PROPONENT:

MS. CHINA CHONGQING HANDU CONSTRUCTION MACHINERY CO LTD

P.O. BOX 4724-00100, NAIROBI

PROPOSED HEAP LEACHING PROCESS PLANT

ON PARCEL KADEM/MACALDROR/175, IN KALANGE SUB-LOCATION, MIKEI LOCATION, NYATIKE SUB-COUNTY, MIGORI COUNTY

ENVIRONMENT & SOCIAL IMPACT ASSESSMENT

STUDY REPORT

TORS REF: NEMA/TOR/5/2/777

AUGUST 2024

LEAD CONSULTANT:

ERICK ABUGA
LEAD EXPERT
NEMA REGISTRATION 2675

Ecomatrix Consultancy

Environment Impact Assessment, Occupational safety, And Health Environmental Audits.

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DECLARATIONS
BY LEAD EXPERT:

I hereby submit this Environmental Impact Assessment project report for the **PROPOSED HEAP LEACHING PROCESS PLANT ON PARCEL KADEM/MACALDROR/175, IN KALANGE SUB-LOCATION, MIKEI LOCATION, NYATIKE SUB-COUNTY, MIGORI COUNTY** to the office of the County Director of Environment; MIGORI County. All information contained in this report is accurate and a truthful representation of all findings as relating to the project to the best of my knowledge.

Signature .....
Mr. Erick N. Abuga
Designation: **EIA/Audit Lead Expert Reg. No 2675**

Date...29/08/2024

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BY PROPONENT:

I…….The Proponent's representative; submit this Environmental Impact Assessment project Report for **PROPOSED HEAP LEACHING PROCESS PLANT ON PARCEL KADEM/MACALDROR/175, IN KALANGE SUB-LOCATION, MIKEI LOCATION, NYATIKE SUB-COUNTY, MIGORI COUNTY.** To the best of my knowledge all information contained in this report is accurate and a truthful representation of all findings as relating to the project.

Signature …… Date……
Designation: ……... Stamp:

Contents

ACKNOWLEDGEMENTS

The Experts take this opportunity to thank the project Proponent **China Chongqing Handu Construction Machinery Co Limited** for giving us a chance to conduct this Environmental Impact Assessment (EIA). This was done in an endeavour to comply with the Legal requirement as stipulated in section 58 of the Environmental Management and Co-ordination Act (EMCA) of 1999 legal Notice No.8. Sincere thanks to our client for availing the necessary documentation and facilitating the site visits to enable the expert and his team to effectively carry out the EIA. We would also like to thank all the participants who took their time to listen to us, gave us their views on the project by attending the organized Baraza as well as filling out the public participation questionnaires, and furnishing us with the information needed to complete this report.

ACRONYMS AND ABBREVIATIONS

a.s.l	Above sea level
BD	Biodiversity
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
CBD	Convention on Biodiversity
CGM	County Government of Migori
COD	Chemical Oxygen Demand
CO	Carbon Monoxide
CO2	Carbon Dioxide
DOHS	Director of Occupational Health and Safety Services
EIA	Environmental Impact Assessment
EA	Environmental Audit
EMCA	Environmental Management and Co-ordination Act, 1999
EMP	Environmental Management Plan
EHS	Environmental, Health and Safety
GDA	Gold Dissolving Agent
GHG	Greenhouse Gas
GOK	Government of Kenya
Ha	Hectares
I&AP	Interested and affected parties
ISO	International Standard Organization
KES/Kshs	Kenya Shillings
km	Kilometres
m	Meters
NEAP	National Environmental Action Plan
NEMA	National Environmental Management Authority
NOx	Nitrogen oxide
O_3	Ozone
PH	Potential hydrogen
MIWASCO	Migori Water and Sewerage Company
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Act
PPEs	Personal Protective Equipment
SERC	Standards and Enforcement Review Committee
TOR	Terms of reference
WRMA	Water Resources Management Authority

DEFINITION OF TERMS

Authority: Refers to NEMA established under section 7 of the Environmental Management and Coordination Act, 1999, (Amendment 2015).

Decommissioning: This is the permanent withdrawal from a site or close down of a facility for restoration.

Developer/Proponent: Means a person proposing or executing a project which is subjected to an ESIA or undertaking an activity specified in the second schedule of Environmental Management and Coordination Act, 1999, (Amendment 2015).

Environment: Physical factors of surroundings of human beings including land, water, atmosphere, climate, sound, odour, taste, the biological factors of animals and plants and social factor of aesthetics, culture and includes both the natural and the built environment.

Gangue: The commercially worthless material that surrounds, or is closely mixed with a wanted mineral in an ore deposit

Leaching: Process of extracting gold from tailings through GDA process. The gold is extracted from slurry of crushed gold ore tailings, water, and Gold Dressing Agent.

Mineral: A naturally occurring inorganic solid with a crystalline structure and a definite range of chemical formula

Mitigation: Measures which include engineering works, technology improvement management ways and means of minimizing negative aspects, including socio-economic and cultural losses suffered by communities and individuals, whilst enhancing positive aspects of the project.

Ore: A concentration of minerals in a rock that is high enough to be economically extracted for use

Scoping: Is the process of determining the content and extent of the matters which should be covered in the environmental information to be submitted to a competent authority for projects which are subject to ESIA.

Screening: It is a coarse analysis of the possible impacts of an action with a view to identifying those impacts which are worthy of detailed study for a project to be considered for an ESIA process or not.

Slurry: The thick pulp made from a solution of crushed tailings, and treated with GDA, mixed with caustic soda lime and hydrogen peroxide.

Standards: Means the limit of discharge or emission established under the Act or under Regulations.

Tailings: Remnant low grade ore left behind as waste after gold has been

EXECUTIVE SUMMARY

Introduction

This Environmental and Social Impact Assessment (ESIA) study report has been prepared in response to the requirements stipulated by the National Environment Management Authority (NEMA) under the reference number **NEMA/PR/MGR/5/2/1311 (PSR 48004)** for the proposed heap leaching processing plant located on Plot L.R. No. KADEM/MACALDROR/175 in Kalange Sub-location, Mikei Location, Nyatike Sub-county, Migori County; **GPS coordinates -1.005618, 34.299703.** The purpose of this ESIA is to assess the potential environmental and social impacts associated with the proposed project and to outline appropriate mitigation measures to address any identified risks.

Background

The proponent, China Chongqing Handu Construction Machinery Co. Ltd, submitted a comprehensive project report for the proposed heap leaching processing plant to NEMA on **11th March 2024**. The project involves the extraction of precious metals from ore through heap leaching, a hydrometallurgical process that uses chemical solutions to dissolve the target metals from the ore. Following an initial review, NEMA advised that a detailed Environmental & Social Impact Assessment (ESIA) study be conducted to further evaluate the potential impacts of the project and ensure compliance with environmental regulations. The terms of reference for this ESIA were subsequently prepared and approved by NEMA on **19th August 2024** under reference **NEMA/TOR/5/2/777**.

Project Overview

The proposed heap leaching processing plant is designed to enhance the extraction of precious metals from ore, contributing significantly to the local economy by providing employment opportunities and stimulating local businesses. However, it also poses potential environmental and social risks, which this study aims to evaluate and address.

Legal and Regulatory Framework

This ESIA has been conducted in accordance with the Environmental Management and Coordination Act (EMCA), 1999, the Environmental (Impact Assessment and Audit) Regulations, 2003, and subsequent amendments. The project is also aligned with other relevant national and international legal frameworks and standards, including climate change adaptation and mitigation requirements as per the Climate Change Act, 2016.

Methodology

The ESIA study employed a multidisciplinary approach, incorporating both primary and secondary data collection methods. Environmental baseline studies were conducted to assess the current state of the project site, covering aspects such as water quality, air quality, soil characteristics, biodiversity, and socio-economic conditions. Public participation and stakeholder engagement were also integral to the study, ensuring that the concerns and suggestions of the local community and other stakeholders were considered.

Key Findings

i. **Environmental Impacts:**

- **Water Resources:** Potential contamination of surface and groundwater due to the leaching process. Mitigation measures include the construction of containment systems and regular monitoring of water quality.
- **Air Quality:** Emissions from machinery and dust generation during construction and operation phases. Mitigation measures include dust suppression techniques and the use of low-emission equipment.
- **Soil and Land Use:** Potential soil degradation and land disturbance. Mitigation measures involve implementing soil conservation practices and ensuring proper waste management.

ii. Social Impacts:

- **Employment and Economic Benefits:** The project will create job opportunities for local residents, contributing to poverty reduction and economic development in the region.
- **Community Health and Safety:** Risks associated with increased traffic, noise, and potential exposure to hazardous materials. Mitigation measures include traffic management plans, noise control measures, and health and safety training for workers and the local community.

iii. Climate Change Considerations:

- A detailed climate change risk and vulnerability assessment was conducted, and adaptation measures have been incorporated into the project design to ensure resilience against climate-related impacts.

Mitigation Measures and Environmental Management Plan (EMP)

An Environmental Management Plan (EMP) has been developed to guide the implementation of mitigation measures throughout the project lifecycle. The EMP outlines specific actions, responsibilities, and monitoring frameworks to ensure compliance with environmental and social safeguards. Regular audits and reporting mechanisms will be established to track the effectiveness of these measures.

Conclusion and Recommendations

The ESIA study concludes that while the proposed heap leaching processing plant has the potential to generate significant economic benefits; it also poses environmental and social risks that must be carefully managed. The implementation of the proposed mitigation measures and adherence to the EMP will minimize these risks, ensuring that the project proceeds in an environmentally sustainable and socially responsible manner. The report recommends that NEMA grant approval for the project, subject to the strict implementation of the outlined conditions.

1.0 INTRODUCTION

1.1 Background

The Environmental & Social Impact Assessment (ESIA) for the proposed heap leaching process plant in Nyatike Sub-County, Migori County, has been conducted to meet the requirements of the Environmental Management and Co-ordination Act (EMCA) of 1999 and its subsequent amendments, as well as the Environmental (Impact Assessment and Audit) Regulations of 2019. The project, which is being developed by China Chongqing Handu Construction Machinery Co. Limited, involves the establishment of a heap leaching process for gold extraction on Parcel KADEM/MACALDROR/175 in Kalange Sub-Location, Mikei Location, Nyatike Sub-County.

1.2 Objectives of the EIA Study

The main objectives of this ESIA study are:

- To collect and analyze baseline environmental, social, and economic data within the project area.
- To identify and evaluate potential environmental and social impacts of the proposed heap leaching project.
- To propose appropriate mitigation measures for the identified negative impacts and enhancement measures for the positive impacts.
- To ensure that all legal and regulatory requirements are met, including those for public participation and stakeholder engagement.
- To develop an Environmental Management Plan (EMP) that will guide the construction, operation, and decommissioning phases of the project.
- To compile an EIA report for submission to the National Environmental Management Authority (NEMA) for approval and licensing.

This report represents the findings of the ESIA study and is structured as follows:

Section 1 provides an introduction to the project and sets out the format and contents of the report

Section 2 outlines the environmental policy, institutional and legislative framework in Kenya relevant to the proposed project. International treaties and agreements on environmental protection and conservation to which the GOK is committed are also outlined.

Section 3 describes the baseline environmental conditions in the project area in sufficient detail to enable an adequate assessment of probable environmental impacts. The baseline studies were both desk and research based supported by secondary data.

Section 4 describes the project design and proposed activities.

Section 5 describes climate change risks and vulnerability.

Section 6 describes the public consultation process that was undertaken and its findings.

Section 7 describes the probable environmental impacts of the proposed project. The assessment includes an evaluation of impacts associated with the construction, operation and decommissioning phases.

Section 8 Presents mitigation measures proposed.

Section 9 describes the alternative options for the project.

Section 10 Presents Environmental Management Plan (EMP) for the construction, operation and decommissioning phases

Section 11 presents the consultants' conclusion and recommendations.

1.3 Methodology of the EIA Study

The EIA study methodology involved several steps:

- **Screening**: The project was identified as requiring an EIA under the Second Schedule of EMCA 1999. This initial step determined the environmental relevance of the project, taking into account its type, location, and potential impacts.
- **Scoping**: A scoping exercise was conducted to focus on significant environmental and social impacts. This involved consultations with the project proponent, consultants, and key stakeholders to clarify the project details and identify key environmental aspects for further assessment.
- **Data Collection**: Baseline environmental data were gathered through desk studies, field surveys, and consultations. The field assessments included site visits, observations, and photography to capture the physical, biological, and social conditions of the project area.
- **Impact Assessment**: A checklist was used to assess potential impacts. Significant environmental effects were identified, and their overall impact was evaluated. The assessment included both positive and negative impacts across the construction, operation, and decommissioning phases of the project.
- **Public Participation**: Stakeholders, including local communities, were engaged through public meetings, questionnaires, and interviews. Their input was considered in the impact assessment and in the development of mitigation measures.
- **Report Preparation**: The findings from the study were compiled into this EIA report, structured to comply with the legal requirements and to facilitate review and approval by NEMA.

1.4 Duties of the Proponent

The proponent, China Chongqing Handu Construction Machinery Co. Limited, is responsible for ensuring compliance with all financial, legal, and environmental requirements. This includes obtaining necessary permits, implementing the EMP, and monitoring environmental impacts during the project's lifecycle.

1.5 Duties of the Contractor

The contractor appointed by the proponent will be responsible for adhering to the EMP, implementing mitigation measures during construction, and ensuring that all environmental and safety regulations are followed. The contractor will also be required to report on environmental performance regularly and address any non-compliance issues promptly.

1.6 Project Cost

The estimated cost of the heap leaching process plant project, including all associated environmental management activities, is **KSHs. 65,890,000.** This includes the costs for environmental monitoring, implementation of mitigation measures, and any necessary remedial actions. *(See Bill of Quantities in Appendix 6).*

2.0 POLICY, LEGAL AND REGULATORY FRAMEWORK

2.1 Policy Framework

The Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations, while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating disasters, protecting the ozone layer and maintaining an ecological balance on earth.

2.1.1 National Environmental Action Plan (NEAP)

According to the Kenya National Environmental Action Plan (NEAP, 1994) the government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programs that disregard environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

2.1.2 The National Industrialization Policy

Aligned with Kenya Vision 2030, this policy focuses on value addition, linking industrial sub-sectors, and fostering rapid industrialization. It provides strategic direction for sector growth and development.

2.1.3 Mining and Minerals Policy

This policy guides sustainable mineral resource development, addressing governance, environmental protection, equity, value addition, post-mine closure, capacity building, and promoting appropriate technology for increased mining sector investment.

2.2 Legal and Regulatory Framework

2.2.1 Environment Management and Coordination Act (EMCA), 1999

The EMCA, 1999 provides the legal framework for management of the Environment and other related issues in Kenya. It is the Policy of the Government of Kenya that EIA be conducted for planned projects that are likely to cause, or will have, significant impacts on the Environment, so that the adverse impacts can be foreseen, eliminated or mitigated. It is also policy of the Government that the EIA process be interdisciplinary, fully transparent so that the stakeholders have access and can express their views. This is in order that the process serves to provide a balance between environmental, economic, social and cultural values for purposes of sustainable development of the entire country. The policy therefore, through the use and application of EIA, seeks to integrate environmental concerns in all development policies, plans, projects and programs of National, Regional, District and Local levels with full public participation of all stake holders. The undertaking and the administration of the EIA process for the proposed project will be in accordance with the

Environmental (Impact Assessment and Audit) Regulations, 2003 of the Kenya Gazette Supplement No. 56 that was published on 13th June 2003. Some of the Administrative procedures are as follows:-

- The EIA process will be applicable to both public and private sector development projects and programs.
- The projects to be submitted to EIA are specified in the Second Schedule of the EMCA, 1999. Beside the scheduled activities, the Act empowers the Minister in charge of Environment to prescribe the EIA appraisal any other activities, which in his view carries significant environmental impacts.
- NEMA will designate Environmental Committees to oversee implementation at County and Sub-County levels.
- NEMA will initiate public participation through uses of public notices and meetings with regard to proposed EIA studies and review of reports
- A scheduled activity will not receive the necessary authorization from NEMA to proceed, until all EIA requirements have been fulfilled and accepted by NEMA and other relevant Lead agencies.
    - EIA license will be granted when NEMA and the Minister are satisfied that an EIA has been satisfactorily conducted and that an Environmental Management Plan of that activity has been sufficiently developed.

    - Complains with regard to compliance with EIA Licensing requirements and procedures that NEMA may not resolve will be subjected to a review by the environment Tribunal. Under the Act, there are general provisions for appeal to high court and to bring the proceedings in a court of Law where necessary, for Judicial Review by third parties including concerned citizens and / or Organization's other than the Government.

The following legislations are relevant to the proposed project:-

- The Environmental Management and Co-Ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009 17.
- Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019
- The Physical Planning Act
- The Local Authority Act
- The Public Health Act
- The Environmental Management and Coordination Act of 1999
- The Environmental Management and Coordination (Water Quality) Regulations, 2006
- The Environmental Management and Coordination (Waste Management) Regulations, 2006
- The Employment Act 2007
- The Labor Institutions Act 2007
- The Work Injuries Benefits Act 2007
- The Occupational Safety and Health Act 2007
- The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009.

2.2.2 The Environmental Management and Co-Ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009.

The following principles shall be observed in the management and conservation of river banks, lake shores and the seashore; (a) Resources on the river banks, lake shores and the sea shore shall be

utilized in a sustainable manner; (b) Environmental impact assessment as required under the Act shall be mandatory for all major activities on river banks, lake shores and the seashore; and (c) Special measures, including prevention of soil erosion, siltation and water pollution are essential for the protection of river banks, lake shores and the seashore. Identification and inventory of degraded river banks, lake shores and sea shores and conservation measures 18. (1) within five years from the date of commencement of these Regulations, the Authority shall, in consultation with the relevant lead agencies – (a) Identify river bank, lake shores and the part of the seashore which are at risk from environmental degradation; (b) Prepare and maintain an inventory of the river banks, lakeshore and the part of the sea shore which are at risk from environmental degradation, and cause such measures as are necessary to be taken to prevent and reduce degradation of such areas; (c) Promote soil conservation measures along river banks, lake shores, and the seashore, including the following. i. bunding; ii. terracing; iii. mulching; iv. tree planting or agro forestry; v. grassing; vi. Soil engineering, compaction and placement of fills; vii. zoning and planning; viii. building of gabions; ix. control of grazing, and x. Recommending the promulgation of appropriate by-laws by the relevant local authorities.

2.2.3 Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019

These are described in Legal Notice No. 32 of the Kenya Gazette Supplement No. 62 of April 2019.

(1) Every proponent undertaking a project specified in the Second Schedule of the Act as being a low risk project or a medium risk project, shall submit to the Authority a summary project report of the likely environmental effect of the project.
(2) The project report submitted under sub regulation (1) shall specify —
(a) The nature of the project;
(b) The location of the project including —
(i) proof of land ownership, where applicable;
(ii) Any environmentally sensitive area to be affected;
(iii) Availability of supportive environmental management infrastructure; and
(iv)Conformity to land use plan or zonation plan; and
(c) Potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project.
(3) Upon receipt of the project report under sub regulation (1), the Authority shall, within five days, undertake screening and assessment thereof for completeness and—
(a) Where the Authority considers that the proposed project may have a significant adverse environmental impact, it shall recommend that the proponent should prepare and submit a comprehensive project report; or
(b) Where the Authority considers that the proposed project is not likely to have any significant adverse environmental impact, it shall exempt the proponent from submitting a comprehensive project report and issue the proponent with an approval to proceed with the project.

2.2.4 Mining Act, 2016

The Mining Act was enacted during May 2016, prior to which the industry was regulated by the Mining

Act 1940 Cap 306, Trade in Unwrought Mineral Act Cap 309 and the Diamond Industry Protection Act Cap 310 (GoK, 2016 a). Regulations pertaining to the repealed acts remain in force until revoked. In part III under general principles it states that a person shall not search for, prospect or mine mineral, mineral deposit or tailings in Kenya unless that person has been granted a permit or license in accordance with this Act. The Act states that the holder of a permit or license under this Act shall use the land in accordance with the terms of the permit or license and will ensure the following:
a) Sustainable use of land through restoration of abandoned mines and quarries;
b) The seepage of toxic waste into streams, rivers, lakes and wetlands is avoided;

c) Disposal of any toxic waste is done in the approved areas only;
d) Blasting and all works that cause massive vibration is properly carried out and muffled with the EMCA, 1999 (Cap. 387), Amendment 2015; and) Upon completion of prospecting or mining, the land in question is restored to its original status or to an acceptable and reasonable condition as close as possible to its original state.
Relevance: The Proponent has been granted a Prospecting License (PL) from the Ministry of Petroleum and Mining. The Proponent will rehabilitate the affected areas after gold exploration activities.

2.2.5 The Physical Planning Act

The Physical Planning Act governs how development is to be carried out in major towns and urban centers. The Department of Physical planning, in the Ministry of Lands and Settlement, administers the Act. Under the Act, the Department of Physical planning first approves all Partial Development Plans (PDPs) of infrastructure and other developments before the projects are implemented. For the proposed project all plans for the proposed shed have been approved by relevant authorities including Physical planning Department.

Section 29 of the Act empowers the local Authorities to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section allows for prohibition or control of the use and development of an area.

Section 30 states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority.

2.2.6 The Local Authorities Act

Under the Local Authorities act, the County assumes a number of roles in its area of jurisdiction, which includes the development area. The roles include issuance of licenses for businesses, collection of refuses, setting up of adequate lighting, provision of water and sewerage services in the area, among others. Therefore for effective management; some of the requirements of the proposed project such as adequate and efficient sewage services from the council, for implementation of the proposed project would have to be carried out in consultation with the council.

2.2.7 The Public Health Act

The Public Health Act outlines how different aspects of a project have to be undertaken to ensure the safety and health of users and neighbors. The Act gives guidelines on construction, maintenance and inspection of drainage system, septic tanks, cesspool or latrines. In implementing the proposed project, the developer has to carry work in line with requirements and provision of this Act.
Part IX section 115 of the Act states that no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health.
Section 116 requires that local Authorities take all lawful necessary and reasonable practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to injuries or dangerous to human health.

2.2.8 The Environmental Management and Coordination (Water Quality) Regulations, 2006

These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006.
These Regulations apply to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following:

- Protection of sources of water for domestic use;
- Water for industrial use and effluent discharge;
- Water for agricultural use;

These regulations outline:

- Quality standards for sources of domestic water;
- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers;
- Monitoring for discharge of treated effluent into the environment

The regulations protect all water resources. Relevant features of this regulation as far as this study is concerned include:-

- Every person shall refrain from any act which will directly or indirectly cause pollution and it shall be immaterial whether or not the water resource was polluted before the enactment of these regulations;
- No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance as to cause pollution;
- Discharge of effluent from sewer must be licensed according to the act;
- Water abstraction must only be done after approval of an Environmental Impact Assessment study;
- The regulations also set out standards to be followed for effluent discharge to the environment.

2.2.9 The Environmental Management and Coordination (Waste Management) Regulations, 2006

- The regulations outlined in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 (September 2006) apply to various categories of waste, including industrial, hazardous, toxic, pesticide-related, biomedical, and radioactive wastes. They set forth requirements for the handling, storage, transportation, and disposal of these waste types. Key provisions include:
- Prohibition of waste disposal in public areas except in designated receptacles.
- Mandatory waste collection, segregation, and disposal by waste generators.
- Encouragement for waste generators to minimize waste through cleaner production methods.
- Licensing requirements for all waste transporters.
- Vehicles used for waste transport must be labeled and maintained to prevent waste scattering or leakage.
- Waste collection and transport must follow approved routes and schedules set by the authority.

2.2.10 Employment Act 2007

(i) General Principal

The Act constitutes minimum terms and conditions of employment of an employee and any agreement to relinquish vary or amend the terms set shall be null and void.

The act stipulates that no person shall use or assist any other person, in using forced labour. Clause 5 of the act states that its shall be the duty of the Minister, Labour officer, the National Labour Court and the subordinate labour courts to; Promote equality of opportunity in employment in order to eliminate discrimination in employment Promote and guarantee equality of opportunity for a person who, is a migrant worker or a member of the family of the migrant worker lawfully within Kenya

No employer shall discriminate directly or indirectly, against an employee or prospective employee or harass an employee or prospective employee on the following grounds; race, colour, sex, language, religion, political or other opinion, nationality, ethnic or social origin, disability, pregnancy, mental status or HIV status. An employer shall pay his employees equal remuneration for work of equal value.

(ii) Part IV Rights and duties of employment
The provisions of this part and part VI constitute basic minimum and conditions of contract of service. The employer shall regulate the hours of work of each employee in accordance with provisions of this Act and any other written law. Subsection (2) of section 27 states that an employee shall be entitles to at least one rest day in every period of seven days. An employee shall be entitles to not less that twenty-one working days of leave after every consecutive months.

(iii) Maternity Leave
Section twenty of the Act stipulates that a female employee shall be entitled to three months maternity leave with full pay. Subsection 8 of section 29 further states that no female employee shall forfeit her annual leave entitlement on account of having taken her maternity leave.

(iv) Section 37 (conversion of casual employment to term contract)
Where a casual employee works for a period or a number of continuous working days which amount in the aggregate to the equivalent of not less than one month; or performs work which cannot reasonably be expected to be completed within a period, or a number of working days amounting in the aggregate to the equivalent of three months or more. The contract of service of the casual employee shall be deemed to be one where wages are paid monthly. In calculating wages and the continuous working days, a casual employee shall be deemed to be entitled to one paid rest day after a continuous six days working period and such rest day or public holiday which falls during the period under consideration shall be counted as part of continuous working days.

2.2.11 Work Injuries Benefits Act 2007
The Work Injuries Benefits Act 2007 outlines the responsibilities and obligations of employers and the rights of employees in Kenya concerning work-related injuries. Key provisions include:

i. **Employer Obligations**: Employers must maintain an approved insurance policy to cover liabilities under the Act.
ii. **Registration of Employers**: Employers must register with the Director of Occupational Health and Safety Services, with separate registrations required for different workplaces or classes of business.
iii. **Record Keeping**: Employers are required to keep records of employees' earnings and other details for at least six years, and these records must be available for inspection.
iv. **Right to Compensation**: Employees injured or disabled in work-related accidents are entitled to compensation unless the accident was caused by the employee's willful misconduct.
v. **Accident Reporting**: Accidents must be reported to the employer and the Director of Occupational Health and Safety within 24 hours, especially in fatal cases.
vi. **Lapse of Right to Benefits**: The right to benefits lapses if the accident is not reported within a specified time, unless the employer was otherwise aware. Compensation for permanent disablement and fatal accidents is calculated based on earnings, with specific guidelines for payment to dependents and funeral expenses.

The Act also includes schedules detailing degrees of disablement and occupational diseases related to specific work descriptions

2.2.12 Labor Institutions Act 2007
The Act establishes the **National Labour Board** with the responsibility to advise the Minister on various employment and labour matters, including legislation, labour relations, trade unionism, labour inspections, strikes, lockouts, and labour market data. The Board, in consultation with the Minister, is also tasked with establishing committees such as the Work Permit Committee, National Manpower Development Committee, Trade Dispute Committee, Productivity Committee, and other necessary panels.

Authorized Officers under the Act have the authority to enter workplaces for inspection, ensuring compliance with laws regarding wages, sanitation, and food provided to employees. They can also mandate that work environments be kept clean and sanitary.

Medical Officers have additional powers, including ordering sick employees to be sent to a hospital at the employer's expense, condemning unfit food, and ensuring proper nutrition and medical supplies for employees.

2.2.13 Occupational Safety and Health Act 2007
Part II – General Duties of the Occupiers

i. **General Duties of Occupiers**:

Occupiers must ensure the safety, health, and welfare of all workers in the workplace. This includes maintaining safe plant systems, handling substances safely, providing necessary information and training, and maintaining a safe working environment. They must also conduct risk assessments, adopt preventive measures, and report risks to the relevant authorities.

ii. **Safety and Health Policy Statement**:

Occupiers must prepare and regularly update a written safety and health policy, ensuring that all employees are informed of it.

iii. **Protection Against Discrimination**:

Occupiers are prohibited from dismissing or discriminating against employees who raise safety concerns, are part of safety committees, or exercise their safety-related functions.

iv. **Safety and Health Committees**:

Workplaces with 20 or more employees, or as directed, must establish a safety and health committee.

v. **No Charges for Safety Measures**:

Employers cannot charge employees for any safety-related measures or provisions.

vi. **Safety and Health Audits**:

Annual safety and health audits must be conducted by a certified advisor, with reports submitted to the Director and available for inspection.

vii. **Duties of Self-Employed Persons**:

Self-employed individuals must ensure their own safety and that of others, use appropriate safety measures, and report any hazards or incidents.

viii. **Duties of Employees**:

Employees must ensure their own safety and that of others, use protective equipment, and follow safety procedures, and report hazards or incidents to their supervisors.

ix. **Duties of Designers, Manufacturers, and Importers**:

Those who design, manufacture, or supply workplace articles must ensure their safety, conduct necessary testing, and provide adequate information for safe use.

x. **Accident Reporting**:

Employers and self-employed persons must notify authorities of any workplace accidents, dangerous occurrences, or occupational poisonings within specific timeframes.

xi. **General Health Provisions**:

Workplaces must be kept clean and free from nuisances, with regular cleaning and maintenance of floors, walls, ceilings, and sanitary facilities.

2.2.14 Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009;

Summary of Key Provisions on Construction, Demolition, Mining, and Noise Control:

i. **Regulations on Construction, Demolition, Mining, and Quarrying**:
   - The Authority can impose specific requirements for these activities, including restrictions on machinery usage and permissible noise levels as outlined in the Second and Third Schedules. Vibration levels from these activities must not exceed 0.5 cm/s beyond the property boundary or 30 meters from a moving source.

ii. **Permissible Noise Levels**:
   - It is prohibited to produce noise levels exceeding those specified in the First Schedule, except when necessary for preserving life, health, safety, or property.

iii. **General Prohibition on Loud and Unreasonable Noise**:
   - Unnecessary or unusual noise that disturbs others or endangers their health and safety is prohibited. Factors like the time of day, proximity to residential areas, and whether the noise is constant or enhanced can be considered when determining if the noise is unreasonable.

iv. **Regulations for Operating Machinery and Equipment**:
   - Activities involving machinery or equipment likely to emit noise or excessive vibrations must comply with the noise levels prescribed in the First Schedule. No construction equipment should emit noise exceeding the permissible levels outlined in the Second Schedule.

2.2.15 The Water Act 2002

The **Water Act** is designed to manage, conserve, use, and control water resources, including the regulation of water supply and sewerage services. The Act grants the state ownership of all surface and groundwater, except for water entirely within private land, with usage rights being granted through licenses.

Key provisions include:

- **National Monitoring and Information Systems (Part II, Section 18)**: The Act mandates the establishment of systems for monitoring water resources. The Water Resource Management Authority can require any person or institution to provide specified information, documents, samples, or materials related to water resources.
- **Pollution Prevention (Section 94)**: It is an offense to dispose of waste or other harmful substances into or near water resources in a way that could cause pollution.

2.2.16 Building Code 2000

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local Authority for permit to connect to the sewer line and all the wastewater must be discharged in to sewers. The code also prohibits construction of structures or building on sewer lines.

2.2.17 Traffic Act (Cap 403)

This is an Act of Parliament that consolidates the law relating to traffic on the roads. The act it prohibits obstruction of traffic, either by persons or facilities which are constructed in such a way as to interfere with the flow of traffic on roads or road reserves.

2.2.18 Conservation of Biological Diversity (BD) Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes Conservation of threatened species, Inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

2.2.19 Fossil Fuel Emission Control Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement no. 74, October 2006.

The regulations include internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions. The fossil fuels considered are petrol, diesel, fuel oils and kerosene.

2.2.20 Climate Change Act 2016

The Climate Change Act of 2016 is Kenya's comprehensive legal framework for addressing climate change. It establishes the National Climate Change Council to oversee and coordinate climate change responses across all levels of government and the private sector. The Act mandates the integration of climate change considerations into national and county development plans, with a focus on low carbon development and resilience building. It also outlines responsibilities for public and private entities in mitigating and adapting to climate change, while establishing a Climate Change Fund to finance related initiatives. The Act emphasizes public participation, transparency, and accountability in climate governance, ensuring that climate change actions are inclusive and sustainable.

2.3 Institutional Framework

Government institutions implementing the legal framework include:

- National Environment Management Authority (NEMA)
- Mines and Geology Department
- Directorate of Occupational Safety and Health Services (DOSHS)
- Water Resources Authority
- County Government of Migori

These institutions have specific mandates for implementing various laws related to environmental management, mining, occupational safety, water resources, and county governance.

2.3.1 Institutions under EMCA 1999

The Government established the following institutions to implement the EMCA 1999.

- National Environmental Council
- National Environmental Management Authority
- County Environmental Committees
- Public Complaints Committee
- Standards and Enforcement Committee

2.3.2 Water Resources Authority

The Water Resources Management Authority (WRA) is of particular relevance to the project. Its mandate covers some sectorial issues which are applicable to environmental management, such as use of water resources, human settlement and administration of activities in the scheme.

Part III of the Water Act 2002 defines the powers and functions of WRA which include:

- Developing principles, guidelines and procedures for the allocation of water resources;
- Monitoring the national water resources management strategy;
- Receiving and determining applications for permits for water use;
- Monitoring and enforcing conditions attached to permits for water use;
- Regulating and protecting water resources quality from adverse impacts;
- Managing and protecting water catchments;

2.3.3 International Conventions and Treaties

Kenya has ratified several international treaties and conventions relevant to environmental management:

i. **Convention on Biological Diversity (CBD) 1993**: This convention mandates countries to create national strategies for conserving biological diversity and integrating these strategies into various sectors. The project is expected to comply with these guidelines, particularly in conserving rare and endangered species, in line with Kenya's Environmental Management and Co-ordination (Conservation of Biological Diversity) Regulations, 2006.
ii. **United Nations Framework Convention on Climate Change (UNFCCC) 1992**: This convention aims to stabilize greenhouse gas levels to prevent harmful human-induced climate changes. Development projects in Kenya, including the proposed project, must consider climate change in their policies and actions.
iii. **United Nations Convention to Combat Desertification 1994**: This convention addresses land degradation due to desertification and drought, especially in arid and semi-arid regions. It is incorporated into Kenya's Environmental Management and Coordination Act (EMCA) 1999, which tasks County Environment Committees with identifying areas needing reforestation and mobilizing local communities to undertake these activities.

2.4 Key Developmental Blueprints

The project will also contribute to the following Government of Kenya developmental blueprints

- Kenya Vision 2030

2.4.1 Kenya Vision 2030

Kenya Vision 2030 is an economic blueprint whose aim is to transform the Country into a modern, globally competitive, middle-income country, offering a high quality of life for its citizens by the year 2030. To achieve this goal, the Government intends to put in place measures that will raise the national Gross Domestic Product (GDP) growth rate from the current to beyond 10% by 2018; create more employment opportunities; and bring more equitable development in all regions of the Country.
The Third Medium Term Plan (MTP) of the *Kenya Vision 2030* identifies the key policy actions and reforms as well as programmes and projects that the Government intends to implement in the period 2018 – 2022 to achieve set national targets. In order to achieve these targets, the Government has identified the big Four priority areas namely **Food and Nutrition, Manufacturing**, Universal health care and Development of affordable housing in which it intends to concentrate its efforts and resources.

3.0 ENVIRONMENTAL BASELINE INFORMATION

3.1 Introduction

The Heap Leaching project site is in Mikai China Chongqing Handu Construction Machinery Co Limited along Karungu Bay road in Migori County.

Migori County is situated in the South-Western part of Kenya. It borders Homa Bay County to the North, Kisii and Narok Counties to the East and the Republic of Tanzania to the South. It also borders Lake Victoria to the West. It is located between latitude 1^{o} 24' South and 1^{o} 40'South and longitude 34^{o} 50'East and covers an area of 2,596.5 km^{2} including approximately 478 km2 of water surface. Figure1below shows the location of Migori County in Kenya.

3.2 Physical and Topographic Features

The county's altitude ranges between 1140m above sea level at the shores of Lake Victoria in Nyatike Sub-county to 4625m above sea level in Uriri Sub-County. Undulating hills cover most of the county's landscape with few stretches of flat lands. Some of the hills found in the county include Nyakune (4625m), Ogengo (4300m) and God Sibwoche (1475m) in Uriri sub-county, God Kwer (1420m), Mukuro (1454m) and Nyabisawa (1489m) in Suna West Sub county, God Kwach (1340m) in Nyatike Sub-county, Renjoka (1592m) in Kuria West Sub-county, and Maeta (1733m) in Kuria East Sub-county The main rivers in the county are Kuja, Migori and Riana, all of which originate from the highland regions of the neighbouring Kisii and Narok Counties while the smaller and mainly seasonal rivers include Ongoche, Oyani and Sare. Rivers Migori, Ongoche, Oyani and Sare eventually drain into River Kuja at various locations within the county which in turn finally drains into Lake Victoria. Another spectacular feature found in the county is the Gogo Falls found along River Kuja. The county's topography is underlain by 'relatively acid' parent rock and Granite covering most parts of Kuria East, Kuria West, Nyatike, some parts of Rongo and Migori Sub-counties with the rest being covered by the Nyanzian and Bukoban rocks.

3.3 Climatic Conditions

The county experiences an inland equatorial climate modified by the effects of altitude, relief and the influence of the large body of water of Lake Victoria. Annual rainfall averages from 700mm to 1,800 mm with long rains experienced between March and May while the short rains occur between September and November. Dry seasons are experienced in two phases annually with the first phase occurring from December to February while the second phase is usually experienced between June and September. The lakeshore divisions of Nyatike, Muhuru and Karungu together with parts of Kegonga experience unreliable and poorly distributed rainfall. Annual temperatures vary between a mean minimum of 240 C and maximum of 310 C, with high humidity and a potential evaporation of 1800mm to 2000 mm per year.

3.4 Roads and Rail Network, Ports and Jetties, Airports and Airstrips

Migori County borders Tanzania and is traversed by 163.6 km of tamacked road as compared to 68km as at 2013.The roads which have been tarmacked since 2013 include Road A1 that links Kenya with Tanzania through Isebania and the Rongo-Riosir road that links Migori and Kisii Counties. Other tarmacked roads within the county include: Isebania – Kehancha – Kegonga – Ntimaru road (E166), Muhuru Bay - Kehancha (C13), Rapogi – Ogwedhi (D202), Toku Bridge, Uriri-Oria, and Approach roads (E205) and Kanga-Kitere Road.

The rest of the road network in the county is made up of 2,888 kilometers out of which 60% is gravel and 40% is earth.There are several footbridges and bridges including Kiringi and Toku Bridgeswhich were completed during the previuos plan period. There are three airstrips, namely, Lichota, Macalderand Kehancha in Suna West, Nyatike and Kuria West subcounties respectively. Water transport is still at its infancy stage as boats rather than ferries form the major mode of transport despite the fact that 478 km2 of the county land mass is comprised of water. It however remains a favorable means of transport between Migori and the adjacent destinations such as Mwanza in Tanzania, Homa-Bay County and major islands within the lake. Other means of transport like the railway and pipeline are not available.

3.5 Housing

Approximately 90% of the county's populations live in rural areas with mud walled structures being the most predominant mode of housing. According to the Basic Report on Well Being in Kenya2015/2016, 71.5%, 6%, 4.1%, 6.7% and 4.8% of the county population live in mud/cow dung walled houses, brick walled houses; cement blocks walled houses, houses with cement finishing and use corrugated iron sheets for walling respectively. Further, for roofing, 92.6% of the population use corrugated iron sheets whereas5.5% use grass. For flooring, 12.2 % of the population use earth, 52.7% use mud/cow dung and 33.5%use cement. The low usage of cement is attributed to high poverty levels. Appropriate infrastructure for housing development is still lacking in the county and it is therefore imperative for the county government in collaboration with the national government and other development partners to modernize housing through appropriate support mechanisms such as mortgage guaranteeing, urban regeneration, appropriate building technologies and housing subsidies.

3.6 Energy Access

Available statistics indicate that there is over dependence on non-renewable hydro-electric power within the county as the main source of energy leading to exploitation of forest resources and low industrial productivity. Firewood, charcoal, kerosene, and LPG continue to be the main sources of cooking fuel at 82.1%, 10.3 %, 4.3%, and 4.0 % respectively based on the Basic Report on Well Being in Kenya2015/2016. For lighting 10.2% use electricity from the main grid,29.7% use solar,12.8%,46.2% and 0.2 % use lantern, tin and pressure lamps respectively.0.75%use torch while 0.2 % use candles. There is need to encourage improved and efficient use of alternative sources of energy other than firewood as the potential for harnessing solar, biogas and wind energy are available within the county. In addition, there ispotential for generation of electricity from locally available resources such as biomass from agricultural wastes and biogas from sugar cane to supplement the existing production from Gogo falls.

3.7 Industry and Trade

3.7.1 Markets

The county has more than 47 open air markets which are distributed across the county as shown in the. They form the major sources of revenue to the county. However, during the previous plan period, the county constructed and operationalized 22 market sheds and improved their sanitation conditions through construction of VIP toilets and ablution block. Concerted efforts shall be made to refurbish and modernize the remaining markets during this plan period.

3.7.2 Major Industries

The main formal industrial venture in the county is the Sony Sugar Company. However, other ventures like the milk cooling and fish processing plants at Rongo sub-county are still at their early stages of development. The county's cottage industry is still at infancy with over 5,000 artisans registered within the existing 200 Jua Kali registered associations. Most of these associations however are dormant and have therefore not been able to marshal sufficient capital to harness the creativity of the indigenous populations.

3.7.3 Information, Communication and Technology (I.C.T)

According to the Basic Report on Well Being in Kenya2015/2016 (source KNBS), mobile phone coverage, use of radio, use of computer, access to internet and use of TV were at 78.6%,91.1%, 7.4% , 12.2% and 35.5% respectively. It is evident from the above statistics that whereas mobile phone and radio usage is satisfactory, the other avenues of ICT usage require to be boosted and as such, the county needs to invest more in provision of internet services which the residents can access from their phone or computers since ICT is a major enabler in the transformation of the county.

3.8 Water and Sanitation

3.8.1 Water Resources
The major water resources in the county comprise of surface, ground and rain water. Surface water consists of Lake Victoria with a total water mass of 475 km^2 and several rivers with the major ones being Kuja, Migori, Sare, Oyani, Riana, Tebesi, Misadhi and Ongoche. All these rivers drain into Lake Victoria. Ground water resources comprise of boreholes, shallow wells and springs. The quality of water from these sources – especially surface water is however relatively poor and usually requires treatment prior to domestic use.

3.8.2 The Blue Economy
Blue Economy means the sustainable use of the water-mass and its resources for economic growth, improved livelihoods and employment creation. It covers both aquatic and marine spaces including oceans, seas, coasts, lakes, rivers, and underground water. It encompasses a range of productive sectors, including fisheries, aquaculture, tourism, transport, shipbuilding and repair, energy, bio prospecting, bunkering, sport fishing, port services, marine insurance, freight forwarding underwater mining and related activities. Migori County has a total water mass of 475 km^2 due to its proximity to Lake Victoria with several beaches along the 42 kilometre shoreline. The county also has several rivers the major ones being Kuja, Migori, Sare, Oyani, Riana, Tebesi, Misadhi and Ongoche.

3.9 Forestry
The County's forest cover vegetation comprises of Indigenous forests, Plantations established through planting of seedlings, Woodlands characterized by trees and shrubs, Bush lands, ASAL and Farm land development

3.10 Health and Nutrition
The health sector plays a pivotal role in economic growth and poverty reduction as exemplified in SDGs 1 and 3. Most of the key health indicators in the county are below the national average particularly those touching on infant and child mortality, nutrition, HIV/AIDS, malaria, upper respiratory tract infections, diarrhea, pneumonia and skin diseases a factor attributed to low health personnel to patient ratios, inadequate health facilities and equipment among other factors.

3.11 HIV/AIDs Prevalence Rates and Related Services
By the end of 2013, the county had an HIV prevalence of 14.7 % as compared to the national rate of 5.6 per cent. This placed Migori County as one of the 9 counties that contributed to the highest HIV incidences across the country. Children constituted 12% of those living with HIV with 6,786 new adult infections reported. Adult and children ART coverage stood at 89% and 37% respectively. Approximately 1,876 adults and 682 children died of AIDS related conditions in 2013 in the county (Kenya HIV County Profiles 2014).

3.12. Agriculture
The county's favorable climate and fertile soils support diverse agricultural practices. Here are some aspects of agriculture in Migori County:

i. **Crop Farming:**
   - **Maize:** Maize is a staple crop grown by many farmers in Migori County, contributing to both food security and income generation.
   - **Sugarcane:** Sugarcane cultivation is significant, and there may be farmers involved in supplying sugarcane to local sugar factories or for other purposes.
   - **Bananas and Horticultural Crops:** Farmers may cultivate bananas and various horticultural crops, including vegetables and fruits, for local consumption and sale.

ii. **Livestock Farming:**
   - **Cattle, Poultry, and Small Ruminants:** Livestock farming is prevalent, with farmers keeping cattle, poultry, goats, and sheep. Livestock provides a source of meat, milk, and other products.

iii. **Fishing:**

- Given the proximity to Lake Victoria, fishing is a vital economic activity in Migori County. Fishermen engage in catching fish for local consumption and sale, contributing significantly to the livelihoods of many residents.

iv. **Irrigation and Water Management:**
- Agriculture in some areas of Migori may involve irrigation practices to ensure consistent crop production, especially during dry seasons. Effective water management is crucial for sustainable agriculture.

v. **Agricultural Cooperatives:**
- Farmers in Migori County may participate in agricultural cooperatives, pooling resources and efforts to enhance productivity, marketing, and bargaining power.

vi. **Challenges:**
- Like many agricultural regions, Migori County may face challenges such as unpredictable weather patterns, pests, and diseases. Access to modern farming techniques, technology, and credit facilities can impact the efficiency and productivity of the agricultural sector

3.13 Mining

The county is known to have mineral resources, and artisanal miners have been involved in extracting minerals from certain areas. Here are some key points related to mining in Migori County:

i. **Gold Mining:** Migori County is known to have gold deposits, and artisanal miners often engage in gold mining activities. These small-scale operations involve individuals or small groups of miners using basic tools and methods for extraction.
ii. **Challenges and Concerns:** Small-scale mining activities, especially when not properly regulated, can pose environmental and social challenges. Issues such as land degradation, water pollution, and inadequate safety measures have been reported in various mining regions.
iii. **Government Regulation:** The Kenyan government has regulations in place to govern mining activities, and there have been efforts to formalize and regulate the small-scale mining sector to ensure environmental sustainability and the well-being of the communities involved.
iv. **Economic Impact:** Mining activities, when conducted responsibly, can contribute to the local economy by providing employment opportunities and generating income for the individuals involved in the sector.
v. **Potential for Growth:** Properly managed, the mining sector in Migori County has the potential for growth and can attract investment. However, it is crucial to balance economic development with environmental protection and community welfare.

3.14 Social and cultural diversity

Social and cultural diversity in Migori County, Kenya, reflects the rich tapestry of Kenya's population, which is composed of various ethnic groups and communities. As of my last knowledge update in January 2022, here are some aspects of social and cultural diversity in Migori County:

i. **Ethnic Diversity:** Kenya is home to numerous ethnic groups, and this diversity is reflected in Migori County. Some of the major ethnic groups in Kenya include the Luo, Kuria, Suba, Luhya, and others. The Luo community, in particular, is prominent in Migori.
ii. **Language Diversity:** Different ethnic groups in Migori County may have their own languages and dialects. While Swahili and English are official languages in Kenya, various local languages are spoken by different communities in Migori.
iii. **Cultural Practices:** Each ethnic group within Migori County has its unique cultural practices, traditions, and ceremonies. These may include rites of passage, traditional dances, storytelling, and rituals that are passed down from generation to generation.
iv. **Religious Diversity:** There is religious diversity in Migori County, with people practicing various faiths, including Christianity, Islam, and indigenous African religions. Churches and mosques can be found in different parts of the county.
v. **Cultural Events and Festivals:** Migori County likely celebrates various cultural events and festivals that showcase the diversity of its communities. These events may involve music, dance, traditional attire, and cuisine.

vi. **Interactions and Integration:** The diverse communities in Migori County interact and often integrate, leading to a blend of cultural elements. This integration can be seen in daily life, social interactions, and even in the fusion of culinary traditions.
vii. **Cultural Preservation:** Efforts to preserve and promote cultural heritage are crucial. Cultural institutions, local leaders, and community members may engage in activities to safeguard traditional practices, languages, and historical sites.
viii. **Social Challenges:** Despite the richness of diversity, some areas may face social challenges related to cultural differences, including issues of inclusivity, discrimination, or misunderstandings. Community leaders and organizations may work towards fostering understanding and harmony.

3.15 Health

i. **Health Facilities:** Migori County has health facilities ranging from dispensaries and health centers to larger hospitals. These facilities provide a range of healthcare services to the residents.
ii. **Disease Prevention and Control:** Public health initiatives, including vaccination programs, are crucial in preventing the spread of diseases. Efforts are made to control diseases such as malaria, HIV/AIDS, and other prevalent health issues.
iii. **Maternal and Child Health:** Maternal and child health services are a priority, with a focus on prenatal care, safe delivery, and postnatal care. Programs may also address child immunization and nutrition.
iv. **Water and Sanitation:** Access to clean water and sanitation facilities is essential for public health. Efforts may be made to improve water supply and sanitation infrastructure to reduce waterborne diseases.
v. **Community Health Programs:** Health education and community outreach programs are conducted to raise awareness about preventive health measures and promote healthy lifestyles.
vi. **Healthcare Workforce:** Training and maintaining a skilled healthcare workforce, including doctors, nurses, and community health workers, is critical for providing adequate healthcare services.
vii. **Emergencies and Epidemics:** Preparedness and response to health emergencies, including epidemics or natural disasters, are important aspects of the healthcare system.

3.15 Education

i. School Infrastructure: Migori County has a network of primary and secondary schools. Investments in school infrastructure, such as classrooms and libraries, contribute to creating conducive learning environments.
ii. Teacher Training and Deployment: Training and deploying qualified teachers ensure the quality of education. In some cases, there may be initiatives to address teacher shortages or improve teacher quality.
iii. Access to Education: Efforts are made to improve access to education for all, including initiatives to increase enrollment, especially for girls and marginalized groups.
iv. Curriculum Development: The education curriculum is periodically reviewed and updated to meet current needs and standards. This may involve incorporating new subjects or adjusting teaching methods.
v. Vocational and Technical Training: Providing opportunities for vocational and technical education helps prepare students for various career paths and contributes to economic development.
vi. Higher Education: Access to higher education institutions, including universities and technical colleges, may be a focus for those seeking advanced education and training.
vii. Community Involvement: Involving local communities in education decisions and programs is important for ensuring that education meets the specific needs and aspirations of the population

3.16 Transportation infrastructure

Transportation infrastructure is vital for the economic development and connectivity of any region.

i. **Road Network:** Migori County has a network of roads that connect various parts of the county, facilitating the movement of people and goods. The road infrastructure includes major highways, rural roads, and feeder roads.
ii. **Public Transportation:** Public transportation services, such as buses, matatus (shared minivans), and motorcycles (bodabodas), are common in Migori County. These modes of transportation play a crucial role in ensuring mobility for residents.
iii. **Inter-County Connectivity:** Migori County is connected to neighboring counties through road networks. The quality and condition of these roads impact the ease of travel and transportation of goods and services between different regions.
iv. **Transportation Hubs:** Migori town, being the county capital, likely serves as a transportation hub with facilities such as bus terminals or matatu stages where commuters can access various transportation services.
v. **Challenges:** Like many regions, Migori County may face challenges related to road maintenance, infrastructure development, and road safety. Addressing these challenges is important for ensuring efficient and safe transportation.
vi. **Transportation for Agricultural Purposes:** Given the significance of agriculture in the county, transportation is essential for moving agricultural produce from farms to markets. Access to reliable transportation contributes to the economic viability of the agricultural sector.
vii. **Water Transportation:** Migori County is situated near Lake Victoria, and water transport may play a role in certain areas. Boats and ferries might be used for transportation on the lake.
viii. **Infrastructure Development:** Ongoing efforts in infrastructure development, such as road expansion, maintenance, and the construction of bridges, contribute to the improvement of transportation within the county

3.17 Tourism Potential

Migori County, located in southwestern Kenya, has the potential for tourism, although it may not be as widely recognized as some of the more popular tourist destinations in the country. Here are some aspects of the tourism potential in Migori County:

i. **Lake Victoria Attractions:**
   - Migori County's proximity to Lake Victoria presents opportunities for water-based activities such as fishing, boat rides, and lakeside relaxation.
   - Scenic views and the diverse ecosystem around Lake Victoria can attract nature enthusiasts and birdwatchers.
ii. **Cultural Tourism:**
   - The county's diverse ethnic communities, including the Luo, Kuria, and Suba, offer rich cultural experiences. Cultural festivals, traditional dances, and ceremonies could be potential attractions.
   - Visitors may be interested in experiencing the local cuisine, traditional music, and storytelling.
iii. **Historical and Archaeological Sites:**
   - Migori County may have historical and archaeological sites that could be of interest to tourists. These sites may have cultural or historical significance.
iv. **Eco-Tourism:**
   - The county's natural landscapes, including hills, forests, and agricultural areas, could be promoted for eco-tourism. Hiking trails and nature walks could be developed.
v. **Gold Mining Tours:**
   - Given that there have been small-scale gold mining activities in the county, organized and responsible gold mining tours could be an attraction for those interested in learning about the local mining industry.
vi. **Wildlife Conservation:**

- Migori County may have areas with diverse flora and fauna. Conservation efforts and the development of wildlife reserves or sanctuaries could attract wildlife enthusiasts.

vii. **Adventure Tourism:**

- The varied topography, including hills and water bodies, provides opportunities for adventure tourism. Activities such as hiking, bird watching, and water sports could be promoted.

viii. **Community-Based Tourism:**

- Engaging local communities in tourism initiatives can create a sustainable and authentic experience for visitors. Community-based tourism projects could include homestays, cultural exchanges, and local crafts.

ix. **Infrastructure Development:**

- To unlock its tourism potential, the county may need to invest in infrastructure such as roads, accommodations, and visitor facilities.

4.0 PROJECT DESCRIPTION

4.1 Introduction

The proposed project by China Chongqing Handu Construction Machinery Co Limited involves the implementation of a heap leaching process for gold extraction. Heap leaching is a widely used method in the mining industry to recover valuable metals from low-grade ores. This project aims to extract gold from ore through a controlled chemical leaching process, contributing to the overall production of precious metals.

4.1.1 Project Location

The proposed site is located at **GPS coordinates [-1.005618, 34.299703]** at an elevation of 1343 m above sea level; and it is accessible via **Karungu Bay road** about 1.5 km from Mikei Center in Migori County. The area is sparsely populated with the predominant economic activity being mixed agriculture and artisanal gold mining activities. *(See site map in appendix 7).*

Figure 4.1: Satellite image of Site layout

4.2 Project Site Baseline Environmental & Social Conditions

A detailed baseline environmental and social conditions assessment for the gold heap leaching project site covers key areas such as water demand and supply, waste management, noise and excessive vibrations, air quality, traffic impacts, geotechnical conditions, and existing land use. Below is a comprehensive analysis for each of these aspects:

4.2.1 Water Demand and Supply Analysis

4.2.1.1 Baseline Conditions:

- **Water Sources:** The primary water sources in Mikei include surface water from rivers like the Migori River, groundwater from boreholes and wells, and rainwater harvesting. The proximity to Lake Victoria also provides an important water resource for the community.
- **Current Demand:** The water demand in Mikei is driven by domestic use, agriculture, livestock farming, and small-scale mining activities. The area experiences seasonal variations in water availability, with higher demand during the dry season.

- **Water Quality:** Surface water sources, especially rivers, are vulnerable to pollution from agricultural runoff, domestic waste, and artisanal mining activities. Groundwater quality is generally better but can be affected by localized contamination from latrines or waste dumps.

- **Existing Infrastructure:** Water infrastructure in Mikei is limited, with many residents relying on traditional wells, boreholes, and unprotected springs. There are also water supply challenges due to inadequate infrastructure and maintenance issues.

4.2.1.2 Proposed Project Impact:

- **Increased Water Demand:** The gold heap leaching project will likely increase water demand for ore processing, dust suppression, and domestic use for the workforce.

- **Potential Impact on Local Water Sources:** The project could strain local water resources, potentially leading to conflicts with local communities over water use, especially during dry periods.

4.2.1.3 Mitigation Measures:

- Implement water-saving technologies and practices in the project operations, including recycling and reusing process water.

- Develop a water management plan that ensures sustainable water use without compromising the needs of the local community.

- Engage with local communities to discuss water use and explore opportunities for shared water resource management.

4.2.2 Waste Management

4.2.2.1 Baseline Conditions:

- **Waste Generation:** Mikei currently generates waste from domestic activities, agriculture, small-scale mining, and commercial activities. Waste disposal is generally unregulated, with common practices including open dumping, burning, and use of local streams for waste disposal.

- **Waste Infrastructure:** The area lacks formal waste collection and disposal infrastructure. Households typically manage waste independently, with limited access to waste management services.

4.2.2.2 Proposed Project Impact:

- **Increase in Waste Generation:** The gold heap leaching project will generate significant amounts of waste, including tailings, waste rock, chemical residues, and domestic waste from the workforce.

- **Potential Environmental Impact:** Improper disposal of mining waste could lead to soil and water contamination, affecting local agriculture, water quality, and community health.

4.2.2.3 Mitigation Measures:

- Develop a comprehensive waste management plan that includes segregation, recycling, safe disposal, and treatment of hazardous waste.

- Establish designated waste disposal areas away from residential zones and water bodies.
- Educate the workforce and local communities on proper waste management practices.

4.2.3 Noise and Excessive Vibrations

4.2.3.1 Baseline Conditions:

- **Current Noise Levels:** Mikei is primarily a rural area with low ambient noise levels, dominated by natural sounds and occasional noise from agricultural activities and small-scale mining.
- **Sources of Vibration:** Existing sources of vibration are minimal, typically limited to occasional small-scale mining operations or the movement of heavy vehicles.

4.2.3.2 Proposed Project Impact:

- **Increased Noise and Vibrations:** The project will introduce significant noise and vibration sources, including ore crushing, heavy machinery, vehicle movement, and possible blasting activities.
- **Impact on Communities:** Elevated noise levels and vibrations could disrupt the local community, leading to complaints, stress, and potential health issues.

4.2.3.3 Mitigation Measures:

- Implement noise control measures, such as installing noise barriers, using modern low-noise machinery, and limiting noisy activities to daytime hours.
- Regularly monitor noise and vibration levels at the project site and in nearby communities.
- Engage with local residents to keep them informed about project activities and address concerns related to noise and vibrations.

4.2.4 Air Quality

4.2.4.1 Baseline Conditions:

- **Air Quality:** Mikei generally enjoys good air quality due to its rural setting, with occasional dust from unpaved roads, agricultural activities, and small-scale mining. There is minimal industrial pollution.
- **Sources of Air Pollution:** The main sources of air pollution are dust from unpaved roads and agricultural fields, smoke from burning waste, and emissions from vehicle exhausts.

4.2.4.2 Proposed Project Impact:

- **Dust Generation:** The project is likely to generate significant amounts of dust from activities such as ore crushing, material handling, and vehicle movement.
- **Chemical Emissions:** Potential emissions from chemical processing during heap leaching could impact air quality if not properly managed.

4.2.4.3 Mitigation Measures:

- Implement dust control measures, such as water spraying on roads and material stockpiles, and covering trucks transporting loose material.
- Use dust suppression systems in crushing and material handling areas.
- Monitor air quality regularly and adjust operations to minimize emissions.

4.2.5 Traffic Impacts

4.2.5.1 Baseline Conditions:

- **Traffic Volume:** Traffic in Mikei is generally low, with roads primarily used by local residents, agricultural vehicles, and occasional trucks servicing small-scale mining operations.
- **Road Conditions:** Many roads in Mikei are unpaved and in poor condition, making them prone to dust generation and wear and tear.

4.2.5.2 Proposed Project Impact:

- **Increased Traffic:** The project will lead to an increase in heavy vehicle traffic, including trucks transporting ore, machinery, and supplies. This could exacerbate road wear, increase the risk of accidents, and lead to traffic congestion.
- **Impact on Local Roads:** Increased traffic could deteriorate road conditions further, making access difficult for local residents and potentially impacting local businesses.

4.2.5.3 Mitigation Measures:

- Upgrade and maintain access roads to the project site to handle increased traffic and reduce dust generation.
- Implement traffic management plans, including designated routes for heavy vehicles, speed limits, and regular road maintenance.
- Engage with local authorities to ensure that roads used by the project are adequately maintained and do not disrupt local traffic.

4.2.6 Geotechnical Conditions

4.2.6.1 Baseline Conditions:

- **Soil and Subsurface Conditions:** Mikei's geotechnical conditions include a mix of lateritic soils, sandy loams, and clayey loams. The region has some areas prone to erosion, particularly where vegetation cover has been removed.
- **Stability and Erosion:** There are concerns about soil stability, especially in hilly areas, where erosion can be exacerbated by human activities such as mining and agriculture.

4.2.6.2 Proposed Project Impact:

- **Erosion and Stability Risks:** The gold heap leaching project may disturb large areas of land, increasing the risk of soil erosion and destabilization, particularly if vegetation is removed.
- **Geotechnical Challenges:** The project might encounter challenges related to soil stability, particularly in areas with steep slopes or loose, erodible soils.

4.2.6.3 Mitigation Measures:

- Conduct detailed geotechnical surveys to assess soil stability and identify areas at risk of erosion or landslides.
- Implement erosion control measures, such as terracing, retaining walls, and re-vegetation of disturbed areas.
- Design heap leach pads and other infrastructure to minimize erosion and ensure long-term stability.

4.2.7 Existing Land Use Character

4.2.7.1 Baseline Conditions:

- **Current Land Use:** Land in Mikei is predominantly used for agriculture, small-scale mining, and residential purposes. The landscape is a mix of farmland, homesteads, and areas designated for mining activities.
- **Land Tenure:** Land ownership in Mikei is a mix of private, communal, and government-owned land. Land tenure issues are common, particularly in areas with high mining potential.

4.2.7.2 Proposed Project Impact:

- **Change in Land Use:** The gold heap leaching project will require a significant amount of land, potentially leading to the displacement of existing land uses, such as agriculture and residential areas.
- **Impact on Local Communities:** The project could lead to conflicts over land use, particularly if agricultural land is converted for mining purposes, impacting food security and livelihoods.

4.2.7.3 Mitigation Measures:

- Conduct thorough land use planning and consultations with local communities to minimize conflicts and ensure that land use changes are acceptable to all stakeholders.
- Compensate affected landowners fairly and provide alternative livelihoods or resettlement options where necessary.
- Monitor land use changes and their impacts on local communities, adjusting project plans to minimize negative outcomes.

4.2.8 Conclusion

This detailed assessment provides a comprehensive understanding of the baseline environmental and social conditions at the proposed Mikei gold heap leaching project site. Addressing these conditions through effective mitigation measures will be essential to minimize the project's impacts on the local environment and community.

4.3 Project Components

The primary components of the heap leaching process include:

- **Ore Crushing:** The mining operation will involve crushing ore to a suitable size for stacking on the heap leach pad.

- **Heap Construction:** Construction of the leach pad, a specially designed area to accommodate the ore stack, will be carried out in accordance with engineering specifications.
- **Irrigation System:** A controlled irrigation system will be established to apply the leaching solution to the ore stack, facilitating the dissolution of gold.
- **Chemical Addition:** Introduction of specific chemicals, including sodium cyanide and other reagents, to enhance the leaching process and maximize gold recovery.
- **Gold Recovery and Processing:** Activated carbon will be utilized to adsorb gold from the leach solution. The loaded carbon will undergo further processing to recover the gold.

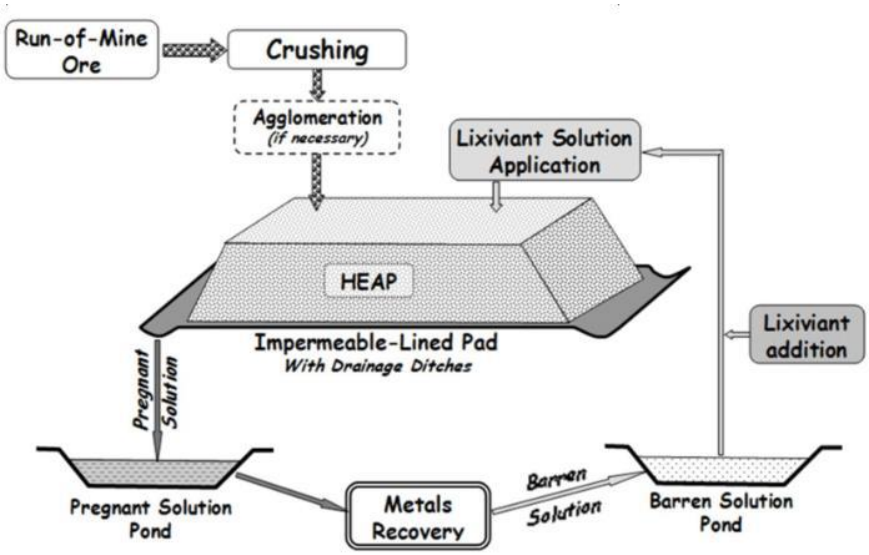


Figure 4.2: Flow diagram of heap leaching process

4.3.1 Ore Preparation:

Ore preparation is a crucial step in the gold heap leaching process. It involves several key stages to ensure the ore is ready for the leaching process. Here's a detailed look at the steps involved:

4.3.1.1 Crushing

- **Primary Crushing**: The ore is initially crushed to reduce its size to manageable chunks.
- **Secondary Crushing**: Further crushing to achieve a finer particle size, typically less than 25 mm.

4.3.1.2. Agglomeration

- **Mixing with Binder**: The crushed ore is mixed with a binder (often cement or lime) to form agglomerates. This improves the permeability and stability of the heap.
- **Agglomeration Drum**: The mixture is processed in an agglomeration drum to ensure uniformity and proper binding.

4.3.1.3. Screening

- **Particle Size Control**: The agglomerated ore is screened to remove any oversized particles that could hinder the leaching process.

4.3.1.4. Transport to Heap

- **Conveying**: The prepared ore is transported to the heap leach pad using conveyor belts or trucks.

4.3.1.5. Heap Formation

- **Stacking**: The ore is stacked in layers on the heap leach pad, ensuring even distribution and proper height for optimal leaching.

4.3.1.6. Pad Preparation

- **Lining**: The heap leach pad is lined with an impermeable liner to prevent leachate from contaminating the environment.
- **Drainage System**: A drainage system is installed to collect the leachate for further processing.

These steps ensure that the ore is properly prepared for the leaching process, maximizing gold recovery and minimizing environmental impact.

4.3.2 Heap Construction:

Heap construction is a critical phase in the gold heap leaching process. Here's a detailed look at the steps involved:

4.3.2.1. Site Preparation

- **Clearing and Grading**: The site is cleared of vegetation and debris, and the ground is graded to create a stable base for the heap.
- **Liner Installation**: An impermeable liner (usually made of HDPE) is installed to prevent leachate from contaminating the environment.

4.3.2.2. Heap Pad Construction

- **Base Layer**: A layer of compacted clay or other impermeable material is laid down to provide additional protection against leachate leakage.
- **Drainage System**: A network of pipes and channels is installed to collect and direct the leachate to a collection pond.

4.3.2.3. Ore Stacking

- **Transporting Ore**: The prepared ore is transported to the heap leach pad using conveyor belts or trucks.
- **Stacking Ore**: The ore is stacked in layers, typically using a radial stacker to ensure even distribution and optimal heap height.

4.3.2.4. Leach Solution Application

- **Drip Irrigation System**: A system of drip lines or sprinklers is installed on top of the heap to evenly distribute the leaching solution.
- **Solution Application**: The leaching solution (usually a cyanide solution) is applied to the heap, allowing it to percolate through the ore and dissolve the gold.

4.3.2.5. Monitoring and Maintenance

- **Heap Stability**: Regular inspections are conducted to ensure the heap remains stable and does not collapse.
- **Leachate Collection**: The collected leachate is monitored for gold content and environmental compliance.

4.3.2.6. Closure and Reclamation

- **Heap Detoxification**: After the leaching process is complete, the heap is detoxified to neutralize any remaining cyanide.
- **Re-vegetation**: The site is re-vegetated to restore the natural habitat and prevent erosion.

This process ensures that the heap is constructed in a way that maximizes gold recovery while minimizing environmental impact.

4.3.3 Leaching:

Leaching is a critical step in the gold heap leaching process, where the goal is to extract gold from the ore using a chemical solution. Here's a detailed look at the leaching process:

4.3.3.1. Solution Preparation

- **Leaching Solution**: A cyanide solution is commonly used for gold leaching. The solution is prepared by dissolving sodium cyanide (NaCN) in water.

4.3.3.2. Solution Application

- **Drip Irrigation or Sprinklers**: The leaching solution is applied to the heap using a drip irrigation system or sprinklers. This ensures even distribution of the solution over the ore heap.

4.3.3.3. Percolation

- **Solution Percolation**: The leaching solution percolates through the heap, dissolving the gold as it moves down through the ore. This process can take several weeks to months, depending on the size of the heap and the ore's permeability.

4.3.3.4. Collection of Pregnant Solution

- **Pregnant Solution**: The gold-laden solution, known as the pregnant solution, is collected at the bottom of the heap. This solution contains dissolved gold and other metals.

4.3.3.5. Recovery of Gold

- **Adsorption**: The pregnant solution is passed through activated carbon columns, where gold is adsorbed onto the carbon.
- **Desorption**: Gold is then stripped from the carbon using a hot caustic solution.
- **Electrowinning**: The gold-bearing solution is subjected to an electric current, causing gold to deposit onto cathodes.
- **Refining**: The deposited gold is melted and refined to produce doré bars.

4.3.3.6. Monitoring and Control

- **Solution Concentration**: The concentration of cyanide and other chemicals in the leaching solution is monitored and adjusted as needed.
- **Heap Conditions**: The heap's moisture content, pH, and temperature are regularly monitored to ensure optimal leaching conditions.

4.3.3.7. Environmental and Safety Measures

- **Containment**: The heap leach pad is lined with an impermeable liner to prevent leachate from contaminating the environment.
- **Detoxification**: After leaching is complete, the heap is detoxified to neutralize any remaining cyanide.
- **Monitoring**: Regular monitoring of groundwater and surface water is conducted to detect any potential contamination.

This process ensures efficient extraction of gold while minimizing environmental impact. If you need more details on any specific step or have further questions, feel free to ask

4.3.4 Pregnant Solution Collection:

Pregnant solution collection is a vital step in the gold heap leaching process, where the gold-laden solution is gathered for further processing. Here's a detailed look at this stage:

4.3.4.1. Collection System

- **Liner and Drainage**: The heap leach pad is lined with an impermeable liner to prevent leachate from contaminating the environment. A drainage system is installed at the base of the heap to collect the leachate.
- **Pipes and Channels**: A network of pipes and channels directs the pregnant solution to a collection pond or tank.

Image 4.1: Pregnant solution collection

4.3.4.2. Pregnant Solution Pond

- **Storage**: The pregnant solution, which contains dissolved gold, is stored in a pond or tank. This pond is also lined to prevent leakage.

- **Monitoring**: The solution is regularly monitored for gold concentration and other chemical parameters to ensure optimal recovery conditions.

4.3.4.3. Transfer to Processing Plant

- **Pumping System**: The pregnant solution is pumped from the collection pond to the processing plant for gold recovery.
- **Flow Control**: The flow rate is controlled to ensure a steady supply of pregnant solution to the processing plant.

4.3.4.4. Environmental Safeguards

- **Leak Detection**: Systems are in place to detect any leaks or spills from the collection system and ponds.
- **Secondary Containment**: Additional containment measures, such as berms or secondary liners, are used to prevent environmental contamination in case of a leak.

4.3.4.5. Maintenance and Inspection

- **Regular Inspections**: The collection system, ponds, and pumps are regularly inspected and maintained to ensure they are functioning correctly.
- **Cleaning**: Periodic cleaning of the collection system and ponds is conducted to remove any sediment or debris that could obstruct the flow of the pregnant solution.

This step ensures that the gold-laden solution is efficiently collected and safely transferred to the processing plant for gold recovery.

4.3.5 Gold Recovery:

Gold recovery is a crucial step in the heap leaching process, where the gold is extracted from the pregnant solution. Here's a detailed look at the steps involved:

4.3.5.1. Adsorption

- **Activated Carbon Columns**: The pregnant solution is passed through columns containing activated carbon. The gold in the solution adsorbs onto the carbon particles.
- **Carbon Loading**: The carbon particles become loaded with gold as the solution flows through the columns.

Image 4.2: Activated carbon chamber

4.3.5.2. Desorption

- **Elution**: The gold-loaded carbon is transferred to an elution column, where a hot caustic solution (usually a mixture of sodium hydroxide and cyanide) is used to strip the gold from the carbon.
- **Gold Recovery Solution**: The resulting solution, now rich in gold, is collected for further processing.

4.3.5.3. Electrowinning

- **Electrowinning Cells**: The gold-bearing solution is subjected to an electric current in electrowinning cells. This causes the gold to deposit onto steel wool cathodes.
- **Gold Deposition**: The gold accumulates on the cathodes as a solid layer.

4.3.5.4. Smelting

- **Cathode Processing**: The gold-coated cathodes are removed from the electrowinning cells and washed to remove any remaining solution.
- **Melting**: The gold is melted in a furnace to separate it from impurities.
- **Doré Bars**: The molten gold is poured into molds to form doré bars, which are typically 90-95% pure gold.

4.3.5.5. Refining

- **Further Purification**: The doré bars are sent to a refinery for further purification to achieve higher purity levels (up to 99.99%).
- **Final Product**: The refined gold is cast into bars or other forms for sale or further use.

Environmental and Safety Considerations

- **Waste Management**: Proper disposal of waste materials, including spent carbon and tailings, is essential to minimize environmental impact.
- **Safety Measures**: Handling of chemicals and high-temperature processes requires strict safety protocols to protect workers and the environment.

This process ensures efficient recovery of gold from the pregnant solution, resulting in high-purity gold ready for market.

4.3.6 Electrowinning:

Electrowinning is a key process in the recovery of metals from a solution, particularly in the gold heap leaching process. Here's a detailed look at the steps involved:

4.3.6.1. Overview

Electrowinning, also known as electroextraction, involves the electrodeposition of metals from their ores that have been dissolved in a solution through leaching. This process uses an electrical current to reduce metal ions and deposit them onto a cathode.

4.3.6.2. Equipment

- **Electrowinning Cell**: A tank where the electrowinning process takes place.
- **Cathodes**: Typically made of stainless steel or other conductive materials, where the metal is deposited.
- **Anodes**: Inert electrodes that complete the electrical circuit.
- **Rectifier**: Provides the direct current (DC) necessary for the process.
- **Pump**: Circulates the electrolyte solution through the system.

4.3.6.3. Process Steps

i. **Preparation of Electrolyte Solution**: The pregnant solution, containing dissolved gold, is prepared for electrowinning.

ii. **Filling the Cell**: The electrolyte solution is pumped into the electrowinning cell.

iii. **Applying Electrical Current**: A DC current is applied between the anodes and cathodes. The positively charged gold ions move towards the cathode, where they gain electrons and are deposited as solid gold.

iv. **Gold Deposition**: Gold accumulates on the cathodes over time. The efficiency of this process depends on factors such as current density, temperature, and the concentration of gold in the solution.

v. **Harvesting the Gold**: The cathodes are periodically removed from the cell, and the deposited gold is scraped off.

vi. **Refining**: The harvested gold is further refined to achieve the desired purity.

4.3.6.4. Environmental and Safety Considerations

- **Waste Management**: Proper disposal of spent electrolyte and other waste materials is crucial to minimize environmental impact.
- **Safety Protocols**: Handling of chemicals and electrical equipment requires strict safety measures to protect workers.

4.3.6.5. Advantages

- **High Purity**: Electrowinning produces high-purity metals.
- **Efficiency**: It is an efficient method for recovering metals from solutions.
- **Scalability**: The process can be scaled up or down depending on the volume of solution to be processed.

4.3.6.6. Applications

- **Gold Recovery**: Widely used in gold mining to recover gold from cyanide solutions.
- **Copper and Nickel Recovery**: Also used for recovering other metals like copper and nickel from their respective solutions.

Electrowinning is a critical step in the gold recovery process, ensuring that the dissolved gold is efficiently and safely extracted from the solution.

4.3.7 Refining:

Refining is the final step in the gold recovery process, where the gold is purified to achieve the desired level of purity. Here's a detailed look at the refining process:

4.3.7.1. Overview

Refining involves removing impurities from the gold to produce high-purity metal. This process can be done through various methods, depending on the level of purity required and the nature of the impurities.

4.3.7.2. Methods of Refining

a. Miller Process

- **Chlorination**: The impure gold is melted and chlorine gas is bubbled through the liquid. The chlorine reacts with the impurities to form chlorides, which separate from the gold.
- **Purity**: This method typically produces gold of about 99.5% purity.

b. Wohlwill Process

- **Electrolytic Refining**: The impure gold is cast into anodes and placed in an electrolytic cell. The anodes are dissolved in an electrolyte solution, and pure gold is deposited onto cathodes.
- **Purity**: This method can produce gold of up to 99.99% purity.

c. Aqua Regia Process

- **Chemical Dissolution**: The impure gold is dissolved in aqua regia (a mixture of hydrochloric acid and nitric acid). The solution is then filtered to remove impurities.
- **Precipitation**: Gold is precipitated out of the solution using a reducing agent, such as sodium metabisulfite.
- **Purity**: This method can also achieve high levels of purity.

4.3.7.3. Steps in the Refining Process

1. **Melting**: The impure gold is melted in a furnace to separate it from non-metallic impurities.
2. **Chemical Treatment**: Depending on the chosen method, the molten gold is treated with chemicals to remove metallic impurities.
3. **Electrolytic Refining**: For the Wohlwill process, the gold is subjected to electrolysis to achieve the highest purity.
4. **Casting**: The refined gold is cast into bars or other forms for sale or further use.

4.3.7.4. Environmental and Safety Considerations

- **Waste Management**: Proper disposal of chemical wastes and by-products is essential to minimize environmental impact.

- **Safety Protocols**: Handling of chemicals and high-temperature processes requires strict safety measures to protect workers.

4.3.7.5. Applications

- **Jewelry**: High-purity gold is used in the manufacture of jewelry.
- **Electronics**: Gold's excellent conductivity makes it valuable in electronic components.
- **Investment**: Refined gold is also used for investment purposes, such as bullion bars and coins.

Refining ensures that the gold produced is of the highest quality, suitable for various industrial, commercial, and investment applications.

4.3.8 Waste Management:

Waste management is a crucial aspect of the gold heap leaching process, ensuring that waste materials are handled in an environmentally responsible manner. Here's a detailed look at the steps involved:

4.3.8.1. Types of Waste

- **Solid Waste**: Includes overburden, waste rock, and tailings.
- **Liquid Waste**: Includes process water, leachate, and any contaminated runoff.
- **Hazardous Waste**: Includes chemicals used in the leaching process, such as cyanide.

4.3.8.2. Waste Management Strategies

a. Solid Waste Management

- **Overburden and Waste Rock**: These materials are typically stored in designated waste dumps. Measures are taken to stabilize these dumps and prevent erosion.
- **Tailings Management**: Tailings are stored in tailings storage facilities (TSFs) designed to contain and isolate the waste. These facilities are lined to prevent leachate from contaminating groundwater.

b. Liquid Waste Management

- **Leachate Collection**: Leachate from the heap leach pad is collected and treated to remove contaminants before being reused or discharged.
- **Process Water Recycling**: Water used in the leaching process is treated and recycled to minimize freshwater use.

Image 4.3: Leachate collection pond

c. Hazardous Waste Management

- **Chemical Handling**: Chemicals such as cyanide are stored and handled according to strict safety protocols to prevent spills and leaks.
- **Detoxification**: After the leaching process, the heap is detoxified to neutralize any remaining cyanide.

4.3.8.3. Environmental Safeguards

- **Liner Systems**: Heap leach pads and tailings storage facilities are lined with impermeable liners to prevent leachate from contaminating the environment.
- **Monitoring Systems**: Regular monitoring of groundwater and surface water is conducted to detect any potential contamination.
- **Emergency Response Plans**: Plans are in place to respond to spills, leaks, or other environmental incidents.

4.3.8.4. Community and Regulatory Compliance

- **Community Engagement**: Ongoing consultation with local communities to address concerns and ensure transparency.
- **Regulatory Compliance**: Adherence to national and international environmental regulations and standards.

4.3.8.5. Closure and Reclamation

- **Site Rehabilitation**: After mining operations are complete, the site is rehabilitated to restore the natural habitat. This includes recontouring the land, covering waste dumps with soil, and revegetation.
- **Long-term Monitoring**: Continued monitoring of the site to ensure that environmental safeguards remain effective.

Effective waste management is essential to minimize the environmental impact of gold heap leaching and ensure the sustainability of mining operations.

4.4 Project Timeline

The project timeline will be outlined, encompassing key milestones such as construction, commissioning, and ongoing operations. This will be detailed in the EIA report, considering potential phases of expansion or modification.

4.5 Environmental Impacts

This EIA report will comprehensively assess potential environmental impacts associated with the heap leaching process. This will include considerations for air quality, water resources, soil quality, biodiversity, and noise levels. Mitigation measures and monitoring plans will be proposed to minimize and manage adverse effects.

4.6 Social and Economic Considerations

Social and economic aspects will be addressed in the EIA report, encompassing potential impacts on local communities, employment opportunities, and socioeconomic benefits. Plans for community engagement and stakeholder consultation will be outlined.

4.7 Health and Safety Measures

Detailed health and safety measures will be incorporated into the project plan to ensure the well-being of workers, local communities, and other stakeholders. Emergency response plans and risk assessments will be provided.

4.8 Regulatory Compliance

The project will adhere to all relevant local, regional, and national environmental regulations. Necessary permits and approvals will be obtained, and the project will operate within the prescribed legal frameworks.

4.9 Closure and Decommissioning Plans

The EIA report will outline plans for the closure and decommissioning of the project, detailing measures for site rehabilitation, monitoring, and ongoing responsibilities post-closure.

4.10 Monitoring and Reporting

A comprehensive monitoring and reporting framework will be established to track environmental, social, and operational performance throughout the project lifecycle. Regular reporting to regulatory authorities and stakeholders will be conducted as per the requirements.

4.11 Monitoring and Reporting

Monitoring and reporting play a crucial role in the responsible and sustainable operation of a gold heap leaching project. Continuous assessment of various parameters ensures operational efficiency, environmental compliance, and the well-being of surrounding ecosystems and communities. The following outlines key aspects of monitoring and reporting in the context of heap leaching:

4.11.1 Environmental Monitoring

Continuous monitoring of air and water quality, soil stability, and biodiversity is conducted to assess the environmental impact of heap leaching operations. This includes regular sampling and analysis of air emissions, leach solution quality, and potential runoff from the leach pad.

4.11.2 Solution Percolation

The efficiency of the leaching process is monitored by assessing the percolation of the leach solution through the ore heap. Flow meters and sensors are employed to measure solution percolation rates and ensure even distribution across the leach pad.

4.11.3 Chemical Concentrations
Regular sampling and analysis of the leach solution are conducted to monitor the concentrations of reagents, such as sodium cyanide, and other chemicals. This ensures that chemical dosages remain within permitted limits and do not pose environmental risks.

4.11.4 Solution pH Levels
pH levels in the leach solution are closely monitored to maintain optimal conditions for gold dissolution. Regular measurements are taken to assess the effectiveness of pH adjustment methods and ensure compliance with regulatory requirements.

4.11.5 Health and Safety Monitoring
Continuous monitoring of health and safety parameters is conducted to safeguard the well-being of workers involved in the heap leaching process. This includes real-time monitoring of air quality, noise levels, and other potential hazards.

4.11.6 Leach Pad Stability
The stability of the leach pad is monitored through geotechnical assessments, including slope stability analyses and regular inspections. This ensures the structural integrity of the pad, minimizing the risk of erosion or failure.

4.11.7 Water Management
Monitoring systems are in place to track water usage, assess the effectiveness of containment measures, and manage water quality. This includes monitoring discharge water to ensure it meets regulatory standards before release.

4.11.8 Emergency Response Systems
Robust emergency response systems are established and regularly tested to address any unplanned events. This includes contingency plans for spills, leaks, or other emergencies, with a focus on minimizing environmental impact and protecting human health.

4.11.9 Data Management
Data collected from monitoring activities are systematically managed and stored for analysis and reporting purposes. Advanced data management systems may be employed to facilitate real-time reporting and trend analysis.

4.11.10 Regular Reporting
Regular reporting is conducted to regulatory authorities, stakeholders, and the public. Reports include comprehensive data on environmental monitoring results, operational performance, and adherence to health and safety standards.

4.11.11 Adaptive Management
Monitoring data are used to implement adaptive management strategies, allowing for adjustments to operational practices based on real-time feedback. This promotes continuous improvement and minimizes the potential for adverse environmental impacts.

4.11.12 Community Engagement
Regular communication with local communities is maintained to address concerns, provide updates on monitoring results, and ensure transparency. Community input may be incorporated into decision-making processes.

Monitoring and reporting in heap leaching are integral components of a proactive and responsible approach to mining operations. By staying vigilant and transparent, the project can adapt to changing conditions, address emerging issues, and contribute to the sustainable development of the mining site

4.12 Cyanide Detoxification

Cyanide detoxification is a critical stage in the heap leaching process, aimed at neutralizing and rendering harmless residual cyanide compounds that may be present in the leach solution and tailings. The detoxification process is imperative for environmental protection and ensuring the safety of surrounding ecosystems. The following outlines key aspects of cyanide detoxification in the context of heap leaching:

4.12.1 Purpose of Cyanide Detoxification

The primary purpose of cyanide detoxification is to mitigate the environmental impact associated with residual cyanide in the leach solution and tailings. Cyanide, used in the leaching process to dissolve gold, can be harmful to aquatic life and poses environmental risks if not properly managed.

4.12.2 Detoxification Methods

Various methods are employed for cyanide detoxification, with the selection dependent on factors such as the concentration of cyanide, characteristics of the ore, and site-specific conditions. Common detoxification methods include:

a. **Chemical Oxidation:** The addition of chemical oxidants such as hydrogen peroxide or sodium hypochlorite to the leach solution to break down cyanide compounds.

b. **Biological Treatment:** The use of microorganisms to naturally degrade cyanide. This method is eco-friendly and can be implemented in specially designed bioreactors.

c. **Precipitation:** The addition of metal ions, such as copper or iron, to the leach solution to form stable and less toxic cyanide complexes.

4.12.3 Detoxification Timing

Cyanide detoxification is typically conducted as part of the overall gold recovery process, following the adsorption of gold onto activated carbon. This ensures that residual cyanide is effectively treated before any discharge or disposal of process water or tailings.

4.12.4 Monitoring Cyanide Levels

Regular monitoring of cyanide levels in the leach solution is essential to assess the effectiveness of detoxification measures. Continuous monitoring allows for real-time adjustments to the detoxification process to maintain cyanide concentrations within permissible limits.

4.12.5 Compliance with Regulations

Cyanide detoxification procedures must comply with local and international regulations governing the discharge of cyanide-containing effluents. Adherence to these regulations is essential to prevent environmental contamination and protect human health.

4.12.6 Residual Cyanide Management

Management of residual cyanide involves ensuring that any treated solutions or tailings are free from harmful cyanide concentrations. Adequate containment and storage measures are implemented to prevent accidental releases and protect the environment.

4.12.7 Safety Protocols

Stringent safety protocols are established for personnel involved in cyanide detoxification activities. This includes proper training, use of personal protective equipment, and adherence to established procedures to minimize the risk of exposure.

4.12.8 Community Awareness

Efforts are made to communicate transparently with local communities regarding cyanide detoxification activities. Public awareness programs ensure that communities are informed about safety measures in place and understand the steps taken to mitigate environmental risks.

4.12.9 Emergency Response Planning

A robust emergency response plan is developed to address any unplanned releases of cyanide. This includes procedures for containment, cleanup, and notification of relevant authorities in the event of an emergency.

5.0 CLIMATE CHANGE RISKS AND VULNERABILITY ASSESSMENT FOR GOLD HEAP LEACHING PROJECT IN MIGORI COUNTY, KENYA

5.1 Introduction

5.1.2 Project Overview:
The gold heap leaching project in Migori County involves extracting gold from ore using a cyanide solution. The project site is located in the southwestern part of Kenya, near the border with Tanzania.

5.1.2 Purpose of Assessment:
This assessment aims to identify and evaluate the potential risks and vulnerabilities posed by climate change to the project, ensuring sustainable and resilient operations.

5.2 Climate Change Context

5.2.1 Regional Climate Trends:
Migori County experiences a tropical climate with two rainy seasons: the long rains (March to May) and the short rains (October to December). The region has seen increasing temperatures and variability in rainfall patterns over the past decades[1].

5.2.2 Future Climate Projections:
Climate models predict that Migori County will experience higher temperatures, more intense and irregular rainfall, and an increase in the frequency of extreme weather events such as droughts and floods.

5.3 Vulnerability Assessment

- **Exposure**: Key elements exposed to climate risks include the heap leach pad, water resources, local infrastructure, and nearby communities.
- **Sensitivity**: The heap leach pad is sensitive to heavy rainfall, which can cause erosion and leachate overflow. Water resources are sensitive to drought conditions, affecting the availability of water for the leaching process.
- **Adaptive Capacity**: The project's adaptive capacity includes existing infrastructure, water management practices, and community engagement programs. However, there is room for improvement in areas such as emergency response and climate-resilient infrastructure.

5.4 Climate Change Risks

5.4.1 Physical Risks:
- **Temperature Increases**: Higher temperatures can reduce ore processing efficiency, increase evaporation rates, and pose health risks to workers.
- **Precipitation Changes**: Variability in rainfall can lead to water scarcity during droughts and flooding during heavy rains, impacting leachate management and heap stability.
- **Extreme Weather Events**: Storms and heat waves can damage infrastructure, disrupt operations, and pose safety risks to workers and local communities.

5.4.2 Environmental Risks:
- **Biodiversity Loss**: Changes in climate can affect local flora and fauna, leading to habitat loss and reduced biodiversity.

- **Soil Erosion**: Increased rainfall intensity can cause soil erosion, affecting heap stability and increasing sedimentation in nearby water bodies.

5.4.3 Social Risks:

- **Community Health**: Changing climate conditions can exacerbate health issues such as waterborne diseases and heat stress.

- **Livelihoods**: Local communities, particularly those dependent on agriculture, may face economic challenges due to climate impacts on crop yields and water availability.

5.5 Impact and Mitigation Matrix

Risk	Description	Mitigation Measures	Monitoring Plan
Temperature Increases	Reduced ore processing efficiency	- Implement cooling systems - Schedule work during cooler hours	- Monitor temperature trends - Regular equipment checks
Precipitation Changes	Water scarcity or flooding	- Develop water conservation strategies - Improve drainage systems	- Monitor rainfall patterns - Regular water quality testing
Extreme Weather Events	Infrastructure damage	- Strengthen infrastructure - Develop emergency response plans	- Monitor weather forecasts - Conduct regular drills
Biodiversity Loss	Impact on local species	- Implement habitat restoration projects - Create wildlife corridors	- Conduct biodiversity surveys - Regular habitat monitoring
Soil Erosion	Heap stability issues	- Use erosion control measures - Stabilize slopes	- Monitor soil conditions - Regular inspections
Community Health	Health risks from climate impacts	- Provide healthcare support - Implement community health programs	- Monitor health indicators - Conduct health surveys
Livelihoods	Economic impacts on local communities	- Support alternative livelihoods - Provide training programs	- Monitor economic indicators - Regular community consultations

Table 5.1: Impact and mitigation matrix

5.6 Adaptation Strategies

5.6.1 Infrastructure Resilience:

Strengthening infrastructure to withstand extreme weather events and changing climate conditions. This includes reinforcing heap leach pads, improving drainage systems, and constructing climate-resilient buildings.

5.6.2 Water Management:
Implementing efficient water use and conservation practices to address variability in water availability. This includes rainwater harvesting, recycling process water, and developing drought-resistant water sources.

5.6.3 Biodiversity Conservation:
Protecting and restoring local ecosystems to enhance resilience to climate change. This includes reforestation projects, creating wildlife corridors, and protecting critical habitats.

5.6.4 Community Engagement:
Involving local communities in adaptation planning and decision-making processes. This includes regular consultations, participatory planning, and capacity-building programs.

5.6.5 Capacity Building:
Providing training and resources to enhance the adaptive capacity of project staff and local communities. This includes emergency response training, climate change awareness programs, and technical support for implementing adaptation measures.

5.7 Monitoring and Evaluation

5.7.1 Monitoring Plan:
A detailed plan for monitoring climate change impacts and the effectiveness of adaptation measures. This includes regular data collection on temperature, rainfall, water quality, and biodiversity.

5.7.2 Reporting:
Procedures for regular reporting to stakeholders, including government agencies, local communities, and investors. This includes annual climate risk assessments, progress reports on adaptation measures, and transparent communication of monitoring results.

5.8 Conclusion

5.8.1 Summary:
This assessment highlights the key climate change risks and vulnerabilities for the gold heap leaching project in Migori County. It identifies potential impacts on physical infrastructure, environmental resources, and local communities, and proposes mitigation and adaptation strategies to enhance resilience.

5.8.2 Commitment:
The project is committed to addressing climate change risks and enhancing its resilience through proactive measures, continuous monitoring, and engagement with stakeholders.

6.0 PUBLIC PARTICIPATION

5.1 Introduction

The planned Heap Leaching is likely to have some impacts on the surrounding areas. Persons within the neighbourhood of the site where the development is to take place were interviewed so that they could shed some light on their expectations from the planned project. The purpose for such interviews was to identify and promote the positive impacts while mitigating the negative ones. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeds as planned. The exercise was conducted via a **Baraza** called by the area chief as well as the administration of pre-designed questionnaires and interviews.

The responses from the questionnaire survey are attached in **Appendix** 9

6.2 Data collection

The data collection was carried out by use of interview schedules and distribution of questionnaires to the members of the public who reside near the area. *(See photo logs in appendix 8)* Observation and photography was also used in gathering information about the area in relation to the proposed project.

6.3 Issues of concern

i) Harmful chemicals

There was concern over harmful chemicals affecting livestock and humans

ii) Water overuse

There were also concerns on stretched water resources

iii) Noise

Another concern raised was noise from the equipment and suggestions of muffled equipment was made

iv) Soil fertility

There was concern about soil infertility as a result of chemical spillage and soil pollution

v) Health & safety concerns

There were health and safety concerns from mines and chemicals and it was suggested proponent ensures proper use of PPEs

6.4 Positive Impacts

i. There would be employment opportunities for locals
ii. Local businesses will get a boost
iii. Road accessibility and good infrastructure
iv. Urbanization
v. Access to water
vi. Improved security in the area
vii. Cultural integration
viii. Improved economic growth

6.5 Recommendations by the respondents

i. Proponent to ensure the road is sprinkled to arrest dust
ii. Plant trees
iii. All workers to observe safety by using PPEs
iv. Neutralize chemicals using catalysts to prevent chemicals from harming the soil
v. Control flow from plant to protect surrounding to prevent run-off water
vi. Operate during normal working hours and Muffle noisy equipment
vii. Employ at least 70% of the locals in non-technical skill
viii. Undertake CSR activities e.g educating local children
ix. Rehabilitate site to original state or better after project cycle ends
x. Sensitize the community of dangers of handling chemicals and mining in general

7.0 CHAPTER SEVEN: POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Construction Phase

This section outlines both positive and negative impacts associated with the proposed processing of precious metals during the Construction Phase.

7.1.1 Positive Impacts

7.1.1.1 Immediate Impacts during Construction

During construction, positive effects include increased job opportunities in the informal sector. Local kiosk operators, providing food to on-site workers, will benefit, promoting entrepreneurship in the area.

7.1.1.2 Job Opportunities

Construction will create job opportunities, particularly for casual workers. This not only benefits the economy but also engages young individuals in productive employment, potentially reducing social issues like drug abuse and crime.

7.1.1.3 Gains in the Local and National Economy

Local and national economies will benefit through the consumption of locally available materials, attracting taxes payable to the government. The consumption of materials like concrete, timber, and cement directly contributes to economic growth.

7.1.1.4 Provision of Market for Supply of Building Materials

The project will stimulate demand for building materials, creating a ready market for suppliers such as quarrying companies, hardware shops, and individuals with construction materials.

7.2 Negative Impacts

7.2.1 Soil Erosion

During construction, the site's gentle slopes increase the risk of soil erosion, especially during rainy and windy seasons. Soil erosion can lead to downstream hydrological changes, increased flooding, and water quality issues.

7.2.2 Storm water

Construction operations may face interference from storm water runoff, impacting both the construction site and neighboring compounds.

7.2.3 Noise Pollution

Construction activities, involving moving machines and vehicles, may result in noise pollution, affecting both workers and nearby residents.

7.2.4 Disposal of Excavated Soil

Excavated soil, categorized as waste, may have adverse impacts on the receiving environment if not judicially disposed of.

7.2.5 Oil Spills

The use of machinery may lead to oil spills, potentially contaminating soil and water on-site. Proper maintenance and containment measures are crucial to mitigate this risk.

7.6.2.6 Increased Water Demand

Construction activities will increase the demand for water, primarily used in concrete preparation, wetting surfaces, curing, and cleaning.

7.2.7 Dust Emissions

Particulate matter pollution may occur during site clearance and excavation, posing health risks to workers and nearby residents.

7.2.8 Faecal Waste Management
Construction workers generating faecal waste necessitate proper handling to prevent disease outbreaks on-site.

7.2.9 Food Kiosks and Informal Settlements
Increased demand for meals from construction workers may lead to the emergence of food kiosks and informal settlements, posing social and environmental challenges.

7.2.10 Destruction of Existing Vegetation
The construction process involves clearing existing vegetation, with plans to replace it with indigenous and useful trees as part of the landscape plan.

7.2.11 Generation of Exhaust Emissions
Construction equipment and vehicles may generate exhaust emissions, impacting air quality and sustainability of natural resources.

7.2.12 Increased Runoff from New Impervious Areas
Construction activities could create impervious areas, increasing runoff and potentially leading to increased flood peaks in developed areas.

7.2.13 Aquatic Species and Communities
Changes in surface hydrology and water quality may negatively impact aquatic species, including fish, plants, and microbes.

7.2.14 Workers' Accidents and Hazards
Construction workers may face hazards and accidents, emphasizing the importance of safety measures and compliance with occupational health standards.

76.2.15 Vector-Borne and Water-Borne Diseases
Improper waste management may create breeding conditions for disease vectors, contributing to diseases like cholera, typhoid, and malaria.

7.2.16 Possible Exposure of Workers to Diseases
During construction, workers may be exposed to diseases from building materials, emphasizing the need for proper inspection and adherence to health and safety standards.

7.2.17 Solid Waste Generation
Construction generates solid waste, affecting aesthetics, attracting pests, causing pollution, and impacting informal recycling communities.

7.2.18 Extraction and Use of Materials
The extraction and use of materials for processing precious metals may negatively affect non-renewable resources, causing landscape changes, displacement of animals, and environmental impacts.

7.2.19 Energy Consumption
The project's energy consumption, mainly from fossil fuels, may have environmental implications on availability, price, and sustainability.

76.3 Operation Phase

7.3.1 Positive Impacts

7.3.1.1 Employment Creation
The operation phase creates long-term employment opportunities.

7.3.1.2 Optimal Use of Land
The project ensures optimal use of land, benefiting the country and its people.

7.3.2 Negative Impacts

7.3.2.1 Increased Population
without Commensurate Services The project's development may lead to increased population density, requiring appropriate services and facilities.

7.3.2.2 Increased Pressure on Infrastructure
Projects of this magnitude may strain existing infrastructure, affecting roads, sewer lines, and electricity supply.

7.3.2.3 Air Pollution
Poor solid waste management during the operation phase could lead to unsanitary conditions and environmental unfriendliness.

7.3.2.4 Water Pollution
Improper waste disposal may contaminate groundwater, causing diseases like malaria and cholera. Efficient waste management is proposed to prevent such issues.

7.3.2.5 Electricity Consumption
Increased use of electricity during the operation phase may negatively impact natural resource sustainability.

7.3.2.6 Insecurity/Social Crime
The project may introduce permanent residents, potentially leading to security concerns. Measures, such as employing security officers and installing security lights, aim to address this issue.

7.3.2.7 Solid Waste Generation
The operation phase is expected to generate substantial amounts of solid waste, posing environmental challenges.

7.3.2.8 Water Use
Increased water demand during the operation phase necessitates efficient water management.

7.4 Decommissioning Phase

7.4.1 Positive Impacts

7.4.1.1 Rehabilitation
Upon decommissioning, the project site will undergo rehabilitation, including topsoil replacement and re-vegetation, improving the area's visual quality.

7.4.1.2 Employment Opportunities
The demolition stage will create employment opportunities for demolition staff.

7.4.2 Negative Impacts

7.4.2.3 Solid Waste
Demolition will generate large quantities of solid waste, potentially releasing hazardous chemicals into the environment.

7.4.2.4 Dust
Demolition works will generate dust, impacting both demolition staff and nearby residents.

7.4.2.5 Noise and Vibration
Demolition works will lead to significant noise and vibration, affecting the acoustic environment in and around the project site.

8.0 CHAPTER EIGHT: MITIGATION MEASURES AND MONITORING PROGRAMMES

This chapter outlines mitigation measures for anticipated negative impacts of the proposed processing of precious metals, organized by two main categories: Construction and Operational.

8.1 Mitigation Measures

8.1.1 Air Quality

Construction Phase

Controlling Dust: To minimize nuisance conditions, implement a standard set of dust control measures for all construction activities. This includes controlling emissions of NOx, CO2, SOx, and diesel-related PMB from heavy equipment.

Training: Train construction personnel to minimize air quality impacts, focusing on reducing dust and exhaust gas emissions from heavy construction vehicles.

Specific Measures:

- Watering active construction areas to lay dust.
- Covering trucks hauling loose materials.
- Paving or applying soil stabilizers on unpaved areas.
- Sweeping paved areas daily.
- Planting fast-growing trees as windbreaks.

8.1.2 Noise Emission

Construction Phase

Noise Impact Significance: Evaluate noise impacts based on exposure levels, ground-borne vibration, and ambient noise increases. Mitigate significant impacts by implementing noise-suppression techniques.

Techniques:

- Install portable barriers for stationary equipment.
- Use quiet equipment with noise control elements.
- Coordinate with relevant agencies.
- Install sound barriers for pile driving.
- Limit vehicle idling time.

Adherence to Regulations: Follow Noise Prevention and Control Rules 2005 and Legal Notice No. 24 regarding workplace noise limits.

8.1.3 Exhaust Emissions

Construction Phase

Control Measures:

- Minimize vehicle idling time.
- Use alternative-fueled construction equipment where feasible.
- Properly tune and maintain equipment.

- Plan material transportation to reduce vehicle trips.

8.1.4 Hydrology and Water Quality Degradation

Emergency Response Plan: Develop a hazardous substance control and emergency response plan to ensure safe cleanup of accidental spills during construction.
Pre-Construction Sampling: Conduct soil sampling and trial holes before construction to inform crews about soil conditions. Address hazardous substances encountered during trenching following regulatory guidelines.

Groundwater Contamination: Sample suspected contaminated groundwater, analyze for pollutants, and dispose of it according to regulations.

Waste Management: Implement proper waste management, using oil absorbents and tarps for minor releases.

8.1.5 Mushrooming of Kiosks and Informal Settlement

Construction Phase
On-Site Kiosk Services: Provide on-site kiosk services with adequate sanitation to alleviate the impact of mushrooming kiosks.

8.1.6 Worker Accidents and Hazards

Construction Phase
Waste Collection and Handling: Ensure adequate collection and storage of waste on-site and safe transportation to disposal sites, adhering to occupational health and safety rules.

8.1.7 Populations of Disease Vectors

Refuse Collection: Provide complete refuse collection and handling services to prevent the proliferation of disease vectors.

8.1.8 Increased Runoff

Stormwater Management: Design a stormwater management plan to minimize impervious area infiltration, using recharge areas and detention/retention structures.

8.1.9 Possible Exposure of Workers to Diseases

Occupational Health Standards: Mitigate possible exposure to diseases from building materials by enforcing occupational health and safety standards.

8.1.10 Worker Accidents During Construction and Operation

Safety Procedures: Enforce safety procedures, contingency plans, and safety education to mitigate accidents during construction and operation.

8.1.11 Reduction of Impacts at Extraction Sites and Efficient Use of Raw Materials

Source Materials: Source materials from registered quarry and sand processing firms with satisfactory environmental performance standards.

8.1.12 Minimization of Vegetation Disturbance

Preservation and Demarcation: Preserve individual trees within the site, demarcate the project area, and implement a landscaping program for reforestation.
Topsoil Excavation: Deposit excavated topsoil in landscaped areas for enhanced plant health.

8.1.13 Minimization of Run-Off and Soil Erosion

Site Design: Terrace and level the project site to reduce runoff velocity and increase rainwater infiltration. Restrict construction vehicles to designated areas.

8.1.14 Minimization of Construction Waste

Recycling and Reuse: Recycle or reuse construction waste to divert materials for productive use. Recover damaged materials for refurbishing and use in other projects.

Materials Management: Budget construction materials carefully, minimize on-site materials, and consider using recycled or refurbished materials.

Additional Recommendations:

- Use durable, long-lasting materials.
- Provide facilities for proper material handling and storage.
- Purchase perishable materials incrementally.
- Minimize packaging waste.
- Use materials with recycled content when possible.

8.2 Monitoring Programmes

To ensure effective implementation of mitigation measures:

8.2.1 Air Quality Monitoring:

Regularly monitor air quality during construction to assess the effectiveness of dust control measures.

8.2.2 Noise Monitoring:

Conduct noise monitoring to ensure adherence to established limits during construction.

8.2.3 Exhaust Emission Monitoring:

Regularly monitor exhaust emissions to ensure compliance with control measures.

8.2.4 Hydrology and Water Quality Monitoring:

Monitor hydrology and water quality regularly during construction to detect and address any degradation.

8.2.5 Waste Management Monitoring:

Monitor waste management practices to ensure compliance with regulations.

8.2.6 Storm water Management Monitoring:

Monitor storm water management measures to assess their effectiveness.

8.2.7 Occupational Health and Safety Monitoring:

Regularly monitor and assess occupational health and safety measures during construction.

8.2.8 Vegetation and Soil Monitoring:

Conduct regular monitoring of vegetation and soil to ensure minimal disturbance and effective reforestation.

8.2.9 Run-Off and Soil Erosion Monitoring:

Monitor run-off and soil erosion control measures to assess their effectiveness.

8.2.10 Construction Waste Monitoring:

Regularly monitor construction waste management practices to ensure recycling and reuse objectives are met.

8.2.11 Materials Management Monitoring:

Monitor materials management practices to ensure adherence to budgeting and recycling/reuse goals.

8.2.12 Populations of Disease Vectors Monitoring:
Regularly monitors refuse collection and handling services to prevent the proliferation of disease vectors.

8.2.13 Run-Off Monitoring:
Monitor storm water management measures to assess their impact on run-off and flooding.

8.2.14 Worker Health Monitoring:
Implement a health monitoring program to ensure the well-being of construction workers.

8.2.15 Overall Compliance Audits:
Conduct periodic audits to assess overall compliance with mitigation measures and regulatory requirements.
These monitoring programs aim to provide real-time feedback on the effectiveness of mitigation measures and allow for prompt corrective actions when needed

9.0 ANALYSIS OF ALTERNATIVES

In order to enable the proposed project to seek different ways of minimizing its impacts on the environment and at the same time achieve its objectives several alternatives were assessed.

9.1 The Zero Option

The "zero option" represents a situation which would result if the project was not implemented. In this case, both the positive and negative impacts of construction and operation the project would not occur. This option will however, involve several losses both to the landowner and the country as a whole. The landowner continues to pay rent on the land while the property remains underutilized. The major impact of not proceeding would be the loss of expected benefits. These include:

- Poor treatment of domestic sewage
- Bad odour from the existing pond due to poor treatment as a result of siltation.
- The local skills would remain under-utilized.
- No employment opportunities will be created

From the analysis above, it is apparent that the No Project alternative is not the best alternative for proponent.

9.2 Alternative land use/site

Relocation option to a different site was assessed. In this case the proponent will have to look for another land to implement the project. The project site will continue to remain under-utilized and this will lead to

In consideration of the above concerns and assessment of the current proposed site, relocation and alternative land use is not a viable option.

9.3 Alternative schedule

This option entails carrying out the project at a later time thereby offsetting the possible impacts at the current time. The only benefit is the hope that in future there may be improvements in baseline conditions and implementation technologies. However these conditions are not guaranteed and may only amount to delays in the project implementation. Therefore carrying out the proposed project with the proposed mitigations would be the most preferred option due to future uncertainties and the need to divert the domestic effluent to a new treatment plant. In addition carrying out the proposed project at later time may lead to more operational and logistic costs due to increasing inflation and standards of living.

9.4 Alternative designs

This option entails undertaking the project but with different project designs. However the current project design has been achieved by considering all the options available that would ensure cost-effectiveness and avoid or reduce environmental and social impacts as much as possible.

9.5 Conclusion on project alternatives

Implementation of the project with the proposed mitigation measures is the most preferred option as it entails carrying out the project with mitigation measures to prevent, offset or avoid its negative impacts thereby maximizing it gains. This option will therefore lead to achieving the project's objectives sustainably and contribute to the achievement of other policy goals and sector objectives.

10.0 ENVIRONMENTAL MANAGEMENT PLAN

10.1 Introduction

The Environmental Management Plan (EMP) involves risk management strategies that should be undertaken by the proponent and all the stakeholders to ensure environmental sustainability of the project. These are approaches to monitor, control, reclaim and restore the environment to an appropriate state. EMP for projects thus provide logical frameworks within which the identified issues of environmental concern can be mitigated or monitored. Environmental monitoring involves measurement of relevant parameters, at a level of details accurate enough, to distinguish the anticipated changes. Monitoring aims at determining the effectiveness of actions to improve environmental quality.

Environmental management and monitoring plans have been developed and outlined to highlight key findings of the Environmental & Social Impact Assessment (ESIA); recommending necessary mitigation actions, defining roles, indicators that can be monitored and the estimated cost. The EMPs outlined in this report addresses the identified issues of concern (potential negative impacts) and mitigation measures as well as roles, costs and indicators that can be monitored and can help to determine the effectiveness of actions to enhance the quality of environment as regards the proposed project. The contractor together with the proponent will incorporate mitigation measures highlighted in this chapter into the contract documents. The project supervisor will ensure the mitigation measures highlighted in this Chapter of the report are implemented. Once the project comes into operation, the health and safety issues as well as environmental considerations will be handed over to the relevant staff committee of the project as well as the technical staff. They should be trained to develop capacity to implement the project which can include issues on environmental considerations and issues affecting the project, implementation of Environmental Management Plan, project management, health and safety risks and their prevention.

10.2 Environment Management Plan (EMP)

Environmental / Social issue/ aspect/ activity	Anticipated negative impacts	Management and mitigation	Responsibility	Performance indicator	Estimated cost (KES)
Site preparation phase					
Compliance with legislations		- Conduct an environmental assessment and prepare a decommissioning report for application of a decommissioning permit from NEMA - Register the site with the Mines and Geology department in accordance with Mining Act requirements - Document and keep records of all environmental and health matters in accordance with Section 68 (3) of EMCA, 1999 and OSHA, 2007	Proponent	Relevant permits	100,000
Establishment of site office:	Construction wastes generation.	-Landscape the area once construction is complete to incorporate as many trees as possible; -Develop a waste management plan and implement it.	Project Manager / Supervisor/ Contractor.	Waste disposal records.	50,000 one-off
Earthworks, demolitions and excavations:	-Collection and stagnation of surface runoff; Increase in susceptibility to soil erosion; -Production of spoil from Excavatedground; -Reduction in aesthetic value of the area; -Risk of contamination to surface water;	-Excavation should be carried out such that drainage is controlled, and water is not allowed to accumulate; -Establish controls for surface runoff during excavation; -Control excavation activities to limit excavation to land which is required for construction; -Cordoning the site off using iron sheets or other appropriate materials to protect passersby and control noise. -Control any likelihood of occurrence of risks	Project Manager / Supervisor/ Contractor	-Performance of erosion control measures. -Noise and dust generation -General due diligence practiced	200,000one-off

Transportation of debris:	-Fuel consumption and exhaust fumes; -Increase in traffic flow in the area.	-Maintenance of equipment for efficiency, minimizing noise production, emissions, spills and consumption; -Erect informative signs prior to commencing construction activities to warn residents; -Avoid transporting during periods of peak traffic activity.	Project Manager / Supervisor and Contractor.	-Fuel consumption; -Frequency of equipment replacement and repair.	200,000 p.m
Leveling and laying of foundation:	Noise and dust.	-Water sprinkling and use of screens to control dust; -Maintenance of equipment for efficiency, minimizing noise production, emissions and spills; -Cordoning the site off.	Project Manager / Supervisor and Contractor.	-Daily spot checks; -Regular servicing of equipment.	-2,000 when dusty conditions set in and 10,000 for site isolation
Environmental / Social issue/ aspect/ activity	**Anticipated negative impacts**	**Management and mitigation**	**Responsibility**	**Performance indicator**	**Estimated cost (KES)**
Occupational health and safety:	-Health hazard; -Physical injury from slipping -Falling and handling equipment.	-Carefully plan for construction sanitary facilities -Provide personal protective equipment (PPE) appropriate to working area for staff and visitors to the site; -Regular site reporting on health, safety and environment (HSE) issues by an appointed HSE representative; -Develop a monitoring programme to assess noise performance in accordance with the revised Noise Prevention and Control Rules (April 2005); and NEMA Noise Control Regulations, 2009 -Assessment of HSE mitigation measures and recording of any matters arising as per Legal Notice No 40, The Factories (Building Operations and Works of Engineering Construction) Rules	Project Manager / Supervisor and Contractor.	-Regularly check on performance of provided sanitary facilities; -Have regular spot checks on use and adequacy of PPE provided -Conduct regular internal assessments on environmental site performance and record findings.	40,000 p.m
Production of Waste:	Soil degradation and surface water	-Develop a solid waste management plan prior to project commencing, identifying optimal waste re-use	Project Manager /	Report on all waste	100,000 one-off

	pollution.	options and licensed disposal areas; -Waste should not be burned on site or dumped in undesignated waste disposal areas; -Minimize waste production by utilizing best available techniques for site preparation; -Re-use construction waste to the maximum extent possible; -Excavation activities and dumping of soil should be properly managed such that land which is not required for the project is left undisturbed.	Supervisor and Contractor.	production and handling procedures.	

Environmental / Social issue/ aspect/ activity	**Anticipated negative impacts**	**Management and mitigation**	**Responsibility**	**Performance indicator**	**Estimated cost (KES)**
Construction phase					
Vegetation Clearance	Loss of vegetation cover Soil erosion	-Areas with exposed soil should be replanted with grass as soon as possible after construction; to help mitigate against flash flood caused soil erosion. -Waste generated during the site clearance/construction phases of the project must be disposed of at an approved disposal site. -Suitable trees should be planted at the periphery of project site and near the River bank -No unnecessary removal of any vegetation shall be done	Contractor Proponent	-Spot checks -Number of trees planted	100,000 for planting trees and suitable vegetation
Loss of Water Quality and interference with riparian reserve	Pollution of nearest stream and sedimentation	• Runoff channels to be constructed to drain storm waters • Water quality tests at the river to be conducted quarterly • Maintain the riparian reserve of 10 meters • Replant the riparian zone with suitable trees	Contractor WRA MIWASCO	-Spot checks -Number of trees planted	20,000 quarterly
Air Quality	Excessive generation of dust and other particulate	-Site access roads should be dampened every 4-6 hours or within reasonable time to prevent a dust nuisance and on hotter days, this frequency should be increased. -The access roads (unpaved sections) through to the	Contractor	-Workers with respirators, nose masks, ear plugs	44,000 as per need

	matter	site should also be wetted and the sections of the road monitored so that any material falling on it as a result of the construction activities be removed. -Minimize cleared areas to those that are needed to be used. -Cover or wet construction materials such as soil for backfill to prevent a dust nuisance. -Where unavoidable, construction workers working in dusty areas should be provided and fitted with respirators		-Wetted roads	
Environmental / Social issue/ aspect/ activity	**Anticipated negative impacts**	**Management and mitigation**	**Responsibility**	**Performance indicator**	**Estimated cost (KES)**
Storage of Raw Material and Equipment	Stored materials becoming air, water or soil borne	-Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne. -Raw material should be placed on hard stands surrounded by walls. - Equipment should be stored on impermeable hard stands surrounded by walls to contain any accidental surface runoff. -No storage of oils or fuels onsite	Contractor	-Labeling of Materials -proper wall for storage	30,000 0ne-off
Waste water Generation and Disposal	-Pollution of ground water -Pollution of local streams	-Provide portable sanitary conveniences for the construction workers for control of sewage waste. A ratio of approximately 25 workers per toilet should be used as a guide.	MIWASCO Public Health	Sanitary facilities installed	35,000 one-off
Transportation of Raw Material and Equipment	Interference With traffic flow including pedestrians	-Adequate and appropriate road signs should be erected to warn road users of the construction activities. For example, reduced speed near the entrance roads. This should be done in conjunction with the Ministry of Transport -Raw materials such as sand, murram and cement should be adequately covered within the trucks to prevent any escaping into the air and along the route to the site. -The movement of equipment (trucks) during the	Contractor	Road signage erected	15,000,000

		construction of the system should be limited to the working hours, 8:00 am - 5:00 pm per day. -Equipment should be transported early morning (6 am – 7 am) with proper care being taken. -The use of flagmen should be employed to regulate when trucks have access to the main roads.			
Traffic Obstruction	Obstruction caused by laying of sewer lines to persons and vehicles	-The laying of sewer pipes across any access road should be done when traffic volumes are lowest, for example, early morning or on weekends (specifically on Saturdays and Sunday). -Adequate notices should be placed along the route. -Adequate signs and flagmen should be put in place.	Contractor	-Signage posted -Flagmen posted appropriately along the route	No extra cost
Environmental / Social issue/ aspect/ activity	**Anticipated negative impacts**	**Management and mitigation**	**Responsibility**	**Performance indicator**	**Estimated cost (KES)**
Emergency Response plans	Occurrence of accidental injuries	-A lead person should be identified and appointed to be responsible for emergencies occurring on the site. This person should be clearly identified to the construction workers. -Make prior arrangements with health care facilities such as a Health Centre in proximity, a private doctor or the Provincial Hospital to accommodate any eventualities. -Material Safety Data Sheets (MSDS) should be store onsite.	**C**ontractor	-Availability of MSDS on site -Lead person to oversee health and safety issues appointed	335,000
Drainage management	Soil, surface and ground water	-Proper construction site drainage management i.e.: Control erosion avoid water pools; -Proper waste and material handling, and storage to avoid flushing of wastes in to the neighbouring stream -Follow designs made for the system	Contractor.	Daily auditing and spot checks	Project budget
Waste management	Pollution, infestation by vermins, work area health and safety	-Waste bins should be strategically placed within the construction site. -The waste bins at the construction site should be adequately designed and covered to prevent access by vermin and minimize odour. -The bins at the construction site should be adequately	Construction site supervisor. Contractor.	Daily auditing and spot checks	120,000

		covered to prevent a dust nuisance. -The bins at the construction site should be emptied regularly to prevent overfilling. -Disposal of the contents of the bins should be done at an approved disposal site. -Controlled use of materials on site; -Waste minimization at the source -Safe waste storage and handling on site -Monitoring and reporting -Erect warning signs against poor waste disposal -Sensitization of workers on waste disposal methods -Encourage and practice reuse and recycling			
Environmental / Social issue/ aspect/ activity	**Anticipated negative impacts**	**Management and mitigation**	**Responsibility**	**Performance indicator**	**Estimated cost (KES)**
Soil erosion	Soil loss and sedimentation of the local stream	-Minimize vegetation disturbance; -Reinstate site immediately after construction -Put bunds to prevent soil and any material from getting to the local stream	Construction supervisor. Contractor.	-Daily spot checks -Workers wearing protective gear -Monitoring of the stream nearby	220,000
Noise / vibration	Nuisance in the project area	-Use equipment that has low noise emissions as stated by the manufacturers. -Use equipment that is properly fitted with noise reduction devices such as mufflers. -Operate noise-generating equipment during regular working hours (e.g. 8 am – 6 pm) so as to reduce the potential of creating a noise nuisance during the night. -Construction workers operating equipment that generates noise should be equipped with noise protection. A guide is a worker operating equipment generating noise of 80 dBA (decibels) continuously for 8 hours or more should use ear muffs. Workers experiencing prolonged noise levels 70 - 80 dBA should	Construction supervisor. Contractor. Proponent	Daily spot checks	120,000

		wear earplugs. -The working hours shall be regulated i.e. from 8 AM to 6PM -Workers shall wear earplugs during construction phase -Implement noise minimization measures; -Site screening; -Manage vibration, where it occurs -Monitoring, reporting and community liaison			
Environmental / Social issue/ aspect/ activity	**Anticipated negative impacts**	**Management and mitigation**	**Responsibility**	**Performance indicator**	**Estimated cost (KES)**
Earthworks excavation	Wastes arising, safety, noise, vibration, surface contamination,	-Noise, dust, vibration minimization measures should be put into place -Minimize excavation and materials for disposal -Exclude water from excavation; -Properly support excavated areas as appropriate -Manage any contaminated materials found -Minimize risk of contaminating surface water -Safe material storage and disposal at appropriate sites.	Construction supervisor. Contractor.	Daily auditing	1,000,000
Materials for construction	Destruction caused by mines and quarries, wastage.	-Document and report on all material sources -Control wastage of block, brick and stone work et al; -Utilize damaged materials elsewhere.	Construction supervisor. Contractor.	Daily, spot checks	Project budget/no extra cost
Fire safety and general accidents	Working conditions, fire related incidents and accidents, pollution.	-Compliance with OHS laws and health and safety committee rules; -Provision of PPE (personal protective equipment) -Secure / screen hazardous areas; -Provision of fire suppression equipment; -"No smoking" signage Prominently displayed; -Provision of First Aid box facilities; -Training in fire response/ First Aid; -No burning of waste or material on site -Fencing the site with strong wire mesh material	Construction Supervisor. Contractor. community	-Regular fire audit -Strict site supervision -A register of incidents and accidents should be kept	230,000

Environmental / Social issue/ aspect/ activity	Anticipated negative impacts	Management and mitigation	Responsibility	Performance indicator	Estimated cost (KES)
Operation phase					
Use of GDA to leach gold tailings	Risk of leakage or spills of GDA slurry during leaching	- Seal the leaching tanks with impervious material to reduce possibility of leakage of GDA chemicals during the leaching process	Project Manager	Regular inspections and recording	160,000
Solid Waste Generation and Disposal	Increase in solid waste on site	-Provide sludge drying beds in the project -Provision of adequately designed bins to prevent access by vermin. -Monitor skips so that they do not become overfilled. -Ensure that the solid waste collected is disposed of in an approved dumpsite	Proponent MIWASCO WRA NEMA	Waste bins onsite Disposal of grit/sludge in licensed dump sites	35,000
Transportation/ Traffic	Increase in traffic along the access road	-Limit tailings delivery to the site between the hours of 8 am and 5 pm. This will limit the noise nuisance to residents and possibly reduce the population exposed to potential accidents, as most persons would have already left their homes to go to work or and schools. -Add adequate and appropriate signs including speed limits along the road in proximity to the access roads.	Construction Supervisor. Contractor.	-Regulated transport hours and times -Noise levels generated on route used by vehicles minimization -Signs posted vehicle route	Budget no extra cost
Emergency Response	Accidents occurrence and sicknesses	-Install safety valves on gas conveyance system -Reduce distances for conveying gas to neighbors -Make prior arrangements with health care facilities such as a Health Centre in proximity. -Design and implement an emergency response plan. -Coordinate with first aid organizations/agencies i.e. St. John's Ambulance, Red Cross to prepare for any eventuality. -Display telephone numbers of emergency response departments for all people accessing the site to clearly see	Proponent contractor	-Sickness and Accident -records Safety valves on gas conveyance system installed	1,000,000

Wastewater Disposal/Water Pollution	Pollution of local stream	Follow the NEMA waste water quality guidelines strictly	Proponent NEMA MIWASCO	-Periodic Water quality tests	240,000
Environmental / Social issue/ aspect/ activity	**Anticipated negative impacts**	**Management and mitigation**	**Responsibility**	**Performance indicator**	**Estimated cost (KES)**
Future environmental protection	Any impact arising	• Environmental monitoring procedures • Involve all stakeholders and let them play their roles in monitoring activities	Proponent	Documented procedures	170,000
Litigation	Court Cases	**-Engage legal representative (s)**	Proponent	Legal personnel	TBD

10.3 Decommissioning phase

Decommissioning holds a significant role in the lifecycle of a gold heap leaching project, marking its conclusive phase. It is the ultimate step to conclude project operations, with the primary objective of restoring the project site to acceptable standards. This restoration, known as rehabilitation, becomes imperative when the project is no longer economically viable. The process involves reestablishing the topographical elements once the leaching operation ceases.

The longevity of the heap leaching system hinges on the maintenance capabilities of China Chongqing Handu Construction Machinery Co Limited. To extend the project's lifespan, the proponent plans to implement a de-sludging schedule. This schedule, if adhered to, is anticipated to prolong the project's operational viability to over 40 years, affording the company the flexibility to continue using the system. Consequently, the responsibility of decommissioning is assumed by the proponent when the project's economic viability is in question or under circumstances necessitating decommissioning.

Recommendably, a comprehensive Environmental Audit should be conducted during the decommissioning phase. This audit will evaluate all aspects of the decommissioning process against prevailing conditions and regulatory requirements.

The primary aim of decommissioning is the rehabilitation of the project site to meet acceptable standards. All endeavors during this phase should be directed towards restoring the site as closely as possible to its original state before project implementation. Decommissioning activities will encompass replanting the area with suitable trees and vegetation, demolishing structures, removing debris, and landscaping.

The social implications of decommissioning involve the displacement of employed workers, leading to income loss and concerns related to health and safety. In this scenario, the proponent's decommissioning approach will focus on landscaping the area for any other appropriate use. Consequently, the impacts of

decommissioning will be relatively minimal, primarily affecting the local community by impacting effective sewer services and influencing water quality in nearby streams.

10.4 Environment Management Plan (EMP) Decommissioning Phase

Environmental / Social issue/ aspect/ activity	Anticipated negative impacts	Management and mitigation	Responsibility	Performance indicator	Estimated cost (KES)
Decommissioning phase					
Structures, wastes and demolition machinery	Generation of scrap material and other waste debris on site	• All buildings, machinery, equipment, structures, tools that cannot be reused or recycled shall be removed from site • Where reuse is not possible, materials should be taken into approved dumping sites	Project contractor, proponent and site manager	Amount of generated waste and stockpiles	250,000
Rehabilitation of project site	Clearing of vegetation, soil erosion	• Fencing and warnings posted at the site restricting access • Do re-vegetation of the site to restore the site to its original status • During demolition, appropriate surface run-off controls will be undertaken to minimize erosion rates • Constant monitoring and inspection of the demolition works to prevent accidents	Proponent Contractor	Number of trees planted Biomass volume present	10,500,000
Socio-economic and health impact	Increased disease incidents levels, lowering of quality of life	• Provide alternatives to connected plots/premises • Offer advice on alternative income generating ventures to workers • Redeploy workers. • Consider redeveloping the project • Prepare proposals to donors for a new sewer project	Proponent	Settled ex-workers	150,000

11.0 CONCLUSION

The Environmental and Social Impact Assessment (ESIA) for the proposed heap leaching processing plant on Plot L.R. No. KADEM/MACALDROR/175 in Kalange Sub-location, Mikei Location, Nyatike Sub-county, Migori County, has thoroughly evaluated the potential impacts of the project on the environment and the surrounding community. This assessment was conducted in compliance with the Environmental Management and Coordination Act (EMCA), 1999, the Environmental (Impact Assessment and Audit) Regulations, 2003, and other relevant legislative and regulatory frameworks.

The study has identified both positive and negative impacts associated with the project. On the positive side, the project is expected to contribute significantly to local economic development through job creation, infrastructure improvement, and increased economic activities in the region. It will also enhance the extraction of precious metals, which is vital for the mining sector and the broader economy.

However, the project also presents environmental and social risks, including potential water contamination, air quality deterioration, soil degradation, noise pollution, and community health and safety concerns. The ESIA has proposed comprehensive mitigation measures to address these risks, including the development and implementation of an Environmental Management Plan (EMP). The EMP outlines specific actions, monitoring frameworks, and responsibilities to ensure that the project complies with environmental and social safeguards throughout its lifecycle.

The study also emphasizes the importance of ongoing stakeholder engagement and public participation to ensure that the concerns of the local community and other stakeholders are continuously addressed. This participatory approach will be crucial in fostering community support and ensuring that the project is implemented in a socially responsible manner.

In conclusion, while the proposed heap leaching processing plant poses certain environmental and social challenges, these can be effectively managed through the strict implementation of the recommended mitigation measures and adherence to the EMP. The study recommends that the National Environment Management Authority (NEMA) grants approval for the project, subject to compliance with the conditions outlined in this report. The successful execution of the project will require ongoing collaboration between the proponent, regulatory authorities, and the local community to ensure that it delivers the intended economic benefits while minimizing its environmental footprint.

List of Appendices

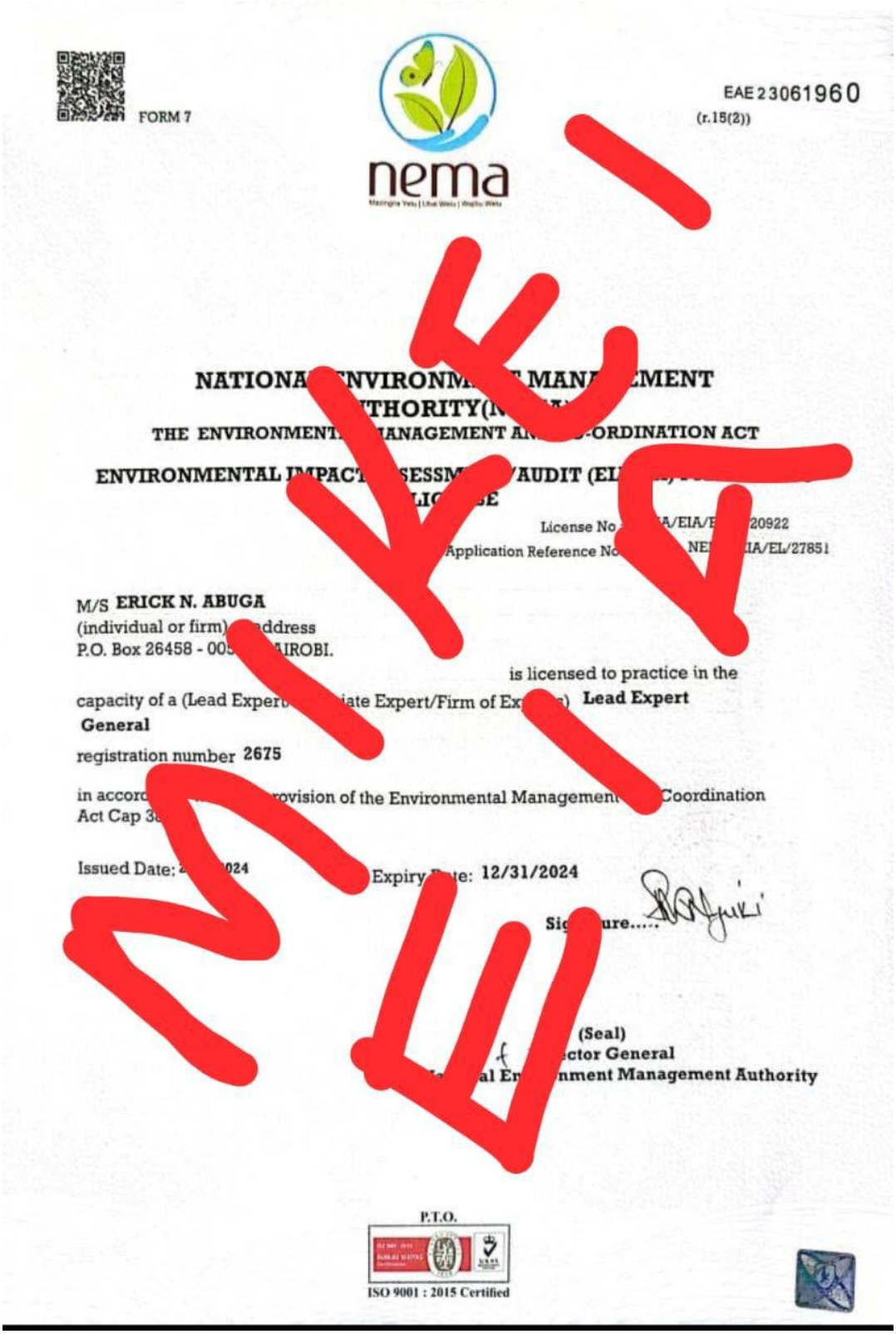
Appendix	Description
Appendix 1:	Expert License
Appendix 2:	Proponents registration Copies
Appendix 3:	Land Lease certificate copy
Appendix 4:	Process chart
Appendix 5:	KRA PIN copy
Appendix 6:	Bill of Quantities
Appendix 7:	Site Sketch Map
Appendix 8:	Photo Logs
Appendix 9:	Public Participation Questionnaires

References

- Kenya gazette supplement Acts 2000, Environmental Management and Coordination Act Number 8 of 1999. *Government printer, Nairobi*
- Kenya gazette supplement Acts *Building Code 2000 by government printer, Nairobi*
- Kenya gazette supplement Acts *Land Planning Act (Cap. 303) government printer, Nairobi*
- Kenya gazette supplement Acts *Local Authority Act (Cap. 265) government printer, Nairobi*
- Kenya gazette supplement Acts Penal Code Act (Cap.63) *government printer, Nairobi*
- Kenya gazette supplement Acts *Physical Planning Act, 1999 government printer, Nairobi*
- Kenya gazette supplement Acts *Public Health Act (Cap. 242) government printer, Nairobi*
- Kenya gazette supplement number 56. Environmental Impact Assessment and Audit Regulations 2003. *government printer, Nairobi*
- County Integrated Development Plan- Migori County
- EMCA noise and Excessive Vibrations Pollution Control 2009
- IFC Environmental Health and Safety EHS guidelines- world bank group

www.nema.go.ke
www.kenyampya.com
www.commonwealthofnations.org
www.wikipedia.com
www.en-climate.com

APPENDIX 1 : NEMA LEAD EXPERT LICENSE



FORM 7

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THE ENVIRONMENT[illegible]ANAGEMENT AN[illegible]ORDINATION ACT

ENVIRONMENTAL IMPACT[illegible]SESSM[illegible]/AUDIT (EI[illegible])
[illegible]LIC[illegible]SE

License No [illegible]A/EIA/E[illegible]20922

Application Reference No[illegible] NE[illegible]IA/EL/27851

M/S **ERICK N. ABUGA**
(individual or firm) [illegible]ddress
P.O. Box 26458 - 005[illegible]AIROBI.

is licensed to practice in the

capacity of a (Lead Expert[illegible]iate Expert/Firm of Ex[illegible]) **Lead Expert**
General

registration number **2675**

in accord[illegible]rovision of the Environmental Management[illegible]Coordination
Act Cap 3[illegible]

Issued Date: [illegible]024 Expiry [illegible]te: **12/31/2024**

Sig[illegible]ure.....

(Seal)
f[illegible]ctor General
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NEMA

P.T.O.

ISO 9001 : 2015 Certified

APPENDIX 2: PROPONENTS REGISTRATION CERTIFICATE

No. CPR/2010/37033

CERTIFICATE OF INCORPORATION

I hereby CERTIFY, that -

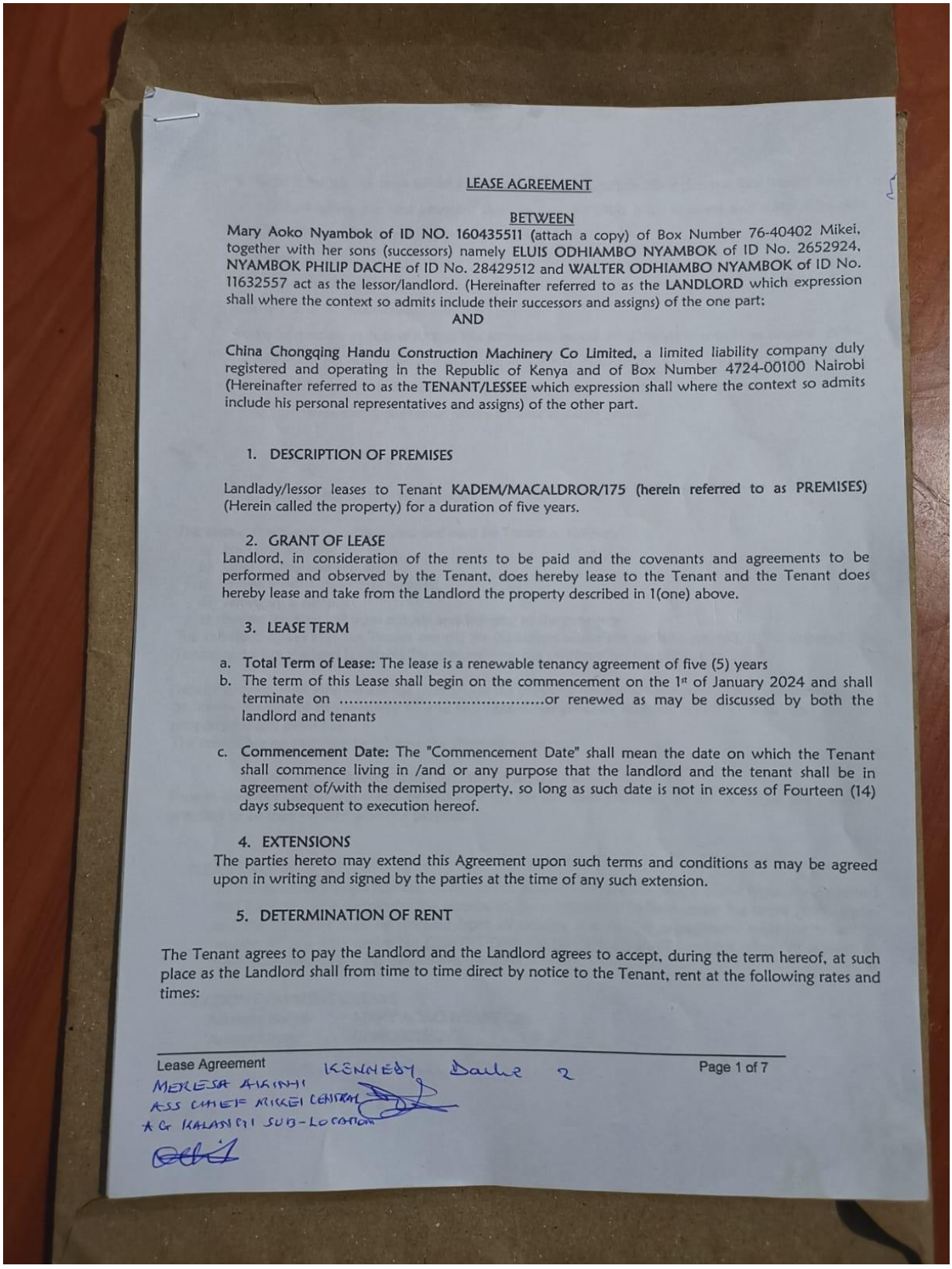
CHINA CHONGQING HANDU CONSTRUCTION MACHINERY CO. LIMITED

is this day Incorporated under the Companies Act (Cap. 486) and that the Company is **LIMITED**.

GIVEN under my hand at Nairobi this **3 rd** day of **December** Two Thousand and **Ten**

Registrar Of Companies

APPENDIX 3: LAND LEASE AGREEMENT



LEASE AGREEMENT

BETWEEN

Mary Aoko Nyambok of ID NO. 160435511 (attach a copy) of Box Number 76-40402 Mikei, together with her sons (successors) namely **ELUIS ODHIAMBO NYAMBOK** of ID No. 2652924, **NYAMBOK PHILIP DACHE** of ID No. 28429512 and **WALTER ODHIAMBO NYAMBOK** of ID No. 11632557 act as the lessor/landlord. (Hereinafter referred to as the **LANDLORD** which expression shall where the context so admits include their successors and assigns) of the one part:

AND

China Chongqing Handu Construction Machinery Co Limited, a limited liability company duly registered and operating in the Republic of Kenya and of Box Number 4724-00100 Nairobi (Hereinafter referred to as the **TENANT/LESSEE** which expression shall where the context so admits include his personal representatives and assigns) of the other part.

1. DESCRIPTION OF PREMISES

Landlady/lessor leases to Tenant **KADEM/MACALDROR/175 (herein referred to as PREMISES)** (Herein called the property) for a duration of five years.

2. GRANT OF LEASE

Landlord, in consideration of the rents to be paid and the covenants and agreements to be performed and observed by the Tenant, does hereby lease to the Tenant and the Tenant does hereby lease and take from the Landlord the property described in 1(one) above.

3. LEASE TERM

a. **Total Term of Lease:** The lease is a renewable tenancy agreement of five (5) years
b. The term of this Lease shall begin on the commencement on the 1st of January 2024 and shall terminate on .....or renewed as may be discussed by both the landlord and tenants

c. **Commencement Date:** The "Commencement Date" shall mean the date on which the Tenant shall commence living in /and or any purpose that the landlord and the tenant shall be in agreement of/with the demised property, so long as such date is not in excess of Fourteen (14) days subsequent to execution hereof.

4. EXTENSIONS

The parties hereto may extend this Agreement upon such terms and conditions as may be agreed upon in writing and signed by the parties at the time of any such extension.

5. DETERMINATION OF RENT

The Tenant agrees to pay the Landlord and the Landlord agrees to accept, during the term hereof, at such place as the Landlord shall from time to time direct by notice to the Tenant, rent at the following rates and times:

Lease Agreement KENNEDY Dalue 2 Page 1 of 7

MERLESA AKINYI
ASS CHIEF MIKEI CENTRAL
A G KALANGU SUB-LOCATION

- Rent: Rent for the term of the Lease shall be **ksh** 4.4million (four decimal four million Kenya shillings) where the rent payment shall be Ksh. 440,000 (four hundred and forty thousand Kenya shillings) to be paid biannually **INCLUSIVE** of tax/ V.A.T.

NOTE

The tenant shall be paying after every six months until such a time when the title deed of the property shall be made available for their perusal.

- To be paid on or before 10th **of the subsequent month after the six Month** have elapsed. In the event that this is not met, the following conditions shall apply:
  - i) The arrears or the outstanding rent will attract a penalty.
  - ii) The landlord shall be at liberty to lease to other people

6. USE OF PROPERTY BY TENANT

The Leased Premises is to be occupied and used by **Tenant** as follows;

a) For Gold leaching
b) Gold Mining and Process.
c) Processing of outsourcing material,
d) Setting up a camp
e) Buying leaching soil from outside and bringing to the property

The Landlord agrees that the Tenant can dig six (6) meters under the earth to get soil, if the material the Tenant gets from the land is suitable for gold refining, the Landlord has the priority to but it.

Nothing herein shall give Tenant the right to use the property for any other purpose or to sublease, assign, or license the use of the property to any Sub-Tenant, assignee, or licensee, which or who shall use the property for any other use.
The tenant has no mandate to sublease the demised property.

7. WASTE, NUISANCE, OR UNLAWFUL ACTIVITY

Tenant shall not allow any waste or nuisance on the demised premises, or use or allow the demised premises to be used for any **unlawful purpose.**

PLEASES NOTE:

In the event of a bona fide sale of the leased property before the expiry of the lease, the Landlord shall have the right to transfer the security to the purchaser to be held under the terms of this lease, and the Landlord shall be released from all liability and further engagement with the tenant in relation to this lease under No CONDITIONS FROM THE TENANT, and the return of security to the Tenant will be in accordance with this lease.

ACCOUNT PAYMENT DETAILS

Account Name: MARY AOKO NYAMBOK
Account No: 074000016637

Bank Name: FAMILY BANK

PLEASE NOTE: This account is to be used for the sole purposes of rent deposit in relation to this lease.

8. LEASE TERMINATION:

This lease can be terminated by the tenant by giving one month (30 days) notice. In which case the landlord will have the time to have the property inspected and repairs done accordingly. In the event that the Tenant wishes to vacate the property kindly be advised that after inspection of the property minor/ major repairs will be done.

9. UTILITIES

Tenant shall pay for water, electricity and other services incident to Tenant's use of the Leased Premises, whether or not the cost thereof is a charge or imposition against the Leased Premises.

OBLIGATIONS FOR REPAIRS

a. **Tenant's Alterations:** The Tenant shall have the right, at its sole expense, from time to time to make such non-structural and structural alterations and changes in such parts thereof as the Tenant shall deem expedient or necessary for its purposes; provided, however, that such alterations and changes shall neither impair the structural soundness nor diminish the value of the Leased Premises. However, on termination or end of the lease period the Tenant will leave the demised property as they found it.

b. **Permits and Expenses:** Each party agrees that it will procure all necessary permits for making any alterations, or other improvements for installations, when applicable. Each Party hereto shall give written notice to the other party of any alterations required of the other pursuant to the provisions of this Article and the party responsible for said alterations agrees promptly to commence such alterations and to prosecute the same to completion diligently, subject, however, to the delays occasioned by events beyond the control of such party.

c. Permit the landlord or agent at all reasonable times during the said tenancy with or without workmen to examine the condition of the said property. However, this should not affect the work of the tenants at any cost.

d. Each party agrees to pay promptly when due the entire cost of any work done by it upon the Leased Premises so that the Leased Premises at all times shall be free of liens for labor and materials. Each party further agrees to hold harmless and indemnify the other party from and against any and all injury, loss, claims or damage to any person or property occasioned by or arising out of the doing of any such work by such party or its employees, agents or contractor. Each party further agrees that in doing such work that it will employ materials of good quality and comply with all governmental requirements, and perform such work in a good and workmanlike manner.

10. TENANT'S COVENANTS

Tenant covenants and agrees as follows:

a. To procure any licenses and permits required for any use made of the Leased Premises by Tenant, and upon the expiration or termination of this Lease, to remove its goods and effects and those of all persons claiming under it, and to yield up peaceably to Landlord the Leased Premises in good order, repair and condition in all respects; excepting only damage by fire and casualty covered by Tenant's insurance coverage, structural repairs (unless Tenant is obligated to make such repairs hereunder) and reasonable wear and tear;

b. To permit Landlord and its agents to examine the Leased Premises at reasonable times and to show the Leased Premises to prospective purchasers of the property and to provide Lanif not already available, with a set of keys for the purpose of said examination, provided that Landlord shall not thereby unreasonably interfere with the conduct of Tenant's business;

11. INDEMNITY BY TENANT

The Tenant shall save Landlord harmless and indemnify Landlord from all injury, loss, claims or damage to any person or property while on the Leased Premises, unless caused by the willful acts or omissions or gross negligence of Landlord, its employees, agents, licensees or contractors.

12. LANDLORD'S REMEDIES

In the event that:

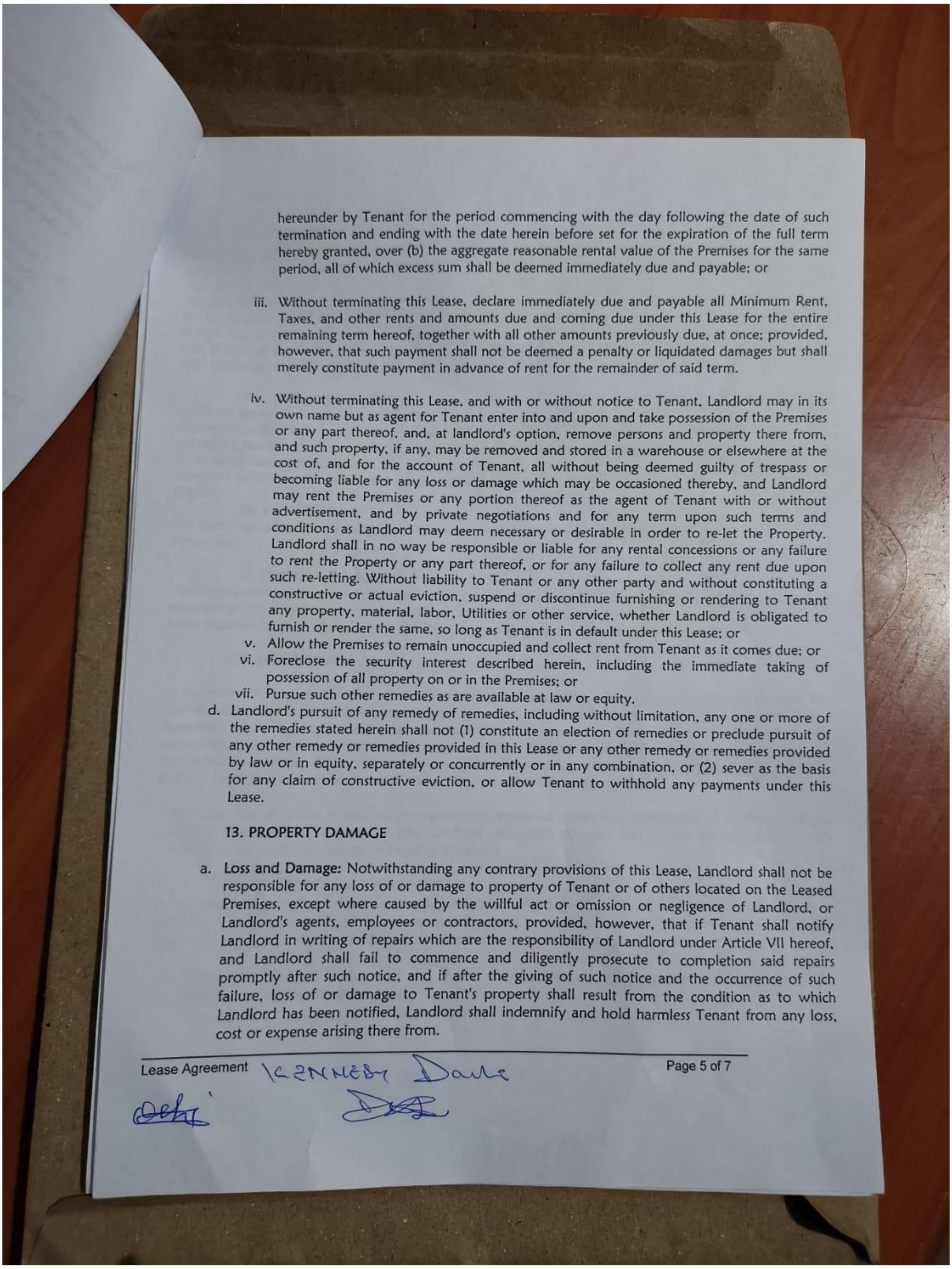
a. Tenant shall on three or more occasions be in default in the payment of rent or other charges herein required to be paid by Tenant (default herein being defined as payment received by Landlord ten or more days subsequent to the due date), regardless of whether or not such default has occurred on consecutive or non-consecutive months; or

b. Tenant has caused a lien to be filed against the Landlord's property and said lien is not removed within seven days of recordation thereof; or

c. Tenant shall default in the observance or performance of any of the covenants and agreements required to be performed and observed by Tenant hereunder for a period of seven (7) days after notice to Tenant in writing of such default (or if such default shall reasonably take more than Seven days to cure, Tenant shall not have commenced the same within the seven days and diligently prosecuted the same to completion); or

   i. Terminate this Lease by giving Tenant notice of termination, in which event this Lease shall expire and terminate on the date specified in such notice of termination, with the same force and effect as though the date so specified were the date herein originally fixed as the termination date of the term of this Lease, and all rights of Tenant under this Lease and i and to the Premises shall expire and terminate, and Tenant shall remain liable for all obligations under this Lease arising up to the date of such termination, and Tenant shall surrender the Premises to Landlord on the date specified in such notice; or

   ii. Terminate this Lease as provided herein and recover from Tenant all damages Landlord may incur by reason of Tenant's default, including, without limitation, a sum which, at the date of such termination, represents the then value of the excess, if any, of (a) the Minimum Rent, Percentage Rent, Taxes and all other sums which would have been payable



hereunder by Tenant for the period commencing with the day following the date of such termination and ending with the date herein before set for the expiration of the full term hereby granted, over (b) the aggregate reasonable rental value of the Premises for the same period, all of which excess sum shall be deemed immediately due and payable; or

iii. Without terminating this Lease, declare immediately due and payable all Minimum Rent, Taxes, and other rents and amounts due and coming due under this Lease for the entire remaining term hereof, together with all other amounts previously due, at once; provided, however, that such payment shall not be deemed a penalty or liquidated damages but shall merely constitute payment in advance of rent for the remainder of said term.

iv. Without terminating this Lease, and with or without notice to Tenant, Landlord may in its own name but as agent for Tenant enter into and upon and take possession of the Premises or any part thereof, and, at landlord's option, remove persons and property there from, and such property, if any, may be removed and stored in a warehouse or elsewhere at the cost of, and for the account of Tenant, all without being deemed guilty of trespass or becoming liable for any loss or damage which may be occasioned thereby, and Landlord may rent the Premises or any portion thereof as the agent of Tenant with or without advertisement, and by private negotiations and for any term upon such terms and conditions as Landlord may deem necessary or desirable in order to re-let the Property. Landlord shall in no way be responsible or liable for any rental concessions or any failure to rent the Property or any part thereof, or for any failure to collect any rent due upon such re-letting. Without liability to Tenant or any other party and without constituting a constructive or actual eviction, suspend or discontinue furnishing or rendering to Tenant any property, material, labor, Utilities or other service, whether Landlord is obligated to furnish or render the same, so long as Tenant is in default under this Lease; or

v. Allow the Premises to remain unoccupied and collect rent from Tenant as it comes due; or

vi. Foreclose the security interest described herein, including the immediate taking of possession of all property on or in the Premises; or

vii. Pursue such other remedies as are available at law or equity.

d. Landlord's pursuit of any remedy of remedies, including without limitation, any one or more of the remedies stated herein shall not (1) constitute an election of remedies or preclude pursuit of any other remedy or remedies provided in this Lease or any other remedy or remedies provided by law or in equity, separately or concurrently or in any combination, or (2) sever as the basis for any claim of constructive eviction, or allow Tenant to withhold any payments under this Lease.

13. PROPERTY DAMAGE

a. **Loss and Damage:** Notwithstanding any contrary provisions of this Lease, Landlord shall not be responsible for any loss of or damage to property of Tenant or of others located on the Leased Premises, except where caused by the willful act or omission or negligence of Landlord, or Landlord's agents, employees or contractors, provided, however, that if Tenant shall notify Landlord in writing of repairs which are the responsibility of Landlord under Article VII hereof, and Landlord shall fail to commence and diligently prosecute to completion said repairs promptly after such notice, and if after the giving of such notice and the occurrence of such failure, loss of or damage to Tenant's property shall result from the condition as to which Landlord has been notified, Landlord shall indemnify and hold harmless Tenant from any loss, cost or expense arising there from.

Lease Agreement Page 5 of 7

14. FIXTURES

All personal property, furnishings and equipment presently and all other trade fixtures installed in or hereafter by or at the expense of Tenant and all additions and/or improvements, exclusive of structural, mechanical, electrical, and plumbing, affixed to the Leased Premises and used in the operation of the Tenant's business made to, in or on the Leased Premises by and at the expense of Tenant and susceptible of being removed from the Leased Premises without damage, unless such damage be repaired by Tenant, shall remain the property of Tenant and Tenant may, but shall not be obligated to, remove the same or any part thereof at any time or times during the term hereof, provided that Tenant, at its sole cost and expense, shall make any repairs occasioned by such removal.

15. OPTION TO RENEW

Landlord grants to Tenant an option to renew this lease agreement for a period of **FIVE (5)** years after expiration of the term of this Lease agreement at a rental fee to be agreed by both parties based on the prevailing market rates as well as the economic factors. With all other terms and conditions of the renewal lease to be the same as those in this lease agreement. To exercise this option to renew, Tenant must give Landlord written notice of intention to do so at least FOURTY FIVE (45) days before this lease agreement expires.

16. BROKERAGE

No party has acted as, by or through a broker in the effectuation of this Agreement, except as set out hereinafter.

17. ENTIRE AGREEMENT

This instrument contains the entire and only agreement between the parties, and no oral statements or representations or prior written matter not contained in this instrument shall have any force and effect. This Lease shall not **be modified in any way except by a writing executed by both parties.**

18. LITIGATION

In the event that litigation results from or arises out of this Agreement or the performance thereof, the parties agree to reimburse the prevailing party's reasonable attorney's fees, court costs, and all other expenses, whether or not taxable by the court as costs, in addition to any other relief to which the prevailing party may be entitled. In such event, no action shall be entertained by said court or any court of competent jurisdiction if filed more than one year subsequent to the date the cause(s) of action actually accrued regardless of whether damages were otherwise as of said time calculable.

If Landlord files an action to enforce any agreement contained in this lease agreement, or for breach of any covenant or condition, Tenant shall pay Landlord reasonable attorney fees for the services of Landlord's attorney in the action, all fees to be fixed by the court.

19. CONTRACTUAL PROCEDURES

Unless specifically disallowed by law, should litigation arise hereunder, service of process therefore may be obtained through certified mail, return receipt requested; the parties hereto waiving any and all rights they may have to object to the method by which service was perfected.

The Agreement is subject to the Laws of Kenya in so far as they are not inconsistent with/or excluded by the provisions of this Agreement.

IN WITNESS WHEREOF the parties hereto have put their respective hands hereunto the day, month and year first hereinbefore written.

SIGNED BY THE SAID LANDLORD
MARY AOKO NYAMBOK)------------------------------ " "
Witnessed by
ELUIS ODHIAMBO NYAMBOK)------------------------------ " "
NYAMBOK PHILIP DACHE)------------------------------ 02-Jan "
WALTER ODHIAMBO NYAMBOK)------------------------------
KENNEDY DACHE PHILLIP)------------------------------ 02-Jan-2024

SIGNED BY THE SAID TENANT
DENG MINFANG (DIRECTOR))------------------------------

In the presence of)
)

ADVOCATE
DRAWN BY
MUNYASYA & CO. ADVOCATES
POSTBANK HOUSE, SERVICE FLOOR
P.O BOX 35572-00200
NAIROBI

MERESA AKINYI
ASS CHIEF MIKEI CENTRAL
A-G KALANGI SUB-LOCATION.

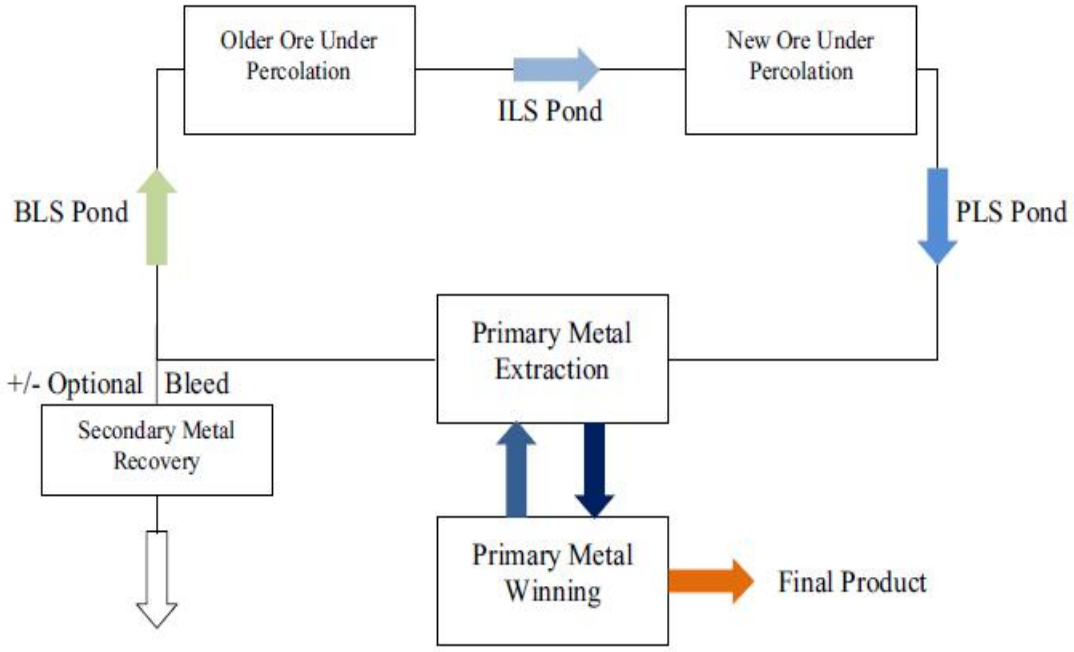
THE PRESIDENCY ASSISTANT CHIEF OFFICE
P.O. BOX 1 NYATIKE
KALANGI SUB-LOCATION

Noted
C.I.
OCS MACALDER P/STATION
SAMUEL ONYANGO.
02/01/2024

MACALDER POLICE STATION

Lease Agreement Page 7 of 7

APPENDIX 4: HEAP LEACHING PROCESS CHART



Abbreviations, names and acronyms used in percolation and more specifically heap leaching:

PLS	Pregnant Leach Solution
ILS	Intermediate Leach Solution
BLS	Barren Leach Solution
RAF	Raffinate – BLS post SX – a specific term for SX
Extraction	Selective recovery of metals via IX (ion exchange resin or activated carbon) or SX (solvent extraction)
Winning	EW (Electrowinning) or selective ppt^{n} of metals from extraction eluates or strip solutions

APPENDIX 5 : PROPONENTS KRA PIN

KENYA REVENUE AUTHORITY

www.kra.go.ke

PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Cell: +254(0711)099 999
Email: callcentre@kra.go.ke

Certificate Date : 09/08/2023

Personal Identification Number

P051345287N

This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

Taxpayer Information

Taxpayer Name	CHINA CHONGQING HANDU CONSTRUCTION MACHINERY CO. LIMITED
Email Address	HANDUKENYA@GMAIL.COM

Registered Address

L.R. Number : N/A	**Building :** EMBASSY HOUSE
Street/Road : PARLIAMENT ROAD	**City/Town :** NAIROBI CITY (NORTH)
County : Nairobi	**District :** Nairobi East District
Tax Area : Nairobi East	**Station :** MTO*
P. O. Box : 4724	**Postal Code :** 00100

Tax Obligation(s) Registration Details

Sr. No.	Tax Obligation(s)	Effective From Date	Effective Till Date	Status
1	Income Tax - Company	03/12/2010	N.A.	Active
2	Value Added Tax (VAT)	03/12/2010	N.A.	Active
3	Income Tax - PAYE	01/11/2011	N.A.	Active

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end month is December unless a change has been approved by the Commissioner-Domestic Taxes Department. The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.

* The station is subject to change based on the verification done by Commissioner.

Disclaimer : This is a system generated certificate and does not require signature.

APPENDIX 6 : BILL OF QUANTITIES

PROPOSED HEAP LEACHING PROCESS PLANT

ON PARCEL KADEM/MACALDROR/175, IN KALANGE SUB-LOCATION, MIKEI LOCATION, NYATIKE SUB-COUNTY, MIGORI COUNTY

BILLS OF QUANTITIES

TABLE OF CONTENTS

BoQs HEAP LEACHING

ITEM	DESCRIPTION	QNTY	UNIT	RATE	AMOUNT (KES)
1.	**BILL NO. 1: PREAMBLES** The following is a high-level BoQ, in Kenyan Shillings (KES), for **PROPOSED HEAP LEACHING PROCESS PLANT** in Nyatike Migori County. The BoQ includes the costs for 3 tipper trucks, 1 excavator, 1 shovel/bulldozer, a sodium cyanide irrigation system (capable of irrigating 2 acres of ore heaps), a double cabin pickup truck, and 15 employees.				
2.	**BILL NO. 2: EQUIPMENT COSTS**				
	A. **Tipper Trucks***(used)*	3	NO	5,000,000.00	15,000,000.00
	B. **Excavator***(used)*	1	NO	6,000,000.00	6,000,000.00
	C. **Shovel/Bulldozer***(used)*	1	NO	7,500,000.00	7,500,000.00
	D. **Sodium Cyanide Irrigation System**	1	NO	4,000,000.00	4,000,000.00
	E. **Double Cabin Pickup Truck***(used)*	1	NO	3,000,000.00	3,000,000.00
	Subtotal for Equipment Costs:				**35,500,000.00**
3.	**BILL NO. 3: LAND PREPARATION AND CONSTRUCTION COSTS**				
	A. Land Clearing and Preparation	10	Acre	50,000.00	500,000.00
	B. Heap Leach Pads Construction	5	Acre	900,000.00	4,500,000.00
	C. Containment Liner (Geo-membrane + Clay)	5	Acre	900,000.00	4,500,000.00
	D. Drainage and Collection System	5	Acre	500,000.00	2,500,000.00
	Subtotal for Land Preparation and Construction Costs				**12,000,000.00**
4.	**BILL NO. 4: CHEMICAL COSTS**				
	A. Sodium Cyanide	5	Ton	500,000.00	2,500,000.00
	B. Other Chemicals (Lime, Caustic Soda, etc.)	Lump	Sum	1,500,000.00	1,500,000.00
	Subtotal for Chemical Costs				**4,000,000.00**

BoQs HEAP LEACHING

ITEM	DESCRIPTION	QNTY	UNIT	RATE	AMOUNT (KES)
5.	**BILL NO. 5: LABOR COSTS/MONTH**				
	A. Skilled Employees	5	Month	130,000.00	650,000.00
	B. Unskilled Employees	10	Month	25,000.00	250,000.00
	Subtotal for Labor Costs (per month)				**900,000.00**
6.	**BILL NO. 6: MISCELLANEOUS COSTS**				
	A. Fuel and Lubricants	Lump	Sum	3,000,000.00	3,000,000.00
	B. Maintenance and Repairs	Lump	Sum	4,500,000.00	4,500,000.00
	C. Safety Equipment and PPE	15	Employee	50,000.00	750,000.00
	D. Contingency (10% of total costs)	Lump	Sum	10%	5,240,000.00
	Subtotal for Miscellaneous Costs				**13,490,000.00**
7.	**BILL NO.7: GRAND SUMMARY**				
	A. Equipment Costs				35,500,000
	B. Land Preparation and Construction Costs				12,000,000
	C. Chemical Costs				4,000,000
	D. Labor Costs (per month)				900,000
	E. Miscellaneous Costs				13,490,000
	TOTAL ESTIMATED COST				**65,890,000.00**

Notes:

1. **Equipment Costs:** The costs are approximate and are for used equipment sourced from road construction.
2. **Land Preparation and Construction Costs:** These include the costs for clearing the land, constructing heap leach pads, installing containment liners, and creating drainage systems.

3. **Chemical Costs:** These are based on the estimated quantity of sodium cyanide and other chemicals required for the operation.
4. **Labor Costs:** This is a monthly estimate for the employees working on the project.
5. **Miscellaneous Costs:** Includes fuel, maintenance, safety equipment, and a contingency allowance to cover unforeseen expenses.

APPENDIX 7:SITE PHOTO LOGS

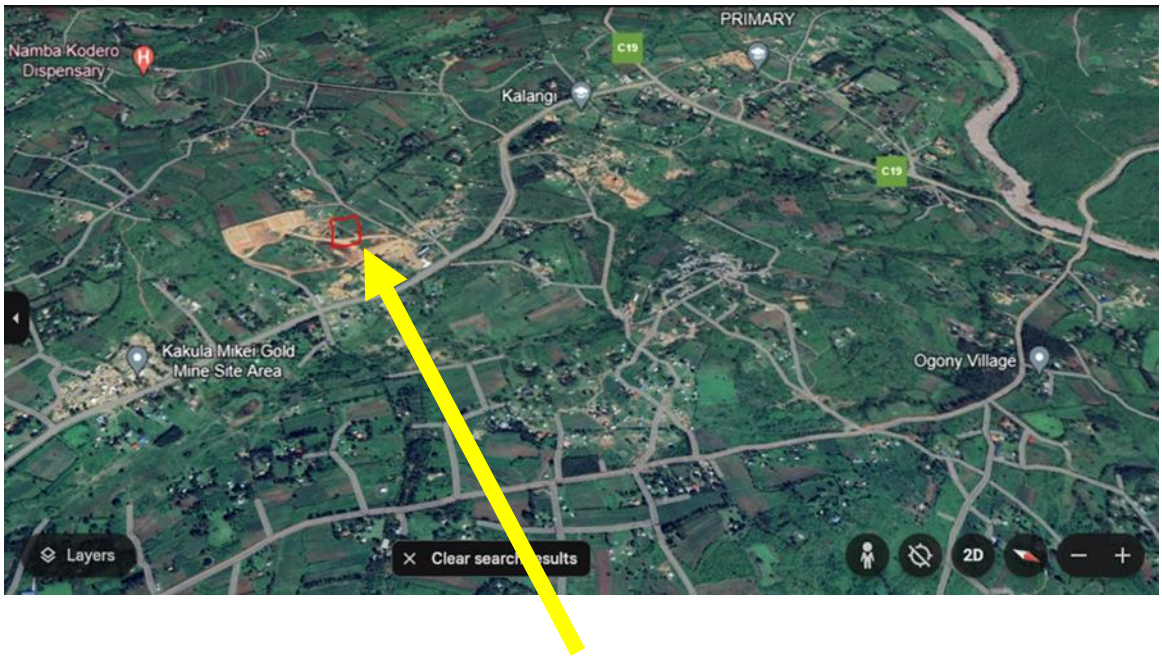





PUBLIC PARTICIPATION SAMPLED PHOTOS




APPENDIX 8: SITE MAP(SATELLITE)



APPENDIX 9:

MINUTES OF PUBLIC PARTICIPATION BARAZA MINUTES, ATTENDANCE SHEETS & QUESTIONNAIRES

HEAP LEACHING E.I.A PUBLIC PARTICIPATION MEETING MINUTES
BY

ECOMATRIX CONSULTANCY

29/08/2024

PRESENT:

MS. NERISA AKINYI	- AREA CHIEF (0711632664)
MR. KAMAU KANJIRI	- COMPANY REPRESENTATIVE (China Chongqing Handu Co Limited) 0712016406
MR. ERICK ABUGA	-LEAD EXPERT EIA/EA (ECOMATRIX CONSULTANCY) 0720666386
MR. RICHARD ONSONGO	- COMMUNITY WORKER 0725173526
MEMBERS PF PUBLIC	- SEE ATTACHED ATTENDANCE SHEET

AGENDA:

PUPLIC PARTICIPATION TO COLLECT VIEWS ON THE PROPOSED HEAP LEACHING PROJECT ON PARCEL KADEM/MACALDROR/175, IN KALANGE SUB-LOCATION, MIKEI LOCATION, NYATIKE SUB-COUNTY, MIGORI COUNTY

MINUTES:

Minutes of the Public Participation Meeting for the Leaching Plant, convened on August 29, 2024, at the project site:

MINUTE01:

- The meeting commenced at 12:10 with an invocation led by Carol.
- Participants provided self-introductions, disclosing their village and family affiliations.

MINUTE 02:

- Erick Abuga of Ecomatrix opened up the agenda of the day and established an open and inclusive atmosphere for the meeting with the agenda focused on the Environmental Impact Assessment (EIA) for the leaching plant.
- Participants acknowledged potential day-to-day impacts and identified positive outcomes such as job creation, water accessibility, urbanization, and economic development.
- Negative impacts, including noise pollution, endangerment of livestock, soil infertility, and safety hazards, were discussed.
- Control measures were proposed, encompassing fencing, prioritizing worker safety, rigorous training, catalyst usage, trenching, and site backfilling.
- Unanimous consensus was reached that the proposed project at the site is deemed worthy of implementation; participants expressed unanimous support for the project's implementation.
- Concerns about the project affecting neighboring land were clarified, emphasizing that it involves leaching, not mining.
- Local employment was suggested at 70%, with 30% comprising external experts.
- Requests were made for project support in tree planting, assistance for the sick, and involvement in burials as part of Corporate Social Responsibility (CSR).
- Participants inquired about post-project community benefits, such as infrastructure development.
- A proposal for a local tailings laboratory to enhance transparency was discussed, acknowledging the complexity and dependence on the Migori lab.
- Confirmation that neighbors can bring materials for leaching to the plant was provided.

MINUTE 03:

- The Area Chief inquired about student scholarships for deserving children.

Ecomatrix Consultancy
P.O. Box 26458-00504, Nairobi
Tel: +254 720666336, +254 787666386

- Participants requested a water supply scheme with standpipes and competitive sainet prices.
- Inquiry was made about the use of modern, silent machinery to mitigate noise pollution.
- The Area Chief requested mitigation measures against potential diseases from the plant.
-

The meeting concluded at 14:27 with a closing prayer led by Carol

SIGNATURE:.....
ERICK ABUGA
LEAD EXPERT EIA/EA
ECOMATRIX CONSULTANCY

Ecomatrix Consultancy
P.O. Box 26458-00504, Nairobi
Tel: +254 720666356, +254 787666386

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PUBLIC PARTICIPATION ATTENDANCE REGISTER

PROJECT NAME: PROPOSED HEAP LEACHING PROCESS **LOCATION:** NYATIKE SUB-COUNTY, MIGORI COUNTY **DATE:** 29/8/2024

SNO	NAME	ID NUMBER	CONTACT	SIGNATURE
1	DANIEL N OTIENO	20673334	0724490864	
2.	Lisandra Mohusani Mike	23033826	07232-31811	
3.	DAVID KARIUKI M	27018904	0723645549	
4	MARSELUS ONTANGO OPIYO	3093411	0722365977	
5.	Jemima Akeno	41063469	0702831063	
6.	Joyce Adhiambo	–	0795717185	
7.	Opiyo Joyce Akinyi	–	0781870791	
8	Shadrack Omondi Ouma	36760896	0713496637	
9.	Nelson Kogeli	28577998	0728431840.	
10.	MICHAEL MACHERIA	22325547	0727696783	
11.	NIKE SUMA	39896103	0795458088	
12.	Vincent Alago	29150804	0742502757	
13	Nyakiage Okeku Ethiambo	35863354	0740158912	
14	Michael Odhiambo Ogutu	25051478	0751345842	
15	Kepha Oluk	28126757	0724054418	
16	Kelvin Worello	40651180	0768635075	
17	Gilberto K Benix	31528868	0728041946	
18	LAURENCE OSINDE	29408172	0790892599	
19	VIOLA CHEMBOICH	32906064	0725499065	
20.	OTIENO LEVINA RINGOR	42732017	0113406283	
21	STANFORD OCHIAMBO	38243830	0794061181	
22	WYCLIFFE ONTITA NYARANGA NYAGWERA	37837845	0713768310	
23	Bildad Otenyo Nyiganyi	32248221	0717393832	
24	JOHN KASYOKI NDIKU	4935379	0712539385	
25	Fanuel Murumba	22692412	0722516829	
26	Philip B. Odhiambo.	23495763.	0705722287	
27	DAVID KARANJA M	28166952	0711919750	
28	PAUL KITHARA	22013080	0728613663	
29	Victor Owino	32572476	0702432711	
30	ESBON KORIR	26764350	0725836732	
31	Amos Ongee	31235725	0728078916	
32	BRIGHTON JUMA	34206144	0797308691	
33	Abraham Kombil	22403563	0729718972	

PUBLIC PARTICIPATION ATTENDANCE REGISTER

PROJECT NAME: PROPOSED HEAP LEACHING PROCESS **LOCATION:** NYATIKE SUB-COUNTY, MIGORI COUNTY **DATE:** 29/8/2024

SNO	NAME	ID NUMBER	CONTACT	SIGNATURE
34	BRIAN NYANDBOK	36733816	0713159997	
35	KENNEDY PHILLIP	26743631	0794471874	
36	MILLICENT ACHIENG ANOLLO	23748728	0729615794	
37	STEVEN ONMA OMIAMBO	37073440	0713668339	
38	Christine Anyango	23598272	011047796	
39	Merecia Atieno	22444509	0711532664	
40	Stephen Muganda Abel	34613758	0769140075	
41	Aggrey Evans	13300497	0728031715	
42	Patrick Ramah	32258275	0725901555	
43	Sonya Stek	—	0742176883	

QUESTIONNAIRE ADMINISTERED TO THE INTERESTED AND AFFECTED DURING THE EIA PROJECT REPORT FOR THE *PROPOSED HEAP LEACHING PROJECT*

This questionnaire is for consulting the public/ Neighbors/Stakeholders as per section 58 of EMCA, 1999 and the EIA/EA Regulations, 2003; Environmental (Impact assessment & Audit) (Amendment) Regulations 2019 in order to ensure environmental concerns are incorporated in the planning of the proposed development. Therefore your input is highly appreciated.

Name.....
ID No /Phone Contact.....
Signature.....

1. Do you think your day to day activities will be affected by the above proposed Heap leaching project? HOW?
   NO.....
   YES.....
2. Name all positive impacts (good things) you think the project will bring to this area during operation.
   i) .....
   ii) .....
3. Name all negative impacts (bad things) you think the project will bring to this area during operation.
   i) .....
   ii) .....
   iii) .....
4. Make suggestions on the measures the developer needs to put in place to control the bad (negative) things you mentioned above.
   i) .....
   ii) .....
   iii) .....
5. Do you think it is worth implementing the proposed project at the proposed site?
   Yes .....No.....
6. Do you support the implementation of the project? IF NO, WHY?
   YES.....NO.....
   .....
7. Is there anything else you would like to add?
   i) .....
   ii) .....
   iii) .....

(Please feel free to write at the back if writing space is not sufficient for you.) Thank you!

(SUBSEQUENT QUESTIONNAIRES ATTACHED AND UPLOADED IN A SEPARATE FILE)