zoachin	5323090 du 29 01 2013	Corn Cotton	0.71
3	GNOUMOU Yassan	1039577 du 23 10 2008	Corn Millet	1.24
4	GNOUMOU Mihi	1939912 du 28 06 2010	Corn Millet	0.71
5	YE Sari	0990668 du 24 01 2008	Corn Sesame	4.21
6	YE Kassiasio	0989029 du 24 10 2008	Corn	2.28
7	GNOUMOU Firmin	5623082 du 28 05 2012	Corn Cotton	0.43
8	YE Wokoum	0990721 du 24 10 2008	Corn Cotton	2.23
9	GNOUMOU GNIKI	1282440 DU 13 01 2010	Corn	0.24
10	GNOUMOU BOTIPBE ZOACHIN	5323090 du 29 01 2013	Corn	0.20
11	GNOUMOU GNIKI	1282440 DU 13 01 2010	Corn Millet	0.22
12	GNOUMOU JONAS	6312345 DU 12 03 2012	Corn	0.13
13	GNOUMOU DOFINIBIE	6756936 DU 01 10 2010	Corn Millet	1.01
14	GNOUMOU DONFIHOUYA	1042147 DU 21 10 2008	Corn	1.00
15	GNOUMOU ANTOINE	0757330 DU 10 03 2008	Corn Sorghum	2.69
16	YE NIBIRIEWOTAN	0669334 DU 05 06 2008	Corn	1.47
17	YE ZOUMOUNABAN	0729131 DU 03 06 2008	Millet Beans Corn	4.35
18	YE BOTOUBE	4615708 DU 29 01 1995	Cotton Millet	2.95
19	YE LOUWOUYA	0669393 DU 05 06 2008	Corn Groundnuts	1.81
20	YE OUBOTE	0669525 DU 04 06 2008	Corn	1.67
21	GNOUMOU HAMI	CARTE CONSULAIRE 0225683 DU 25 04 2000	Corn	1.58
22	GNOUMOU TIEPOBE	CARTE ELECTEUR 2516570	Corn	0.99
23	GNOUMOU Firmin	5623082 du 28 05 2012	Maïs Cotton	1.72
24	GNOUMOU NIEDOUBE	0757298 DU 10 06 2008	Corn	1.58
25	GNOUMOU DENIS	REFERENCE SIRIKI EXTRAIT DE NSSCE 243	Corn	0.93
26	GNOUMOU Yassan	1039577 du 23 10 2008	Groundnuts	1.26
27	GNOUMOU NIEDOUBE	0757298 DU 10 06 2008	Millet	1.24
28	YE HEKOHOUN	6540767 DU 09 04 012	Corn	1.90
29	YE POUGNATEBIEHI	0990656 DU 24 10 2008	Corn	0.39
30	YE SIMON	1799750 DU 10 06 2010	Corn Cotton	0.83
31	YE NSIPOHINO	EXTRAI NSSCE N° 37 DU 13 07 12	Corn	2.35
32	YE KAYATORO		Cotton Millet	1.72
33	YE EMMANUEL	EXTRAIT DE NSSCE 1183 DU 14 04 1997	Corn Groundnuts Millet	2.70
34	YE LONWORE	0692435 DU 21 06 2008	Corn Millet	1.26
35	YE TIABOUTIEN	0990621 DU 24 10 08	Corn Millet	0.98
36	YE ZOUMOUSSAN	EXTRAIT DE NSSCE 210 DU 27 04	Corn Millet	1.56
37	YE YAZION	0989346 DU 24 10 08	Corn	0.75
38	YE MISSIANO	0719201 DU 17 06 2008	Groundnuts Sorghum Corn	0.90
39	YE DOFINDOUBA	0719145 DU 17 06 2008	Beans Sorghum Corn	0.85
40	YE KASSIASSIE	729137 DU 03 06 2008	Corn Sorghum	7.32
41	YE LAMOUSSA	4889625 DU 20 04 2012	Corn	0.00

42	YE YAROBIE	CARTE ELECTEUR N° 02516418	Sorghum Arachode	1.39
43	LAMIEN LAMOOUSSA	0693373 DU 2106008	Sorghum Corn	3.37
44	GNOUMOU AUBIN	0989493 DU 24 10 08	Corn Sorghum	7.04
45	YE ZONOUBADOUN	2968289 DU 26 03 10	Corn Sorghum	2.14
46	YE DOFINDOUBA	0719145 DU 17 06 2008	Millet Beans	0.71
47	YE DOFINDOUBA	0719145 DU 17 06 2008	Millet Beans	0.91
48	GNOUMOU DONOU ERNEST	0989432 DU 24 10 08	Millet Sorghum	2.20
49	YE TAMOUTIN	0990807 DU 24 10 08	Sorghum Cotton	2.47
50	YE NIBIRIEWOTAN	0669334 DU 05 06 08	Millet	0.73
51	GNOUMOU DOFIHOYAN	1042147 DU 21 10 08	Sorghum	0.54
52	MIHIN BIENVENU	1039451 DU 23 10 08	Sorghum	0.53
53	DOUBARO MIHIN	0689903 DU 19 06 08	Cotton	1.48
54	MIHIN ZINIKO	0727694 DU 04 06 08	Corn	0.19
55	MIHIN SEOUYA	CARTE ELECTEUR N° 02516319	Corn	0.42
56	MIHIN TIENWAN	0717278 DU 19 06 08	Corn	0.21
57	MIHIN TINIENOU	0693539 DU 21 06 08	Corn	0.66
58	MIHIN GNINOU	ACT DE NSSCE N°1413 DU 21 08 06	Corn	0.09
59	MIHIN BIENVENU	1039451 DU 23 10 08	Corn	0.39
60	MIHIN TIENWAN	0717278 DU 19 06 08	Corn	0.39
61	MIHIN YAZOUMA	1891454 DU 11 05 10	Corn	1.15
62	DOUBARO MIHIN	0689903 DU 19 06 08	Sorghum Corn	0.19
63	YE SIANI		Corn	0.34
64	MIHIN NIEBEBE		Corn Millet Cotton	0.77
65	MIHIN ZINIKO	0727694 DU 04 06 08	Corn	0.32
66	MIHIN OUANOU	5164370 DU 07 12 12	Groundnuts Cotton Corn	1.54
67	MIHIN TINIENOU	0693539 DU 21 06 08	Corn	1.97
68	MIHIN YEREPOBE	0727655 DU 04 06 08	Cotton	0.68
69	MIHIN TIENWAN	0717278 DU 19 06 08	Corn Millet	1.94
70	KOHIWO GNISSAN	0669430 DU 05 06 08	Groundnuts Corn Cotton	3.18
71	GNOUMOU NAZOUNKI	0719180 DU 17 06 08	Corn Cotton Sorghum Groundnuts Sesame	3.27
72	GNOUMOU ANTOINE	0757330 DU 10 06 08	Sorghum Corn Cotton	2.46
73	YE MICHEL BAPOBA	2933003 DU 18 06 10	Corn Millet	0.90
74	YE NIBIRIEWOTAN	0669334 DU 05 06 08	Sorghum Corn	1.14
75	GNOUMOU GERARD DOUYIRI	0692739 DU 20 06 08	Corn Cotton	1.02
76	GNOUMOU AUBIN	0989493 DU 24 10 08	Corn Sorghum Cotton Beans	7.91
77	GNOUMOU NANI LIONCE	0719154 DU 17 06 08	Corn Sorghum Cotton	7.66
78	GNOUMOU MIETIEN	0730406 DU 02 06 08	Corn Sorghum	5.91
79	GNOUMOU HEBATIN	0692570 DU 2 0 06 08	Corn Groundnuts	4.93
80	YE WATIEN	1041210 DU 21 10 08	Corn Sorghum	5.56
81	YE NIBIRIEWOTAN	0669334 DU 05 06 08	Corn Cotton Sorghum Groundnuts	3.38
82	GNOUMOU DOFIWIYAN	0689940 DU 19 06 08	Corn Groundnuts Cotton Sorghum	3.51
83	GNOUMOU TIEMINEVO	1041240 DU 21 10 08	Corn Sorghum	2.70

84	LAMIEN BAGNAMOU	0694148 DU 21 06 08	Corn Sorghum	7.20
85	MIHIM LOWIAN JEAN BAPITISTE	0693329 DU 21 06 08	Corn Sorghum	1.67
86	LAMIEN ISSOUF	6582827 DU 30 01 12	Corn Sorghum	2.60
87	GNOUMOU BOROMO	0715747 DU 17 06 08	Corn Sorghum	1.44
88	GNOUMOU BOTI	ACT NSSCE N°38 01 04 1959	Corn Sorghum Groundnuts	1.00
89	GNOUMOU OUEENABANE BENI JONAS	6312345 DU 12 03 12	Corn Sorghum	2.20
90	YE POTIMOU	17 82687 DU 30 06 10	Corn Sorghum	6.78
91	GNOUMOU YANZON		Corn	1.95
92	GNOUMOU DONOU ERNEST	00989432 DU 24 10 08	Corn Sorghum	1.59
93	YE NDOUDIE	0717312 DU 19 06 08	Corn Sorghum Cotton	5.33
94	YE DAMAWONI	EXTR 497 DU 02 05 97	Corn Cotton Groundnuts	6.61
95	YE SARI	0990668 du 24 01 2008	Corn Sorghum Cotton	6.61
96	LAMIEN ANTOINE	0600138 DU 19 06 08	Corn Sorghum	0.79
97	YE YAZON	CARTE CONSULAIRE N°1426058 DU 21 09 95	Corn Cotton Beans	6.63
98	GNOUMOU LOTE	0755243 DU 10 06 08	Corn Sorghum	0.68
99	YE MAHOUISSOUSSOUNOU	1040992 DU 21 10 08	Corn Sorghum	1.44
100	YE DAKIN	CARTE SCOLAIRE N°23 2012-2013	Corn Sorghum	1.39
101	YE MAKANENOU	0669544 DU 05 06 08	Corn Sorghum	0.45
102	YE YAZOUMA	2619348 DU 27 07 10	Sorghum Corn	0.47
103	GNOUMOU ZOUMOUNITE	0729101 DU 03 06 08	Corn Sorghum Groundnuts	1.33
104	YE DAKONOU	0719129 DU 17 06 08	Corn Groundnuts Sorghum	2.89
105	YE BOTOUBE	CNB 4615708 DU 29 01 95	Corn Groundnuts Sorghum	1.29
106	YE JANVIER	0719135 DU 17 06 08	Corn Sorghum	1.54
107	YE MAKANENOU	0669544 DU 05 06 08	Corn Sorghum	2.83
108	GNOUMOU ERNEST	0729038 DU 03 06 08	Corn Cotton Beans Sorghum	4.67
109	YE SAWARI	0989010 DU 24 10 08	Cotton Corn	1.87
110	YE LIBAHO	0731664 DU 03 06 08	Corn Sorghum	3.36
111	YE PANGAPOBE	2325227 DU 05 07 10	Corn Sorghum	3.20
112	YE LONABANPATRICE	0757249 DU 10 06 08	Corn Cotton Sorghum	1.03
113	BAMBIO VANIEYAGNIBATEBAVE	0731659 DU 03 06 08	Corn Cotton Sorghum	6.44
114	GNOUMOU FRANCOIS	CARTE SCOLAIRE N°20	Corn Cotton Sorghum	3.18
115	YE AMADO SAWARE	4320396 DU 05 10 12	Corn Cotton Sorghum	8.98
116	GNOUMOU LOTI	0689589 DU 19 06 08	Groundnuts Corn Cotton Sorghum	6.74
117	GNOUMOU YANZON PAULIN	0728028 DU 04 06 08	Corn Cotton Beans Groundnuts Sorghum	5.76
118	GNOUMOU DOMOU	0719103 DU 17 06 08	Corn Sorghum	7.47
119	GNOUMOU SIEZAGA	0689663 DU 19 06 08	Corn Sorghum Groundnuts	3.16
120	GNOUMOU JACQUE	0766726 DU 23 06 08	Corn Sorghum Groundnuts	2.45
121	GNOUMOU LOHAMI GEORGES	0769264 DU 23 06 08	Beans Sorghum Corn Cotton Okra Groundnuts	14.09

122	GNOUMOU TIENWOUIMAHOUN	3300522 DU 24 03 10	Corn Sorghum	0.97
123	YE LOTIOHI	0720698 DU 18 06 08	Fallow land (Sorghum Corn)	2.52
124	YE YEREMITE	5622059 DU 30 05 12	Sorghum Corn	3.87
125	YE SIYIOSSAN CHRISTOPHE	0689971 DU 19 06 08	Sorghum Corn Cotton Groundnuts	2.41
126	BAMBIO PÈRE	CNI 2958332 DU 08 08 06	Sorghum Corn	1.68
127	YE DOFINITIE	EXTRAIT 294 DU 18 03 13	Corn Sorghum	3.24
128	GNOUMOU BOUNOUSSAN	3297986 DU 24 03 10	Corn Sorghum	6.58
129	GNOUMOU NIEDOUBE	0757298 DU 10 06 08	Corn Millet	6.74
130	GNOUMOU DONOU ERNEST	0989432 DU 24 10 08	Corn Millet	2.76
131	GNOUMOU YANZON		Corn Millet	1.56
132	GNOUMOU DOUBASIN		Corn Millet	3.11
133	GNOUMOU DONOU ERNEST	0989432 DU 24 10 08	Corn Millet	1.07
134	GNOUMOU DOFINBIE	6756936 DU 01 10 10	Corn Sorghum	5.14
135	GNOUMOU DONFIHOUYAM	1042147 DU 21 10 08	Corn Sorghum	0.95
136	GNOUMOU DOUHASSAN	0715924 DU 17 06 08	Groundnuts	1.33
137	GNOUMOU TIANPOBE	EXTRAIT 920 DU 07 02 2001	Corn Sorghum	5.61
138	GNOUMOU BIENOUMI		Corn Cotton	1.63
139	GNOUMOU MICHEL	0692719 DU 20 06 08	Groundnuts Sesame	4.16
140	YE NIBERIEWOTAN	0669334 DU 05 06 8	Sorghum Corn	3.38
141	GNOUMOU SAWARIE	3293729 DU 20 03 10	Millet Corn Sorghum Beans	2.84
142	YE DOMABO	0715851 DU 17 06 08	Cotton Millet	1.65
143	GNOUMOU DIANOUE	S/C GNOUMOU MADOU CNIB 0719597 DU 24 06 08	Sorghum	2.69
144	GNOUMOU MICHEL YAROBIE	EXTRAIT N° 418	Sorghum Mäis Beans	4.43
145	GNOUMOU NITINOUE	CNB 1198325 DU 03 03 03	Corn Sorghum Cotton	5.70
146	GNOUMOU TIABAYEHIN	0589016 DU 26 05 08	Sorghum Corn Groundnuts Millet	12.31
147	GNOUMOU HANITA	EXTRAIT N° 503 DU 18 12 1966	Sorghum Groundnuts	3.19
148	GNOUMOU GNOUMANOU	S/C GNOUMOU SAWARIE CNIB 3293729 DU 20 03 10		1.76
149	YE TIENWA	0715779 DU 17 06 08	Corn Cotton Sorghum	3.08
150	YE DABA	0715825 DU 17 06 08	Corn Cotton Sorghum Beans	3.31
151	YE YANZON		Corn Sorghum Cotton	0.90
152	YE WEYERE	CIB 3055778(ILLISIBLE) DU	Cotton Sorghum Millet Corn	2.48
153	GNOUMOU SIBINOUE	6933208 DU 21 10 10	Corn Sorghum Millet	11.08
154	GNOUMOU PANGA	1799573 DU 10 06 10	Corn Sorghum Groundnuts	0.00
155	GNOUMOU DOUBAHIEHO	6943208 DU 27 10 10	Millet Corn Beans	2.51
156	GNOUMOU BOTIN	EXTR 704 05 10 10	Corn Sorghum Cotton Groundnuts	1.32
157	GNOUMOU KASSOUM HINIEVO	6936897 DU 22 10 10	Corn Sorghum Cotton Groundnuts	7.35
158	GNOUMOU OUAZOUNOU	1939916 DU 28 06 10	Beans Corn Sorghum Cotton Groundnuts	3.85
159	YE TAMOUTIN	0990807 DU 24 10 08	Sorghum Corn Sorghum Cotton	1.57

160	YE BIAVO	0754356 DU 09 06 08	Corn Cotton Groundnuts	2.15
161	YE BERNARD	0690085 DU 19 06 08	Cotton Corn Sorghum	2.04
162	YE DRISSA	0754377 DU 09 06 08	Groundnuts Cotton Corn Sorghum	0.00
163	MIHIN NIEBERA	545273 DU 08 05 13	Sorghum Corn	1.30
164	YE HEKOHOU	6540767 DU 09 04 12	Sorghum Corn	1.96
165	YE SIETE	6937327 DU 22 10 10	Corn Sorghum Rice	3.57
166	YE NAHAYE	0990633 DU 24 10 08	Cotton Corn Sorghum	1.52
167	YE ZOUNOUMITIE	0990990 DU 24 10 08	Cotton Corn Sorghum	7.05
168	YE LOMBATE	0689991 DU 19 06 08	Cotton Corn Sorghum	1.67
169	YE SIMON	1799750 DU 10 06 2010	Corn Sorghum	4.22
170	LAMIEN YERESSA	0690037 DU 19 06 08	Cotton Corn Sorghum	2.23
171	LAMIEN NIANTA LOMITE	0717859 DU 19 06 08	Cotton	0.74
172	YE KANI	CNIB 0754402 DU 09 06 08	Corn Sorghum Groundnuts Millet Beans	10.87
173	YE DOFINITA		Corn Sorghum Beans	2.12
174	YE YEREAVE ROMAIN	0985939 DU 23 10 08	Sorghum Groundnuts	1.05
175	YE HABILOUYA	CNIB 0754402 DU 09 06 08	Cotton Corn Sorghum Groundnuts	10.69
176	YE YEREPOBE	1039411 DU 23 10 08	Corn Sorghum Groundnuts	2.12
177	YE SIEYINOU	0719128 DU 17 06 08	Corn Sorghum Groundnuts	3.20
178	YE WOGAWE	0729199 DU 03 06 08	Sorghum Corn Cotton	1.42
179	YE KATIENRO	5623254 DU 28 05 12	Sorghum Corn Cotton	4.77
180	YE BONOU S/C YE KATIENRO	5623254 DU 28 05 12	Corn Sorghum	0.63
181	YE PANGAPOBE NESTOR	0716064 DU 18 12 08	Corn Sorghum Cotton Rice Watermelon	2.77
182	MIHIN MOKONOU	1043168 DU 23 10 08	Millet Corn Cotton Groundnuts	2.29
183	YE DOFINITA		Corn Sorghum Cotton	3.89
184	YE KANI	1041073 DU 21 10 08	Corn Sorghum Cotton	5.22
185	YE KATIENRO	5623254 DU 28 05 12	Corn Sorghum Groundnuts Cotton	1.68
186	YE SIEOUYAN EZECHIEL	0727686 DU 04 06 08	Corn Millet Cotton Groundnuts	2.64
187	YE OUETELO	2327791 DU 05 07 10	Corn Cotton Sorghum	3.01
188	YE FRANCOIS	CNB 1718977 DU 14 04 05	Corn Cotton Millet Groundnuts	0.85
189	GNOUMOU NAZOUNKI	0719180 DU 17 06 08	Millet Corn	2.18
190	YE DOFINITIE		Cotton Corn	1.64
191	MIHIN OUIBAHO		Corn Sesame	0.22
192	MIHIN DOUBARO		Sorghum Groundnuts Corn	0.45
193	YE OUETELO	2327791 DU 05 07 10	Corn Sorghum Cotton	0.81
194	MIHIN ZINIKO		Corn Sorghum Cotton	0.60
195	MIHIN DOUBARO		Corn Sorghum Cotton	1.37
196	MIHIN LOUYIA		Cotton Corn	0.39
197	MIHIN YAZOUMA	1891454 DU 11 05 10	Corn Sorghum Cotton	0.27

198	MIHIN YEREPOBE	0727655 DU 04 06 08	Corn Sorghum Cotton	0.43
199	GNOUMOU AUBIN	0989493 DU 24 10 08	Corn Sesame	2.16
200	YE KARAFI		Sorghum Groundnuts	0.39
201	MIHIN ZOUNOUTIE		Corn Sorghum	0.42
202	MIHIN MOKONOU	1043168 DU 23 10 08	Corn Sorghum	0.66
203	MIHIN LOTIEN		Corn Sorghum	0.55
204	YE YEREPOBE	1039411 DU 23 10 08	Corn Cotton	1.50
205	BONOU PANGAPOBAN	0721188 DU 19 06 08	Corn Sorghum	0.40
206	YE YIEZOUMA	0689611 DU 19 06 08	Corn Cotton Sorghum	1.37
207	YE NAJOUNOU	0986014 DU 23 10 08	Corn Cotton Sorghum	1.11
208	YE YANZON	0690118 DU 19 06 08	Corn Cotton Beans Rice Groundnuts Sorghum	9.49
209	YE PÈRE		Cotton Corn Sorghum	4.83
210	YE LELIMI N'DOUFOUI	3297443 DU 23 03 10	Sorghum Corn	5.84
211	OUEDRAOGO SOULEYMAN		Corn Sorghum	1.08
212	KOHIO SIEHOUYAN	5668296 DU 17 05 11	Groundnuts Sorghum	0.99
213	LAMIEN YERESSA	0690037 DU 19 06 08		0.85
214	LAMIEN YERESSA	0690037 DU 19 06 08	Corn Sorghum Cotton	1.79
215	LAMIEN NIENDOUBA		Groundnuts Corn Sorghum Cotton	0.64
216	LAMIEN NAZOUNOU			0.61
217	LAMIEN WIBEHOU		Corn Sorghum Cotton	0.45
218	LAMIEN SANI		Groundnuts Corn Sorghum Cotton	0.39
219	YE BOUGNATEBEIHIN	5534084 DU 01 01 11	Corn Sorghum Cotton	2.43
220	MIHIN LIENIBA GILBERT	EXTR N°1629 DU 12 07 12	Groundnuts Sorghum Corn	0.51
221	LAMIEN ZOUNOUTI	EXTR N°413 DU 04 10 95	Corn	1.13
222	MIHIN YEREPOBE	0727655 DU 04 06 08	Corn Sorghum	1.86
223	LAMIEN SANI		Corn Sorghum Cotton	1.38
224	LAMIEN OUIBEBAHOU		Corn Sorghum Cotton	0.39
225	YE DONFINTE	0669419 DU 05 06 08	Corn Sorghum	1.88
226	YE NIKIEGNOUNOU	0717411 DU 19 06 08	Corn Sorghum	0.35
227	DAHOUROU GNIKY EDOUARD	0990991 DU 24 10 08	Groundnuts Sorghum Corn	2.50
228	YE LADINENOU	0715985 DU 17 06 08	Corn Sorghum Beans	1.33
229	LAMIEN SANI		Cotton Sorghum Corn	0.61
230	YE SIEGNOUNOU	0757339 DU 10 06 08	Cotton Corn Sorghum Groundnuts	8.56
231	YE HABILOUYA	0754402 DU 09 06 08	Corn Sorghum Cotton	5.62
232	MIHIN YAZOUMA	1891454 DU 11 05 10	Cotton Corn Sorghum	2.88
233	MIHIN LOSSAN	1267679 DU 25 05 09 BOBO	Corn Sorghum	3.10
234	MIHIN LOUIAYA		Corn Sorghum Cotton	0.98
235	YE KANI	CNIB 0754402 DU 09 06 08	Corn Sorghum Groundnuts Cotton	6.64
236	YE PANGAPOBE NESTOR	0716064 DU 18 12 08	Corn Millet Cotton	2.99
237	YE LOHO	1891268 DU 11 05 10	Millet Corn Groundnuts Cotton	3.59

238	YE NIEDOUBA	EXTR N° 150 09 09 1962	Corn Millet Groundnuts Beans	6.29
239	YE NAJOUNOU	0986014 DU 23 10 08	Corn Cotton Groundnuts Sorghum	5.23
240	YE DIEUDONNE	4892868 DU 13 06 12	Corn Sorghum Cotton	1.94
241	YE YEREPOBE	1039411 DU 23 10 08	Corn Sorghum Cotton Groundnuts	7.47
242	YE LAMOUSSA BIENVENU	1892127 DU 12 05 10	Corn Millet Groundnuts Beans	2.79
243	YE DIEUDONNE	4892868 DU 13 06 12	Corn Beans Groundnuts	1.10
244	KOUADIO SOGUIE		Corn Sorghum	3.10
245	YE YEREAVE ROMAIN	0985939 DU 23 10 08	Corn	0.32
246	YE YEREPOBE		Beans Groundnuts Corn	1.04
247	YE HOLOYAMIZOUNOU	1039369 DU 23 10 08	Groundnuts Millet Beans	0.75
248	YE KANI PASCAL	3294327 DU 20 03 10	Millet Corn	1.46
249	YE LAWA		Millet Corn Groundnuts	1.33
250	YE YEREPOHOUIA EUGENE	6836217 DU 04 10 10	Millet Groundnuts	0.86
251	YE MAHOUISSOUSSOUNOU	1040992 DU 21 10 08	Millet	1.70
252	YE GNOUMOUNANOU	0717182 DU 18 06 08	Corn	0.57
253	YE KANI PASCAL	3294327 DU 20 03 10	Groundnuts Peas	0.54
254	YE ZONOMITE	1039301 DU 23 10 08	Millet Corn	0.32
255	YE YAZOUMA	2619348 DU 27 07 10	Corn Sorghum	0.21
256	YE BIAVO	0754356 DU 09 06 08	Groundnuts Millet	1.07
257	YE GNOUMOUNANOU	0717182 DU 18 06 08	Corn Groundnuts Sorghum	0.59
258	YE YAZOUMA	0730455 02 06 08	Corn Sorghum Groundnuts	0.42
259	YE TIATIEN	0990621 DU 24 10 08	Corn Groundnuts	0.20
260	YE MAHOUISSOUSSOUNOU	1040992 DU 21 10 08	Corn	0.15
261	YE YEREPOHOUIA EUGENE	6836217 DU 04 10 10	Corn	0.25
262	LAMIEN ZOUNOUSSAN	0727697 DU 04 06 08	Corn Cotton Beans	0.00
263	YE DAZOUNOU	0717197 DU 18 06 08	Corn Rice	4.58
264	YE DONFITA	0669419 DU 05 06 08	Sorghum Corn Cotton	0.47
265	YE WOHOUNOU		Sorghum Corn Cotton	0.43
266	YE TINIENOU	0754361 DU 09 06 08	Sorghum Corn Cotton	1.86
267	YE FRANCIS		Sorghum Corn Cotton	0.48
268	YE SIEHOUYEN		Sorghum Corn Cotton	20.43
269	YE DOUTIEN	3320136 DU 20 09 10	Sorghum Corn Cotton	5.83
270	SOUANE YADIAMI	6756765 DU 0110 10	Cotton Corn	2.38
271	MIHIN DOTIN	0989375 DU 24 10 08	Corn Sorghum	1.28
272	MIHIN YEREPOBE	0727655 DU 04 06 08	Corn Sorghum Cotton Groundnuts	1.62
273	YE BOUGNATEBIEIN	5534084 DU 01 01 11	Corn Millet	5.05
274	MIHIN OUANOU	5164370 DU 07 01 12	Corn Sorghum	6.58
275	YE YANZON	3300530 DU 4 03 10	Corn Sorghum Cotton	2.01
276	YE DONFITA	0669419 DU 05 06 08	Sorghum Groundnuts	3.00
277	YE SIEHAMI	6756765 DU 0110 10	Corn Sorghum	1.80

			Groundnuts	
278	YE TINIENOU	0754361 DU 09 06 08		8.75
279	MIHIN TIENIENOU	0693539 DU 21 06 08	Corn	1.01
280	YE DONFOUIN	0715873 DU 17 06 08	Corn Sorghum	1.15
281	YE DONFOUIN	0715873 DU 17 06 08	Sorghum	1.23
282	YE DONFOUIN	0715873 DU 17 06 08	Sorghum	1.61
283	YE ZOUNDO	S/C LAMIEN HINKAIN CARTE ELEC 02560057	Corn Millet	2.62
284	YE LOMBATA	1917376 DU 08 06 10	Beans Millet	0.72
285	SOUANE YADIAMI	0693600 DU 21 06 08	Corn Mil Groundnuts	2.20
286	YE YEREPOBA	0721227 DU 19 06 08	Corn Sorghum Cotton	5.47
287	YE VYDOUBE BRUNO	0693585 21 06 08	Corn Millet Groundnuts Cotton Beans	6.21
288	YE DAZOUNOU	3298871 DU 24 03 10	Corn Sorghum Cotton Beans	6.31
289	YE KOUANOU S/C YE WOKANE	0721176 19 06 08	Groundnuts Corn Sorghum Cotton	11.60
290	YE KOKI	EXTR 0118 DU 08 10 79	Cotton Millet Groundnuts	1.52
291	YE MAMADOU	CIB 3449989 DU 25 10 07	Millet Corn Beans Cotton	1.53
292	YE KOKI	EXTR 0118 DU 08 10 79	Corn	0.29
293	YE NIEDOUBE	5252081 DU 28 11 12	Corn Sorghum Beans Cotton	1.55
294	YE YANZON	1041071 DU 21 10 08	Sorghum	0.80
295	YE KOKI	EXTR 0118 DU 08 10 79	Corn Millet	1.26
296	YE KOYIDALE	0990618 DU 24 10 08	Cotton Sorghum Corn Rice	7.43
297	YE ROBERT	0727735 DU 04 06 08	Cotton Sesame Corn Groundnuts Beans	5.12
298	YE PHILIPPE	0731619 DU 04 06 08	Corn Cotton	4.56
299	YE MAMADOU	CNB 3449989 DU 25 10 07	Groundnuts Peas Cotton	2.56
300	YE SIDIKI	0719115 DU 17 06 08	Corn Millet	1.92
301	YE SOUMBE	0690036 DU 15 06 08	Corn Millet Cotton	3.49
302	YE DAZOUNOU	3298871 DU 24 03 10	Cotton	1.45
303	CHAMP HORS DU PERMIS			0.68
304	KOHIO YERETE	6264049 DU 07 02 12	Corn Sorghum	1.07
305	YE ZOUNOUMITE	0989320 DU 24 10 08	Corn Cotton Groundnuts	1.96
306	YE MATAMI	0732458 DU 02 06 08	Corn Sorghum Cotton	2.49
307	YE WATIEN	0524993 DU 29 11 12	Corn Sesame	0.64
308	YE OUAZOUNOU	0717039 DU 18 06 08	Corn Sorghum Cotton Groundnuts Beans	3.28
309	YE BIELIEMI BENJAMIN	0727795 DU 04 06 08	Corn Sorghum Cotton	2.19
310	YE YANZON	1041071 DU 21 10 08	Corn Sorghum Cotton	3.60
311	YE SILOMI	CIB 2958163 DU 19 06 06	Corn Sorghum Cotton	3.33
312	YE DAOUDA	1717392 DU 080610	Corn Sorghum Cotton	7.56
313	BONOU PANGAYAVE	3298398 DU 06 03 10	Corn Cotton	4.37
314	YE BINIBIE	0669585 DU 05 06 08	Corn Sorghum	5.38

315	YE DANZOUNOU	0689945 DU 19 06 08	Corn Sorghum	2.03
316	YE MAKANIEMOU	LIVRET FAMILLE N° 301 DU 02 11 98	Corn Sorghum	1.32
317	BARRY ADAMA	1039723 DU 23 10 08	Beans Cotton	2.11
318	BARRY ADAMA		Beans Cotton	0.65
319	GNOUMOU PANGUE	1042181 DU 21 10 08	Corn Sorghum Beans	0.57
320	BARRY ADAMA		Mil	0.34
321	LAMIEN BOUZOUZOUNOU		Corn Sorghum Groundnuts	4.19
322	TINDO DOFONKI		Corn Sorghum Millet Cotton Groundnuts Beans	6.46
323	TINDO BAGANOU	CIB 5677883 DU	Sorghum Corn Cotton	2.19
324	TIENDO BENIMI	0989034 DU 24 10 08	Corn Sorghum Groundnuts Cotton	7.96
325	TINDO GNESSANKI	1039857 DU 23 10 08	Corn Cotton	4.28
326	TINDO ALLASSANE		Cotton Groundnuts Beans	1.87
327	TINDO DOFINVAIYA		Beans Cotton	2.49
328	TINDO SANLON	09864 10 DU 24 10 08	Corn Mil Cotton Groundnuts Cotton Beans	6.10
329	YE YIEZOUMA	0689611 DU 19 06 08	Beans	0.18
330	GNOUMOU DENIS	S/C GNOUMOU SIEDOUBA CNIB 0716022 DU 17 06 08	Corn Millet Groundnuts	1.28
331	GNOUMOU KOHIDARE	EXTR 7208 DU 24 12 09	Corn Cotton Groundnuts	1.35
332	GNOUMOU NIEDOUBA	6822110 DU 02 10 10	Corn Millet Cotton	1.73
333	GNOUMOU SIEDOUBA	0716022 DU 17 06 08	Millet Groundnuts Cotton	1.46
334	YE FELIX		Groundnuts Sorghum	0.76
335	GNOUMOU BAGABOWE	0690002 19 06 08	Millet Corn Cotton Groundnuts Beans	12.43
336	GNOUMOU BAGABOWE		Sorghum	0.95
337	GNOUMOU MICHEL	1779196 DU 30 06 10	Sorghum Groundnuts	1.01
338	GNOUMOU BOBAHAOUGOUM BERNADIN	0721070 DU 19 06 08	Corn Sorghum Beans	5.67
339	YE DOFIMITE		Corn Sorghum Beans	0.53