

FINAL REPORT OF THE

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED GRANITE QUARRY (35121QL) IN KAYAUKI VILLAGE, BATAGARAWA LGA KATSINA STATE, NIGERIA.



BY

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SUBMITTED TO

FEDERAL MINISTRY OF ENVIRONMENT
HEADQUARTERS, MABUSHI, ABUJA

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STATUS PAGE

Eso Terra Investment Limited declares that it has prepared this report using the best resources and methods available and, therefore, takes responsibility for implementing the Environmental Management Plan (EMP) drawn up in this report.

It, therefore, declares its intention to take responsibility for protecting the environment around the proposed project area and its associated social environment in compliance with applicable international and Katsina state environmental laws and regulations.



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LIST OF ABBREVIATIONS AND ACRONYMS

BOD	Biochemical Oxygen Demand
BP	Bank Policy
CBO	Community-Based Organization
CDD	Community-Driven Development
CSO	Community Support Organizations
CITES	Convention on International Trade in Endangered Species of Wild Fauna & Flora
DO	Dissolved Oxygen
DS	Dissolved Solids
EA	Environmental Assessment
EAR	Environmental Audit Report
ESA	Environmentally Sensitive Areas
ESIA	Environmental & Social Impact Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESMF	Environmental and Social Management Framework
FRDP	Federal Roads Development Project
FGN	Federal Government of Nigeria
FGDs	Focus Group Discussions
GIS	Geographic Information System
HC	Hydrocarbon
HSE	Health Safety and Environment
IEE	Initial Environmental Examination
HIV/AIDS	Human Immuno-deficiency Virus/Acquired Immune Deficiency Syndrome
IDA	International Development Association
LB	Land Bureau
LGA	Local Government Area
LVO	Land Valuation Office
LFN	Laws of the Federation of Nigeria
MDAs	Ministries, Departments & Agencies
MDG	Millennium Development Goals
MIGA	Multilateral Guarantee Agency
SME _{Env}	State Ministry of Environment
SMoH	State Ministry of Housing
NGO	Non-Governmental Organization
NS	Not Specified
OD	Operational Directives (of the World Bank)
NGO	Non-governmental Organization
OP	Operational Policy
PPE	Personal Protective Equipment
SEPA	State Environmental Protection Agency
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solids
ToR	Terms of Reference
TSP	Total Suspended Particulate

UNITS OF MEASUREMENT

cfu/ml	Colony forming unit per millilitre
cm	Centimetre
dBA	Decibel
ft	Feet
g	Gramme
kg	Kilogramme
g/cm	Gramme per Centimeter
Km	Kilometer
m	Meter
m ³	Meter Cube
meq	Milliequivalent
mg	Milligram
mg/Kg	Milligram per Kilogramme
mg/l	Milligramme per Litre
ml	Millilitre
mm	Millimetre
m/s	Meter per Second
NTU	Turbidity Unit
o/oo	Parts per thousand
oN	Degree North
Ph	Hydrogen ion concentration
ppb	parts per billion
ppm	parts per million
ToC	Temperature in degrees Celsius
µg	Microgramme
µS	micro-Siemens
µm	micrometre
%	Percentage

CHEMICAL ELEMENTS AND COMPOUNDS

Al	Aluminium
C	Carbon
Ca	Calcium
CaCO ₃	Calcium Carbonate
CCl ₄	Carbon Tetrachloride
Cd	Cadmium
Cl	Chloride
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
Cr	Chromium
Cu	Copper
Fe	Iron
H	Hydrogen
H ₂ O	Water
H ₂ S	Hydrogen Sulphide
Hg	Mercury
K	Potassium
Mg	Magnesium
Mn	Manganese
N	Nitrogen
Na	Sodium
Na ₂ PO ₄	Sodium phosphate
NaOH	Sodium hydroxide
NH ₃	Ammonia
NH ₄ ⁺	Ammonium ion
NH ₄ F	Ammonium fluoride
Ni	Nickel
NO ₂ ⁻	Nitrite ion
NO ₃ ⁻	Nitrate ion
NO _x	Nitrogen Oxides
O ₂	Oxygen
P	Phosphorus
Pb	Lead
PO ₄	Phosphate
SiO ₂	Silicate
SO ₂	Sulphur dioxide
SO ₄	Sulphate ion
V	Vanadium
Zn	Zinc

ORGANISATIONS

APHA	America Public Health Association
FMEEnv	Federal Ministry of Environment
FMW	Federal Ministry of Works
UNEP	United Nations Environmental Programme
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WB	World Bank
WHO	World Health Organization
KSG	Katsina State Government
MSMD	Ministry of Solid Minerals Development

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EXECUTIVE SUMMARY

General

This report presents the Environmental Impact Assessment (EIA) for the Quarry Project proposed by Eso Terra Investment Limited, an indigenous company charged with providing granite for the Kano-Maradi rail project. The proposed quarry covers an area of about 0.4 km². The EIA of the proposed project was conducted following the statutory requirements for environmental management in Nigeria. These include the EIA Act CAP E12 LFN 2004, the Federal Ministry of Environment (FMEnv) Sectoral Guidelines for Quarry/Mining Projects (1995) and the Nigerian Minerals and Mining Act (2007). Even though the site has already been exposed to active mining by the previous site owners (Borini Prono Construction Limited & Katsina State Mining Company). To acquire an adequate environmental permit, Eso Terra seeks to examine both the positive and negative effects that the proposed project is likely to have on both the physical and socioeconomic environment to allow sound decision-making to promote human activities that align synergistically with the natural world within a sustainable development framework. The project was borne to provide essential raw materials such as gravel, granite, sand dust, and other products needed for the construction of the Kano-Maradi Rail project.

Objectives of the EIA

The objectives of the EIA for the proposed project are to:

- provide information on the current ecology (ambient air quality, soil, fauna, flora, microorganisms, biological diversity, surface water, groundwater, geology, hydrogeology) of the environment within which the Quarry will be located.
- determine the project's impacts on the environment, including the socio-economic and socio-cultural activities of the community.
- examine the health situation of the human population around the project site

- examine and assess the significant potential and associated impacts of all activities and auxiliary facilities in all project phases (mobilisation, site preparation, construction, operation, abandonment) on the natural, social and health environments.
- provide recommendations for mitigating identified adverse impacts and enhancing beneficial impacts of the project.
- develop an Environmental Management Plan for implementing the mitigation measures and an Environmental Monitoring Plan for monitoring their efficiency.

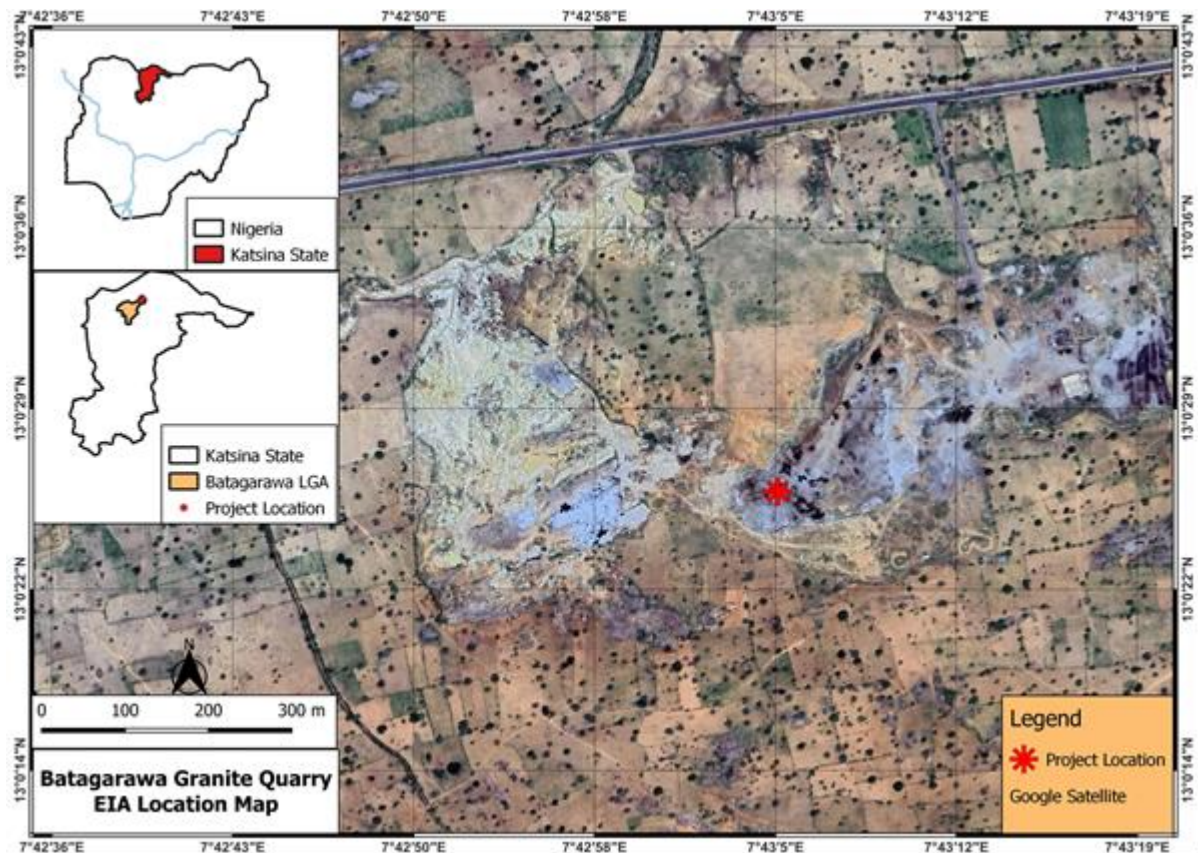
Project Objectives

The main objective of this project is to extract granite materials within the project site, which will be done by drilling and blasting the body of rocks into smaller units of specific sizes. These units are then loaded/conveyed to another location for crushing within the project area. This activity will be followed by transporting crushed materials to feed the Kano-Maradi Rail project. However, the quarry lease tenor is five years, and the project can source another market beyond the Kano–Maradi rail line.

Project Location

The proposed Batagarawa Quarry project shall be located within the Kayauki community, Batagarawa Local Government Area, Katsina State, Northwestern Nigeria. The host community (Kayauki) is located about 3.5km away from Batagarawa LGA headquarters. The proposed Batagarawa Quarry project shall be located within the acquired property by Eso Terra Investment Limited with a corner coordinate defined as follows.

BEACONS	LATITUDE			LONGITUDE		
CB1	13	0	34.1	7	43	7.6
CB2	13	0	24.6	7	43	2
CB3	13	0	23.24	7	43	10.9
CB4	13	0	33.9	7	43	20.2



Google Map Showing the Project Area (Source Arc GIS)

Need for the Project

Eso Terra intends to participate efficiently in converting rocks into usable materials for society by converting heavy rocks into usable materials like sand, gravel, granite, and other products that would be used for the Kano - Maradi rail line and the construction and erecting of structures within and around the Katsina state. This will, in turn, help convert our natural resources into something useful to man.

Benefits of the Project

When operational, the benefits of the Quarry are numerous and cannot be over-emphasized. Some of the benefits of the project include:

- Provision of granite to support the construction and operation of Kano-Maradi Rail Line

- Convert natural resources into material usable by man.
- Production of sand, stones, gravel, granite, and other products.
- Provide employment opportunities for many skilled and unskilled Nigerians, especially those from the host communities.
- Enhancement of the provision of basic social amenities to the host communities.
- Poverty alleviation through increased derivation funds to local and state governments.
- Promote a good relationship between Eso Terra and the host community through increased socioeconomic assistance.

Legal and Regulatory Framework

The EIA of the proposed project was conducted following the National, international, and Katsina State legal and Regulatory framework for environmental management. These include the EIA Act No. 86 of (1992) and the Federal Ministry of Environment (FMEnv). Other regulatory requirements include The National Effluent Limitation Regulation, S.I.8 of (1991), Pollution Abatement in Industries, Industries Generating Wastes Regulation, (1991, (No. 42, Vol. 78, August, (1991), The management of hazardous and solid waste regulation as govern by National Environmental Standards and Regulation Enforcement Agency (NESREA) Act (2007), The Nigerian Mineral & Mining Act (2007) and Regulation (2011) , Labour Act, CAP L1 LFN 2004, The Nigerian Urban and Regional Planning Act CAP N138 LFN 2004, Public Health Law CAP 103 LFN 1990, Katsina State Environmental Protection Agency Law.

Project Components

The quarry project is divided into two zones: the blasting zone (drilling, blasting, and the production zone (admin, crushing, stockpiling, material, and explosive stores). The critical activities for the proposed installation of the Quarry Plant are:

- Mobilization to site for bush clearing and extraction of water contained in quarry pit
- Site preparation with earth-moving equipment and vibrators: stumping, levelling, and site consolidation.
- Erection of foundation support for the Quarry.
- Construction of office buildings
- Installation of quarry accessories
- Demobilization

Waste Types and Management

The waste management plan has been developed to ensure that the Esso Terra Quarry project in Kayauki Community adheres to best practices for waste management throughout all phases of development, operations, and decommissioning.

Waste management guidelines for the proposed Esso Terra Quarry in Kayauki Community include:

- **Development Phase:**
 - Development of a comprehensive waste management plan before initiating quarry operations.
 - Identifying the types of waste likely to be generated during development.
 - Implementing practices to reduce waste generation, such as using recycled materials and energy-efficient equipment.
- **Operational Phase**
 - Properly store waste in designated areas on-site to prevent spills or contamination.
 - Implement waste segregation to separate different waste streams for appropriate disposal and recycling.

- Ensure hazardous waste is managed in compliance with regulations and best practices.
 - Emphasize recycling and reusing materials to minimise waste generation.
 - Dispose of waste properly using licensed facilities and contractors following local regulations.
- **Decommissioning Phase**
 - Develop a decommissioning plan that includes managing waste during site closure.
 - Cover waste storage areas, restore the site to its natural state, and dispose of remaining waste appropriately.
- **Monitoring and Review**
 - Regularly monitor waste management practices to ensure compliance.
 - Conduct periodic reviews of the waste management plan to identify areas for improvement and implement necessary actions.

Study Approach

The approach was to obtain ecological and socioeconomic baseline data from desktop, field and laboratory studies, interviews and consultations with the relevant stakeholders, individuals, etc. It is hoped that this approach provides adequate information for establishing the baseline status of the environment of the project area. Therefore, the project's potential environmental impacts are measured, mitigative measures are proposed, and an environmental management plan (EMP) is rightfully developed. Field assessments conducted include but were not limited to the following: Air, water and soil Quality Assessment, Vegetation mapping and characterisation (including Health status), Animal Resources, Socio-economic/Social Assessment and Health Impact Assessment, amongst others, were adequately addressed.

Flora and fauna were identified through visual observations, hearing animal calls, and examining footprints, remains, etc. These are followed by interpretations and discussions of results and a report on the flora and fauna species in the area. The field assessment/data gathering runs from 27th September 2023 to 30th September 2023 for a single season, covering only a spatial boundary of 600m and 2km for environmental media and socioeconomic assessment. The sampling collations are as follows:

- Air quality and noise level assessment was done in 6 locations, plus a control
- Soil sample was from 6 locations plus a control
- Surface water sample collection from a quarry pit located within the project area plus a pond within the Kayauki community
- Underground water sample collection from a borehole in Kayauki Community.

The samples were taken to the Kano State Ministry of Environment laboratory for analysis.

Description of the Environment

Regional Climate/Meteorology

The project area is within the tropics, dominated by two contrasting seasons: dry and wet (rainy). The two season regimes depend on the two prevailing air masses blowing across the country at different times of the year: the south-westerly humid maritime air mass blowing from across the Atlantic and the north-easterly air mass of Saharan origin (Harmattan).

Geology

Katsina State forms part of the extensive plains known as the High Plains of Hausa land. The state comprises undulating plains that rise gently from 360m in the northeast around Daura to 600m around Funtua in the southwest.

The state generally has two geological regions. The south and central parts are underlain by crystalline rocks of the Basement Complex (from Funtua to Dutsinma).

Still, in the northern parts of the site, cretaceous sediments overlap the crystalline rocks.

Ambient Air Quality Assessment

The pollutants monitored about air quality are nitrogen dioxide (NO₂), sulphur dioxide (SO₂), suspended particulate matter (SPM), ammonia (NH₃), hydrogen sulphide (H₂S), carbon monoxide (CO), methane (CH₄), carbon dioxide (CO₂) Total volatile organic content (TVOC), formaldehyde (HCHO). The ambient relative humidity ranges from 61% to 72%, and the temperature ranges from 30oC to 35°C. These values were consistent with the control stations. However, the control station recorded a lower humidity but higher temperature than the quarry site. The wind speed ranged from 1.54m/s to 2.78m/s within the site, while the control station recorded 0.28m/s.

Ambient SPM levels in the study area ranged from 21 to 39 ug/m³. These recorded values were above the FMEnv daily average maximum limit permitted of 250 ug/m³. The concentration of HCHO ranged from 0.001 µg/m³ -0.009µg/m³. The study showed that the concentration of TVOC ranged from 0.002 to 0.018 µg/m. These values are comparable to FMEnv stipulated limits of 0.016ppm (50µg/m³).

Noise

In all the sampling points, noise levels measured (55.2-71.4 dBA) were below the tolerable limit or noise level zone that could annoy, and they were within the values of 90 dBA stipulated by the FMEnv and WHO.

Water Physio Chemistry

Water samples were collected from a quarry pit within the site, a pond, and a borehole in the Kayauki community. The water sample in the project area was generally colourless, odourless, and tasteless.

The pH of the water samples from the project area was slightly alkaline and fell within the regulatory Limit except for the EBQSW2 (Pond water sample water in Kayauki Community), whose concentration was 8.92, thus slightly above 6.5-8.5.

The turbidity of the water sample was 15, 3 and 0 NTU for samples (EBQSW1, EBQSW2 and EBQGW), respectively. Borehole water (EBQGW) has a lower turbidity level than the samples from the quarry pit and the community pond. The electrical conductivity of the water samples (EBQSW1, EBQSW2 and EBQGW) was 263 $\mu\text{S}/\text{cm}$, 160 $\mu\text{S}/\text{cm}$, and 799 $\mu\text{S}/\text{cm}$, respectively. Most underground water contains more dissolved solids than surface water, leading to high conductivity. The permissible EC level by FMEnv was set for 1000 $\mu\text{S}/\text{cm}$. The total hardness of the water samples (EBQSW1, EBQSW2 and EBQGW) was 39.4, 21.9 & 296 mg/l. The result signifies that the borehole water sample was above the regulatory limit. The concentrations of the heavy metals in the water sample (EBQSW1, EBQSW2 and EBQGW) fall within the regulatory limit except for the concentration of Fe, whose value was above the regulatory limit across the entire Sample. The water samples show the presence of E-coli in samples EBQSW1 and EBQSW2. The total coliform count was 0 CfU/ml for EBQGW, while EBQSW1 and EBQSW2 recorded 19 and 8 CfU/ml for EBQGW.

Soil Physio-Chemistry

The soils of the study area varied from moderately alkaline to slightly alkaline, with a pH ranging from 7.5 to 8.09. These values were consistent with the control sample, which had a concentration of 8.16. The alkalinity could be attributed to the leaching loss of exchangeable anions. The textural distribution of the soil samples shows a high percentage of sand ranging from 59-75%. EBQ SS6 has a high percentage of silt at 64%, while the control sample has a high sand percentage of 50%. The soil's colour is yellowish-brown colour across the entire sample. The soil's sandy and silty nature is associated with the soil's bigger grain size. The permeability and porosity of the soil samples are consistent with the result of the particulate size.

The heavy metals evaluated for the soil samples include but are not limited to the following: copper, cadmium, nickel, mercury, zinc, and iron. The concentrations were within the WHO (1996) limit of organic content (TPH, benzene, xylene, toluene, PAH and Oil and Grease) of the soil within the study area. Soil organic

contents were 0.0mg/kg across the board except for phenol, whose concentration was slightly above 0.00mg/kg. Analysis results of soil samples collected from the project area indicated the absence of *E. coli*, while the total heterotrophic fungi (THF) count ranged between 7–56cfu/g. The concentration was consistent with the control sample, which had a concentration of 26cfu/g.

Biodiversity

The biodiversity study was conducted through observations, interviews and documentation of vegetation and wildlife characteristics of the area in two surveys (dry and wet seasons). This was achieved by dividing the study area into three (3) transects for easier classification and evaluation. The following transects were obtained as a result:

- Transect A: Limited to project site + 500m South of project site;
- Transect B: 1km East of the site
- Transect C: 1km West of the project site.

At the time of the field survey, there were few farmlands with crops and few economically significant trees.

Tall, deciduous, and fully grown trees provide shade to inhabitants. Shrubs and grasses were also observed. The most abundant trees were *Acacia nilotica*, *Acacia albida*, and *Vitellaria paradoxa*; they collectively cover about 30% of the transect. These trees were as tall as 20m in height. *Adansonia digitata* (baobab) was found only in this transect. Also common was *Azadirachta indica* (neem tree).

The unique trees here include *Prosopis africana* and *Borassus aethiopum*. *Azadirachta indica* (neem tree) was the most abundant. *Borassus aethiopum* was the tallest tree in the area.

The bird group comprises the Black kite, Francolin, Cattle egret, Finch, Sunbird, Weaver, and White stork. The Vultures once common in the study area have become locally extinct.

Ten mammal species were observed or previously recorded in the area. The Greater Cane rat (*Thryonomys swinderianus*) and Giant Pouched rat (*Cricetomys gambianus*) were rodents. Livestock species make up the bulk of the mammalian species.

The reptile groups include cobras, Pythons, and Lizards. According to the hunters, snakes have become locally extinct due to overexploitation.

Socio-economics

Socioeconomics and Health Studies/ Consultation. The study was designed to obtain all relevant socio-economic and health data on the community from primary and secondary sources. The target population for this study were the host community members and ex-miners residing in the communities during the survey. 360 houses with 2,160 households were identified in the Kayauki community, and 120 in the Fandare community with 720 households. A systematic random sampling was adopted, and 72 households were selected in Kayauki and 24 in Fandare, respectively. However, the systematic sampling technique was used to enumerate community houses for easy administration of questionnaires. The procedure for selecting the sample size for the community members was 5.0% in the community using Creswell (2013) sample size methodology. A total number of 96 questionnaires were administered, and 80 were filled and returned. Regarding the in-depth interview, the informants were purposively selected, and the participants during the focus group discussion were also purposively selected for the study area. The focus group discussion comprised one community leader, one farmer, and two ex-miners in the community. Members of these communities expressed their concerns about the proposed project. These concerns bordered on perceived effects on their environment, livelihood, and health. They also acknowledged that the project would bring development to the area. 30% of the community members stated that the proposed project would help the host community reduce poverty, and 50% noted that the proposed project would help reduce unemployment. While 10% believed that the project would bring forth development in the community, and 10% agreed that the project would bring out improvement in their livelihood.

The most common ailments in the study area are malaria and typhoid fever, which account for 78.6% and 15.7%, respectively. There were no reported cases of cardiac problems during the period under study.

Stakeholders Engagement and Scoping Workshop

The primary stakeholders identified for the proposed project are Immediate communities, Local Government, Traditional councils in the project area, and Katsina State Government. Also, the regulatory bodies identified are the Federal Ministry of Environment Abuja (FMEnv), Katsina State Ministry of Environment, and Katsina State Ministry of Mines. Also, community-based organisations within and around the proposed project environment were consulted.

The consultation team has sought to ensure that all identified stakeholders, including the project-impacted communities, are aware of the proposed Project and the EIA process through extensive community consultation. The stakeholder engagement strategy was designed to attain meaningful participation and involvement that enabled stakeholders and the community to actively contribute to developing new ideas and options as the Project is planned and developed.

The scoping workshop of the proposed project was done on the 29th of September 2023, at the project site. The objectives of the scoping exercise cover the identification of stakeholders, formal announcement of the project, provision of project and ESIA details and identification of potential project risks. The medium used for the scoping was background information, information and presentation of the project, key stakeholder meetings, site verification and feedback. The lead consultant (Mr. Ahmad Sa'ad) gave a presentation during the scoping exercise. The presentations entailed an outline of the project, the environmental assessment process, and the identified main potential issues or impacts. The Minister's Representative (FMEnv Rep) delivered the programme's opening remark.

Potential and Associated Impacts

The proposed quarry had significant positive (beneficial) and adverse (negative) impacts on the ecology, social, and health of the people within the area. The associated and potential significant beneficial impacts are included.

- Improvement of the economic status of landlords and traditional rulers through payment of adequate compensation
- Mining and production of chippings of various sizes will generate revenue for the government and support the Kano-Maradi rail line.
- Contribute to the country's general economic growth as it would positively affect directly or indirectly some sectors of our country directly or indirectly.
- Creation of employment opportunities for both skilled and unskilled labour that will be employed at different project phases.
- Increase in socioeconomic activities in the host community due to purchasing chippings and other associated activities.
- Chippings of various sizes will be available to construct the Kano-Maradi rail line.
- There will be a transfer of technical knowledge in the mining industry to Quarry workers.
- The proposed project's associated and potentially significant adverse impacts included but were not limited to the following.
- Increase in the ambient noise level in the area above baseline values due to noise generated during the drilling of holes.
- Vegetation cover removal leads to the destruction of the natural habitat of soil flora and fauna and the migration of wildlife.
- Security problems due to community interference and conflicts.
- Injury to personnel (surveyors) due to exposure to wild bushes and animals
- Injury/death/assets damage due to accidents during dumping of materials from the point of generation to the feed hopper.
- Increased traffic volume/delays due to the daily movement of work trucks and personnel to the site.

- Negative effects on air quality due to emission of atmospheric pollutants (COX, NOX, etc.) from internal combustion engines/exhausts during personnel movement.
- Changes in drainage and hydrological patterns may result in erosion and flooding in the area.
- Soil compaction due to heavy vehicle movement and excavated material will affect the diversity of soil fauna within the area and alter the drainage pattern.
- Increase in population leading to transmission of infectious diseases, especially sexually transmitted infections.
- Pollution of soil and groundwater sources around the facility.

Mitigation of Potential and Associated Impacts

Appropriate mitigation measures have been proposed to reduce these potential and associated impacts to As Low as Reasonably Practicable (ALARP). All impacts associated with the proposed project were reduced to LOW after mitigation. This is based on the following:

- The area proposed for the quarry is a secondary forest with very sparse vegetation and wildlife. Thus, the impact on biodiversity is minimal.
- Issues associated with fire outbreaks and risks related to safety within the facility will be adequately handled by design and firefighting and ancillaries, which will be installed within the facility yard.
- Eso Terra Investment Limited management shall ensure adequate and continuous consultation and interaction with the property owners and the entire community to prevent crises arising from acquiring the quarry site.

Summary of the Mitigation Measure

POTENTIAL ISSUES	MITIGATION MEASURE
Noise Pollution	Implement noise control measures, such as using equipment with noise-reducing features, scheduling noisy activities during less sensitive hours, and installing noise barriers around the quarry, use ear protection PPEs by the staff working in a noise prone area
Air pollution	Regularly maintain equipment to ensure proper functioning and emission control, implement dust control measures such as watering roads, stockpiles, use of sprinklers in crushing area and use alternative fuels to minimise emissions.
Water pollution	Implementing erosion control measures, conducting regular water quality monitoring, and using sediment traps and drainage systems to prevent runoff from entering water bodies
Habitat Disturbance	Implement habitat restoration and enhancement projects, conduct surveys to identify sensitive habitats within the quarry site, and implement buffer zones to protect wildlife and vegetation, minimise vegetation cutting as low as possible
Traffic congestion	implementing traffic management plans, providing designated parking areas for staff and visitors, use proper signages and coordinating deliveries and truck routes to minimise traffic congestion.

Grievance Redress Mechanism

A Grievance Redress Mechanism will be implemented to ensure that all complaints from local communities are dealt with appropriately, with corrective actions being implemented, and the complainant being informed of the outcome. It will be applied to all complaints from affected parties or PAPs. Eso terra will maintain a Complaints Database, which will contain all the information on complaints or grievances received from the communities or other stakeholders. This would include: the type of complaint, location, time, actions to address these complaints, and final outcome. Eso Terra, shall set-up a grievance redress committee that will address any complaints during project implementation. Grievances should be resolved within 15 working days.

The grievances, influenced by their physical, situational (e.g., employment), and/or social losses, can surface at different stages of the project cycle. Some grievances may arise during the project design and planning stage, while others may come up during project implementation. Not only should affected persons (AP's) be able to raise their grievances and be given adequate hearing, but also satisfactory solutions should be found that mutually benefit both the APs and the Eso terra.

Environmental and Social Management Plan

Cost-effective Environmental Management and Monitoring plans were developed to ensure that the adverse (negative) environmental impacts identified in this impact assessment are effectively remediated and continuously monitored. The plans included Action Party, Timing of Mitigation, Parameters to be Monitored, Responsible Party, and Monitoring Frequency and Cost Implications of the plans. A summary of the EMP cost is presented below.

Summary of the ESMP and Monitoring Cost

Item	Responsibility	Cost Estimate	Cost Estimate
		NGN (₦)	USD (\$)
Mitigation	Eso Terra	₦8,000,000.00	\$5,333.33
Monitoring	FMEEnv, MSMD, Katsina State Departments/Ministries, Consultancy for Compliances	₦82,500,000.00	\$55,000.00
Capacity Building	Eso Terra Management, Community Leaders/CBOs /NGOs	₦10,250,000.00	\$6,833.33
Grievance Redress Mechanism	Eso Terra Management, Grievance Redress Committee	₦7,050,000.00	\$4,700.00
Community Development Agreement/CSR	Eso Terra, FMEEnv, Batagarawa LGA	₦105,000,000.00	\$70,000.00
Environmental Protection & Rehabilitation Plan	Eso Terra, MSMD, FMEEnv	₦101,544,333.95	\$67,696.22
Sub- Total		₦314,344,333.95	\$209,562.89
Contingency (Add 5% of Sub Total)		₦15,717,216.70	\$10,478.14
Total		₦330,061,550.65	\$220,041.03

Decommissioning and Reclamation Framework

At the expiration of the mine, Eso Terra Investment Limited shall fence the site using wire gauze and put the area under a lock. A preliminary abandonment and restoration plan shall be developed by Eso Terra Investment Limited and reviewed by the relevant regulatory bodies. The plan shall consider all technically feasible options for restoration, decommissioning and abandonment, including alternative uses for the asset, following company policy and government regulations. Such considerations shall include:

- Restoration of land to conditions capable of prior land use, equivalent uses, or environmentally acceptable uses.
- Uses of overburden and topsoil for reclamation.
- Re-contouring of slopes of more than 300 to minimise run-offs.
- Contouring of slopes to minimise erosion and run-offs.
- Planting native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem on the reclaimed land.

For the site restoration, Eso Terra Investment Limited shall implement the following.

- Survey the site for contamination.
- All equipment and debris shall be removed from the environment.
- All cleared spaces resulting from the decommissioning and removal of associated structures shall be re-vegetated using native species.
- All excavated routes shall be reinstated to their original topographical status to minimise negative impacts such as erosion.
- A good waste management plan would be put in place.
- Building used for administrative and residential functions shall be leased out for other purposes.

Conclusion

This project's social and economic rating is highly positive from the preceding analysis. Evaluation of alternatives has already shown that options are limited and not productive. Already, the proponent has sunk a substantial amount of time and commitment to the project. Further delay of the project denies all stakeholders the anticipated benefits. Redesigning or relocation will lead to a loss of time and money that is already tied to the preliminary costs of the project. The project does not pose any severe and negative environmental impacts. Adequate mitigation measures have been proposed to address any of the adverse effects arising from the project.

It is observed and established that most of the negative impacts on the environment are low and short-term with no significant effect. The positive impacts are highly rated and will benefit all stakeholders and residents. The project proponents have proposed adhering to prudent implementation of the environmental management plan as advised by the expert. They are obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to do the project as proposed.

ACKNOWLEDGEMENT

Eso Terra Investment deeply values the significant contributions of the Federal Ministry of Environment, the Katsina State Ministry of Environment, and Snafhcore Limited in preparing this report for the EIA of the proposed Quarry Project.

We also wish to recognise the diverse and crucial contributions of the project engineers, as well as the numerous public officers and professionals who have played a pivotal role in conducting this EIA exercise.

CHAPTER ONE

INTRODUCTION & BACKGROUND INFORMATION

1.1 General

Quarrying activities in Nigeria are categorised as a significant sector that contributes positively to supporting local construction. However, the quarrying process has some safety, environmental, and socio-economic concerns that must be addressed.

To comply with the Federal Ministry of Environment (FMEnv) and Ministry of Solid Minerals Development statutory provisions, Eso Terra Investment Limited, an indigenous company, commissioned Snafhcore Limited to conduct an Environmental Impact Assessment (EIA) of the proposed stone quarry operations at Kayauki, Batagarawa Local Government Area of Katsina State. The proposed quarry covers a total land area of about 0.4 km² with a Quarry Lease Number 35121 in Kayauki Community.

Environmental Impact Assessment (EIA) is considered part of environmental planning. EIAs are undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority. This report presents the Environmental Impact Assessment (EIA) for the Batagarawa Granite Quarry proposed by Eso Terra Investment Limited. Even though the site has already been exposed to active mining by the previous site owners Borini Prono & Company Nigeria Limited (Borini Prono) and recently Katsina State Exploration and Mining Company Limited (KEMCO), Eso Terra seeks to examine both the positive and negative effects that the proposed project is likely to have on both the physical and socioeconomic environment to allow sound decision making to promote human activities that align synergistically with the natural world within a sustainable development framework. Thus, this study conducted broad stakeholder participation. It is an essential planning tool for the project proponent as it will outline any significant project impacts and clearly define mitigation measures to avoid or curb any adversities. The

proposed mitigations have taken into consideration the concerns of various stakeholders.

The EIA of the proposed project was conducted following the statutory requirements for environmental management in Nigeria. These include the EIA Act CAP E12 LFN 2004, the Federal Ministry of Environment (FMEnv), Nigerian Minerals & Mining Act, 2007 and Regulation, 2011', AfDB ISS and the World Bank guideline on environmental assessment.

1.2 Project Objectives

The main objective of this project is to extract granite materials within the project site, which will be done by drilling and blasting the body of rocks into smaller units of specific sizes. These units are then loaded /conveyed to another location for crushing within the project area. This activity will be followed by transporting crushed materials for constructing the Kano-Maradi Rail project. The Kano-Maradi rail project is the C3 West Africa rail interconnection project. The rail will run about 45 km in Maradi, Niger Republic and 1,328 km between Kano, Jigawa and Katsina state, Nigeria. The recommended gauge design includes a 1,067 mm gauge, 25-tonne load limits, and a maximum speed of 80 km per hour and 60 km/h for passenger and freight trains, respectively (CIMA 2008).

1.3 Project Location

The proposed Batagarawa Quarry project is located within the acquired property by Eso Terra Investment Limited with a central geographical coordinate of 13°0'24.16" N and 7°43'0.6" E. in Kayauki Community, Batagarawa Local Government Area, Katsina State. Nigeria (**Figures 1.1-1.4**). The corner coordinate is presented in Table 3.1. The community within which the quarry is located is about 3.5km northwest of Batagarawa LGA headquarters. The Federal Republic of Nigeria, the host nation, covers an area of 923,768 km² in Africa. It lies in the tropics between latitudes 4°N and 14°N and longitudes 3°E and 14°E. Katsina State – in which the study area for this project is located, is situated in the Northwestern Nigeria area, specifically bordered by Kano and Jigawa State to the east, Zamfara State to the

west, Kaduna State to the south and Maradi in Niger Republic to the North.
(**Figures 1.1 and 1.2**)

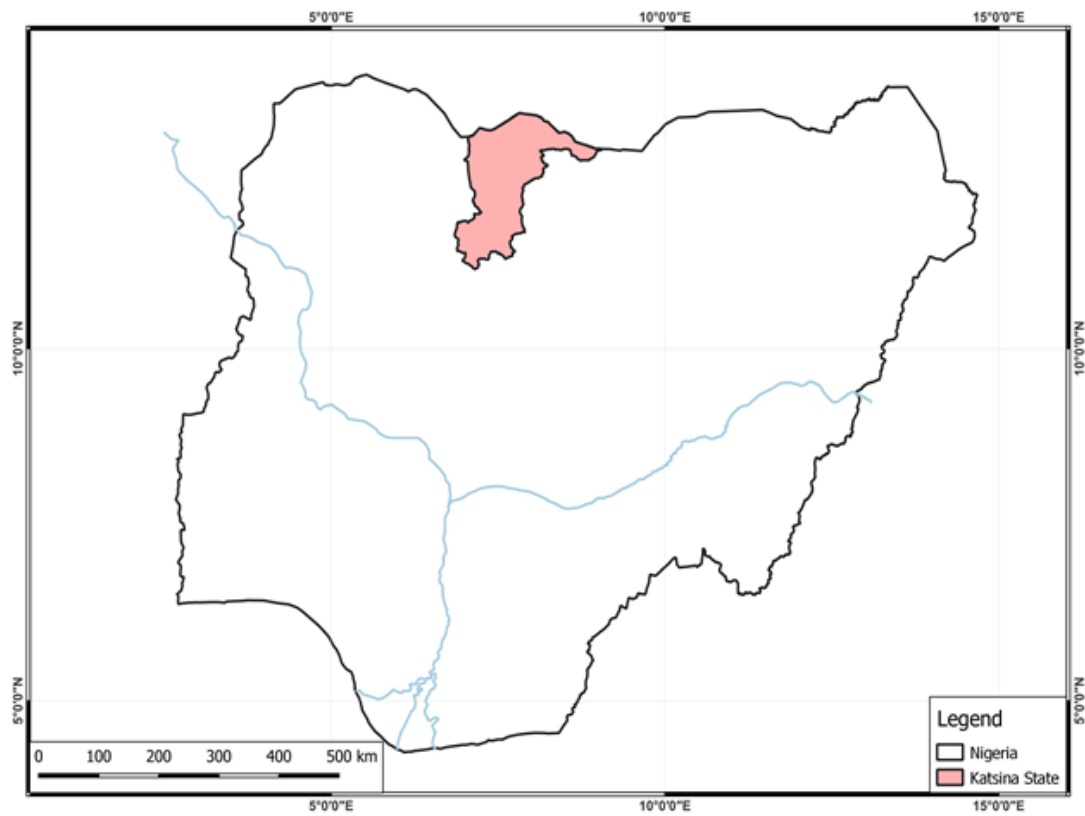


Figure 1.1. Map of Nigeria showing Katsina State (**Source QGIS**)

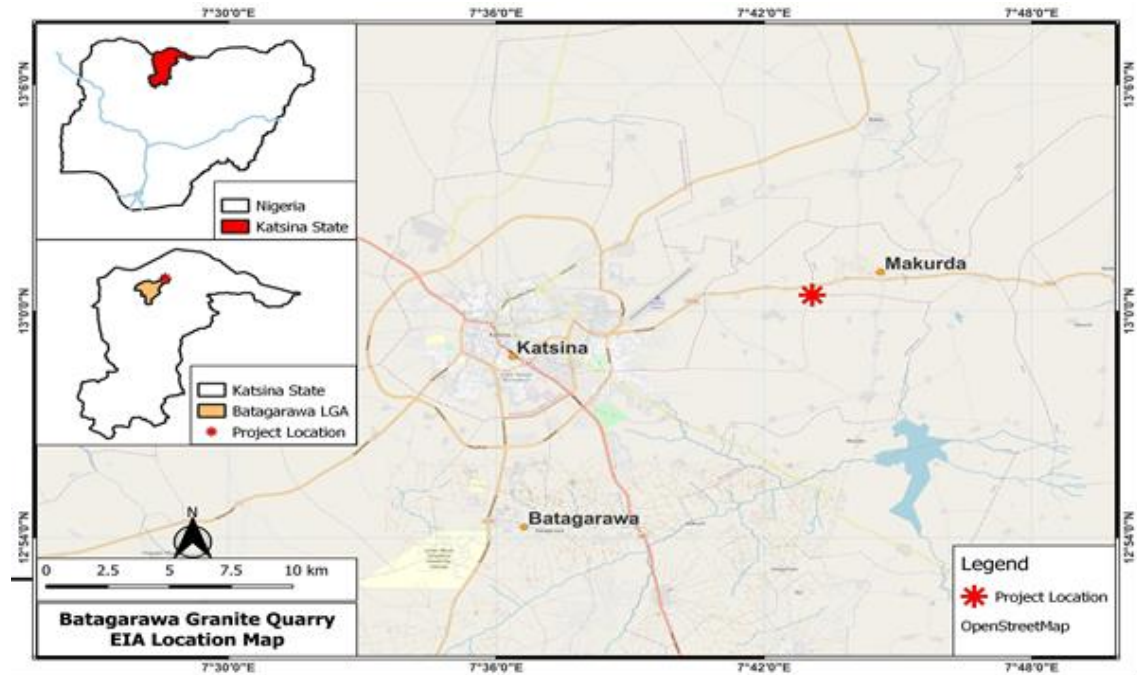


Figure 1.2. Map of Nigeria with Katsina State in Red and extracted in yellow showing Batagarawa LGA (Source QGIS)

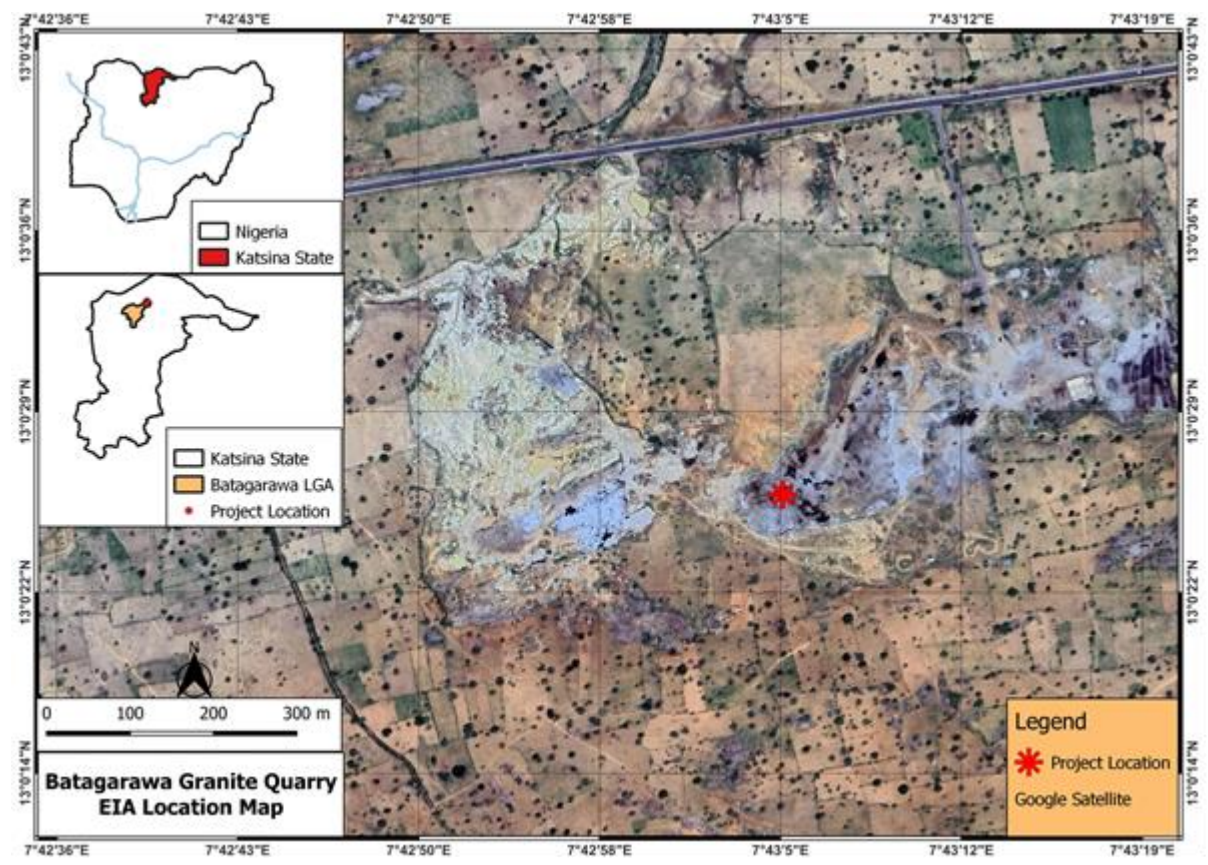


Figure 1.3. Map of Katsina State showing Batagarawa LGA (Source QGIS)

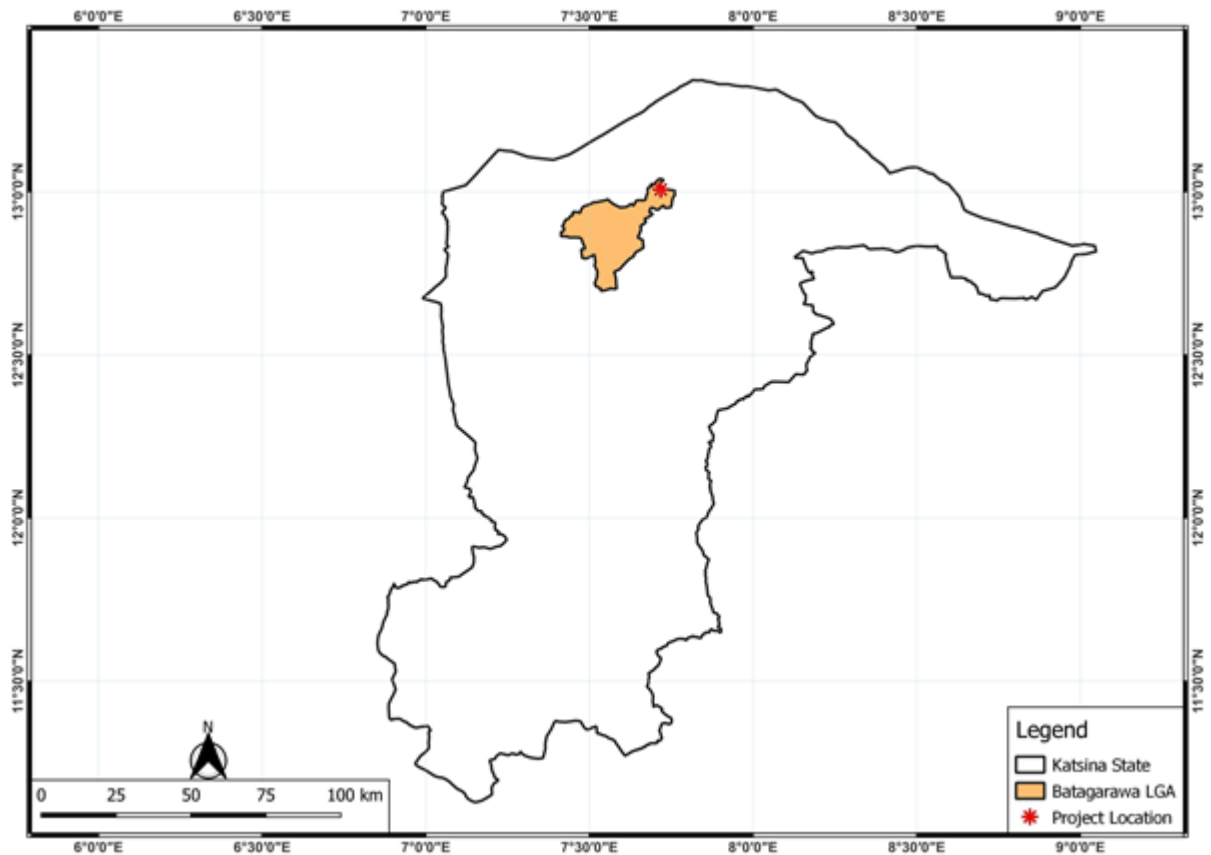


Figure 1.4. Google Map Showing the Project Area (**Source QGIS**)

1.4 The Proponent

Eso Terra Investment Limited, described as the Proponent, is incorporated in Nigeria with RC: 1248634. It was registered on 13th March 2015 with a registered office address of No 2 Waziri Ibrahim Crescent, Abakpa GRA - Kaduna, Kaduna State. With close to a decade of experience, the business focus of the company on the mining sector is to become one of the leading Mining Companies in Nigeria within a very short time through effective management of workforce, technology and resources while contributing to the economic and technological development of Nigeria by becoming a significant producer of materials such as granite, gravel, sand, and other related products for construction. The mission is to engage in these activities profitably and responsibly, ensuring the best class of Health, Safety and Environmental Practices in the industry, to benefit all stakeholders.

Under the Mineral and Mining Act 2007, the Nigerian Mining Cadastre Office granted the Quarry Lease title - 35121 QLS to Katsina State Exploration and Mining

Company Limited (KEMCO). KEMCO has signed an agreement with Eso Terra Investment to develop the quarry. The quarry, formerly operated by Borini Prono, still possesses a reasonable quantity (about 1,500,000 tonnes) and quality granite to be extracted to support the Kano-Maradi rail line.

1.5 EIA Terms of Reference

The Terms of Reference (ToR) for the EIA of the proposed project were defined at the initial stages of the project. The Submitted and approved ToR is attached to the appendix. Table 1.1 presents the summary of the TOR:

Table 1.1: Summary of the TOR

ENVIRONMENTAL AND SOCIAL COMPONENT	DATA
Air quality	Emissions (NOX, SOx, H2S, CO, CO2, NH3, HCHO, TVOC, SPM2.5 & 10) within and around the project site
Meteorology data	<ul style="list-style-type: none"> • Temperature • Rainfall • Sunshine • Cloudiness • Wind speed • Wind direction • Seasonal variation and extreme microclimates and determining factors.
Water Quality (Surface and Quarry Pit)	<ul style="list-style-type: none"> • Biochemistry of water samples for Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) where applicable. • Chemistry: total nitrogen, sulphates, chlorides, phosphate, exchangeable cations (Ca⁺⁺K⁺. Mg²⁺, Mn²⁺), heavy metals (Fe, Zn, Cr, Pb, Cu, V, Ni, Ba, Bo). This also includes the study of phenols, cyanide, and sulphide. • Physio-chemical characteristics, Total Dissolved Solid (TDS), Turbidity, Oil and grease content, dissolved Oxygen (DO), electrical conductivity, pH, etc
Noise	<ul style="list-style-type: none"> • vibration level at random locations within and around the site
Land and soil	<ul style="list-style-type: none"> • Satellite imagery supplemented by a land use map of the area shall be used to assess land use in the area. • Representative bulked samples (15cm & 30cm) shall be collected at designated distances along transects. • Topographical survey to determine natural phenomena like drainage/channel patterns, identify geomorphic features, and establish flood controls. • History of flooding and sediment transport studies involving

	<p>field measurement and</p> <ul style="list-style-type: none"> • Laboratory analysis (Physical, Chemical, microbiology components)
Archaeology	<ul style="list-style-type: none"> • Social anthropological considerations will be examined, including identifying shrines, burial sites, and archaeological sites affected by the project. • Parks designated environmental/amenity value area and nature reserve will be identified and described. • Various aspects of the local culture, customs, religious beliefs, social taboos, sacred places, etc., will be identified and described.
Geology and hydrogeology	<ul style="list-style-type: none"> • Identify the rock sequence and describe the principal rock types in the area. • Physio-chemistry, dissolved oxygen (OD), salinity (as chlorides), total suspended solids (TSS), total dissolved solids (TDS), turbidity, total hydrocarbon content, etc. Water chemistry (exchangeable cations (Ca²⁺, K⁺, Mg²⁺, Mn²⁺)). Heavy metals (Fe, Zn, Cr, Cu) and water microbiology of the underground water.
Biodiversity	<ul style="list-style-type: none"> • Assess the general and specific characteristics of vegetation and wildlife by determining the composition of the florist, life form and biological spectrum.
Waste Management Studies	<ul style="list-style-type: none"> • Waste inventory of the project area • Type of waste generated in the area and disposal/management methods.
Human health and safety	<ul style="list-style-type: none"> • assessment of Common diseases in the area • An inventory of diseases prevalent in the area.
Socioeconomic	<p>The key information includes the following:</p> <ul style="list-style-type: none"> • Type of occupation • Educational level of people in the area • Kind of disease in the area • The feelings/opinions of the affected communities on the power project • The operations of people in the affected Community • Type of Culture • Level of income • Assess on environmental/safety risk • Also, physical observation and professional judgment shall be used to identify the following: <ul style="list-style-type: none"> • Historical sites • Settlements pattern • Land requirement • Infrastructure Development • Industrial activities vis-à-vis women • Cost of living and income level
Community engagement	<p>Consultation to intimate the stakeholders of the project includes the following;</p>

	<ul style="list-style-type: none"> • Federal Ministry of Environment • States Environmental Protection Board (Katsina State Ministry of Environment) • Local Government Council (Batagarawa LGA) • Neighbouring Community (Kayauki)
Traffic and transport	Traffic data, transport route, traffic assessment, accidents, proposed car parking Lots and traffic congestion

1.6 The EIA Objectives

The objectives of the EIA for the proposed project are to:

- To Provide information on the current ecology (ambient air quality, soil, fauna, flora, microorganisms, biological diversity, surface water, groundwater) and socioeconomic condition of the environment within which the Granite Quarry is to be located.
- To Determine the project's impacts on the environment, including the socioeconomic and sociocultural activities of the community.
- Examine the health situation of the human population around the project site
- Examine and assess the significant potential impacts of all activities and auxiliary facilities in all phases of the project (construction, operation, abandonment) on the natural, social and health environments.
- Provide recommendations for the mitigation of identified adverse impacts.
- Develop an environmental management plan for implementing mitigation measures and an environmental monitoring plan for monitoring efficiency.

1.7 EIA Work Scope

The proposed study work scope includes the following:

- Review national and international environmental regulations, standards, codes, and conventions relevant to the proposed project activities.
- Review existing literature on the study area, including study reports (EIA, EA PIA, etc.) to characterise the baseline conditions.
- Comprehensive field sampling/testing at the proposed project area for a single season.
- Consultation with all stakeholders and regulatory agencies.

- Impact identification, prediction, interpretation, and evaluation.
- Development of cost-effective mitigation/ameliorative measures, monitoring programmes and an Environmental Management Plan covering the project life cycle.
- Prepare draft and final EIA reports that meet regulatory requirements.

1.8 EIA Methodology

This study combined multidisciplinary standard methods from pure science, engineering, and social sciences to obtain basic data for impact identification and evaluation and to establish ameliorative measures. It generally involved site identification, characterisation of the existing environment, review of the proposed project, and development of an environmental management plan.

Site Identification

The geography and relevant environmental and socio-economic information on the proposed project area were identified using maps, charts, articles, previous study reports on the area and similar environments, photographs, and a reconnaissance visit to the site (25th September 2023). The information generated enabled the definition of the limits of the area to be surveyed/ assessed.

Data Collection

Using the information gathered from site identification and consultation, the major habitats in the area were categorised, and their respective sampling requirements were defined. This enabled the effective collection of qualitative and quantitative data on the flora and fauna of the project area. The fieldwork conducted between 29 September 2023 and 6 October 2023 covered all relevant ecological, socio-economic, and health environment elements to complement information obtained from the literature.

Consultation with Stakeholders and Experts

This involved the dissemination of information and interactions/dialogues with the various stakeholders in the proposed project, including professionals in engineering, science, health, and environmental issues.

Impact Assessment and Mitigation

The potential and associated impacts of the proposed project were systematically assessed using the (FMEnv) EIA Sectorial Guidelines (1995), African Development Bank's Integrated Safeguards System (AfDB's ISS) and World Bank Safeguard Policy on Environmental Assessment (OP/BP 4.01) as well as the ecological and socioeconomic status data collected from the project area were used to identify and evaluate the potential and associated impacts of the proposed project and also to proffer appropriate mitigation measures.

In addition, professional judgement, knowledge of the ecosystem in which the proposed project is to be located, and consensus of opinions based on similar projects were essential tools for determining appropriate impact mitigation measures.

Furthermore, auditing or monitoring has been designed into the proposed project's Environmental Management Plan (EMP) to allow for ongoing improvement of operational practices if those initially established prove inadequate. The EMP shall also enable a rapid rescue/response if an unforeseen environmental impact occurs.

Reporting and Review

The findings of the proposed project EIA study were subsequently documented, as contained in this report. The final version of this report will be issued after regulators/stakeholders review it. This version shall incorporate all pertinent issues and comments from the review, as directed by FMEnv.

1.9 Legal and Administrative Framework

Existing statutes on environmental protection in Nigeria contain specific provisions designed to prohibit or control environmental pollution/degradation and to prescribe

sanctions or damages to be enforced against persons or corporate entities who contravene the provisions.

The principal bodies responsible for environmental matters are the Federal and the State Ministries of Environment; these bodies are saddled with enforcing existing statutes and regulations in Nigeria. The following subsections outline the guiding policies and regulations by the FMEnv and the Katsina State Ministry of Environment, which are relevant to the proposed Quarry installation. Other national and international statutes and conventions are also presented.

1.9.1 The Federal Ministry of Environment

National Environmental Standards and Regulation Enforcement Agency (NESREA) Act (2007) [presently subsumed into the Federal Ministry of Environment (FMEnv)]. The body is charged/empowered with the overall responsibility of environmental enforcement matters in Nigeria. It has developed intervention instruments to halt ecological degradation through policies, standards, guidelines, regulations, and programmes. With the initiation of these instruments, enforcement by FMEnv has become the most effective tool to bring industries and regulated communities into compliance through compliance promotions. The relevant policies, guidelines, and ministry regulations are outlined below.

The Federal Ministry of Environment (Revised 2016)

The goal of the National Policy on the Environment is to ensure environmental protection and the conservation of natural resources for sustainable development.

The goal will be achieved by the following strategic objectives:

- Securing all Nigerians a quality of environment adequate for their health and well-being.
- Conserving and using natural resources for the benefit of present and future generations.
- Restoring, maintaining, and enhancing the ecosystem and ecological processes are essential for preserving biological diversity.

- Raising public awareness and promoting understanding of the essential linkages between the environment, resources, and development; and
- Cooperate with other countries, international organisations, and agencies to optimise the use of transboundary transport and prevent environmental recourse.

National Guidelines and Standards for Environmental Pollution Control in Nigeria

In line with the strategic thrust of the National Policy on the Environment, the National Guidelines and Standards for Environmental Pollution Control in Nigeria was published in March 1991 to serve as a primary instrument for monitoring and controlling industrial and urban pollution. The main thrusts of these guidelines are:

- Effluent limitations.
- Pollution abatement in industries.
- Water quality or industrial water uses at the point of intake.
- Noise exposure limitations.
- Industrial emission limitations; and
- Management of solid and hazardous wastes.

National Effluent Limitation Regulation

The National Effluent Limitation Regulation, S.I.8 of 1991 (No. 42, Vol. 78, August 1991), makes it mandatory for industries as waste-generating facilities to install anti-pollution and pollution abatement equipment on-site based on the best available technology (BAT) for detoxification of effluent and chemical discharges. The regulation is specific to each category of waste-generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the ecosystem. Appropriate penalties for contravention are also specified in the regulation. The proposed Batagarawa Quarry project is expected to produce liquid and solid waste; thus, this regulation is applicable.

Pollution Abatement in Industries, Industries Generating Wastes Regulation

The pollution abatement regulation, S.I.9 of 1991 (No. 42, Vol. 78, August 1991) imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency plans by industries; submission of lists and details of chemicals used by industries to FMEV; requirement of the permit by industries for the storage and transportation of harmful or toxic waste; the generator's liability; strategies for waste reduction; permissible limits of discharge into public drains; protection of workers and safety requirements; for environmental audit (or environmental impact assessment for new industries) and penalty for contravention.

Management of Hazardous and Solid Wastes Regulation

The management of hazardous and solid waste regulation, S.I.15 of 1991 (No. 102, Vol. 78, August 1991) defines the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, incinerators, etc. It also describes the hazardous substances tracking programme with a comprehensive list of acutely hazardous chemical products and dangerous waste constituents. It also states the inspection, enforcement, and penalty requirements and procedures.

Environmental Impact Assessment Act

EIA Act CAP E12 LFN 2004 makes EIA mandatory for all new major public and private projects in Nigeria. The EIA Act sets out to:

- Consider the likely impacts and the extent of these impacts on the environment before embarking on any project or activity.
- Promote the implementation of appropriate policy in all Federal Lands consistent with all laws and decision-making processes through which the goal of this Act may be realised.
- Encourage the development of procedures for information exchange, notification and consultation between organisations and persons when the proposed activities are likely to have significant environmental effects on

boundary or trans-state or on the environment of bordering towns and villages.

- The Act gives specific powers to the FMEnv to facilitate environmental assessment of projects.

1.9.2 Other National Regulations

Other relevant national regulations on environmental protection relevant to the proposed project are:

Federal Land Use Act (CAP 202LFN) 2004

The laws of the Federation of Nigeria (1990) Federal Ministry of Justice, Land Use Act (Chapter 202), Part II, Section 11 (Power of Governor or Public Officer to enter and inspect land and improvements) “the Governor or any public officer duly authorised by the Governor in that behalf, shall have the power to enter upon and inspect the land comprised in any statutory right of occupancy or any improvements effected thereon, at any reasonable hours in the day time and the occupier shall permit and give free access to the Governor or any such officer to enter and inspect”.

Penal Code of Northern Nigeria

The Nigerian Penal Code was enacted in 1959 and is based on the British criminal code of the colonial era. The Code under Chapter XXXVI makes it an offence, punishable under the law, for anybody to

- Violate the atmosphere in any place to make it harmful to the health of persons in their dwelling places, neighbouring businesses, or public ways;
- Do any act that he/she knows or has reason to believe to be likely fraudulent dealings with minerals and mines.

National Effluent Limitation Regulation, S.1.8. S.I (1991)

This makes it mandatory for industries to install antipollution equipment in their facilities, provides for effluent treatment, and sets maximum limits for effluent parameters that can be discharged into the ecosystem.

National Pollution Abatement in Industries and Facilities Generating Wastes Regulation, S.1.9.S.I (1991)

This imposes restrictions on releasing toxic substances into the environment and stipulates requirements for monitoring pollution to ensure that permissible limits are not exceeded. Contingency plans are made for unusual and accidental discharges. Generators of waste liability, strategy for waste reduction, and worker safety are also addressed.

National Environmental Protection (Management of Solid and Hazardous Waste) Regulation, S.1.15.S.I(1991)

This sets out the guidelines for the management of solid and hazardous wastes. The objectives of the regulation are, therefore, to:

- Identify solid, toxic, and highly hazardous wastes dangerous to the public and the environment.
- Provide surveillance and monitoring of dangerous and highly hazardous waste substances until they are detoxified and safely disposed of.
- Provide guidelines to establish a system of proper record keeping, sampling, and labelling of dangerous and extremely hazardous wastes.
- Establish suitable requirements to facilitate the disposal of hazardous wastes.
- Research into possible reuse and recycling of hazardous wastes

National Environmental Standards and Regulation Enforcement Agency (NESREA) Act 2007

The act was the embodiment of laws and regulations focussed on the protection and sustainable development of the environment and its natural resources with the following provisions;

- Provides authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution, prevention, and control through monetary measures
- Empower the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances and other forms of environmental pollution and sanitation
- Prohibits, without lawful authority, the discharge of hazardous substances into the environment.

This offence is punishable with a fine not exceeding N1,000,000 (one million Naira) and an imprisonment term of five years. In the case of a company, there is an additional fee of N50,000 for every day the offence persists.

The Nigerian Mineral & Mining Act (2007)

This act was passed in 2007 to repeal the Minerals and Mining Act of 1999 and to re-enact the Nigerian Minerals and Mining Act of 2007. This act regulates all aspects of the exploration and exploitation of solid minerals in Nigeria. The Act was passed to regulate the exploration and exploitation of solid materials in Nigeria. The Key Provisions of the act includes;

- Ownership and Control of Minerals: The Act vests control of all properties and minerals in Nigeria in the State and prohibits unauthorised exploration or exploitation of minerals.
- Mineral Titles: The right to search for or exploit mineral resources is obtained through one of the following mineral titles:
 - Reconnaissance Permit
 - Exploration License
 - Small Scale Mining Lease
 - Mining Lease
 - Quarry Lease
 - Water Use Permit

The Minister is responsible for ensuring the orderly and sustainable development of Nigeria's mineral resources, creating an enabling environment for private investors, and identifying areas where government intervention is desirable. Based on the above regulations, the quarry project proponent requires a permit to operate within the stipulated law.

The Nigerian Mineral & Mining Regulation (2011)

The Ministry of Solid Minerals Development (the 'Ministry') recently issued new mining regulations titled the Nigerian Minerals and Mining Regulations 2011 (the 'Regulations'), which are intended to establish a more coordinated and accountable solid minerals sector in the country and to stamp out the discretionary grant of mineral titles. The Regulations were issued to set out the rules, procedures, and processes for acquiring mineral titles and to give effect to the Minerals and Mining Act No. 20 of 2007 (the 'Act'). Inter alia states thus.

Section 30: Deductibility of Environmental Costs

Companies engaged in exploiting mineral resources, etc., shall establish a tax-deductible reserve for environmental protection, mine rehabilitation, reclamation, and mine closure costs.

Section 114: Restoration of Mines Land

The Minister shall, by order, require a guarantee of a mining lease to restore any area in respect to which mining operations have been or are to be conducted.

Section 115: Reclamation

Where land subject to a mining lease has been exploited, the reclamation mined-out area shall be restored by the applicant under the condition.

Section 118: Environmental Obligation

Every holder of a mineral title under this Act shall, as far as it is reasonably practicable, minimise, manage and mitigate any environmental impact resulting from activities carried out under this Act and Rehabilitate and reclaim, where

applicable, the land disturbed, excavated, explored, mined or covered with tailings arising from mining operations to its natural or predetermined state or too the such as may be specified in this Act, its regulations and other pertinent laws in force and following established best practices.

Section 118: Environmental Impact Assessment

Every holder of an exploration license, small-scale mining lease, mining lease, quarry lease, and water use permit shall;

- Prior to the commencement of mining operations, or upon application for an extension of the term; or
- Upon an application for the conversion of a mineral title, submit to the Mines Environmental Compliance Department:
 - (i) An environmental impact assessment approved by the Federal Ministry of the Environmental in respect of the Exploration or Mining Operations to be conducted within the Mineral title Area and
 - (ii) An Environmental Protection and Rehabilitation Program containing details that may be provided in the environmental regulation issued pursuant to this Act.

Section 120: Contents of the Environmental Protection and Rehabilitation Programme

The Environmental Protection and Rehabilitation Programme required under the provisions of this Act shall

- a) Provide for specific rehabilitation and reclamation actions, inspections, and annual reports.
- b) A reasonable estimate of the total cost of rehabilitation
- c) Cost estimates for each specific rehabilitation and reclamation action; and

- d) A timetable for the orderly and efficient rehabilitation and reclamation of the Mineral title area to a safe and environmentally sound condition suitable for future economic development or recreational use.

The Mines Environmental Compliance Department shall exercise all its powers regarding Environmental Protection and Rehabilitation Programmes provided for in section 119 in consultation with the State Mineral Resources and Environmental Management Committee established pursuant to Section 19 of this Act.

The Mines Environmental Compliance Department may approve or reject an Environmental Protection and Rehabilitation Programme submitted by the Mineral title holder of its decision thereon within sixty days of the submission of the Environmental Protection and Rehabilitation Programme;

1. If the Mines Environmental Compliance Department does not notify the Holder of a Mineral title within the period specified under subsection (3), the Environmental Protection and Rehabilitation Programme shall be deemed approved as submitted.
2. In the case of rejection of the Environmental Protection and Rehabilitation Programme by the Mines Environmental Compliance Department, the Mineral title holder may;
 - a) Submit such other number of Environmental Protection and Rehabilitation Programme as may be necessary to obtain the approval of the Mines Environmental Compliance Department or
 - b) If its application is rejected twice, the Holder may submit the matter to arbitration within thirty days of notification of the decision under subsection (3) of this section.

Section 121: Establishment of the Environmental Protection and Rehabilitation Fund.

- (1) The Minister shall establish an Environmental Protection and Rehabilitation Fund to guarantee the environmental obligations of Holders of Mineral titles as provided under this Act.

- (2) The Minister shall appoint a reputable institution customarily engaged in business as trustee of the fund manager to administer the Environmental Protection and Rehabilitation Fund.
- (3) The trustee appointed pursuant to 10 subsection (2) of this section shall operate the fund in accordance with the provision of the Trustees Investments Act, cap T2i laws of the Federation of Nigeria, 2004 or amendment thereof.
- (4) Every holder of a mineral title shall commence contribution to the Environmental Protection and Rehabilitation Fund in accordance with the amounts specified in the approved Environmental Protection and Rehabilitation Programme not later than one year from such approval.
- (5) If the Mines Environmental Compliance Department determines that the estimated cost of implementing the approved Environmental Protection and Rehabilitation Programme is substantially less than the amount already deposited in the Environmental Protection and Rehabilitation Fund, it may:
 - (a) refund any excess amount in the Fund to the Holder of the Mineral title or
 - (b) review the number of future contributions or modify the contributions schedule as circumstances require.
- (6) Where a Mineral title is reviewed, the Holder shall pay into the Environmental Protection and Rehabilitation Fund such annual amounts as may be specified in an amended Environmental Protection and Rehabilitation Programme approved under section 120 of this Act
- (7) The trustee shall keep proper records in respect of the operation of the Fund and shall cause to be prepared by an independent firm of Chartered accountants in respect of the financial year
- (8) The trustee shall, not later than three months after the end of each financial year, send a copy of the audited statement of accounts referred to in subsection (6) of this section to be sent to the Minister and each member of the State Mineral Resources and Environmental Management Committee

- (9) The Environmental Protection and Rehabilitation Fund and any sum accruing, therefore, shall be applied only to implementing the Environmental Protection and Rehabilitation Programme to which they relate following the timetable of payments established in the Environmental Protection and Rehabilitation Programme.
- (10) The Holder of a mining lease shall implement and meet all obligations described in the Environmental Protection and Rehabilitation Programme during the term of the mining lease.
- (11) When the Environmental Protection and Rehabilitation Programme has been fully implemented and completed further to certification by an independent external audit has confirmed that the implementation of the Environmental Protection and Rehabilitation Programme has been satisfactorily completed, the Head of Mines Environment Compliance Department shall authorise the refund of any remaining in the Environmental Protection and Rehabilitation Fund to the title holder within thirty days of the receipt of the certification.

The Labour Act Cap L1, LFN 2004

The Labour Act Cap L1, LFN 2004, is the primary law protecting the employment rights of individual workers. The act covers the protection of wages, contracts, employment terms and conditions, and recruitment. It also classifies workers and special worker types. Union membership is governed by the Trade Union Amendment Act (1995). The 1999 constitution stipulates "equal pay for equal work without discrimination on account of sex or any other ground whatsoever."

While Nigeria has ratified all eight core International Labour Organisation Conventions and enacted laws to enforce the provisions, there are indications of restrictions on the trade union rights of workers in Nigeria, discrimination, child labour and forced labour.

Employee's Compensation Act, 2010

The Employee Compensation Act, of 2010, is a social security/welfare scheme that provides comprehensive compensation to employees who suffer from occupational diseases or sustain injuries arising from accidents at the workplace or in the course of employment. The basis or justification for 'compensation' is the employer's duty of care. The Employee Compensation Act of 2010 specifically addresses compensation for work-related injuries, disabilities, or death, establishing a framework for employer liability in such cases. The Employees' Compensation Act, 2010, was signed into law on 17th December 2010. This Act repeals the Workmen's Compensation Act Cap.

Child's Right Act (2003)

The law guarantees the rights of all children in Nigeria. So far 24 out of 36 states of Nigeria have adopted the CRA as a state law. There are therefore twelve (12) states in Nigeria that are yet to adopt the CRA in their laws of the 36 states of the federation. Children as defined by Child's Right Act (2003) is any person under the age of 18. National Human Rights Commission as parts of its mandates to promote, protect and enforce the rights of all citizens as well as foreign nationals in Nigeria undertakes several procedures of promoting and protecting the rights of children under this age because they are vulnerable.

Violence Against Persons (Prohibition) Act, 2015

The Violence Against Persons (Prohibition) Act (VAPP) was enacted in May 2015. The Act resulted from agitations to protect persons against the different forms of violence. Violence, both at the home front and in the larger society, is fast becoming a trend in recent days in Nigeria. Daily, we hear of someone killing or maiming their spouse, a scorned lover pouring acid on an ex-lover, or someone being forcefully taken away from their family and loved ones. The need to protect citizens from violence such as these led to enacting the VAPP Act in 2015. The Violence Against Persons (Prohibition) Act is an improvement on the penal and criminal code concerning violence; it also compensates victims and protects their rights.

National Gender Policy, 2006

The goal of the National Gender Policy is to “build a just society devoid of discrimination, harness the full potentials of all social groups regardless of sex or circumstance, promote the enjoyment of fundamental human rights and protect the health, social, economic and political wellbeing of all citizens to address the inequalities that exist in the socio-economic sphere’, and combat all forms of violence against women and girls, among other things. It further draws from regional and international instruments to Nigeria as a party. The persistence of gender inequalities and underrepresentation of women in decision-making positions at all levels continue to provide the need for a gender policy to provide the policy framework for addressing them. The overall goal of the policy is “to build a just society devoid of discrimination, where the needs and concerns of women, men, girls, and boys are mainstreamed equitably into all sectors of national development

Endangered Species Act (Cap 108), 1990

This Act prohibits hunting, capture, and trade of some endangered species like crocodiles, alligators, turtles, parrots, etc. The Federal Republic of Nigeria has enacted the Endangered (Control of International Trade and Traffic) Decree (No. 11 of 1985) specifically to implement CITES. It is broader than CITES because it also covers domestic taking of listed species. Two schedules are included: Schedule I (Endangered Species – Animals in relation to which International Trade is Prohibited) and Schedule 2 (Animals in Relation to which International Trade may only be conducted under License). The decree prohibits taking Schedule 1 species and requires that taking Schedule 2 species be in accordance with a license issued under the decree.

Nigerian Urban and Regional Planning Act *CAP N138, LFN 2004*

The Nigerian Urban and Regional Planning Act CAP N138, LFN 2004 established a Development Control Department (DCD) charged with the responsibility for matters

relating to development control and implementation of physical development plans at the Federal, State, and Local Government levels within their respective authority.

- Approval of the relevant DCD shall be required for any land development
- A developer shall submit a development plan for the approval of the DCD of the local Government, State or Federal Government.
- A developer (whether private or government) shall apply for a development permit using such forms and providing information, including plans, designs, drawings, and any other information as may be prescribed.
- A developer shall, at the time of submitting his development application, submit to an appropriate Development Control Department a detailed Environmental Impact Statement (EIS) for an application for residential land of more than 2 hectares or Permission to build or expand a factory or for the construction of an office building more than four floors of 5000 square meters of a settable space or Permission for a major recreational development.

1.9.3 Katsina Environment Environmental Protection Agency

The Federal Ministry of the Environment is responsible for providing a decent, orderly, and reasonably conducive environment for a habitable society, as contained in the assignments of Ministerial responsibilities.

The States have State Ministries/EPA to protect public health and safety, restore and enhance environmental quality, and sustain economic vitality through effective and efficient implementation of environmental programmes; the States have State Ministries/EPA. Inter alia, these are empowered by the respective State Government to give direction to all environmental issues, monitor and control pollution, and dispose of solid, gaseous, and liquid wastes generated by various state facilities. Some of their functions include;

- Consulting with the Federal Ministry of Environment to achieve a healthy or better management of the environment via the development of a National Policy on the Environment

- Co-operating with FMEnv and other National Directorates/Agencies in the performance of environmental functions, including environmental education/awareness to the citizenry
- Responsibility for monitoring waste management standards,
- Responsibility for general environmental matters in the State, and
- Monitor the implementation of EIA studies and other environmental studies for all development projects in the state.

State laws on the environment are generally still evolving. Specifically, for EA, the States rely on the federal EIA Act.

The Katsina State Environmental Protection Agency is responsible for conserving and protecting the environment and all other matters concerning the environment in the state, particularly monitoring and controlling pollution and the disposal of solid, gaseous, and liquid wastes. Some of the specific functions of the include:

- Formulating and enforcing policies, statutory rules and regulations on solid waste collection and disposal, general environmental protection, flood control and regulation of the ecological system and all activities related therein throughout the State.
- Conduct public enlightenment campaigns, disseminate vital information on environmental and ecological matters, and mobilise the inhabitants of all areas to observe environmental rules and guidelines practically for a healthy and safe environment.
- monitoring the implementation of Environmental assessment studies and other environmental studies for all development projects in the State.

Local Government Authorities

Environmental matters at the Local Government Areas (LGA) hosting the quarry project under consideration are essentially guided by the Katsina State Environmental Agency policies. The host LGAs have Environment and Public Health Departments that are responsible for environmental health issues in their respective LGAs.

1.9.4 International Guidelines and Conventions

In addition to the national laws/regulations, Nigeria is a signatory or party to several international conventions and treaties that support using EIA as a critical tool for achieving sustainable development. Some of these include:

World Bank Group Environmental and Social Policies and Guidelines

World Bank Safeguard Policies

The World Bank has 10+2 Environmental and Social safeguard policies designed to help prevent and mitigate undue harm to people and their environment in the development process and ultimately ensure that environmental and social issues are addressed throughout the life cycle of a World Bank-financed project. Specifically, the proposed project has triggered the following policies: OP/BP 4.01: Environmental Assessment; OP/BP 4.04: Natural Habitat; OP/BP 4.12: Involuntary Resettlement and OP/BP 4.11: Physical and Cultural Resources as the project entails the rehabilitation of rural roads traversing farmlands and communities across the state. The description and applicability of triggered policies are presented in Table 1.2.

Table 1.2: Safeguard Policies Triggered and Applicability to the Proposed Project

OPERATIONAL POLICY	DESCRIPTION OF POLICY/ REASON FOR TRIGGER
Environmental Assessment OP/BP 4.01	The project is categorised as category B, and OP 4.01 is triggered because the proposed project is essentially civil engineering work entailing rehabilitation of existing rural roads. As such, some project activities, such as site clearing, grading, excavation, concrete works, etc., may lead to environmental and social impacts. This EIA has been prepared to address the triggered policies.
Natural Habitats OP/BP 4.04	This safeguard policy aims to conserve biological diversity and promote the sustainable use of natural resources. The policy is triggered because some of the road rehabilitation interventions, especially site clearing and excavation, could disturb flora and fauna in their natural habitats and affect downstream rivers and floodplains. To mitigate such adverse impacts, this EIA contains sections detailing the mitigation measures for

	eliminating or minimising potential negative impacts on natural habitats.
Physical Cultural Resources OP 4.11	This policy addresses physical cultural resources, defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes with archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. The results of the E&S screening exercise conducted for the proposed project show no risk concerning OP4.11 as the project will not be implemented in any culturally sensitive site.
Involuntary Resettlement OP/BP 4.12	The policy aims to avoid involuntary resettlement to the extent feasible or to minimise and mitigate its adverse social and economic impacts. It promotes the participation of displaced people in resettlement planning and implementation. The main objective of this policy is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement. This policy is triggered as the project will involve taking of existing farmland where the project is located. Where necessary, an Abbreviated/ Resettlement Action Plan (A/RAP) shall be prepared as a standalone instrument to ensure affected persons and communities are adequately compensated in line with the requirements of this policy.

World Bank Group Environmental, Health, and Safety Guidelines

World Bank Group Environmental, Health, and Safety (EHS) Guidelines are technical reference documents that provide general and industry-specific examples of good international industry practice. The EHS guidelines contain performance levels and measures usually acceptable to the World Bank Group and generally considered achievable for infrastructural developments and mining.

Paris (France) Good Practice for Environmental Impact Assessment of Development Projects 1991

This is an endorsement by the OECD Ministers of the importance of EIA for developmental Projects.

World Heritage Convention 1978

The World Heritage Convention (1978) seeks to set aside cultural and natural heritage, defined as areas with outstanding universal value from the aesthetic, scientific, and conservation points of view.

Convention on International Trade in Endangered Species of Wild Fauna and Flora 1975

This convention was signed into law in 1973 during the Washington Summit but became effective in 1975. It restricts the trade of endangered fauna and flora species. It establishes a list of endangered species for which international commercial trade is prohibited or regulated by a permit system to combat illegal trade and overexploitation.

Vienna Convention for the Protection of the Ozone Layer 1985

The convention, instituted in 1985, places general obligations on countries to respond appropriately to protect human health and the environment against adverse effects resulting from human activities that tend to modify the ozone layer.

Protocol on Substances that deplete the Ozone layer 1987

The protocol was amended for the first time on 29 June 1990 in London. A second set of amendments was adopted in Copenhagen in November 1992; these entered into force in 1994

United Nations Guiding Principles on the Human Environment 1972

These guiding principles are formal declarations that express the basis on which an environmental policy can be built and provide a foundation for action. The United Nations has been concerned about harmful environmental trends since they were formed. As a result of this, they published two major concept documents, the United Nations Guiding Principles on the Human Environment in 1972 and the Rio Declaration on Environment and Development. The principles applicable to this project include:

Principle 2

The earth's natural resources, including the air, water, land, flora and fauna, and especially representative samples of natural ecosystems, must be safeguarded through careful planning or management for the benefit of present and future generations.

Principle 4

Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife, must, therefore, be given importance in planning for economic development.

Rio Declaration on Environment and Development 1992

The Rio Earth Summit (1992) emphasised the need for the preservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilisation of genetic resources, including access to genetic resources and appropriate transfer of relevant technologies, considering all rights over those resources and to technologies. The principles adopted include:

Principle 1

Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 17

Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

UN Convention on Biological Diversity 1994

The Convention's objectives include conserving biological diversity, sustainable use of its components, and fair and equitable sharing of benefits from utilising genetic resources.

Convention Concerning the Protection of the World Cultural and Natural Heritage Sites (or World Heritage Convention) 1972

The convention sets aside areas of cultural and natural heritage for protection. The latter is defined as areas with outstanding universal value from the aesthetic, scientific and conservation points of view.

United Nations Framework Convention on Climate Change (1992)

To achieve sustainable social and economic development, energy consumption for developing countries needs to grow, considering the possibilities of achieving greater energy efficiency and controlling greenhouse gas emissions. This also includes the application of new technologies on terms that make such an application economically and socially beneficial and determined to protect the climate system for present and future generations.

African Convention on the Conservation of Nature and Natural Resources 1968

It emphasises the conservation of nature and natural resources in African Countries.

Jakarta Mandate on Biodiversity 1995

Given the worldwide concern for coastal biodiversity and recognising the significant differences between marine and terrestrial biodiversity, policies and Conventions on Biological Diversity (CBD) were developed at the Jakarta conference in 1995. This is also called the Institute of Integrated Coastal Area Management (ICAM).

Articles 5

Establish and maintain Marine Protected Areas (MAPAs) for conservation and sustainable use of threatened species, habitats, living marine resources and ecological processes.

Basel Convention on the Control of Trans-Boundary Movements of Hazardous Wastes and Their Disposal 1989

The convention focuses attention on the hazards of the generation and disposal of hazardous wastes. It defines waste as regulated and controls its transboundary movement to protect human and environmental health against its adverse effects.

Montreal, Canada- Cartagena Protocol on Biosafety Convention on Biological Diversity 2000

This protocol, signed in Montreal (Canada), emphasises biosafety and biological diversity.

Paris (France) UNESCO Convention 1972

This emphasises the protection of the World's Culture and Natural Heritage.

Stockholm (Sweden) Declaration on Human Environment 1972

This declaration demands that nations cooperate to develop further international laws regarding liability and compensation for victims of pollution and other environmental damage caused by activities within their authority.

Bonn Convention on Conservation of Endangered Species 1979

This emphasises promoting measures for conservation (including habitat conservation, especially for endangered species listed in Bonn's Appendix 1) and managing migratory species.

Bern, Switzerland Convention of Protection of Workers against Occupational Hazards 1979

This emphasises the protection of workers against occupational Hazards in their working environment due to Air Pollution, Noise and Vibration (ILO No. 148)

International Labour Organisation (ILO) Convention on Indigenous and Tribal People in Independent Countries 1989

The article requires that Governments must ensure that studies are conducted to assess the Environmental Impact of planned development activities and take measures, in cooperation with the people concerned, to preserve the environment of the territories they inhabit

Protocol on Cooperation in Combating Pollution 1981

This emphasises the need to combat pollution in cases of emergencies in the West and Central African Region

The Solid Waste Management Act of 1976

This emphasises the Resource Conservation and Recovery Act (RCRA).

International Best Practice Standards and Guidelines

There is the possibility that Eso Terra may seek financing from financial institutions that have specific requirements for environmental and social performance. As such, the Project design and recommended mitigation will endeavour to uphold international best practices and maintain or reduce impacts to ALARP (as low as reasonably practical) levels. This EIA report may be updated later should specific standards or requirements, such as those of the IFC, be determined necessary.

Eso Terra's policy considers international standards and industry best practices in all projects, including joint ventures and supply chains.

The African Development Bank's Integrated Safeguards System, 2023

The African Development Bank's 2023 Integrated Safeguards System (ISS) incorporates ten Operational Safeguards (OSs) to manage and mitigate environmental and social risks. In the following areas:

OS 1: Environmental and Social Assessment: Ensures that projects are assessed for potential environmental and social impacts before approval, identifying and addressing risks early in the project lifecycle.

OS 2: Labor and Working Conditions: Ensures fair and safe labor practices are upheld, focusing on worker rights, health and safety, and fair wages and working conditions.

OS 3: Resource Efficiency and Pollution Prevention and Management: address resource efficiency and pollution prevention and management throughout the project life cycle in a manner consistent with Good International Industry Practice (GIIP).

OS 4: Community Health, Safety, and Security: Focuses on protecting communities from potential health and safety risks arising from project activities, including ensuring the safe operation of project facilities.

OS 5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement: Addresses issues related to land acquisition and the impact on livelihoods, ensuring that processes are transparent and fair, and that affected individuals are adequately compensated.

OS 6: Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources: Aims to protect and enhance biodiversity and ecosystem services, requiring projects to avoid significant negative impacts on natural habitats and species with sustainable use.

OS 7: Vulnerable Groups: Ensures that opportunities for vulnerable groups including female-headed households, the landless, the elderly, youth and children, and persons with disabilities are enhanced to participate in, and benefit from, the development process in ways that do not threaten their unique cultural identities and well-being.

OS 8: Cultural Heritage: Safeguards cultural heritage by ensuring that projects avoid or mitigate impacts on tangible and intangible cultural resources.

OS 9: Financial Intermediaries: Addresses the environmental and social (E&S) requirements associated with intermediated financing through financial and nonfinancial institutions.

OS 10: Stakeholder Engagement and Information Disclosure: Promotes meaningful stakeholder engagement throughout the project cycle, ensuring that affected communities are informed and have opportunities to participate in decision-making processes.

These safeguards collectively aim to ensure that projects funded by the AfDB are environmentally and socially responsible, with a strong emphasis on protecting vulnerable communities and ecosystems.

1.10 The EIA Process

The procedure laid down by the FMEnv for undertaking an EIA to satisfy the EIA Act CAP E12 LFN 2004 is presented in **Figure 1.5** below. The summary process involves submitting a project proposal to the FMEnv by the project proponent. An initial evaluation of the proposed project is done by FMEnv, screening and scoping of the proposal by FMEnv, EIA draft preparation by an accredited consultant, panel review exercise and the preparation of the Final Draft EIA Report and approval by the technical committee.

EIA Process Flowchart

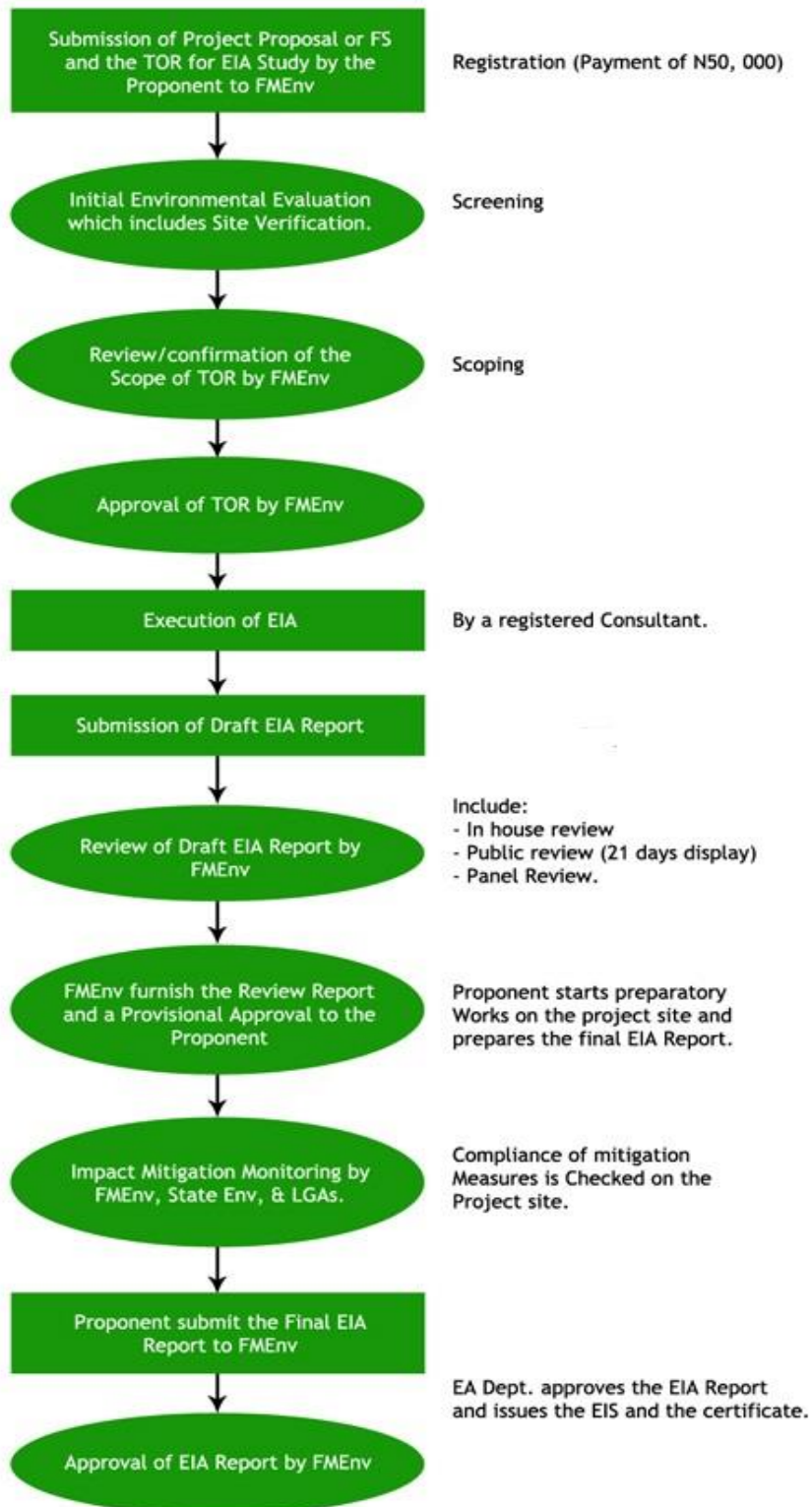


Figure 1.5: Federal Ministry of Environment’s EIA Procedure

1.11 Structure of the Report

This report is presented in Nine chapters, viz.

Chapter One introduces the proponent and provides background information, an outline of the EIA terms of reference, objectives, work scope, and methodology, and a review of the legal and administrative framework for EIA in Nigeria as applicable to the proposed project.

Chapter two discusses the project justification, the need/value, and the envisaged sustainability of the project.

Chapter three discusses the technical details of the proposed project.

Chapter four describes the baseline data acquisition method and the study area's ecological, socio-economic and health baseline status.

Chapter five discusses the impact assessment approach and presents the associated and potential impacts of the proposed project.

Chapter six presents mitigation measures for the proposed project's identified medium and high significant impacts.

Chapter seven presents the Environmental Management Plan (EMP) to be adopted throughout the project cycle. This includes an environmental monitoring programme.

Chapter eight presents the project decommission phase

Chapter Nine highlights the key findings of the study in conclusion.

CHAPTER TWO

PROJECT JUSTIFICATION

2.1 General

The proposed Quarry project is integrated to extract and crush large pieces of rock into smaller fragments such as sand, granite, and stone. When functional, the plant shall crush large volume of rocks using different heavy equipment like a drill machine, Excavator, Bulldozer, Crushers, Dump Trucks to achieve its final products, which include stone dust, granite aggregates of various sizes. This will be of great benefit to the actualisation of Kano-Maradi Rail line; it will also be of economic benefit to the country.

2.2 Need for the Project

Eso Terra intends to efficiently processed rocks into usable materials by converting natural granite resources into usable materials like stone dust, gravel (boulders), granite aggregates of various sizes, which would be used for the Kano-Maradi rail line and construction and other construction purposes associated with the railway project. This will, in turn, help convert our natural resources into value for the benefit human.

2.3 Benefits of the Project

When operational, the benefits of the Quarry are numerous and cannot be over-emphasized. Some of the benefits of the project include:

- Provision of granite aggregates to support the construction and operation of Kano-Maradi Rail Line
- Convert natural resources into value for humans.
- Production of stone dust, stones, gravel, granite and other products.
- Provide employment opportunities for many skilled and unskilled Nigerians, especially those from the host communities.

- Enhancement of the provision of basic social amenities to the host communities.
- Poverty alleviation through increased derivation funds to Kayauki and Fandare communities, Batagarawa LGA, Katsina state and Nigerian Federation.
- Promote a good relationship between Eso Terra and the host community through increased socioeconomic assistance.

2.4 Value of Project

The estimated value of the project is **₦2,030,886,678.91**. This capital investment includes the cost of planning, detailed design, construction of crushing plant consultancy for various project components, compensation, and the preliminary running costs. The value of the project is subject to adjustment at the implementation stages and market fluctuation.

2.5 Envisaged Sustainability of the Proposed Quarry

Economic and Commercial Sustainability

The quarry's sustainability depends on the quantity of material to be mined and the extent of its support for the Kano-Maradi rail project. In general, quarry activities are a main core area of Nigerian construction economy; as the country is still a developing country, the need for quarry products will be in high demand for the construction of roads and rails, erecting of structures and maintenance of existing ones and hence conferring economic sustainability on the proposed facility. The project may employ directly over 36 persons during the construction and operation phases. Priority will be given to qualified persons from the host community, followed by the nearby communities within Batagarawa LGA, Katsina state, before the others. Eso Terra has already incorporated plans to absorb the artisan miners (female majorly) into the quarry project. This will help cope with any future issues of public disturbance caused by the quarry acquisition by Eso Terra. The mining activities will create avenues for many business and employment opportunities, thus

greatly enriching the financial capacity of the project host communities. This will be achieved through the involvement of contractors, suppliers, employment, provision of public facilities and services, increased social capital in the host communities, provision of microcredit schemes, etc. The project will, therefore, contribute economically to Batagarawa LGA, Katsina State and Nigeria.

Technical Sustainability

Eso Terra has a team of professionals who have vast knowledge in the area. More so, the best available technology (Automated Quarry System, Dust suppression system, Electric and hybrid quarry equipment, advanced drilling and blasting techniques, and adequate water management, etc) to be used shall be ensured to have optimum maintenance and servicing and hence will ensure the technical sustainability of this project. The project will require the importation of expatriates, and there shall be skill and knowledge transfer.

Environmental Sustainability

The project shall be environmentally sustainable because of the adoption of FMEEnv EIA processes followed by the development and Implementation of an adequate Environmental Management Plan (EMP) throughout the project's life span, Adherence to the international best practices (such as AfDB ISS, 2023). Strict adherence to occupational health and safety and good housekeeping practices will be strictly followed. The choice of equipment within the perimeter of acquired land will reduce to the barest minimum environmental impacts on biodiversity, soil, and agricultural resources; this increases the project's environmental sustainability.

Social Sustainability

The project has secured the acceptance of the host community. Eso Terra has comprehensive community engagement policy and shall keep constant communication with other stakeholders, to ensure success of the project. The proposed project shall create job opportunities for the unemployed. In addition, Eso Terra is committed to effective and continuous stakeholder engagement and consultation and effective implementation of the social aspect of the ESMP. Esso

Terra is committed to complying with applicable national social laws, relevant international conventions, and AfDB's and AFC's social safeguard policies

2.6 Project Development Options

During the Project planning phase which was a major component of the EIA process three project development options were considered as analysed on the table: using a score rate on a scale of importance from 0 to 5 with a cumulative score of 15 base on the technical feasibility and capacity of the company to executive the project, the economic viability of the proposed project and Environmental and Social sustainability of the proposed project:

Table: 2.1 Project Alternative Analysis

Project Option & Alternatives	Assign scores			Total score
	Technical feasibility	Economic viability	E&S Sustainability	
No project option	0	0	0	0
Delay option	2	1	2	5
Project execution	4	4	2	10

Option 1 (Do Nothing or No Development Option)

This amounts to the cancellation of the construction of the proposed quarry project. In this case, no impact associated with the project will occur. The disadvantages of adopting this option include.

- For example, the delay/suspension of the Kano-Maradi rail line will eventually affect the positive impact of the rail project.
- The rock deposits will not be mined, and thus, its economic value cannot be assessed and utilised profitably.
- Loss of revenue paid to the Government to obtain the mining license lease and other logistic expenses.

- There is a risk of forfeiting the right to the minefields after the stipulated years of non-development.
- Loss of revenue to the Batagarawa LGA, Katsina state, and Federal Governments of Nigeria and the Kayauki/Fandare community.
- Loss of job opportunities that the project execution would have afforded some Indigenous inhabitants of Kayauki and other neighbouring communities.
- Loss of commercial and economic benefits to Batagarawa Local Government Area.
- Continuation of illegal, unregulated artisanal mining.
- Exposure of animals and humans to the risk of falling on existing quarry pits.

This option was rejected.

Option 2: Delayed Option

This implies implementing the proposed project later for reasons such as lack of funds, communal crises, banditry, and war. This option was rejected since none of these situations are obtainable at the proposed project site. If the option is considered, the manifest and associated benefits of the project will be delayed, so this option was also rejected. Delaying the project may also slow down the rail construction.

This option was rejected.

Option 3: Project Execution

This option involves implementing the project. This will help the Government and Eso Terra achieve their goal of harnessing the rock deposits, thus contributing to the company's economy and revenue profile. The option would also benefit the Kayauki/Fandare community members, Batagarawa LGA, Katsina State and Nigeria. This was the recommended option, given its importance in providing rock aggregates for the Kano-Maradi rail and other aspects of the Nigerian economy's

construction and building industry. This option was accepted considering the high score on scale of importance.

2.7 The Proposed Alternatives

Quarry Alternative

The development area for the proposed project will see some negative changes to its environmental and social attributes. Ecologically, there will be loss of habitat and species diversity in the area. While not discounting the value of the ecology that persists in the region, the loss will be insignificant. Moreover, the proponent plans to retain any ecologically sensitive areas. Drainage patterns, groundwater, surface water and soil quality may also be affected. From a Socioeconomic perspective, the proposed development would contribute significantly to national, regional, and local income generation. In addition, the development would create numerous jobs, either directly or indirectly, and community growth and development for the host and neighbouring communities.

Farming Alternatives

Farming project option: Since the site is already exposed to mining, this option is not feasible or economically viable, as the quarry pits have already covered sections of the area. Only a tiny portion of the land has viable soil conducive to farming. As indicated in our inspection, few mammals and Aves survive in the area. Even if crops could be planted, they would be restricted to only that small portion of land with soil conducive to growing. Such restrictions make it economically impossible to have agriculture. This alternative is therefore not recommended. The topography of the land may not allow productive and efficient agricultural production.

CHAPTER THREE

PROJECT DESCRIPTION

3.1 Project Area Description

Topographically, a greater part of the project land lies on a naturally high terrain, indicating an external outcrop of the granite material. There are visible pockets of previous mining, and a quarry pit has shown evidence of active mining before the site was acquired by Eso Terra (Plate 3.1 and 3.2); however, the site still possesses a substantial quantity of rock materials to be mined. The approximate area for the granite material is about 0.4 km². The desired ores are covered with overburden material, whose thickness varies within the region. However, some portions of the project area have been exposed due to mining activities by Borini Prono and Katsina State Exploration and Mining Company.

The area is accessible through a decently tarred road linking Katsina and Daura; it is about 3km Northwest of Batagarawa town, the area's major settlement. However, the closest settlement to the proposed project area is Kayauki, which is about 1.5km to the west. The project is expected to impact Kayauki and Fandare communities, Batagarawa LGA and Katsina State by extension. The immediate communities are more 1km away from the project sites which is more than 500m radius (buffer zone) required by the Nigerian explosive regulation.

The proposed quarry area is to be operated within the 35121QLS granted by the Nigerian Mining Cadastre Office to the Katsina Mineral and Mining Development Company Limited and now acquired by Eso Terra. The 35121 QLS boundary is defined by the geographical coordinates presented in Table 3.1.

Table 3.1 Outline Coordinates of The Proposed Quarry Lease

BEACONS	LATITUDE (N)			LONGITUDE (E)		
CB1	13	0	15	7	43	0
CB2	13	0	45	7	43	0
CB3	13	0	45	7	43	15
CB4	13	0	15	7	43	15



Plate 3.1: Quarry Pit and Evidence of Mining Activities (Snafhcore Limited Fieldwork September 2023)



Plate 3.2: Abandoned Equipment within the Site (Snafhcore Limited Fieldwork September 2023)

3.2 Geological Consideration

Rock aggregates have diverse usage and applications in infrastructure development, mainly in concreting, stone masonry, drainage construction and road building. Depending on the size of the aggregate material, aggregates are classified as coarse, fine, dust, or powder, resulting from crushing rock materials (Table 3.2). For the sake of the project the quarry is designed for, more coarse aggregates will be produced to meet the needs of railway track construction. These quarried materials shall be stored on site before being transferred to the Kano-Maradi rail project site, where the materials will be needed.

Table 3.2: Rock Texture

SN	AGGREGATES (mm)	TEXTURE	USES
1	0– 5	Coarse	Mixed material used for road sub-base.
2	15–22	Coarse	Concrete works
3	22–30	Coarse	Concrete works
4	5– 10	Fine	Asphalting of road
5	0– 1	Powder	Fillers for asphalts
6	100 – 300	Hard Core	Stone pinching and soil stabilisation jobs

Generally, Katsina State is underlain by basement complex rocks of Precambrian origin. Prolonged weathering of the rocks produced deep clay-rich regolith. The reserve estimation method used was the random drilling of pilot holes across the stretch of the rock deposit. Drilling information was used to ascertain the average overburden depth and rock volume. The surface-proven reserve of the granite is about 206,250 tonnes. The planned crushing capacity of 600tph for stone aggregate; the daily output of 1,000 tons on a full operation based on eight (8) hours. Total output per annum (250 working days, i.e., considering weekends and public holidays) will be 250,000 tonnes/yr. The average estimated reserve of the sub-surface granite is 1,500,000 million tonnes. Therefore, the sub-surface outcrop of the proposed aggregate granite quarry will have a life span of about five years or more. Waste rocks shall be stockpiled away from the quarry pits and protected against storms. They will, therefore, be kept for reuse within the site and for community development as backfilling, construction aggregates, drainage/erosion control, landscaping and reclamation, and fill materials.

3.3 Project Components

The quarry project is divided into two zones: the primary production zone (blasting, blasting, haulage of materials to crushing site) and the production zone (Admin, crushing, screening, stockpiling).

The critical activities for the proposed Quarry include:

Pre-Operation - Planning Phase

- Conduct feasibility studies and market research.
- Identify and acquire quarry site and surrounding land (35121QLS Tenements and required ground in Kayauki/Fandare areas).
- Develop quarry design and layout.
- Engage with local communities and stakeholders
- Prepare Environmental Impact Assessment and other Permitting Applications
- Develop quarry operations and management plan
- Secure financing and investment

Development – Quarry Construction Phase

- Clear and prepare quarry site
- Construct access roads and infrastructure
- Install quarry equipment and machinery
- Build processing facilities and material storage areas
- Implement environmental management systems
- Construct offices, amenities and worker accommodation
- Recruitment and capacity building

Operations – Production Phase

- Extract and process quarry materials (extraction of materials, processing, rock blasting and stoke pilling)
- Haulage and transport of materials to customers or storage facilities
- Monitor and manage environmental impacts
- Maintain equipment and infrastructure
- Implement safety and health management systems
- Engage with local communities and stakeholders
- Optimize quarry operations and management

Post Operation Phase - Decommissioning Stage

- Cease quarry operations and remove equipment
- Rehabilitate and reclaim quarry site
- Backfill and grade quarry pits and haul roads
- Revegetate and reforest disturbed areas
- Monitor and maintain the rehabilitated site
- Complete final closure and handover to local authorities or landowners
- Implement post-closure management and monitoring plan

3.3.1 Site Planning

In the proposed quarrying project, spatial consideration and planning will essentially be done to reflect National mining regulations, aesthetics, and overall efficiency. Distance and location chosen within the quarry site for constructing an explosive storage facility shall conform to the stipulations of the MSMD Regulations. The rock processing facility shall be situated at a reasonable distance of about 150m, guaranteeing efficient workflow from the extraction pit to the crushing plant. Other structural units like the office building, workshop, main entrance gate, diesel dump, weighing bridge, roads (12m width + 1.1km Long from the entrance of the quarry to the main area) and walkways (3m width running the length of the road) within the premises shall be positioned in a well-organized manner to make the site have an appealing look.

The site will be developed in a sequence of discrete stages, each of which will involve a series of Phases:

- Site establishment (E), development (D), and construction (C) stages (featuring several intermediate phases).
- Quarry operation stage (Q) (featuring several phases) associated with the development of the quarry pit itself and
- Rehabilitation and decommissioning of the site once the operations have concluded.

The timing and rate of progression through the stages associated with the quarry development will be defined by the speed of construction of the Kano-Maradi rail line. Still, the quarry will have an operational life of at least five years. During the establishment, development and construction stages, the proposed Quarry will operate with a permanent fixed plant as soon as practicable after the plant site infrastructure area and initial pit have been established.

3.3.2 Quarry Development

The Quarry Plant shall be sited within the confines of the land (0.4km²) granted by Mining Cadastre Office (operated by the past operators) and additional ground rented by Eso Terra Investment Limited to ensure safe and efficient quarry operation. The overall site outline shall be sizable enough to accommodate the heavy machinery and other supporting facilities.

The detailed site preparation activities are presented below:

Removal of Overburden

This involves removing the waste material that often overlies a pit or quarry site using sizeable earth-moving equipment such as excavators, bucket loaders, dozers, and dump trucks. Granite resources within the waste (Spoils) are removed before excavation of the construction materials beneath it.

The Drilling & Blasting Zone

The Blasting Zone is the area where the granite is blasted. It is set a great distance from the production zone. Equipment used at the blasting zone includes drilling materials, compressors, excavators, and dump trucks.

The process begins with a detailed three-dimensional survey of the quarry surface. This allows the mining engineer with expertise in blasting to design the blast and to plot where the holes should be drilled so that the blast can be carried out safely and efficiently. The survey will show if there are any bulges or hollows on the surface. A bulge will need more explosive than usual to ensure that it is completely fragmented and not left in place on the surface. Hollow areas require less explosive

than normal. The placement of explosives is professionally planned to ensure that the necessary fragmentation of the rock is achieved with minimum environmental impact.

Approval for blasting shall be obtained from the MSMD before quarrying activities, and there will be strict adherence to the specified principles detailed in the national laws and regulations as well as international best practices with reasonable precautions taken to ensure workers' and public safety as well as protection of properties. The explosives to be used for blasting shall be those specified by MSMD and will be securely stored in the magazines (away from the blasting area).

The rock mass shall be drilled with a pneumatic crawler drill machine and pneumatic jackhammers capable of producing a drill hole diameter of at least 3 inches depending on the desired explosive consumption and a drill depth of at least 10 m and then charged with high and low explosives in the most efficient method that will create a good fragmentation. Drilling cores will be carried out at the desired burden to facilitate the insertion of explosive (dynamite), which will be detonated to blast the rock material into large boulders. **Figure 3.1** shows the blasting process. After developing a work programme, the quarry engineer shall fully ascertain the blast pattern, drilling diameter, depth, number, quantity of explosives, and spacing of blast holes. Blasted rocks from the project shall be gathered and loaded into the dumper trucks of at least 8-10 tons of boulders size by loaders.

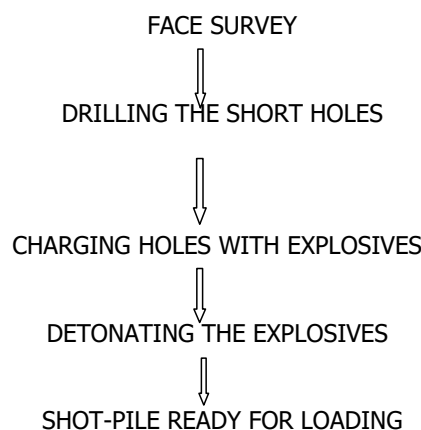


Figure 3.1. Blasting Process

Production

In this area, the boulders derived from the quarry are broken down into rocks and chippings of varying sizes using sets of mechanical crushers. A network of conveyor belts transports the crushed and ground stones to a stacking area, segregated according to the dimensions of the chippings. The finished product is then transported offsite by bucket loaders and trucks. **Figure 3.2** shows the crushing process.

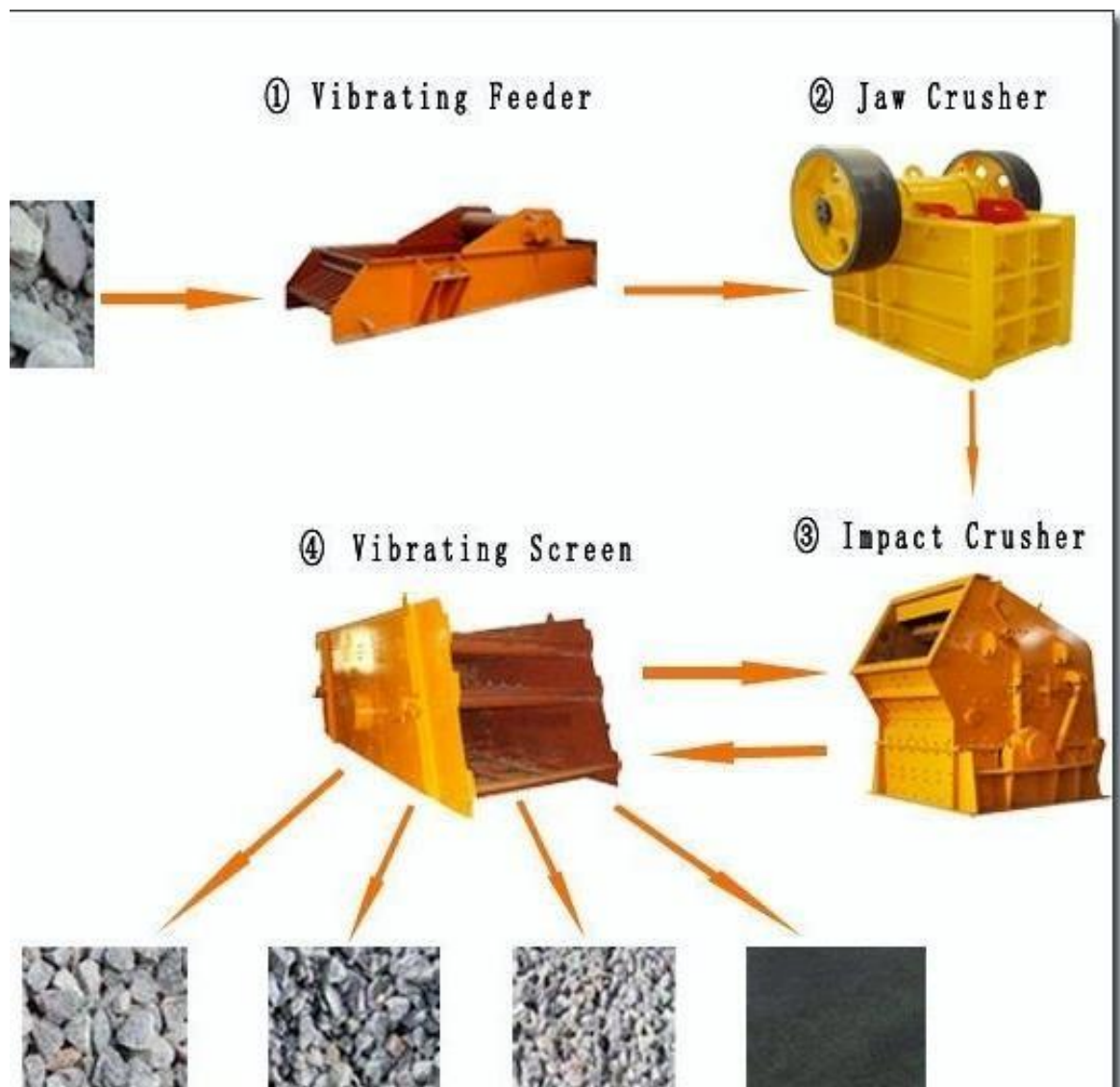


Figure 3.2 Crushing Process

CONSTRUCTION OF ANCILLARY FACILITIES

Table 3.3 describes the Proposed Infrastructure to be provided within the site.

Earthworks

This will involve stripping topsoil, sinking foundational materials to support the plant, and filling with appropriate materials to the recommended level, which shall be carried out using excavators, bulldozers, tipper trucks, etc.

Plant House

This shall involve building the plant house with approved materials. The house shall be constructed to allow for proper ventilation. There shall be an emergency exit, and the floors shall be sufficiently concreted to support the quarry and the vibrations from the plant operations.

Plant Shelter Entrance

This shall be constructed using foldable steel doors sufficiently raised for easy access by vehicles transporting the plant's materials. All site preparation and related activities shall be carried out within the limits of the acquired land, per Eso Terra Investment Limited Facility contractor specifications, and in line with regulatory requirements.

Vehicle Parking Area

This is where vehicles will be parked for usage as required, such as Tippers/Trucks and Cars. The vehicle park area is designed to accommodate about 25-30 vehicles with an approximate space of about 5 m by 7 m each.

Other Structures

Borehole: To meet the site's water requirements, a borehole will be drilled, a 10,000-litre water storage overhead tank will be installed, and a 500 kVa generator will be stationed to pump water to the overhead tank.

Mini Canteen: This is to serve as a food outlet for the quarry workers.

Measuring Scale: This is where trucks will be measured to ascertain their appropriate tonnage capacity and weight material in the truck.

3.3.3 Quarry Operation Phase

The quarrying operations proposed will include both Machine and Manual Operations. The quarry production/excavation activities and spatial arrangements will consist of drilling, blasting, a crushing unit, a haulage road within the quarry pit, a workshop, an administrative office, and other structural units. **Table 3.4** shows the equipment to be used to achieve the quarry operation.

The rock excavation approach envisaged in this project shall be the conventional quarrying process where rock breakage is achieved through the mechanical action of explosives on rock using the most efficient methods.

Table 3.3 Proposed Infrastructure

SN	INFRASTRUCTURE	PURPOSE
1	Explosive Magazines	Explosive material storage
2	Rock crushing facility	Process of rock crushing to standard aggregate sizes
3	Workshop	For maintenance and repairs of quarry machines
4	Offices	For administration of the site
5	Stores	Safekeeping of spare parts and other items
6	Weighing bridge	For determination of weights of crushed materials
7	Ground level fuel dump and bond wall	For storage of diesel and Petrol (33,000 Litres)
8	Entrance gate	To control the movement of persons and material as well as security concerns.

Table 3.4 Equipment Selection

SN	EQUIPMENT	USES
1	Air drill machine	For drilling of blast holes into rock
2	Air compressor	To power the air drill machine
3	Excavators	This is for loading blasted rocks into trucks, digging earth, etc.
4	Front-loaders	This is for loading crushed rock into trucks and cleaning the yard.
5	Dump trucks	For conveying blasted and crushed rock to crushing plants and material stockyards, respectively
6	Hydraulic Hammer	For breaking of boulder rock to crushable sizes
7	Bulldozer	For clearing site
8	Crushers	Disintegration of rock boulders into desired aggregates

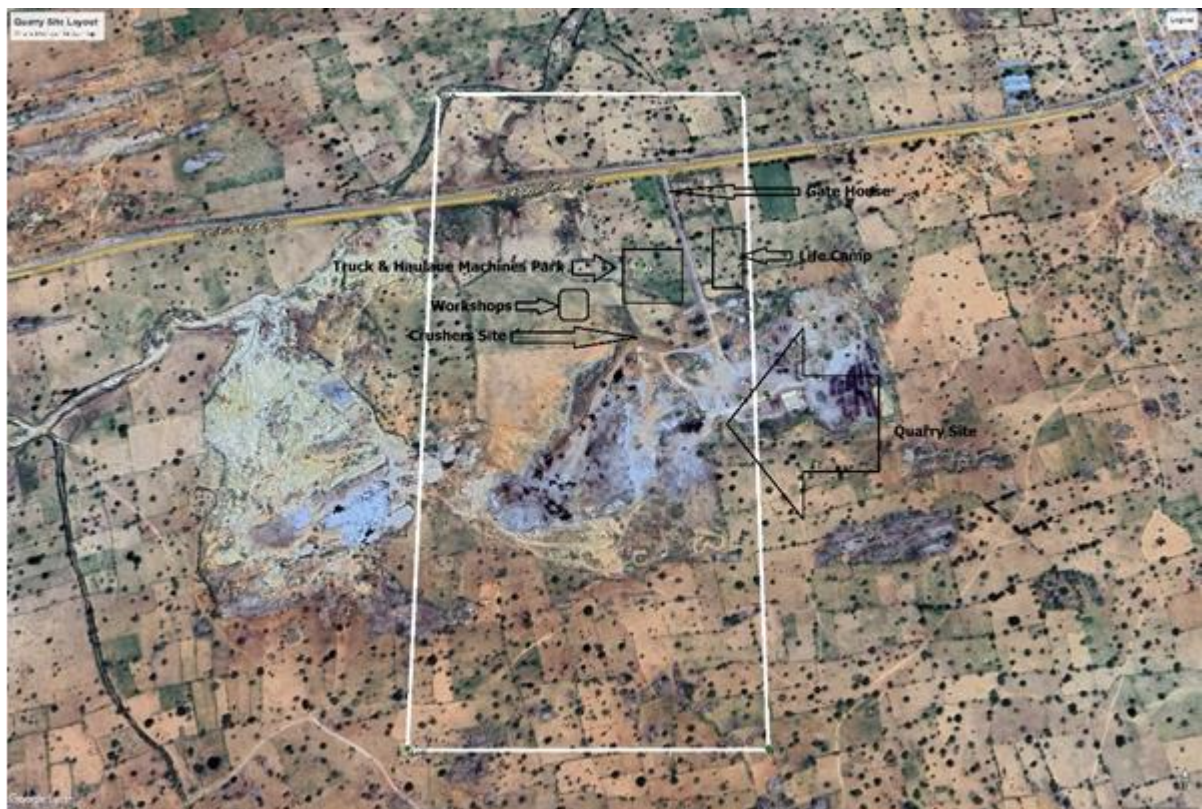


Figure 3.3: Quarry Layout Superimposed on Satellite Image of the Area

3.4 Proposed Crushing and Power Machinery

A crushing plant capable of producing between 200-250tph is considered. The primary section of the plant will be made of:

- 200-250 tons per hour
- Primary feeder of 60m³
- Waste and discharge conveyors
- Secondary section of plants will be made of:
 - 48" cone crusher
 - 36" cone crusher
 - Screening Machines
 - Assorted sizes of conveyors.

The 500-800 kVa power generating plant powers the entire crushing plant. Internal zoning shall be done to provide a buffer to conditioned spaces for unfavourable orientations. Externally, trees shall be planted around to provide good scenery, improve the landscaping, and serve as a buffer for dust particles and wind.

3.5 Commissioning Plan

Commissioning comprises a series of checks and tests of equipment. The various tests are highlighted below:

- Completion check: The technician responsible for inspecting the plant for Completion of Plant Installation will ensure that all parts are correctly installed.
- Finishing of the Work - confirm that all installation works have been finished
- Safety aspects - confirm that all protection equipment has been properly installed.
- Site preparedness - confirm the site is clean of debris and safe for work
- Mechanical test - All mechanical parts of the plant will be started, and the responsible technician will inspect the plant for;

1. smooth operation of each piece of equipment
 2. function of logical circuits
 3. function of safety circuits
- Quarry shall be started, and the responsible technician shall inspect the quarry for:
 1. Proper function of the quarry
 2. Smooth throughput of materials through the various machinery

The Quarry commissioning process will extend across many days as individual components, subsystems, and systems are checked for correct functionality. The quarry plants shall be maintained quarterly, which will include a structural integrity test for the crushing plants. The mechanical devices shall be maintained based on the manufacturers' specifications.

3.6 Plant Closure/Decommissioning

The FMEEnv and MSMD Guidelines for decommissioning quarry plants shall be employed to decommission the Quarry Plant. All mechanical, electrical, and civil works shall be effectively demobilised, and the unit shall be properly uninstalled and securely sealed. All supporting infrastructures shall be demobilised from the site.

Appropriate warning signs shall be implemented to prevent people from tampering with the sealed unit and its infrastructures. There shall be re-vegetation of necessary areas with indigenous plant species. Regular inspections of the abandoned plant shall be conducted to ensure compliance with the decommissioning and abandonment plan.

Decommissioning planning will start at least three years before the end of quarry operations.

- The decommissioning process shall be done following local regulations and international best practices.

- The quarry operator shall engage with local communities and stakeholders throughout the decommissioning process
- The decommissioning plan shall include provisions for ongoing environmental monitoring and maintenance.
- The quarry operator shall ensure the site is safe and secure during and after decommissioning.

The timeline for the decommissioning of the quarry project includes the following:

Stage 1:

- ❖ Quarry operations cease
- ❖ Equipment and machinery removal
- ❖ Initial site clearing and remediation

Stage 2:

- ❖ Environmental monitoring and reporting
- ❖ Rehabilitation and reclamation of quarry pits and haul roads
- ❖ Revegetation and reforestation of disturbed areas

Stage 3:

- ❖ Continued environmental monitoring and reporting
- ❖ Completion of final rehabilitation and reclamation works
- ❖ Site inspections and audits

Stage 4:

- ❖ Long-term environmental monitoring and maintenance
- ❖ Ongoing rehabilitation and reclamation as needed
- ❖ Final closure and handover to local authorities or landowners

Stage 5 - Post-closure:

- ❖ Ongoing environmental monitoring and maintenance

- ❖ Periodic site inspections and audits
- ❖ Implementation of post-closure management and monitoring plan

3.7 Project Schedule

Quarry development activities require adequate resources in workforce, machinery, and capital. Careful planning and timely deployment of sufficient funds to acquire needed resources are paramount for successful project implementation. The proposed quarry will be operated as a construction project quarry as was nurtured to support the Kano-Maradi Rail Line. This quarry operation is scheduled to commence immediately after the quarry lease is issued by the Ministry of Solid Mineral Development (MSMD) Abuja and subsequently approval of environmental clearance by the FMEnv and the EPRP, CDA by MSMD. Quarry development schedules are presented in Table 3.5.

Table 3.5. Project Schedule

Timing	PROJECT PHASES	MONTHS												20 YEARS	2 MONTHS		
		1	2	4	3	5	6	7	8	9	10	11	12				
December 2023-January 2024	Mobilisation																
December 2023-June 2024	Site Preparation																
June 2024-December 2024	Quarry Plant Construction																
2024-2033 +	Operation and Maintenance																
January-March 2034	Decommissioning and abandonment																

3.8 Quarry Waste and Proposed Management Method

The type of waste that will be generated in the Eso Terra Investment Limited site and the proposed management methods are as follows - Table 3.5 and Table 3.6:

Table 3.6. Waste Types, Management & Quantities – Pre-Operational Stage

WASTE TYPE	SOURCE(S)	MANAGEMENT METHOD	ESTIMATED QUANTITY
Cleared vegetation	Clearing site for quarry access roads and site infrastructure	<ul style="list-style-type: none"> Reusing vegetation waste on site for rehabilitation, landscaping, and erosion control was possible. 	<ul style="list-style-type: none"> About 100m³
Excavated waste (soil and overburden)	Excavation for quarry, roads, and site infrastructure	<ul style="list-style-type: none"> Excessive material is used for reclamation of deep gully areas within the Kayauki area. 	<ul style="list-style-type: none"> 2500m³
Concrete	Site infrastructure area	<ul style="list-style-type: none"> Minimize waste by producing or procuring only the amount required. All excess concrete will be returned to the point of supply. 	<ul style="list-style-type: none"> Less than 50m³
Scrap metal	Site infrastructure area	<ul style="list-style-type: none"> Segregation and collection on site. Transportation off-site by a waste contractor for off-site recycling. 	<ul style="list-style-type: none"> Variable.
Paints and resins	Site infrastructure area and workshop	<ul style="list-style-type: none"> Minimise waste by procuring only the amount required. Collect on-site and store in a segregated covered area. Transport from the site by a licensed, regulated waste transporter for disposal at a licensed facility. 	<ul style="list-style-type: none"> Variable
Waste oil and containers (Regulated waste)	Workshop	<ul style="list-style-type: none"> Collected, labelled, and stored separately on-site in a bunded tank. Transported from the site by a licensed waste transporter to a licensed facility for recycling. 	<ul style="list-style-type: none"> Variable
General wastes putrescible and organic	Workshop and offices	<ul style="list-style-type: none"> Putrescible waste will be stored in a sealed and covered bin and disposed of off-site weekly to minimise the attraction of vermin and pests. 	<ul style="list-style-type: none"> Less than 30m³ bin per week

General waste, including plastics, packaging, and materials	All site operations	<ul style="list-style-type: none"> General waste will be taken off-site for disposal at a government-approved waste facility. Collection and segregation of recyclable waste on site. Transportation from the site by a licensed waste transporter to a licensed facility for recycling. 	<ul style="list-style-type: none"> Approximately One 5m³ bin per week
Sewage treatment, sludge (Regulated waste)	All site operations	<ul style="list-style-type: none"> Wastes will be collected in septic tanks and treated in an on-site Sewage Treatment Plant. The produced waste sludge will be disposed of at a landfill facility approved by the Katsina State government. Portable toilets are proposed before construction of the Sewage Treatment Plant. Waste removed from the site by a licensed contractor. 	Variable depending on the workforce

Table 3.7. Waste Types, Management & Quantities – Operational Stage

WASTE TYPE	SOURCE(S)	MANAGEMENT METHOD	ESTIMATED QUANTITY
Pre-coat emulsions (Regulated waste)	Stockpile areas	<ul style="list-style-type: none"> Blend material into a usable product. If recycling is impossible, the material must be disposed of as regulated waste. Oil water separators are used on-site to control run-off. 	Variable
Oily sludge, absorbent, degreaser, grease, oily rags, and oilfilters (Regulated waste)	Workshop	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed facility for recycling, treatment, and disposal. 	Variable
Waste oil and Containers	Workshop	<ul style="list-style-type: none"> Drained on-site with collection drums transported off-site by the waste contractor for off-site re-use, recycling, or disposal. 	Approx. 5,000 litres per year

WASTE TYPE	SOURCE(S)	MANAGEMENT METHOD	ESTIMATED QUANTITY
Scrap metal	Site infrastructure areas	<ul style="list-style-type: none"> Segregation and storage on-site in open storage bins. Transportation off-site by a wastecontractor for off-site recycling. 	Variable
General wastes – Putrescence and organic	Workshop and offices	<ul style="list-style-type: none"> To minimise the attraction of vermin and pests, putrescence waste will be stored in a sealed and covered bin and disposed of off-site weekly. 	Approx. one 3m ³ bin per week
General wastes – plastics	Workshop and offices	<ul style="list-style-type: none"> Collection on-site and stored in a segregated area. Transportation from the site to a government-approved waste facility. 	Less than 1m ³ per week
Explosives	Quarry Pit	<ul style="list-style-type: none"> No waste explosives produced on site. 	Nil (all used on site)
Recyclable waste – paper, cardboard, plastics, glass, and aluminium cans	Workshop and offices	<ul style="list-style-type: none"> Collect recyclable products segregated according to Eso Terra Quarry Limited recyclable material collection arrangements in appropriate containers. 	Variable
Diesel & solvents (Regulated waste)	Workshop	<ul style="list-style-type: none"> Recycle through an approved licensed waste collection agency. 	Variable
Hazardous waste – paints and resins (Regulated waste)	Workshop	<ul style="list-style-type: none"> Collection on-site and stored in a segregated area. Transported off-site by a licensed, regulated waste transporter to a licensed facility for treatment and disposal 	Variable
Tyres (Regulated waste)	Workshop.	<ul style="list-style-type: none"> But not always; truck tyres can be re-trodden. Earthmover tyres can be re-used as bunding around the site. Light vehicle tyres will be stored on-site and transported from the site by the supplier or a licensed, regulated waste transporter to a licensed facility for recycling or disposal. 	Variable
Vehicle batteries (Regulated waste)	Workshop	<ul style="list-style-type: none"> Dead batteries shall be removed from the site by the battery supplier. Batteries not removed by the supplier shall be stored on-site for collection and disposed of as regulated waste by a certified regulated waste contractor. 	Approx. 50 per Year

WASTE TYPE	SOURCE(S)	MANAGEMENT METHOD	ESTIMATED QUANTITY
Sewage waste and sludge (Regulated waste)	Workshop and offices	<ul style="list-style-type: none"> Wastes will be treated in an on-site septic tank, pre-treated, and disposed of at a landfill facility approved by KSG. 	Approx. 1,500 litres per annum
Crusher lubricants (Regulated waste)	Crusher	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed facility for recycling, treatment, and disposal. 	Approx. 2,750 litres per annum
Heavy Mobile Equipment (HME) Lubricants (Regulated waste)	Heavy Mobile Equipment	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed facility for recycling, treatment, and disposal. 	Approx. 3,000 litres per annum
Crusher wear liners (Cast manganese steel) (Regulated waste)	Crusher	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed facility for recycling, treatment, and disposal. 	Approx. 15 tonnes per annum

Table 3.8. Waste Types & Quantities – Operational Stage

WASTE TYPE	SOURCE(S)	MANAGEMENT METHOD	ESTIMATED QUANTITY
Oily sludge, absorbent, degreaser, grease, oily rags, and oil filters (Regulated waste)	Workshop	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed facility for recycling, treatment, and disposal. 	Variable
Waste oil and Containers	Workshop	<ul style="list-style-type: none"> Drained on-site with collection drums transported off-site by the waste contractor for off-site re-use, recycling, or disposal. 	Approx. 5,000 litres per year
Scrap metal	Site infrastructure areas	<ul style="list-style-type: none"> Segregation and storage on-site in open storage bins. Transportation off-site by a waste contractor for off-site recycling. 	Variable
General wastes – Putrescence and organic	Workshop and offices	<ul style="list-style-type: none"> To minimise the attraction of vermin and pests, putrescence waste will be stored in a sealed and covered bin and disposed of off-site weekly. 	Approx. one 3m ³ bin per week

WASTE TYPE	SOURCE(S)	MANAGEMENT METHOD	ESTIMATED QUANTITY
General wastes and plastics	Workshop and offices	<ul style="list-style-type: none"> Collection on-site and stored in a segregated area. Transportation from the site to a government-approved waste facility. 	Less than 1m ³ per week
Explosives	Quarry Pit	<ul style="list-style-type: none"> No waste explosives produced on site. 	Nil (all used on site)
Recyclable waste - paper, cardboard, plastics, glass, and aluminium cans	Workshop and offices	<ul style="list-style-type: none"> Collect recyclable products segregated according to Eso Terra Quarry Limited recyclable material collection arrangements in appropriate containers. 	Variable
Diesel & solvents (Regulated waste)	Workshop	<ul style="list-style-type: none"> Recycle through an approved licensed waste collection agency. 	Variable
Hazardous waste paints and resins (Regulated waste)	Workshop	<ul style="list-style-type: none"> Collection on-site and stored in a segregated area. Transported off-site by a licensed, regulated waste transporter to a licensed facility for treatment and disposal 	Variable
Tyres (Regulated waste)	Workshop.	<ul style="list-style-type: none"> But not always; truck tyres can be re-trodden. Earthmover tyres can be re-used as bunding around the site. Light vehicle tyres will be stored on-site and transported from the site by the supplier or a licensed, regulated waste transporter to a licensed facility for recycling or disposal. 	Variable
Vehicle batteries (Regulated waste)	Workshop	<ul style="list-style-type: none"> Dead batteries shall be removed from the site by the battery supplier. Batteries not removed by the supplier shall be stored on-site for collection and disposed of as regulated waste by a certified regulated waste contractor. 	Approx. 50 per Year
Sewage waste and sludge (Regulated waste)	Workshop and offices	<ul style="list-style-type: none"> Wastes will be treated in an on-site septic tank, pre-treated, and disposed of at a landfill facility approved by KSG. 	Approx. 1,500 litres per annum
Crusher lubricants (Regulated waste)	Crusher	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed facility for recycling, treatment, and disposal. 	Approx. 2,750 litres per annum
Heavy Equipment Lubricants Mobile (HME)	Heavy Mobile Equipment	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed 	Approx. 3, 000 litres per annum

WASTE TYPE	SOURCE(S)	MANAGEMENT METHOD	ESTIMATED QUANTITY
(Regulated waste)		facility for recycling, treatment, and disposal.	
Crusher wear liners (Cast manganese steel) (Regulated waste)	Crusher	<ul style="list-style-type: none"> Collected on-site and transported off-site by a licensed, regulated waste transporter to a licensed facility for recycling, treatment, and disposal. 	Approx. 15 tonnes per annum

CHAPTER FOUR

DESCRIPTION OF THE ENVIRONMENT

4.1 General

This chapter provides concise information on the study approach and field methodology for the Environmental Status Report studies. It describes the present state of the environmental conditions of the project site, Kayauki, in Batagarawa Local Government Area of Katsina State. The results presented here represent the analysis of field and laboratory works covering a single-season (wet season) sample for the environment's physical and biological components as approved by the FMEEnv.

The human and health issues discussed are based on analyses of responses and occurrences from literature, checklists, and Focus Group Discussions.

4.2 Baseline Study Methodology and Chain of Custody

The approach was to obtain ecological baseline data from desktop, field and laboratory studies, interviews and consultations with the relevant stakeholders, individuals, etc. It is hoped that this approach provides adequate information for establishing the baseline status of the environment of the project area. Therefore, the project's potential environmental impacts are measured, mitigative measures are proposed, and an environmental management plan (EMP) is rightfully developed. Field assessments conducted include but were not limited to the following: Air, water and soil Quality Assessment, Vegetation mapping and characterisation (including Health status), Animal Resources, Socio-economic/Social Assessment and Health Impact Assessment, amongst others, were adequately addressed.

Flora and fauna were identified through visual observations, hearing animal calls, and examining footprints, remains, etc. These are followed by interpretations and discussions of results and a report on the flora and fauna species in the area.

The socio-economic studies were conducted through interviews, consultations, and questionnaires issued to the people of the communities, as well as visits to public places such as markets, schools, and other sensitive receptors in and around the project area. The field assessment/data gathering runs from 27 September 2023 to 30 September 2023 for a single season (wet) only.

Details of the methodology are as follows:

4.2.1 Methodology Used for the Socioeconomic Study

The methodology adopted for this study covers the following:

- Field survey to identify all stakeholders that are directly or indirectly impacted by the proposed project;
- Focus Group Discussion (FGD) with proposed project-affected communities;
- Personal observations;
- In-depth interview with community leaders of the identified communities (women leaders, Artisanal Miners, religious leaders, and youth leaders); this provides vertical depth knowledge on the likely socioeconomic impacts of the proposed project; Structured questionnaire to collect the baseline information and community member's perceptions of the proposed project.

4.2.2 Literature Review

Literature relevant to the study area was reviewed in relation to water, air, soil, noise, climate temperature, humidity, rainfall, topography, geology, hydrogeology, ecology, and the socioeconomic status of the communities. Literature was also reviewed to identify the composition of flora and fauna and understand features peculiar to the project area.

4.2.3 Field Survey

The field data and sample collection, which was done between 27th September 2023 and 30th September 2023, involved:

- Identification of sensitive receptors around the project site.

- Reconnaissance visits to understand the peculiarity of the project site.
- Identification of ecologically sensitive areas and important species of flora and fauna present.
- Identification and marking of sampling points.
- Analysis of project activities and their interactions with environmental components such as soil, water, flora, and fauna.
- Collection of relevant samples in and around the project site.

4.2.4 Methods of Sampling Data Collection

Water and soil samples were collected from different points in the study area and taken to the laboratory for analysis. The geographic coordinates of the sampling points were taken accordingly.

- Air quality and noise level assessment was done in 6 locations plus a control.
- Soil sample was from 6 locations plus a control.
- Surface water sample collection from a quarry pit located within the project area, plus a pond within the Kayauki community.
- Underground water sample collection from a borehole in Kayauki Community.

The samples were taken to Kano State Ministry of Environment Laboratory for analysis.

On-site assessment of the physical, chemical, geological, topographical as well as geophysical conditions and positions of the study area were conducted as follows:

Noise levels

Noise levels were measured using a sound level metre at various points and elevations in the study area.

Decibel (Sound Level Meter): This instrument has three measuring ranges (30-80, 50-100, 80-130). After powering the unit, a proper measuring range is selected by pressing the Range Button. The instrument is held at a height of about 2-2.5m so that the microphone sensor measures the noise level, and the sound level value (dB (A)) will be displayed on the LCD (Light Crystal Diode).

Noise, vibration detection, and air sampling were done using their meters. These detection meters are powered and handheld. A steady digital reading display on the screen marks the specific parameter value. Soil and water samples were collected in specified well-labelled containers and stored under proper conditions before being transported to the lab for analysis. Colourimetry and titrimetric techniques were used to evaluate the concentrations of various metals and inorganic and organic elements while adopting the American Public Health Association (APHA) standard method.

Air quality

Air quality analysis was conducted at various locations in the study area using a hand-held Crowcon multi-gas air quality meter.

Gasman (Crowcon Detection Instrument) is an intrinsically safe personal gas detector designed to warn the user of dangerous conditions in the immediate vicinity. It monitors flammable gases, oxygen enrichment, and other toxic gases. With the unit placed in normal air (site of visit), the switch is turned on to the GAS position and ready for use. The reading is in ppm (parts per million) for all the gases measured.

Haz-Dust Particulate Monitor: *This portable direct-reading particulate monitor* senses airborne particles using infrared electromagnetic radiation. The sensing method is traditionally referred to as near-forward light scattering. The mass concentration readout is expressed in milligrams per cubic meter (mg/m³). The unit is held in the palm, so the display faces up—plate 4.1.



Plate 4.1: Onsite Air Quality and Noise Level Assessment (Snafhcore Limited Fieldwork September 2023)

Water Samples

Water samples were collected from 2 quarry pits within the site (Surface) and 1 borehole from Kayauki Community using sterilised bottles. pH values were measured on-site with a pH meter. Temperature and Total Dissolved solids (TDS) were also measured on-site using their respective meters. The sulphates, nitrates and phosphorus analyses were conducted using appropriate test kits, while an Ion Meter was used to detect and analyse compounds such as ammonia—plate 4.2 and 4.3.



Plate 4.2: Insitu Water Quality Test for the Surface Water Sample within the Site (Snafhcore Limited Fieldwork September 2023)



Plate 4.3: Borehole Water Sampling within Kayauki Community (Snafhcore Limited Fieldwork September 2023)

Soil Samples

Soil samples in the study area were collected and analysed using suitable laboratory instruments for pH, temperature, TDS, etc. Plate 4.4.



Plate 4.4: Soil Sampling and Labelling within the Site (Snafhcore Limited Fieldwork September 2023)

4.2.5 Preservation and Transfer of Samples

The methods of sample preservation shown in Table 4.1 below were adopted. Samples were transferred into proper preservation containers and transported to the Katsina State Ministry of Environment laboratory, where they were placed in freezers for analysis. These freezers were set to recommended temperature levels and put in the refrigerator for microbiological analysis. Table 4.2 presents the Summary of Analytical Methods and Equipment Used in Laboratory Analysis of Soil and Water.

Table 4.1: Preservatives for Various Constituents used by the Laboratory

SN	PARAMETER	REQUIRED VOLUME (ml)	CONTAINER	PRESERVATION	MAXIMUM HOLDING PERIOD
1	PH	35	P, G	Cool 4°C Detect On-site	6 Hours
2	Electrical Conductivity	100	P, G	Cool 4°C	24 Hours
3	Colour	50	P, G	Cool 4°C	24 Hours
4	Odour	200	P, G	Cool 4°C	24 Hours
5	Turbidity	100	P, G	Cool 4°C	7 Days
6	Total Dissolved Solids (TDS)	50	P, G	Filter on site Cool 4°C	24 Hours
7	Total Suspended Solids (TSS)	50	P, G	Filter on site	6 Months
8	Total Hardness	100	P, G	Cool 4°C HNO ³ to PH<2	7 Days
9	Acidity and Alkalinity	100	P, G	Cool 4°C	24 Hours
10	Salinity as Cl	50	P, G	None Required	7 Days
11	Chemical Oxygen Demand (COD)	50	P, G	2ml H ₂ SO ₄ per litre	7 Days
12	Biological Oxygen Demand (BOD)	1000	P, G	Refrigeration at 4°C	6 Hours
13	Surfactants as (MB AS)	250	P, G	Cool 4°C	24 Hours
14	Dissolved Oxygen (DO)	300	G only	Detect on site	No Holding
15	Ammonia	400	P, G	Cool 4°C H ₂ SO ₄ to PH<2	24 Hours
16	Oil & Grease	1000	G only	Cool 4°C H ₂ SO ₄ or HCL to PH<2	24 Hours
17	Nitrate (NO ₃)	100	P, G	Cool 4°C H ₂ SO ₄ to PH<2	24 Hours
18	Sulphate (SO ₄ ²⁻)	50	P, G	Cool 4°C	7 Days
19	Carbonate (CO ₃) free CO ₂ & HCO ₃	-	P, G	-	-
20	Cyanides	500	P, G	Cool 4°C NaOH to pH 12	24 Hours
21	Phosphorus	-	-	40mg, HgCl ₂ per litre 4°C	7 Days
22	Phenolics	500	G only	Cool, 4°C, H ₂ PO ₄ to pH<4.1g CuSO ₄ /litre	24 Hours
23	Chromium	100	P, G	HNO ₃ to pH<2	-
24	Arsenic	100	P, G	-	6 Months

25	Cadmium	100	P, G	-	6 Months
26	Cobalt	-	P, G	-	6 Months
27	Copper	-	P, G	-	6 Months
28	Iron	-	P, G	-	6 Months
29	Mercury	100	P, G	Filter, HNO ₃ to pH<2	38 Days (Glass)
30	Lead	100	P, G	HNO ₃ to pH<2	6 Months
31	Nickel	100	P, G	-	6 Months
32	Zinc	100	P, G	-	6 Months
33	Vanadium	100	P, G	-	6 Months
34	Calcium	100	P, G	None Required	7 Days
35	Magnesium	100	P, G	-	6 Months

Where P = Plastic and G = Glass

Table 4.2: Summary of Analytical Methods and Equipment Used in Laboratory Analysis of Soil and Water Analysis

SN	PARAMETERS DETERMINED	EQUIPMENT/TECHNIQUE
1	pH	Jenco UC meter 6100
2	Temperature	Jenco UC meter 6100
3	Conductivity, $\mu\text{S}/\text{cm}^{-1}$	Hanna H1
4	Salinity % or ppt	Salinometer
5	Dissolved Oxygen, mg/l	DO meter, wrinkler's
6	Transparency (m)	Secchi disc
7	Grain size	Granulometry and sedimentation
8	BOD ₅ mg/l	Hach BOD track
9	NH ₄ mg/l	Nessler's reagent
10	NO ₃ mg/l	Phenoldisulphonic acid
11	PO ₄ mg/l	Colorimetry with molybdenum blue solution
12	SO ₄ mg/l	Turbidometry and photometry
13	THC mg/l	Capillary GL
14	Aliphatic and Aromatic mg/l	GC-MS
15	TOC %	Graphite furnace and gravity
16	N%	Graphite furnace and gravity
17	TDS mg/l	Gravimetry after drying to constant weight
18	TSS mg/l	Gravimetry after drying to constant weight
19	Heavy Metal mg/l or ppm	AAS, UNICAM 939, after digestion
20	Soil Moisture Content %	Gravimetry after drying to constant weight
21	Soil permeability	Falling head permeability test

SN	PARAMETERS DETERMINED	EQUIPMENT/TECHNIQUE
22	Exchangeable cations mg/l	AAS, after digestion

4.2.6 Sampling Points

Sampling was designed to comprehensively capture all the environmental/ecological components peculiar to the project site. The spatial boundaries for the field study and sampling were a 600m radius, while that of the socioeconomic survey was a 2km radius; the description is highlighted below. Figure 4.1 shows the sample location Map. Tables 4.10, 4.11, and 4.12 show sampling coordinates and sample analysis results.

- Air quality assessment in 7 locations plus a control location in and around the project site.
- Noise level assessment in 7 locations plus control in and around the project site.
- Soil sample collection from 7 locations plus control in and around the project site {encompassing Topsoil and Subsoil}.
- Surface water sample collection from a quarry pit located within the project area and a pond within Kayauki Community
- Underground water sample collection from a Borehole in Kayauki Community.

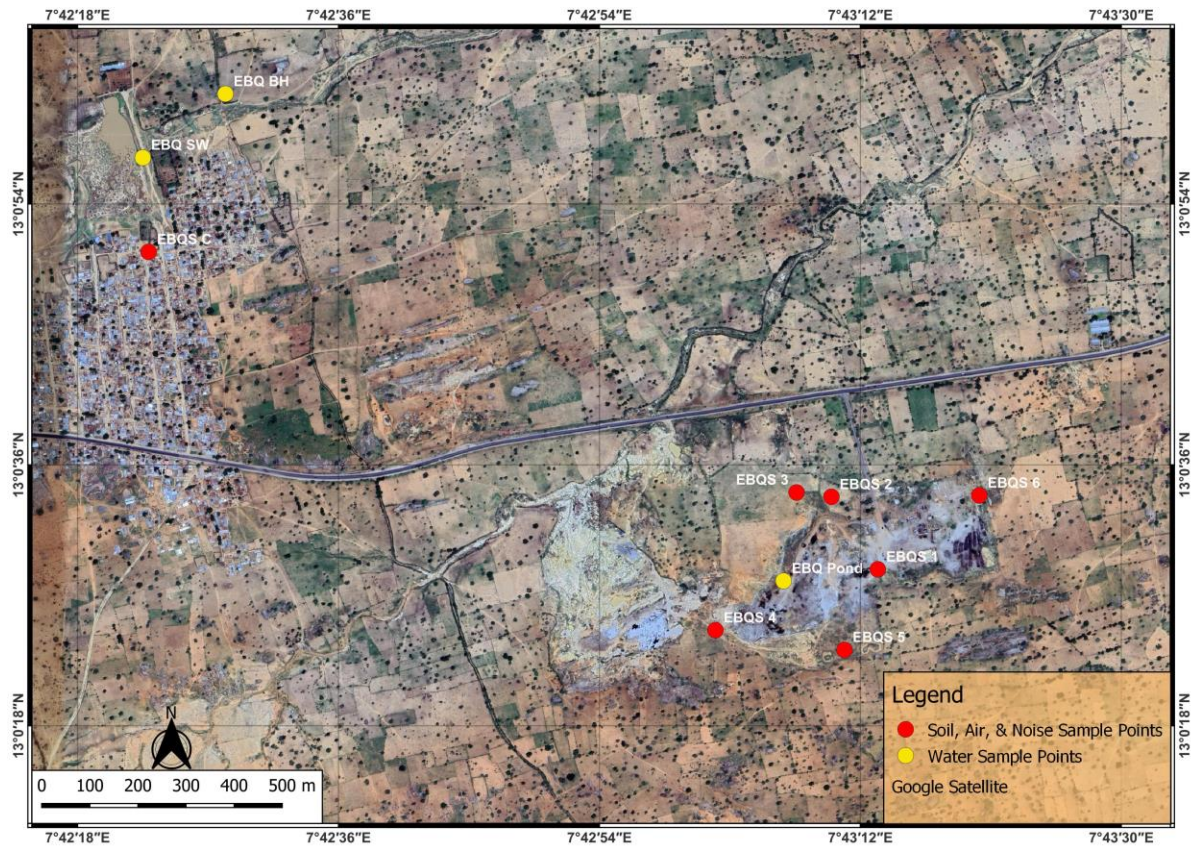


Figure 4.1: Map Showing the Location of Sampling Points within the Project Area

Table 4.3: Sample Coordinates

SN	SAMPLE CODE	LOCATION	DEG	MIN	SEC	DEG	MIN	SEC
1	EBQ AN/SS 1	Batagarawa	13	0	28.8	7	43	13.2
2	EBQ AN /SS2	Batagarawa	13	0	33.8	7	43	10
3	EBQ AN/SS 3	Batagarawa	13	0	34.1	7	43	7.6
4	EBQ AN /SS4	Batagarawa	13	0	24.6	7	43	2
5	EBQ AN/SS 5	Batagarawa	13	0	23.24	7	43	10.9
6	EBQ AN /SS6	Batagarawa	13	0	33.9	7	43	20.2
7	EBQ AN/SS C	Batagarawa	13	0	50.7	7	42	22.9
S/N	SAMPLE CODE	LOCATION	DEG	MIN	SEC	DEG	MIN	SEC
1	EBQ Pond	Batagarawa	13	0	28	7	43	6.7
2	EBQ SW	Batagarawa	13	0	57.2	7	42	22.5
3	EBQ BH	Batagarawa	13	1	1.6	7	42	28.2

Source: Field Work September 29th, 2023

4.3 Regional Climate/Meteorology

Climate encompasses the statistics of temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle counts, and other meteorological elements in each region over long periods. A location's climate is affected by its latitude, terrain, and altitude, as well as nearby water bodies and their currents. Climates can be classified according to the average and typical ranges of different variables, most commonly temperature and rainfall.

The climate of Nigeria is characterised by two regimes- the dry and wet seasons. These depend on two prevailing air masses blowing over the country at different times of the year: the north-easterly air mass of Sahara origin (the tropical continental air mass) and the humid maritime air mass blowing from the Atlantic (the tropical maritime air mass). The two air masses blowing from nearly opposite directions meet along a slanting surface (the Inter-Tropical Front). The area about this front, where the air masses to some extent mix, is called the inter-tropical discontinuity (ITD) or the inter-tropical convergence zone (ITCZ). This zone moves north and south with the front depending on which air mass gains ground over the other. The influence of the north-easterly air mass causes the dry season, while that of the humid maritime air mass causes the rainy season.

The project area is within the tropics, dominated by two contrasting seasons, the dry and wet (rainy) seasons. The two season regimes depend on the two prevailing air masses blowing across the country at different times of the year: the south-westerly humid maritime air mass blowing from across the Atlantic and the north-easterly air mass of Saharan origin (Harmattan). The climate data for the project area, as collated from World Weather online, is presented below;

Sunshine

The mean daily sunshine for the months of the year in the project area is between eight (8) and ten (10) hours in the dry season and six (6) and nine (9) hours in the wet season. The study area experiences a mean annual sunshine of 3,048 hours,

representing (31 %) of the maximum possible amount of sun in the environment, presented in Figure 4.2. Sunny days ranged from 31 to 10 days. The lowest sun hours and sun day is in August.

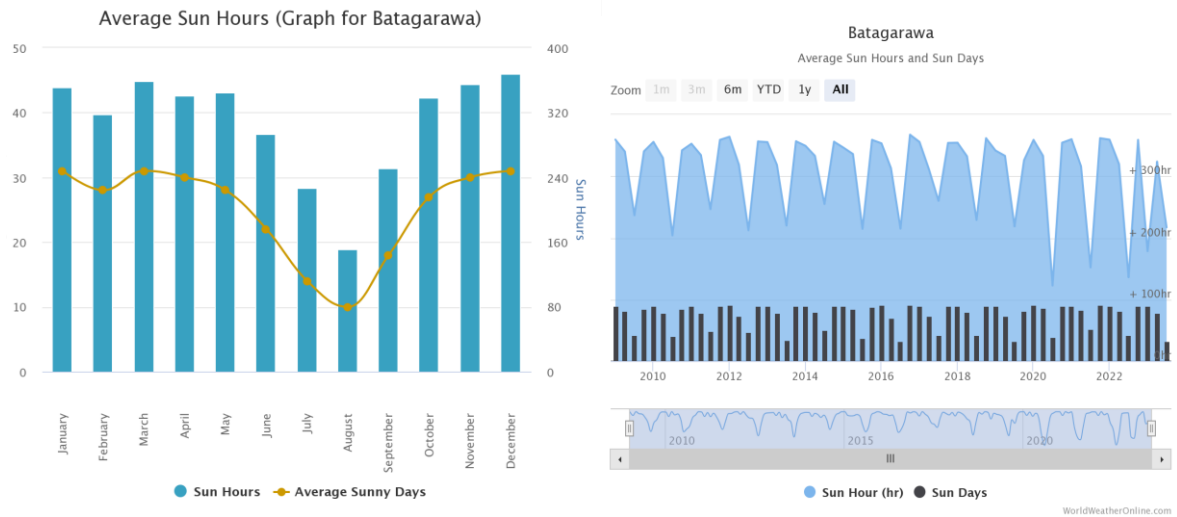


Figure 4.2: Average Annual Sunshine within the Project Region (WMO, 2023)

Temperature

The temperature of the area varies with season. Maximum daily temperature of about (40°C) and minimum daily temperature of about (22°C) are common. The daily maximum temperature gradually rises from January to its highest value (40°C) in April. It then drops rapidly in August due to heavy clouds and rainfall received. The lowest minimum temperature (15°C) is recorded between December and January each year. This period coincides with the dry, dusty Harmattan winds that blow from the Sahara Desert and, at times, reduce visibility to almost zero. Figure 4.3

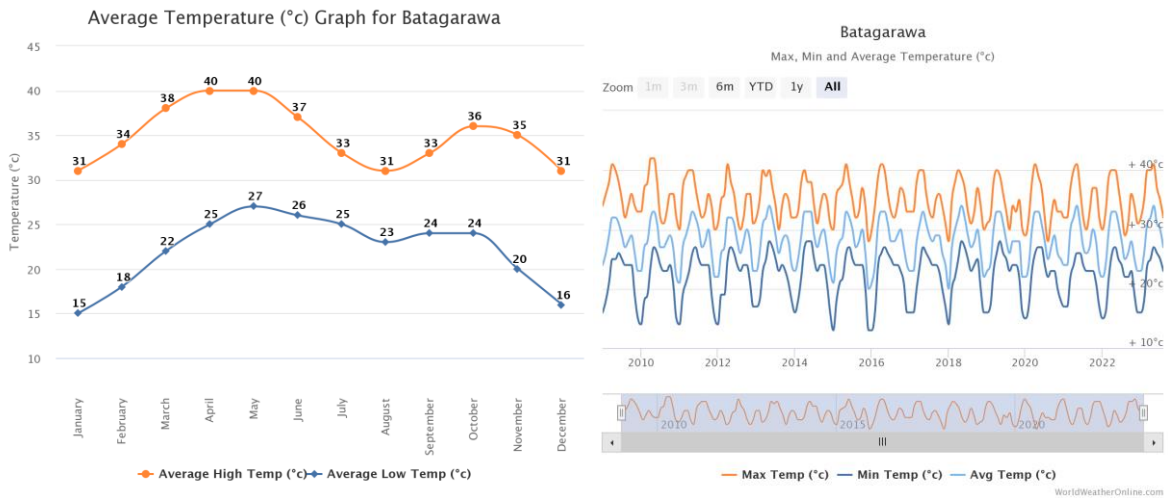


Figure 4.3: Temperature of the Project Area (WMO, 2023)

Atmospheric Pressure

Pressure is the weight of air on the ground. Variations in atmospheric pressure are closely related to air temperature, water vapour content, and vertical and horizontal air movements. Cool or cold air subsides, increasing its pressure on the air and the earth beneath it, but warm air expands and rises relative to its surroundings, thus decreasing pressure locally.

May through August witnessed a rise in atmospheric pressure, with a gradual decline in September. The lowest recorded values occur in April, corresponding to the rainfall pattern for those months. The atmospheric pressure fluctuates between 1013.4 mb and 1007.3 mb. The highest average pressure was recorded in 2016, and the lowest in 2014 (Figure 4.4).

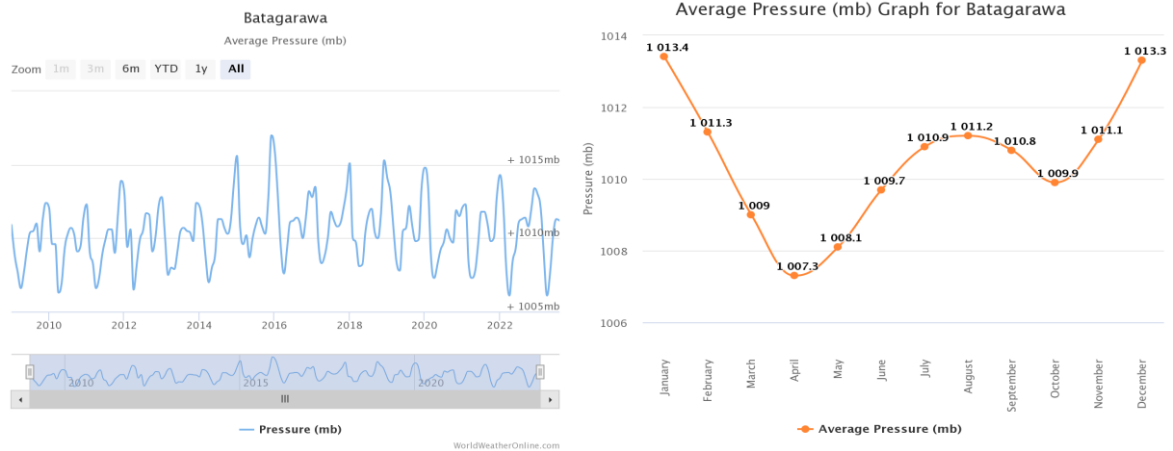


Figure 4.4: Atmospheric Pressure within the Project Region (WMO, 2022)

Relative Humidity and Cloud Cover

Relative humidity is the ratio of water vapour in the air at a specific temperature to the maximum amount the air can hold, expressed as a percentage. For example, a reading of 100 per cent relative humidity means that the air is saturated with water vapour and cannot hold any more, creating the possibility of rain.

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier, and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night. Batagarawa experiences extreme seasonal variation in the perceived humidity.

The muggier period of the year lasts for 5.9 months, from April to October, during which time the comfort level is muggy, oppressive, or miserable at least 25% of the time. The month with the muggiest days in Batagarawa is August, with 30.7 days that are muggy or worse. The months with the fewest muggy days in Batagarawa are November and December, with 0.0 days that are muggy or worse.

In Batagarawa, the average percentage of the sky covered by clouds experiences significant seasonal variation over the course of the year. The clearer part of the

year begins around November and lasts for 3.8 months, ending around March. The clearest month of the year in Batagarawa is January, during which, on average, the sky is clear, mostly clear, or partly cloudy 66% of the time. The cloudier part of the year begins around March and lasts for 8.2 months, ending around November.

The cloudiest month of the year in Batagarawa is May, during which, on average, the sky is overcast or mostly cloudy 67% of the time. The average cloud cover is below 50%, while the average annual humidity level runs between 50%-200%.

Figure 4.5

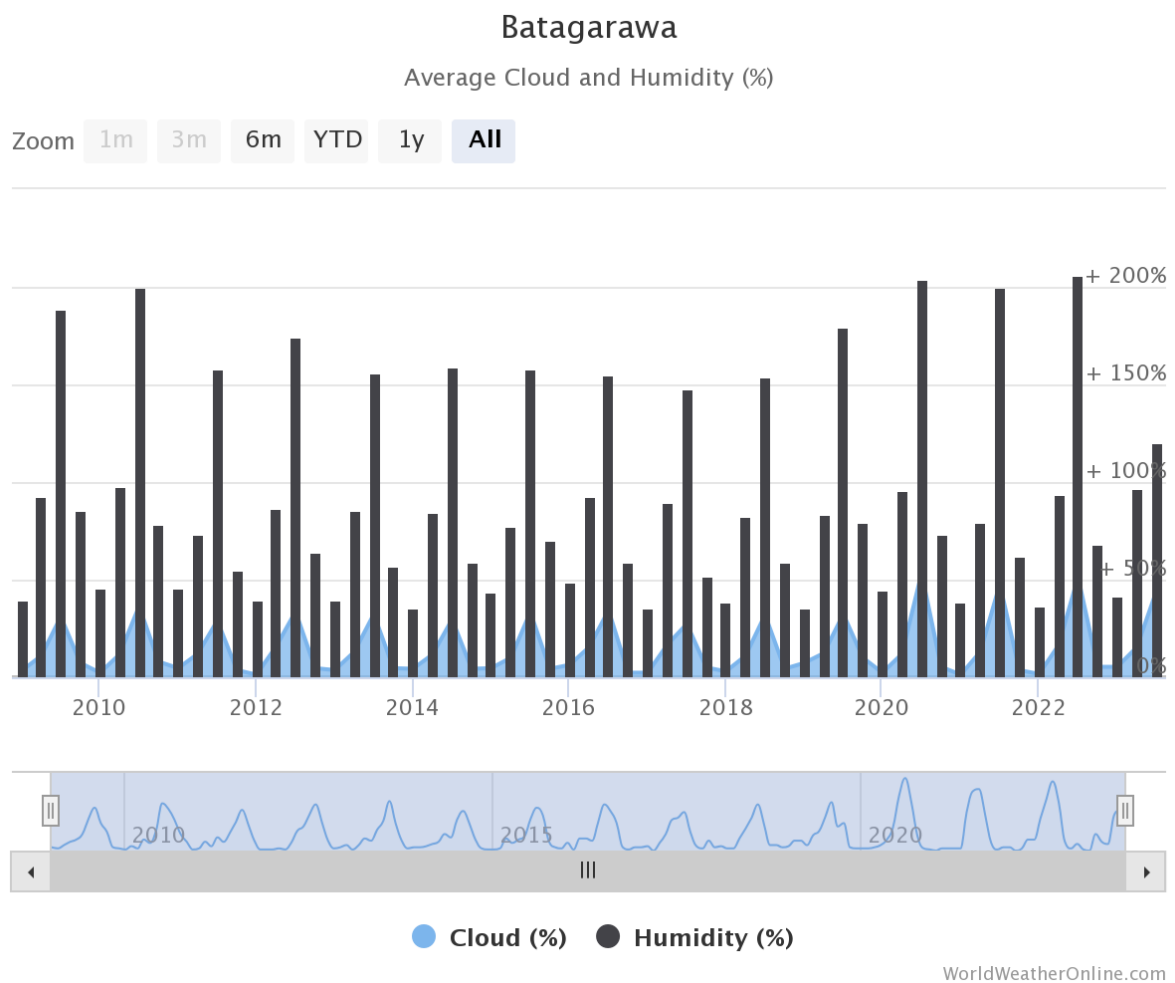


Figure 4.5: Relative Humidity and Cloud Cover (WMO, 2022)

Precipitation and Rainfall

The study area is characterised by a short-wet season, with most rainfall between May and September. During this period, rainfall is a daily occurrence even though it rarely lasts long and is very different from the regular torrential rain known in wet tropical regions of the south. The average annual rainfall ranges from 100mm to 300mm in the study area. Historically, rainfall in the region usually peaks in August with little or no rain between October and April, during which the climate is dominated by the harmattan wind blowing Sahara dust over the land. The dust dims the sunlight, lowering temperatures significantly and leading to dust disturbance, especially in rural regions with unpaved road surfaces.

A wet day has at least 0.04 inches of liquid or liquid-equivalent precipitation. The chance of wet days in Batagarawa varies very significantly throughout the year.

The wetter season lasts 3.6 months, from June to September, with a greater than 39% chance of a given day being a wet day. The month with the most wet days in Batagarawa is August, with an average of 23.2 days with at least 0.04 inches of precipitation. The drier season lasts 8.4 months, from September to June. The month with the fewest wet days in Batagarawa is December, with an average of 0.0 days with at least 0.04 inches of precipitation.

The month with the most days of rain alone in Batagarawa is August, with an average of 23.2 days. Based on this categorisation, rain alone is the most common form of precipitation throughout the year, with a peak probability of 77% in August. Batagarawa experiences extreme seasonal variation in monthly rainfall. The rainy period lasts 5.6 months, from May to October, with a sliding 31-day rainfall of at least 0.5 inches. The month with the most rain in Batagarawa is August, with an average rainfall of 6.3 inches.

The rainless period lasts for 6.4 months, from October to April. The month with the least rain in Batagarawa is January, with an average rainfall of -0.0 inches. The average annual rainfall is presented in Figure 4.6.

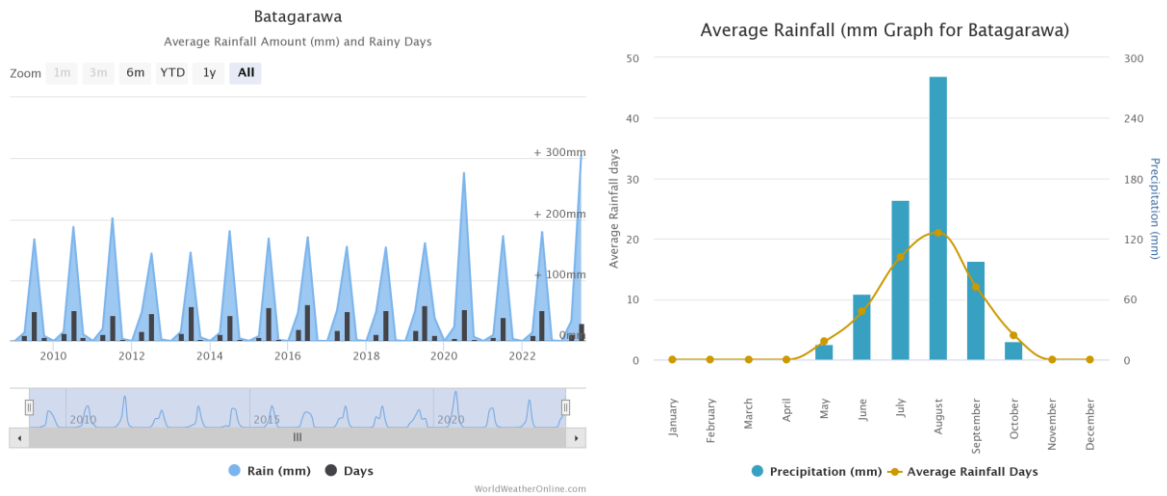


Figure 4.6 Average Monthly Precipitation and Rainfall (WMO, 2023)

Visibility

Fogs are formed in the morning, impairing visibility to less than 10km. In November through February, the harmattan period, morning mist is usually prominent, with visibility as low as 4 miles and remaining below 6 miles for several days, thus constituting a severe hazard to land and air transport. Generally, visibility, especially in the dry season, is foggy in the early hours and improves as the day progresses. **Figure 4.7**

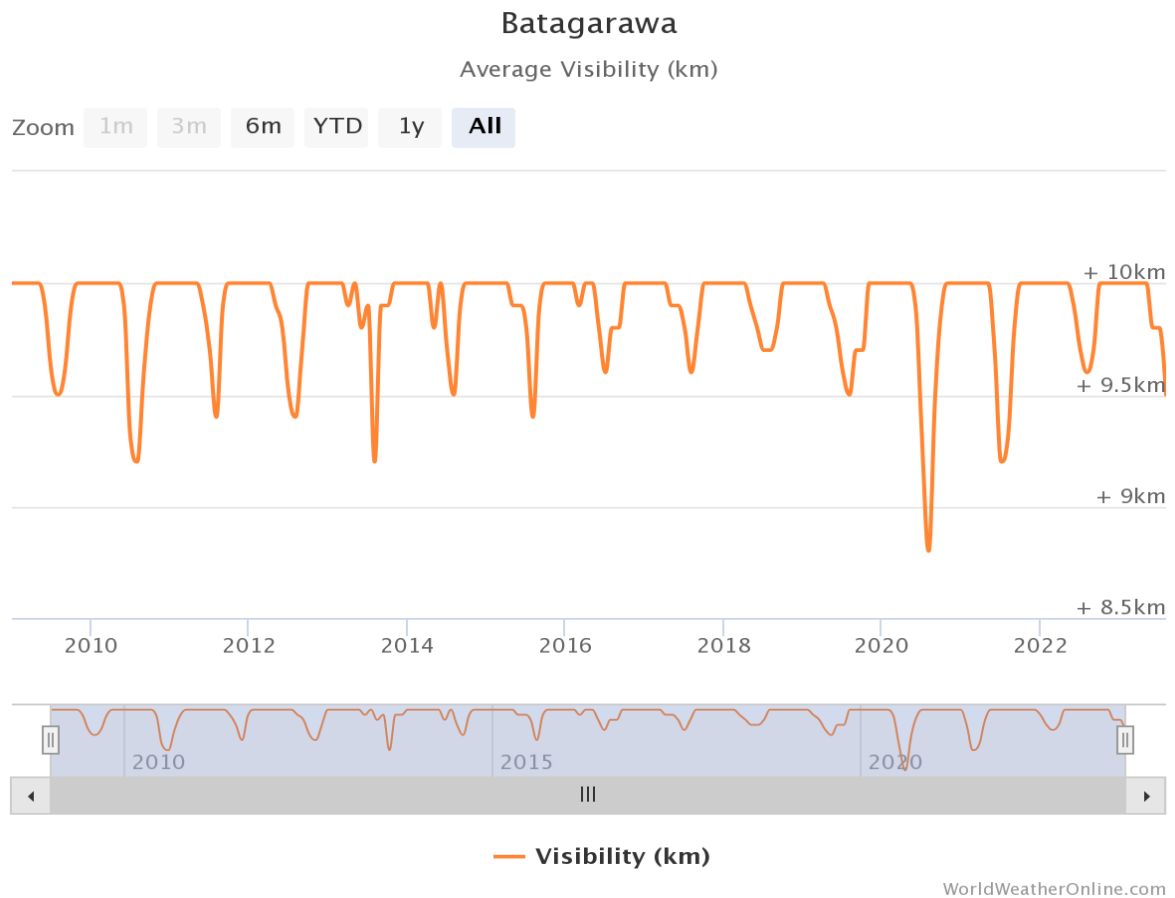


Figure 4.7 Average Visibilities in the Project (WMO, 2023)

Ultraviolet index

The ultraviolet index or UV Index is an international standard measurement of the strength of sunburn-producing ultraviolet (UV) radiation at a particular place and time. The scale was developed by Canadian scientists in 1992 and then adopted and standardised by the UN's World Health Organization and World Meteorological Organization in 1994. It is primarily used in daily forecasts aimed at the public and is increasingly available as an hourly forecast.

The UV Index is designed as an open-ended linear scale directly proportional to the intensity of UV radiation that causes sunburn on human skin. For example, if a light-skinned individual (without sunscreen) begins to sunburn in 30 minutes at UV Index 6, then that individual should expect to sunburn in about 15 minutes at

UV Index 12—twice the UV, twice as fast (Table 4.4). The average monthly UV index for the project area ranged from 6 to 8 (Figure 4.8).

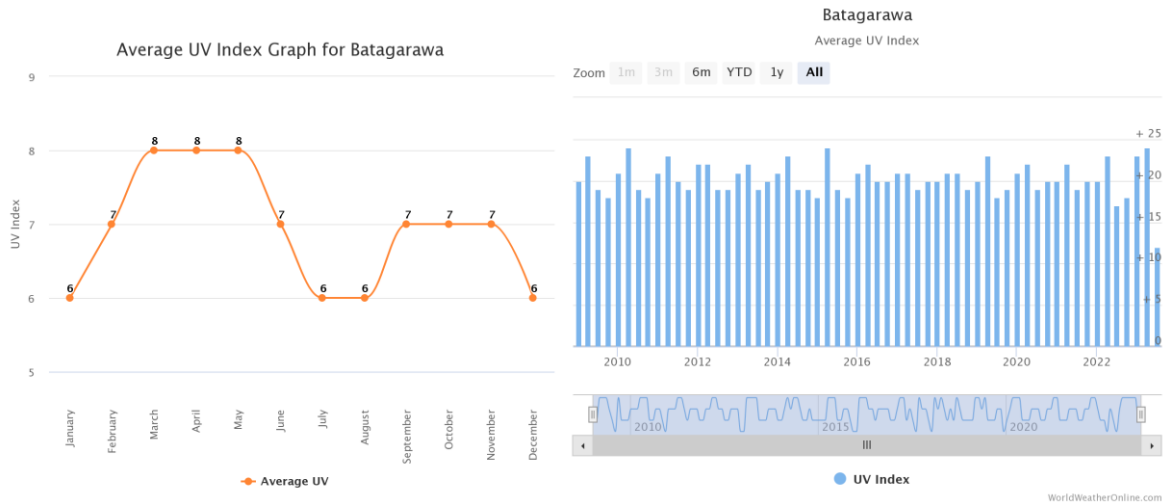


Figure 4.8 Average UV index of the Project area (WMO, 2023)

Table 4.4: UV Index Scale

UV INDEX			MEDIA GRAPHIC COLOUR	RISK OF HARM FROM UNPROTECTED SUN EXPOSURE FOR THE AVERAGE ADULT	RECOMMENDED PROTECTION
0.0–2.9			Green	"Low"	A UV Index reading of 0 to 2 means low danger from the sun's UV rays for the average person. Wear sunglasses on bright days. If you burn easily, cover up and use broad spectrum SPF 30+ sunscreen. Bright surfaces like sand, water, and snow will increase UV exposure.
3.0–5.9			Yellow	"Moderate"	A UV Index reading of 3 to 5 means a moderate risk of harm from unprotected sun exposure. Stay in the shade near midday when the sun is strongest. Wear sun-protective clothing, a wide-brimmed hat, and UV-blocking sunglasses outdoors. Use broad-spectrum SPF 30+ sunscreen every 2 hours, even on cloudy days and after swimming or sweating. Bright surfaces like sand, water, and snow will increase UV

					exposure.
6.0–7.9			Orange	"High"	<p>A UV Index reading of 6 to 7 means a high risk of harm from unprotected sun exposure. Protection against skin and eye damage is needed.</p> <p>Reduce time in the sun between 10 a.m. and 4 p.m. If outdoors, seek shade and wear sun-protective clothing, a wide-brimmed hat, and UV-blocking sunglasses. Use broad spectrum SPF 30+ sunscreen every 2 hours, even on cloudy days and after swimming or sweating. Bright surfaces like sand, water, and snow will increase UV exposure.</p>
8.0–10.9			Red	"Very high"	<p>A UV Index reading of 8 to 10 means a very high risk of harm from unprotected sun exposure. Take extra precautions because unprotected skin and eyes will be damaged and can burn quickly.</p> <p>Minimise sun exposure between 10 a.m. and 4 p.m. If outdoors, seek shade and wear sun-protective clothing, a wide-brimmed hat, and UV-blocking sunglasses. Use broad-spectrum SPF 30+ sunscreen every 2 hours, even on cloudy days and after swimming or sweating. Bright surfaces like sand, water, and snow will increase UV exposure.</p>
11.0+			Violet	"Extreme"	<p>A UV Index reading of 11 or more indicates an extreme risk of harm from unprotected sun exposure. Take all precautions, as unprotected skin and eyes can burn in minutes.</p> <p>Try to avoid sun exposure between 10 a.m. and 4 p.m. If outdoors, seek shade and wear sun-protective clothing, a wide-brimmed hat, and UV-blocking sunglasses. Use broad-spectrum SPF 30+ sunscreen every 2 hours, even on cloudy days and after swimming or sweating. Bright surfaces like sand, water, and snow will increase UV exposure.</p>

Wind Speed

Wind speed describes how fast the air is moving past a certain point. This may be averaged over a given unit of time, such as miles per hour or an instantaneous speed, reported as a peak wind speed, wind gust or storm. Wind direction describes the direction on a compass from which the wind emanates, for instance, from the North or the West. Wind speed and direction are essential for monitoring and predicting weather patterns and global climate. Wind speed and direction have numerous impacts on surface water. These parameters affect rates of evaporation, mixing of surface waters, and the development of seiches and storm surges. Each of these processes has dramatic effects on water quality and water level.

Wind speed is affected by several factors and situations, operating on varying scales (from micro to macro). These include the pressure gradient, Rossby waves and jet streams, and local weather conditions. Wind speed and direction are linked, notably with the pressure gradient and terrain conditions.

Pressure gradient is a term that describes the difference in air pressure between two points in the atmosphere or on the surface of the Earth. It is vital to wind speed because the more significant the pressure difference, the faster the wind flows (from the high to low pressure) to balance the variation. The pressure gradient influences wind direction when combined with the Coriolis Effect and friction. The wind experienced at any given location depends highly on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

The average hourly wind speed in Batagarawa experiences significant seasonal variation over the course of the year. The windier part of the year lasts 7.8 months, between November and July, with average wind speeds of more than 10kmph. The windiest month of the year in Batagarawa is January, with an average hourly wind speed of 13.45 km/h. The calmer time of year lasts for 4.2 months, from July to November. The calmest month of the year in Batagarawa is September, with an average hourly wind speed of 6.88kmph. The average annual wind speed runs from 7kmph to over 20kmph. Figure 4.9 shows the annual wind speed.

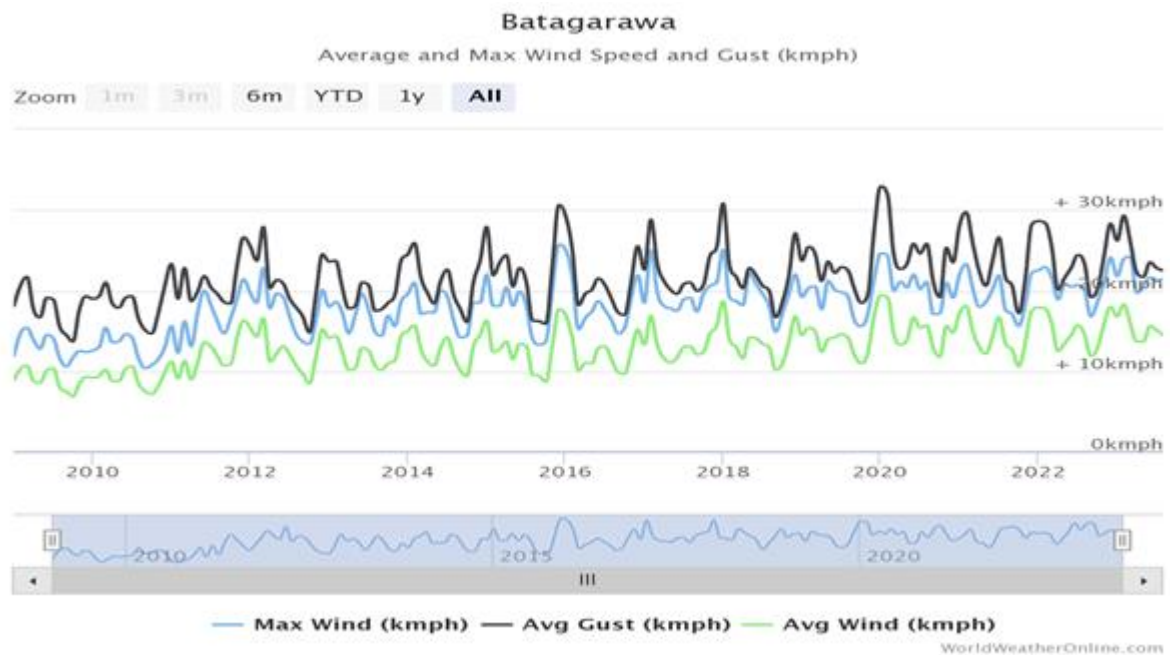


Figure 4.9: Wind Speed in the Project Area {Source: (WMO, 2023)}

4.4 Topography

Topography describes the configuration of a surface, including its relief and the position of its natural and manufactured features. In a broader sense, topography is concerned with general local detail, including relief, vegetative and human-made features, and even local history and culture. For this study, topography explicitly involves recording relief or terrain, the surface's three-dimensional quality, and identifying specific landforms.

The northern terrain of the project area has a higher topography than the southern part, and the ground elevation could be up to 520m. It crosses the geomorphic units of fluctuating hilly regions, erosion plains, and denudation areas from south to north.

The topography within 2 miles of Batagarawa is flat, with a maximum elevation change of 85 feet and an average above-sea level of 1,365 feet. Within 10 miles, it is essentially flat (358 feet). Within 50 miles, it contains only modest variations in elevation (1,791 feet). The area within 2 miles of Batagarawa is covered by cropland (78%), within 10 miles by cropland (76%), and within 50 miles by

cropland (71%5) and grassland (14%). The average elevation in Batagarawa is about 526m, with a minimum and maximum elevation of 472m and 563m, respectively.

The project area's topography is flat with few dots of granitic outcrops. The rocks are poorly exposed and can reach 482m above sea level in some places, especially in the main area where the main quarry is proposed. Figure 4.10 shows the Topography Map of Batagarawa.

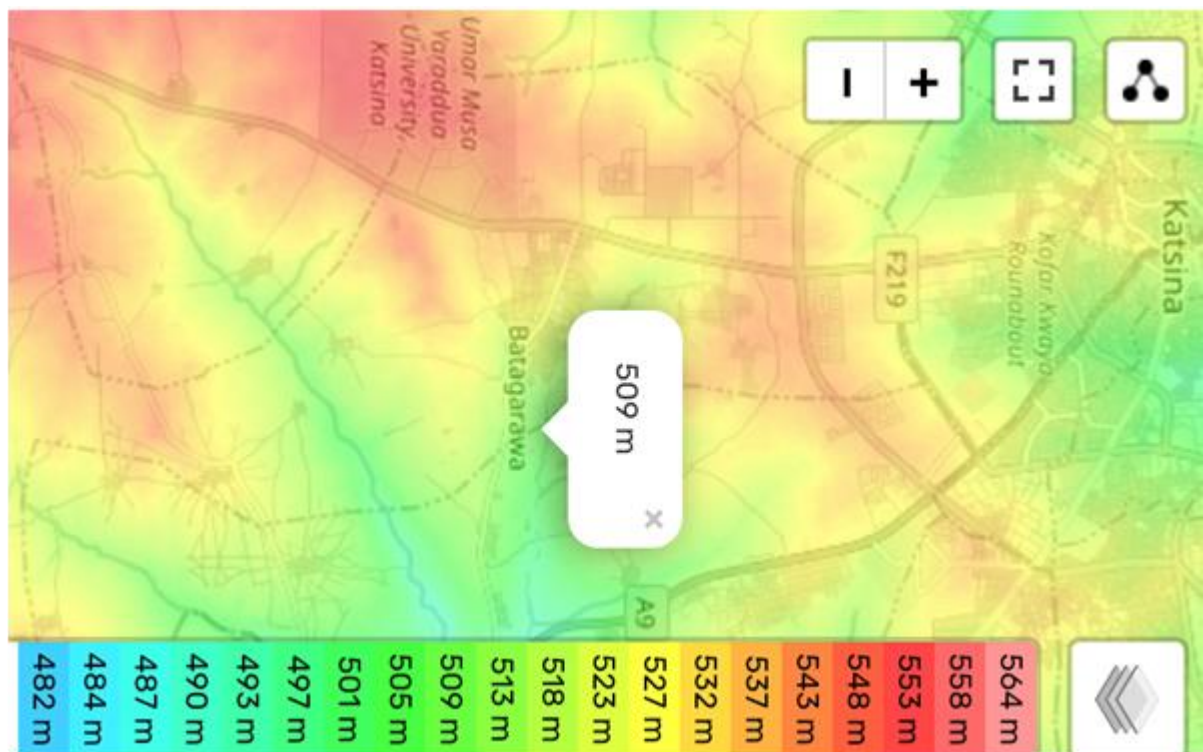


Figure 4.10: Topography Map of Batagarawa (Source: ArcGIS online ESRI)

4.5 Geology

Katsina State forms part of the extensive plains known as the High Plains of Hausa land. The state is composed of undulating plains that rise gently from 360m in the northeast around Daura to 600m around Funtua in the southwest.

The state generally has two geological regions. The south and central parts are underlain by crystalline rocks of the Basement Complex (from Funtua to Dutsinma). However, in the northern parts, where the site is located, cretaceous sediments overlap the crystalline rocks. Figure 4.12 shows the geology map of Nigeria.

The Katsina Daura Plains lie at a lower base level than other parts of the state. Southwards of the Katsina Daura plains is the flat to gently undulating surface, resulting from years of erosion action on the surface rock. In areas around Funtua and Dutsinma, numerous Quarzitic and granitic hills rise 60200m above the surrounding plains.

These hills are probably the result of the intrusion of older granites into the basement complex, which has undergone long periods of denudation (Buchanan & Pugh, 1955). Katsina has gently undulating sandy drift plains, scattered ironstone hills, and low outcrops overlying Pre-Cambrian Basement Complex rocks formed by gneisses and other igneous rocks (FORMECU, 1998). The aquifer consists mainly of laterite clay, coarse sands, gravel, and decomposed granite (at the bottom). The pump test boreholes in the region produced 8,160 litres/hour free flow yields and an average specific yield of about 33,120 litres/hour/metre. The boreholes were dug to 75.8m below the surface soil. The high yields may be from deeply fractured zones of the basement rocks (Offodile, 1992). Katsina State is geologically underlain by the Precambrian migmatites and gneisses, the metasediments/metavolcanics, and the Older Granites. A variety of structures and textures characterises the migmatites, and they represent reactivated older metasediments. The metasediments/metavolcanics are metamorphosed sedimentary and volcanic rock groups consisting of ferruginous quartzites (Banded Iron Formation), amphibolites and pelitic slightly migmatized schists.

The Older (Pan African) granites are characterised by lofty topography and inselbergs, with lithological varieties of rock formation believed to have been emplaced during the Late Palaeozoic era (550±100 my). They consist of coarse-grained porphyritic granite, biotite hornblende granite and fine granites, and fayalite-quartz monzonite (Ajibade & Wright, 1988; Oluyide, 1995).

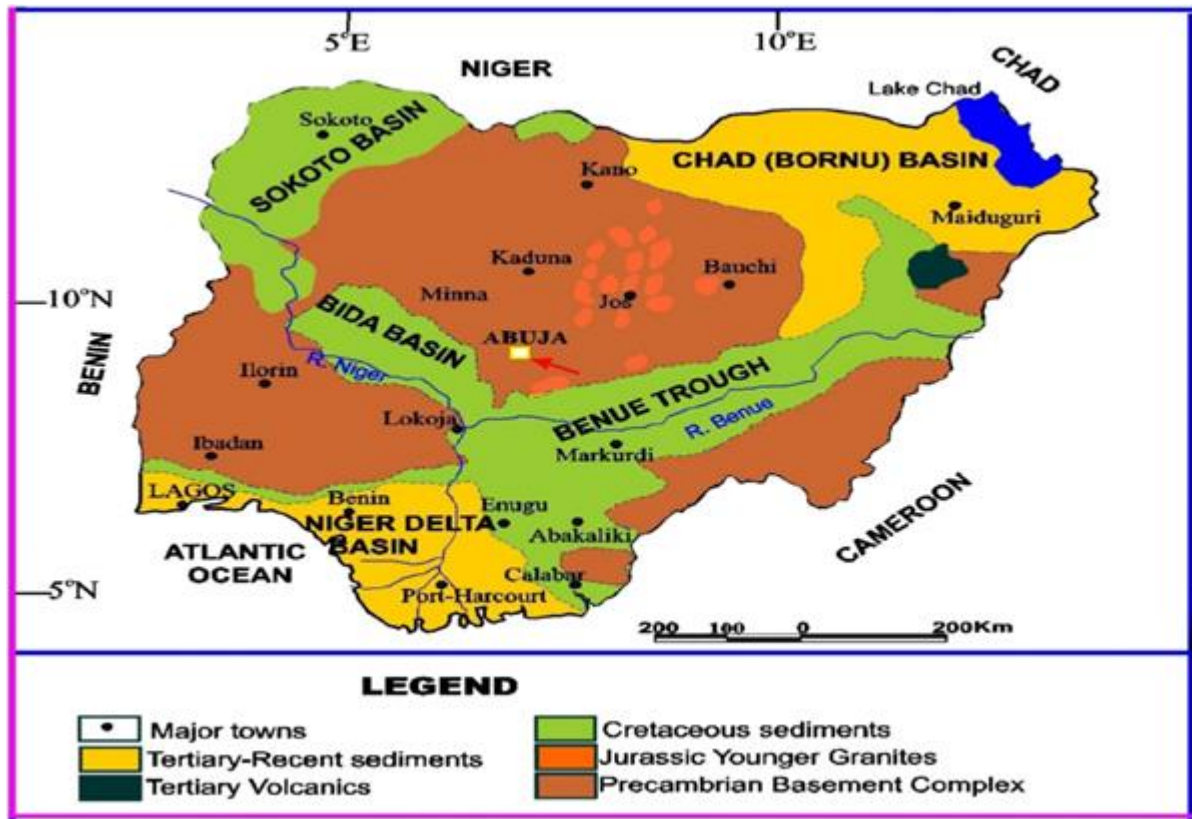


Figure 4.11: Geological Map of Nigeria. **Source: Omeje, 2013**

The Basement Complex is characterised by limited groundwater potential. Generally, groundwater wells in this region are only suitable for small-scale water supply, such as rural needs. Water supplies at Kayauki are generally obtained from a single borehole with hand pumps. The discharge is not steady throughout the year. Four other boreholes dug within the community have dried up due to the poor water retention properties of the aquifer. The water source for irrigation and other domestic uses in the study area is the Kayauki Pond. The water in the pond is collected from stormwater and flows into the artificial trench constructed for the purpose.

4.6 Ambient Air Quality Assessment

Air quality test was conducted in 11 random locations within the site and a control outside the site. The result is presented in Table 4.5 and Appendix 1. The atmosphere is a layer of gases held in its place by gravity. These layers of gases constitute what is known as air. Air is a mixture of gases, composed mainly of

nitrogen and oxygen, with small amounts of carbon dioxide, noble gases, and water vapour essential to life on Earth. Introducing any chemical, physical, or biological agent into the air in quantities large enough to produce harmful effects on man and his surroundings is a call for concern.

Effects of air pollutants on human health, vegetation, property, or the global environment, as well as aesthetic insults in the form of brown or hazy air or unpleasant smells, have been reported in literature (Smith, 1991; Rim-Rukeh & Okokoyo, 2003; Pope, 1992. McComick *et al.*, 1995).

The pollutants monitored in relation to air quality are nitrogen dioxide (NO₂), sulphur dioxide (SO₂), suspended particulate matter (SPM), ammonia (NH₃), hydrogen sulphide (H₂S), carbon monoxide (CO), and methane (CH₄), carbon-dioxide (CO₂) Total volatile organic content (TVOC), formaldehyde (HCHO). The observed air quality and noise data of the study area are presented in Table 4.5. The data is compared with permissible limits recommended by NESREA (2007), (Table 4.6).

The ambient relative humidity ranges from 61% to 72%, and the temperature ranges from 30oC to 35oC. These values were consistent with the control stations; however, the control station recorded a lower humidity but higher temperature level compared to the quarry site. The wind speed ranged from 1.54 m/s to 2.78 m/s within the site, while the control station recorded 0.28 m/s.

Table 4.5: Air Quality and Noise Level Measurement (**Snafhcore Limited Fieldwork September 2023**)

SN	SAMPLE CODE	TVOC Ug/m3	HCHO ₃ Ug/m3	O ₂ %	CO ppm	CO ₂ ppm	H ₂ S ppm	CH ₄ ppm	pm 2.5 Ug/m3	pm 10 Mg/m3	Temp	Noise	Relative Humidity	WS	WD
1	EBQ AN 1	0.014	0.004	20.8	1.0	408p	0.0	0	30	39	32.0°C	62.5db	72%	2.02m/s	S-W
2	EBQ AN 2	0.008	0.006	20.9	1.0	408	0.0	0	28	36	30.0°C	61.7db	66%	1.72m/s	S-W
3	EBQ AN 3	0.011	0.004	20.8	1.0	405	0.0	0	23	30	34.0°C	71.4db	66%	1.54m/s	S-W
4	EBQ AN 4	0.018	0.007	20.9	1.0	408	0.0	0	28	36	32.0°C	57db	66%	2.56m/s	S-E
5	EBQ AN 5	0.002	0.001	21.0	2.0	410	0.0	0	21	27	31.0°C	58.9db	61%	1.65m/s	S-W
6	EBQ AN 6	0.007	0.009	20.8	2.0	404	0.0	0	28	36	35.0°C	55.2db	66%	2.78m/s	S-E
7	EBQ AN C	0.015	0.008	20.9	2.0	406	0.0	0	30	39	37.0°C	57db	55%	0.28m/s	S-E
8	FME _{Env} Limit	50	-	20.9	10	-	0.05	-	250	250	<40	90	-	-	-

Pm	Particulate Matters
TVOC	Total Volatile Organic Compound
dB	Decibels
KQ	Batagarawa Quarry
AN	Air and Noise

Table 4.6: Nigerian Ambient Air Quality Standard (**NESREA 2007**)

POLLUTANTS	TIME OF AVERAGE	LIMIT
Particulates	Daily Average	250µg/m ³
Sulphur Oxides	Daily Average	0.01ppm
Carbon Monoxide	Daily Average	10ppm
Nitrogen Oxides	Daily Average	0.04ppm-0.06ppm
VOCs	Daily Average	50µg/m ³

Suspended Particulate Matter: Suspended particulate matter (SPM) is a finely divided particle of anthropogenic and natural origin in ambient air, such as dust, smoke, and other aerosols. High concentrations of suspended particulate matter (SPM) are known to irritate the mucous membranes and may initiate a variety of respiratory diseases. Fine particulates may cause cancer and aggravate morbidity and mortality from respiratory dysfunctions (CCDI, 2001). Dust, smoke, and diesel exhaust are particulate pollutants that pose direct health threats to people. People living with Asthma, people with other lung problems, and children are most vulnerable to this pollution. Some particulates also indirectly affect people when combined with chemical pollutants. These Particulate Matter of Microbe 10 (PM-10) particulates can penetrate and damage people’s lungs and cause the worst health problems. SPM can also cause damage to materials by soiling clothing and textiles, corroding metals (at relative humidity above 75%), eroding building surfaces, and discolouring/destroying painted surfaces (Peavy et al., 1985).

Ambient SPM levels in the study area ranged from 21 to 39 ug/m³. These recorded values were above the FMEnv daily average maximum limit permitted of 250 ug/m³ (FMEnv, 1995).

Carbon Monoxide: Carbon monoxide (CO) is a colourless, odourless, and tasteless gas produced by the incomplete combustion of carbonaceous materials or fossil fuels - gas, oil, coal, and wood. Adverse health effects have been observed with carbon monoxide concentrations of 12 - 17ppm for 8 hours, while prolonged (45 minutes to 3 hours) exposure to concentrations of CO between 200ppm and 800ppm often results in severe headache, dizziness, nausea, and convulsions

(CCDI, 2001). Ambient CO levels in the study area were in the range of 1-2ppm across all sampling stations, including the control station. These recorded values were within FMEV's daily average maximum limit permitted of 10ppm (FMEV, 1995)

Hydrogen Sulphide: Hydrogen sulphide (H₂S) is a toxic and corrosive gas rapidly oxidised to SO₂ in the atmosphere. It is odorous and can typically be perceived at levels of 0.1 ppm. It can be in natural gas in certain areas and released by sulphate-reducing bacteria (SRB) in specific aquatic environments. Adverse health effects can be encountered with longer-term exposures above 1 ppm, and exposure to concentrations more than 500 ppm can be fatal (SIEP, 1995).

Ambient H₂S levels in the study area were 0.00 ppm across all sampling stations.

Methane (CH₄): Methane gas in the atmosphere arises from fugitive emissions, vents, and incomplete combustion of fuels, mainly where fuel-to-air ratios are too high. Most members of this group are significantly toxic, and exposure to high concentrations in the atmosphere (about 1000 ppm or more) could result in interference with oxygen intake and acute leukaemia (SIEP, 1995). Ambient CH₄ levels in the study area were 0 ppm across all sampling stations.

Formaldehyde

Formaldehyde irritates the nose, eyes, and throat. These irritations can happen at a low level of Formaldehyde. Other short-term effects include headache, runny nose, nausea, and difficulty breathing. Exposure to a high concentration may also lead to wheezy asthmatic attacks and other respiratory symptoms. The US Occupational Safety and Health Administration has set the permissible exposure limit at 0.75 for 15 minutes. The concentration of HCHO ranged from 0.001 µg/m³ -0.009 µg/m³.

Total Volatile Organic Compound (TVOC)/Hydrocarbon

Total volatile organic compounds (TVOCs) are organic chemicals with a high vapour pressure that can quickly evaporate into the air. They can come from various

sources, including industrial processes, transportation, household products, and natural sources.

TVOCs can have harmful effects on human health, including respiratory problems, headaches, and dizziness. They can also contribute to environmental pollution and the formation of smog. The study showed that the concentration of TVOC ranged from 0.002 to 0.018 $\mu\text{g}/\text{m}^3$. These values are comparable to FMEnv stipulated limits of 0.016ppm ($50\mu\text{g}/\text{m}^3$). There was no significant variation in the TVOC concentration at various locations in the study area. Reducing exposure to TVOCs by using low-emitting products, improving ventilation, and using air purifiers and filters is recommended.

4.7 Noise and Vibration

Noise is a periodic fluctuation of air pressure. The frequency expressed in hertz (cycles per second) is the rate at which these fluctuations occur. The range of sound pressures encountered is extensive, and to keep values in manageable proportions, noise levels are measured in decibels (dB), which have a logarithmic scale. Noise pollution is defined as 'unwanted sound.' In addition to causing a disturbance, excessive noise can affect human health and physiology (Rim-Rukeh, 2009).

The noise levels at the sampling stations ranged from 55.2 to 71.4 (dBA). The highest value was recorded at the Control station. These values are within FMEnv's permissible exposure limits of 90dB (A) per day for an 8-hour working period (FMEnv, 1995) (Table 4.7).

Table 4.7: Noise Exposure Limits for Nigeria (**NESREA 2007**)

Duration Day, Hour	Permissible Exposure Limit dB (A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110

0.25 or less	115
Note: Exposure to impulsive or impact noise should not exceed 140 dB (A) peak sound pressure level.	

4.8 Soil Study

The study area's soil was sampled at the surface or from 0 to 15 cm of the surface and 15 to 30 cm below the surface with a soil auger. Six soil sample locations were randomly established across the study area, and a control station was to represent the soil zones or ecoregions in the project area. A grid size of 200m was adopted for the soil sample spread. Also considered was an environmentally sensitive area. A composite sample for each point was analysed in the laboratory. A uniform cross-section soil auger was used to ensure that the uncontaminated and reproducible unit of soil samples were collected. Surface litters of undecomposed plant materials were removed to ensure that uncontaminated soil samples were collected. The samples were transferred into laboratory-cleaned labelled sample materials, preserved, and transported to the Kano state Ministry of Environment Laboratory, Kano state, following Standard Procedures of ASTM (Anon, 1994), FMEnv (1991) and APHS (1975).

Table 4.8: Soil Analysis Result (Snafhcore Limited Fieldwork September 2023)

SN	PARAMETERS	UNIT	EBQ SS1	EBQ SS2	EBQ SS3	EBQ SS4	EBQ SS5	EBQ SS6	EBQ CONTROL SAMPLE
	Latitude	N	13028.8	13033.8	13.034.1	13024.6	13023.24	13033.9	13050.7
	Longitude	N	74313.2	74310	7434.6	7432	74310.9	74320.2	74222.9
A	PHYSICOCHEMICAL								
1	Colour	PtCoU	Yellowish brown	Yellowish brown	Yellowish brown	Dark Yellowish-brown	Dark Yellowish-brown	Yellowish brown	Yellowish brown
2	Temperature	°C	30.1	29	28	28	29	28	29
3	PH	-	7.55	7.83	7.64	7.87	7.97	8.09	8.16
4	Electrical Conductivity	µ/cm	2178	2200	2086	2170	2170	2192	2184
B	EXCHANGEABLE CATION								
5	Ammonium (NH ₄ ⁺)	mg/kg	2.402	2.113	0.82	1.926	0.931	1.42	1.114
6	Potassium (K ⁺)	mg/kg	0.03	0.82	0.62	0.06	1.28	1.04	0.69
7	Magnesium (mg ²⁺)	mg/kg	2.22	0.96	1.49	2.82	2.32	2.01	2.27
8	Calcium (Ca ²⁺)	mg/kg	6.64	4.01	5	6.32	6.29	6.41	6.78
9	Sodium (Na ⁺)	mg/kg	15	19	23	14	14	14	15
C	EXCHANGEABLE ANION								
10	Sulphate (SO ₄ ²⁻)	mg/kg	1.3	0.7	0.3	1.2	1.2	1	1.6
11	Chloride (Cl ⁻)	mg/kg	0.08	0.03	0.11	0.09	0.15	0.06	0.07
12	Nitrate (NO ₃ ²⁻)	mg/kg	9.83	11.47	33.9	17.03	4.81	27.16	15.19
13	Nitrite (NO ₂ ⁻)	mg/kg	0.000	0.000	0.006	0.001	0.000	0.000	0.000
14	Phosphate (Po ₄ ²⁻)	mg/kg	0.2	2.8	1.7	1.2	0.7	2	2.1
D	ORGANICS								
15	Phenols	mg/kg	0.0130	0.0004	0.0030	0.0060	0.0000	0.0110	0.0000
16	Benzene	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Oil and Grease	mg/kg	0	0	0	0	0	0	0
18	Toluene	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	2,4,6-Trichlorophenol	mg/kg	0.000	0.000	0.000	0.000	0.000	0.000	0.000
E	SOIL CHARACTERISTICS								
20	Sand	%	75	63	69	59	68	29	50
21	Silt	%	10	20	19	39	33	64	33

22	Clay	%	15	17	12	2	0	7	17
23	Porosity	mm	2.3	2.2	2.2	3.4	3	0.3	2.6
24	Permeability	cm/hr	15	13	14	10	14	4	8
F	MICROBIOLOGICAL								
25	E. coli	cfu/ml	0	0	0	0	0	0	0
26	Fungi	cfu/ml	14	28	56	13	16	7	26
G	HEAVY METALS								
27	Arsenic (AS ²⁺)	g/kg μ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
28	Zinc (Zn ²⁺)	mg/kg	4.8732	9.771	2.831	0.641	0.972	3.666	4.327
29	Lead (Pb ²⁺)	g/kg μ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	Iron (Fe ²⁺)	mg/kg	16.532	29.400	0.289	1.380	1.009	1.478	1.020
31	Copper (Cu ²⁺)	mg/kg	0.306	0.001	0.047	0.053	0.01	0.003	0.001
32	Manganese (Mn ²⁺)	mg/kg	0.0008	0.0000	0.0002	0.0020	0.0000	0.0000	0.0000
33	Chromium (Cr ³⁺)	mg/kg	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0+B12:K45

KEYS:

EBQ:- Eso Terra Batagarawa
Quarry

mg/l:- milligram per litre

mg/kg:- milligram per kilogram

g/l:- microgram per μ

s/cm: micro-Siemens μ

ppm:- part per million

PtCoU:- platinum cobalt unit

Discussion

Soil Physicochemical Quality

The chemical characteristics of the soil in the project area are presented in Table 4.8 and Appendix 1. The soils of the study area varied from moderately alkaline to slightly alkaline, with a pH ranging from 7.5 to 8.09. These values were consistent with the control sample, whose concentration was 8.16. The alkalinity could be attributed to the leaching loss of exchangeable anions. The textural distribution of the soil samples shows a high percentage of sand ranging from 59-75%. EBQ SS6 has a high percentage of silt at 64%, while the control sample has a high sand percentage of 50%. The soil colour is yellowish-brown colour across the entire sample. The soil's sandy and silty nature is associated with the soil's bigger grain size. The permeability and porosity of the soil samples are consistent with the result of the particulate size. The soil temperature ranged from 28 to 30.1 °C.

Nutrients: The concentration of Nitrite, Nitrate, Sulphate, Nitrogen, and Chlorine in the soil samples as anions was evaluated.

The importance of these nutrients in plants cannot be over-emphasized. Chlorophyll, plant proteins and nucleic acids are nitrogen compounds which play significant roles in plant growth (Donahue *et al.*, 1990). The concentration of Nitrite, Nitrate, Sulphate, Phosphate, and Chlorine ranged from SO_4^{2-} ; (0.3-1.3mg/kg) NO_3^{2-} (4.81-33.1mg/kg), Po_4^{2-} (0.2-2.8mg/kg) and Cl_2 (0.03-0.15mg/kg), while NO_2^- (0.00mg/kg) across all the samples. The results were consistent with the control sample. The amount of this nutrient required in the soil depends on the types of crops.

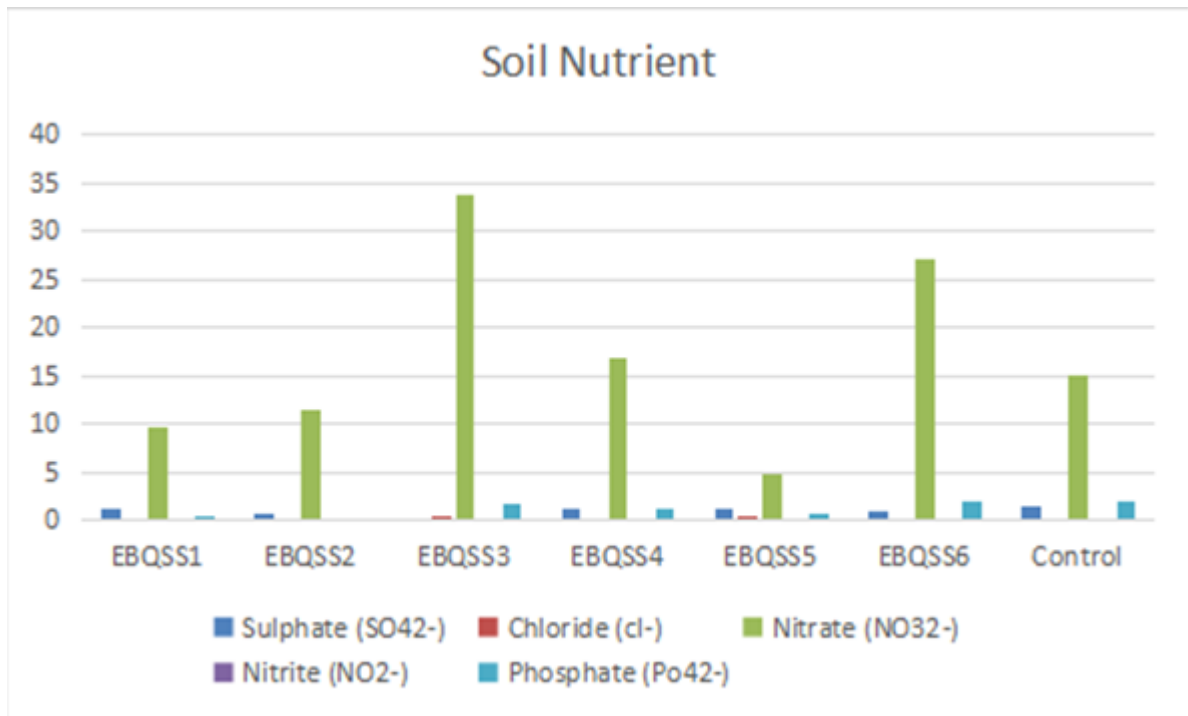


Figure 4.12: Graphic Presentation of the Soil Samples Nutrient Composition

Cation Exchange Capacity (CEC): Exchangeable cations are readily released from the surface of the soil minerals or within the crystal lattice and substituted with cations absorbed from the leaching solution. A soil's cation exchange capacity (CEC) can be estimated by the sum of the concentrations of all the exchangeable cations expressed in milli-equivalents per 100g of soil (meq/100g). Different cations have varying replacement powers, but the predominant ones are calcium, magnesium, sodium, potassium, iron, aluminium, manganese, and ammonium. The exchange capacity varies with the pH, the type of clay minerals and the amount of organic matter. Measuring CEC provides an indication of soil fertility as well as physical soil properties. The distribution of exchangeable cations in a profile is a measure of weathering since soil cations leached by acidic waters are only slowly replaced by primary minerals.

The concentration of Ammonium, Potassium, Magnesium, Calcium, and Sodium ranged from NH₄⁺(0.820-2.402mg/kg) to K⁺(0.03-1.28mg/kg), mg₂⁺ (0.96-2.82mg/kg), Ca₂⁺(4.01-6.64mg/kg), and Na⁺ (14-23mg/kg). These values were consistent with the control sample.

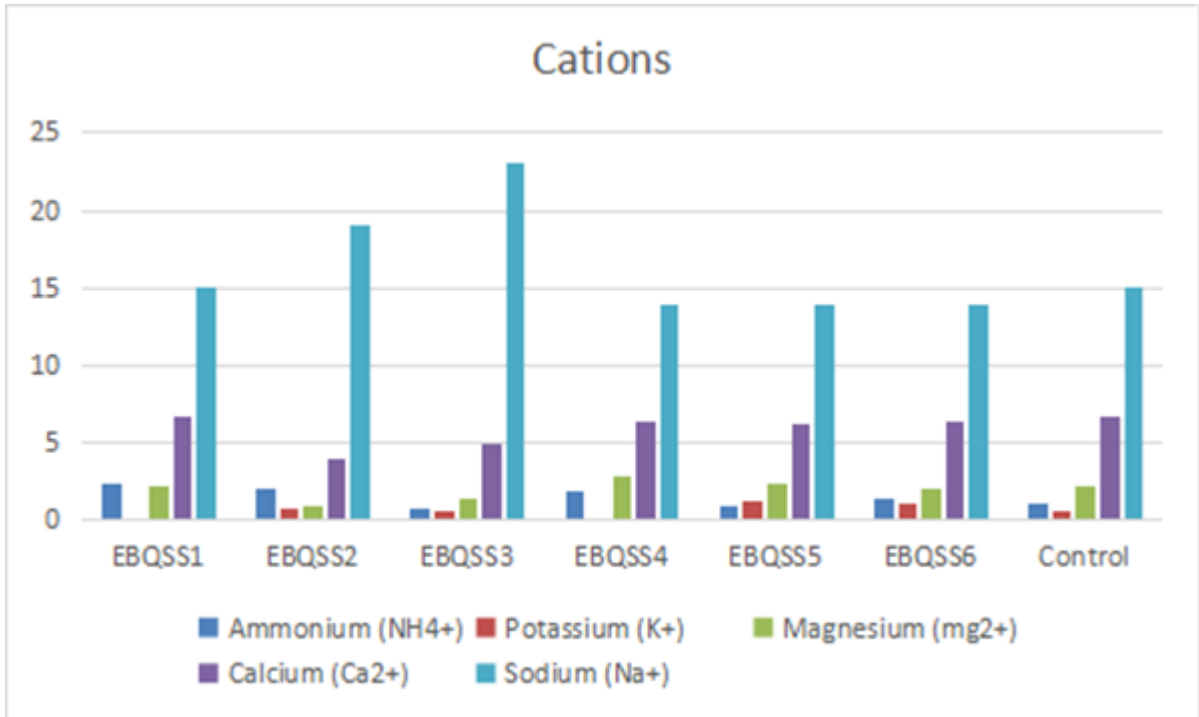


Figure 4.13: Graphic Presentation of the Cations in the Soil

Heavy Metals

The study's heavy metals concentrations show a low concentration for the soil samples. The heavy metals evaluated for the soil samples include but are not limited to, copper, cadmium, nickel, mercury, zinc, and iron. The concentrations were within the WHO (1996) Limit.

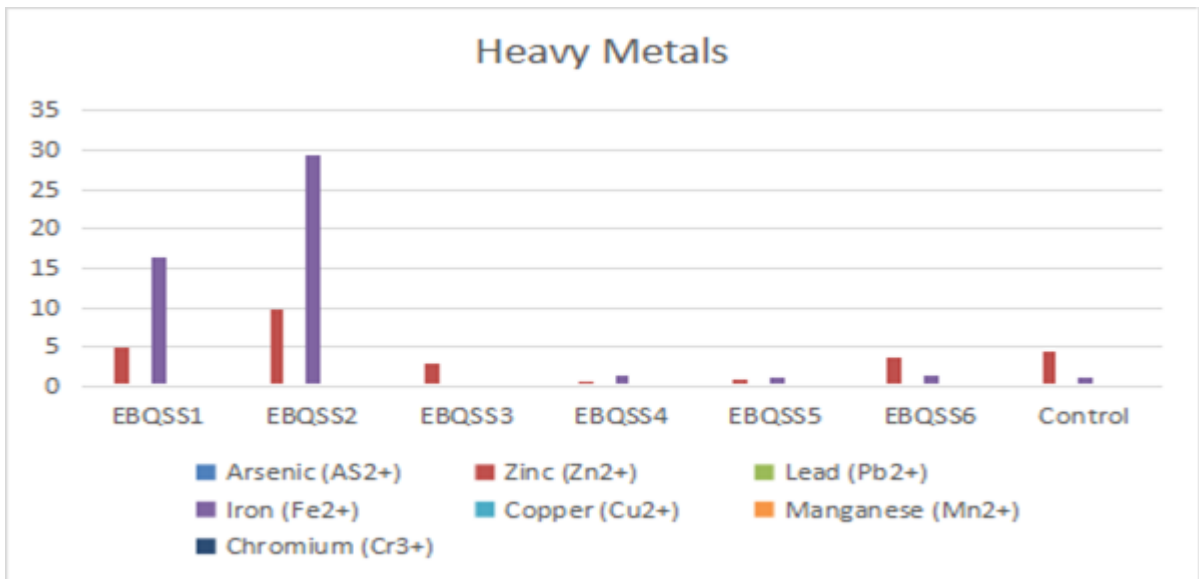


Figure 4.14: Concentration of Heavy Metals for the Soil Samples

Organics

Table 4.8 shows the soil's organic content (TPH, benzene, xylene, toluene, PAH, and Oil and Grease) within the study area. The soil organic Content was 0.0 mg/kg across the board except for phenol, whose concentration was slightly above 0.00 mg/kg.

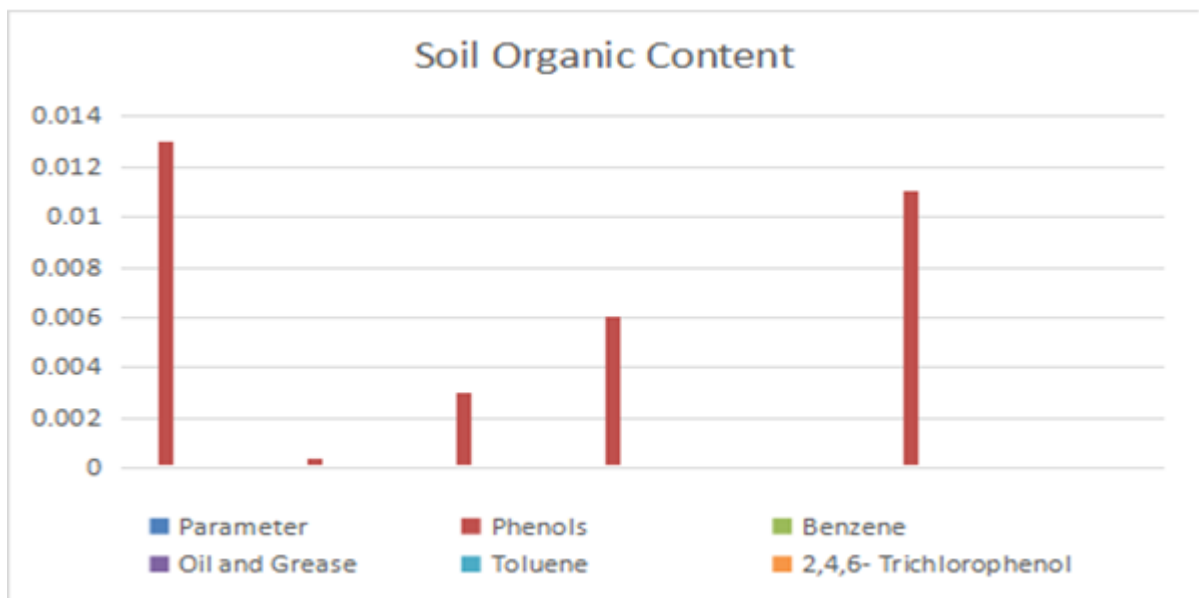


Figure 4.15: Organic Component of the Soil Samples

Microbiology.

Bacteria are ubiquitous unicellular microorganisms, meaning they are virtually found everywhere. They are classified into autotrophic and heterotrophic bacteria. Most bacteria are heterotrophic (THB) and thus depend on organic matter for nutrients. They include the nitrogen-fixing and non-nitrogen-fixing groups. The non-nitrogen-fixing group are the most prevalent bacteria and accounts for much of the decomposition of organic materials. The bacteria genus *Klebsiella* is reported to be associated with nitrogen fixation with numerous types of grass (Donahue et al., 1990). Some bacteria can degrade hydrocarbons, which is called hydrocarbon utilising bacteria (HUB). Analysis results of soil samples collected from the project area indicated the absence of *E. coli*.

Fungi: These are organisms devoid of the green pigment (chlorophyll); therefore, they cannot manufacture their food using the sunlight as energy. Some members of these groups are macro-organisms (seen with the naked eye), while others are microscopic and are the group of interest in this study. However, they live on dead or living plant and animal tissues. The heterotrophic fungi are vigorous decomposers of organic matter; they readily attack cellulose (woody materials), lignin, gums, and other complex compounds, even in quite acidic conditions (unusual for most living organisms). They also compete with economic plants for nutrients released from organic residue decomposition, particularly nitrogen, phosphorous, and sulphur, and they secrete substances that aid in forming water-stable soil aggregates. Some fungi also possess the unique ability to degrade hydrocarbons in the soil and are called hydrocarbon-utilising fungi (HUF). The total heterotrophic fungi (THF) count analysis results ranged between 7 and 56 cfu/g. The concentration was consistent with the control sample, which had a concentration of 26 cfu/g.

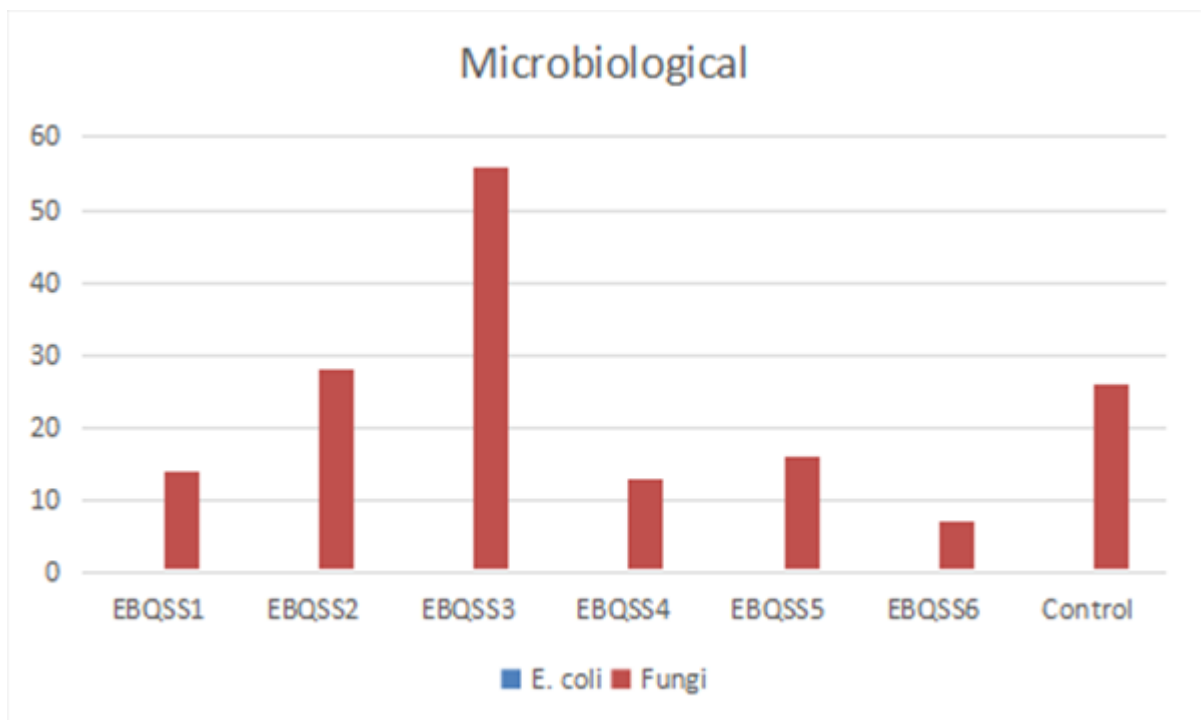


Figure 4.16: Graphic Presentation of the Soils Microbiological Component

4.9 Water Quality

Water samples were collected from a quarry pit within the site, a pond, and a borehole in the Kayauki community. The quarry site where the water sample from the pit was collected is about 1.5km from the pond and the borehole water sources within the Kayauki community. Water samples were collected with 1-litre glass sample bottles to analyse physio-chemical parameters and 1-litre plastic containers to analyse heavy metals. The water sample for microbiology analysis was also collected by transferring 5-10g or 10ml portions into sterile McCartney bottles. The sample was preserved in ice-packed containers (coolers) in the field, later transported to the laboratory, and refrigerated at 4°C before laboratory analyses. For trace (heavy) metal analysis, samples were acidified with concentrated HNO₃ for preservation and to inhibit the precipitation of metal ions.

Numerous physical variables, such as topography, land cover, soil conditions, mineralogy, and groundwater conditions, may affect surface water characteristics, which in turn may be affected by geologic conditions. Stream flow is also affected by numerous climatic variables, including timing, intensity, and amount of precipitation, as well as other variables affecting evaporative processes. The physiochemical characteristics of surface water samples from the area are presented in Table 4.9 and Appendix 1.

The groundwater chemistry varies from place to place depending on the subsoil's nature and the rocks it passes through. Daly (1994) observed that in areas with typical limestone bedrock and limestone-dominated subsoil, groundwater is often 'hard', containing high concentrations of calcium, magnesium, and bicarbonate. However, softer water is typical in areas where volcanic rocks or sandstones are present. Therefore, in considering the impact of human activities, it is necessary first to consider the natural (or baseline) water quality. Groundwater is usually considered pure and safe to drink as it undergoes a filtering and cleansing process through a subsoil cover and rock medium that surface water does not have. However, this does not guarantee groundwater purity. Problems can arise due to the ground's natural conditions or human activities' pollution. A water sample was

collected and analysed from a well in the project area. The result is presented in Table 4.9 and Appendix 1.

Table 4.9: Water Quality Test Result (**Snafhcore Limited Fieldwork September 2023**)

SN	PARAMETERS	UNIT	EBQSW1 QUARRY PIT	EBQ SW2 Kayauki Pond	EBQ GW1 BOREHOLE	FMEV LIMIT
1	Latitude	N	13028.6	13057.2	1311.6	-
2	Longitude	E	102974136.7	74222.5	74228.2	-
PHYSICOCHEMICAL						
3	Colour	PtCoU	Clear	Clear	Clear	Clear
4	Odour	-	Odourless	Odourless	Odourless	Unobjectionable
5	Taste	-	Tasteless	Tasteless	Tasteless	Unobjectionable
6	Ph	-	7.85	8.92	7.72	6.5-8.5
7	Electrical conductivity	s/cm μ	263	160	799	1000
8	Total dissolved solids	ppm	174	98	566	500
9	Temperature	°C	27.9	28.5	28.5	Ambient
10	Total suspended solids	mg/l	131	59	18	30
11	Dissolve oxygen	mg/l	2.9	3.2	4.7	2-8
12	Turbidity	NTU	15	3	0	5
CHEMICAL PARAMETERS						
13	Nitrate (NO ₃ ²⁻)	mg/l	19.7	12.3	2.9	50
14	Phosphate (PO ₄ ²⁻)	mg/l	4.2	3.9	1.6	NS
15	Sulphate (SO ₄ ²⁻)	mg/l	33	12	7	100
16	Chloride (cl-)	mg/l	5.736	5.008	0.341	25
17	Ammonium (NH ₄ ⁺)	mg/l	1.113	0.694	0.326	0.25
18	Calcium (ca ²⁺)	mg/l	4.8	3.3	21.7	200
19	Potassium (K ⁺)	mg/l	1.3	1.0	5	2.0
20	Total Hardness	mg/l	39.4	21.9	296.0	150
21	Magnesium (mg ²⁺)	mg/l	0.9	0.2	4.4	200
HEAVY METALS						
22	Lead (Pb ²⁺)	g/l μ	0.000	0.000	0.000	0.01
23	Mercury (Hg ⁺)	g/l μ	0.000	0.000	0.000	0.001
24	Zinc (Zn ²⁺)	mg/l	2.043	2.000	1.532	3
25	Chromium (Cr ³⁺)	mg/l	0.004	0.020	0.000	0.05
26	Iron (Fe ²⁺)	mg/l	1.362	1.024	0.922	0.3
MICROBIOLOGICAL TEST						
28	E. coli	Cfu/ml	3	2	0	0
29	Total coliform	Cfu/ml	19	8	0	0

Note:	
EBQ	= Eso Terra Batagarawa Quarry
SW	= Surface Water samples
GW	= Ground Water Sample

Colour: The colour of the water sample was colourless. The appearance of colour in drinking water is caused by the absorption of specific wavelengths of normal

white light by dissolved or colloiddally dispersed substances. The appearance of colour in the water sample may be due to the presence of coloured organic substances originating in the decay or aqueous extraction of natural vegetation, such as in soil runoff; the presence of metals such as iron, manganese, and copper, which are abundant in nature, are weathered from the rock as have been similarly reported (Black et al., 1963). The obtained true colour units (TCU) of water samples are within the aesthetic objective for colour has therefore been set at ≤ 15 TCU (APHA, 1998). For domestic consumption, water should be free from colour and odour, and its taste should be agreeable. The water sample in the project area was generally colourless, odourless, and tasteless. These characteristics conform with the regulatory limit.

pH: pH is one of the most common water quality parameters evaluated. It is the negative logarithm of hydrogen ion concentration. By its logarithmic nature, pH is a dimensionless quantity expressed in equation 4.1.

$$\text{pH} = -\log [\text{H}^+]$$

pH affects many chemical and biological processes in the water. For example, different organisms flourish within different ranges of pH. The largest variety of aquatic animals prefers a range of 6.5-8.0 (KWW, 2001). pH outside this range reduces the stream's diversity because it stresses most organisms' physiological systems and can reduce reproduction. Low pH can also allow toxic elements and compounds to become mobile and available for uptake by aquatic plants and animals. This can produce toxic conditions for aquatic life, particularly for sensitive species like rainbow trout. Changes in acidity can be caused by atmospheric deposition (acid rain), surrounding rock, and certain wastewater discharges. The pH of the water samples from the project area was slightly alkaline and fall within the regulatory limit except for the EBQSW2 (Pond water sample water in Kayauki Community), whose concentration was 8.92, thus slightly above the 6.5 to 8.5.

Temperature: The temperature of a water sample is the most critical parameter measured because excessive temperature ($> 35^\circ\text{C}$) through the addition of heated

liquid effluents to water bodies alters the state of the recipient body in several waters. High temperatures increase the level of turbidity and invariably result in a reduced rate of light penetration, and this, in turn, offsets the photosynthetic process of phytoplankton (the beginners of the food chain), which is the primary food link between fry and fingerlings and the adult fish. A high temperature increases the metabolic rate of aquatic organisms and causes a reduction in dissolved oxygen (DO) levels. This may retard the growth and reproduction of fish and, in severe conditions, result in the death of marine life. High temperatures cause suspended solids to settle faster (2.5 times faster at 35°C than at 0°C). The density and viscosity of water will also reduce at higher temperatures. Temperature values recorded in the water samples ranged from 27.9°C-28.5°C.

Turbidity: Turbidity is the cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eye. The measurement of turbidity is a crucial test of water quality. Turbidity is an optical property relating to light adsorption and scattering in water. It is an important parameter because it affects the penetration of sunlight into the water body. Their presence leads to high biochemical oxygen demand (BOD), low DO, and a high total suspended load in the aquatic system. High turbidity also reduces visibility and directly interferes with autotrophic production. Settling of particulate by gravity to the bottom can smother benthic organisms. The units of turbidity from a calibrated nephelometer are called Nephelometric Turbidity Units (NTU). The turbidity of the water samples was 15, 3 and 0 NTU for samples (EBQSW1, EBQW2 and EBQGW), respectively. Borehole water (EBQGW) has a lower turbidity level compared to the samples from the quarry pit and the community pond. The turbidity level of the quarry pit sample was higher than the regulatory limit.

Electrical Conductivity: Electrical conductivity refers to the specific electrical conductance of water, i.e., the ability of water to pass electric current. The conductivity of water in $\mu\text{S}/\text{cm}$ is roughly proportional to the concentration of dissolved solids (mostly inorganic salts) it contains. Thus, conductivity is important in ecology and environmental management as an indicator of the total dissolved

inorganic salts and other solids in water. The electrical conductivity of the water samples (EBQSW1, EBQSW2 and EBQGW) was 263 μ S/cm, 160 μ S/cm, and 799 μ S/cm, respectively. Most underground water contains more dissolved solids than surface water, leading to high conductivity. The permissible EC level by FME_{env} was set for 1000 μ S/cm.

Total Dissolved Solids: Total Dissolved Solids (TDS) are the total amount of mobile charged ions, including minerals, salts or metals dissolved in each volume of water, expressed in units of mg per unit volume of water (mg/L), also referred to as parts per million (ppm). TDS is directly related to electrical conductivity of water as;
$$\text{TDS (mg/L)} = \text{EC } (\mu\text{S/cm at } 25^\circ\text{C}) \times 0.6$$

The TDS levels in the water samples (EBQSW1, EBQSW2, and EBQGW) were 174, 98, and 566 ppm, respectively. As a rough estimation, fresh water may be considered to have a TDS of 1500mg/l; brackish water, 5000 mg/l; saline water, above 5000 mg/l; and seawater TDS values lie between 30,000 and 34,000 mg/l. The recommended maximum value for drinking water is 500 mg/l. The borehole water sample recorded a TDS value higher than the regulatory limit.

Nutrients: Nitrates, Nitrites, Sulphates, and Phosphates are essential plant nutrients in water. The ionic forms are the utilisable forms of nitrogen, sulphur, and phosphorous, which are key elements in plant growth.

The major impact of nitrates on freshwater bodies is enrichment or fertilisation, which may lead to eutrophication (Rim-Rukeh et al., 2003). An excess of nitrogen can cause an overproduction of plankton, and as they die and decompose, they use up oxygen, which causes another oxygen-dependent organism to die.

Phosphate will stimulate the growth of plankton and other aquatic plants, providing fish food. However, excess phosphate in a water body could cause algae and aquatic plants to grow wildly, using large amounts of oxygen. This condition is known as eutrophication or over-fertilisation of receiving waters. Phosphorous is also an essential part of nucleoproteins in the cell nuclei, which control cell division

and growth, and deoxyribonucleic acid (DNA) molecules, which carry the inheritance characteristics of living organisms (Donahue *et al.*, 1990).

Many aquatic and microscopic organisms utilise sulphates for their growth. These minerals are essential in maintaining the intricate food chain that supports all life forms. Reduced concentrations (<0.5mg/l) of sulphur in water may have a detrimental effect on algal growth. The concentration of nitrate, sulphate, chlorine, and phosphate was evaluated in the water samples (EBQSW1, EBQSW2 and EBQGW); the value was Nitrate (19.7, 12.3 & 2.9 mg/l), Sulphide (13, 12 & 7mg/l, Chlorine (5.736, 5.008 & 0.341 mg/l) & Phosphate (4.2, 3.9 and 1.6 mg/l) respectively. Compared to the standard limit, these concentrations were low for the entire sample.

Exchangeable Cations: Magnesium (Mg) and calcium (Ca) were the exchangeable cations determined. Calcium causes hardness in water and, if present with sulphate, may cause boiler scale (GEMS, 1992). The concentrations of ammonium, potassium magnesium and calcium in the water samples (EBQSW1, EBQSW2 and EBQGW) were magnesium (0.9, 0.2 & 4.4 mg/l), ammonium (1.113, 0.694 & 0.326 mg/l) potassium (1.3, 1.0 & 5 mg/l) and calcium (4.8, 3.3 & 21.7 mg/l) respectively. These concentrations were low for all samples except for the ammonium content. EBQGW recorded a high concentration of potassium.

Total Hardness (Carbonate and Bicarbonate): Hard water is water that has a high mineral content (in contrast with soft water), usually consisting of calcium (ca²⁺) and magnesium (mg²⁺) ions, and possibly including other dissolved metals, bicarbonates, and sulphates. It is defined as "Water which does not produce lather with soap solution but produces white precipitate (scum) is called hard water."

The simple way to determine the hardness of water is the lather test: soap, when agitated, lathers easily in soft water but not in hard water. Total water hardness (including both Ca²⁺ and Mg²⁺ ions) is reported in water units of ppm or mg/l of calcium carbonate (CaCO₃). Although we usually measure the total concentration of calcium and magnesium (the two most prevalent metal ions), iron, aluminium and

manganese may also be present at elevated levels in some locations. The total hardness of the water samples (EBQSW1, EBQSW2 and EBQGW) was 39.4, 21.9 & 296 mg/l. The result signifies that the borehole water sample has a high total hardness level above the regulatory limit.

Heavy Metals: The availability of trace metals in water is controlled by physical and chemical interactions. These interactions are affected by factors like pH, redox potential, temperature, CO₂ level, the type and concentration of available ligands and chelating agents, and the type and concentrations of the metal ions. Trace or heavy metals, from an environmental perspective, have the potential for bioaccumulation and bio-concentration in aquatic organisms. Severe effects of heavy metal contamination include reduced growth and development, cancer, organ damage, nervous system damage, and, in extreme cases, death. Exposure to some metals, such as mercury and lead, may also cause the development of autoimmunity, in which a person's immune system attacks its cells.

The concentrations of the heavy metals in the water sample (EBQSW1, EBQSW2, and EBQGW) fall within the regulatory limit except for the concentration of Fe, which was above the regulatory limit across the samples.

Microbiological Characteristics of the Water Samples

Generally, microbiology is the scientific study of living organisms that the naked eye cannot see but are around us. Microorganisms are essential components of the aquatic ecosystem and participate in synthesising many organic and inorganic compounds during primary production and the decomposition of the organic matter. For drinking water, the presence of bacteria is as dangerous as bad water. The water samples show the presence of E-coli in samples EBQSW1 and EBQSW2. The total coliform count was 0 CfU/ml for EBQGW, while EBQSW1 and EBQSW2 recorded 19 and 8 CfU/ml for EBQGW.

4.10 Biodiversity

The biodiversity study was conducted to assess the vegetation and wildlife composition in the area. Photographs taken during the study were used as objective evidence in this report, as presented in subsequent sections. Plant and animal species recorded are those observed or previously reported within the study area.

4.10.1 Vegetation Studies

The vegetation type in the project area is the Sudan Savannah Vegetation, which consists mainly of shrubs and short grasses with a few scattered wooded savanna trees. Figure 4.17 shows the vegetation zones within Nigeria, and to the far north is Katsina State (project Region).

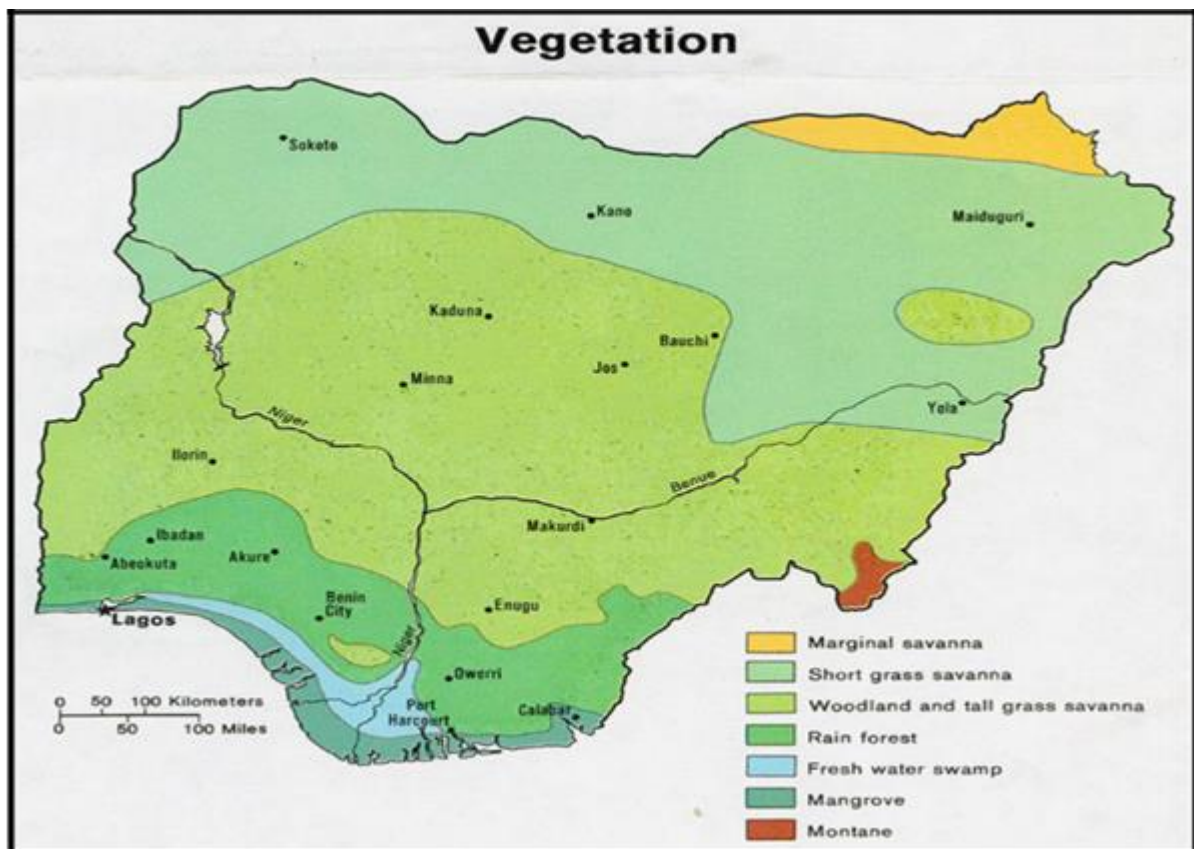


Figure 4.17: Vegetation Zones within Nigeria

Katsina State is one of the few states in the country where crops are grown all year round. Apart from farming during the rainy season, dry-season farming is done along riverbanks and along the numerous dams built by the State and Federal Governments (Rabi et al., 2013).

Biodiversity Study Methodology

The biodiversity study was conducted through observations, interviews and documentation of vegetation and wildlife characteristics of the area. This was achieved by dividing the study area into three (3) transects for easier classification and evaluation. The following transects were obtained as a result:

- Transect A: Limited to project site + 500m South of project site;
- Transect B: 1km East of the site
- Transect C: 1km West of the project site.

It should be noted that, at the time of the field survey, there were few farmlands with crops and few economically significant trees.

Plants Species within Transect A

Transect A is the land delineated for the quarry project 500m south of the project area. This transect covers a total area of approximately 1km by 1km. It is plain with vegetation devoid of canopies. Plants were directly exposed to sunlight. At the time of the field survey, there were no farmlands, cash crops, or economic trees of significant importance within the site, but few farmlands were found within 500m South of the project area.

A few plant species were observed in this transect. A total of 7 plant species belonging to 6 taxonomic families were observed. During the visits, several grasses, shrubs (being the highest) and two trees were observed within this transect. **Table 4.10** below presents the plant species found within this transect, common/ local names, plant type and IUCN ranking (2014).

The plants observed were naturally occurring. Evidently, vegetation within this transects had undergone secondary re-growth or succession over time.

Table 4.10: Plants Observed within Transect A

PLANT SPECIES	FAMILY	COMMON NAME	LOCAL NAME	TYPE	IUCN RANKING
<i>Calotropis procera</i>	Asclepiadaceae	Sodom apple	Tumfafiya	Shrub	-
<i>Borassus aethiopum</i>	Areaceae	African fan palm	Giginya	Tree	-
<i>Eragrostis gangetica</i>	Poaceae	Slim flower love grass	Durburwa	Grass	-
<i>Grewia mollis</i>	Malvaceae	-	Kamomowa	Shrub	-
<i>Grewia villosa</i>	Malvaceae	-	-	Shrub	-
<i>Commiphora africana</i>	Burseraceae	African myrrh	-	Tree	Least Concern
<i>Cynodon dactylon</i>	Pinaceae	Bermuda grass	Tsírkiiyár dámóó	Grass	-
<i>Neem Tree</i>					

The most abundant plant was *Grewia mollis*, a shrub that covered about 55% of the entire transect. It grows to about 2m and is clustered together. The *Grewia mollis* species was conspicuously greener and more widespread. The next most abundant was *Grewia villosa*, a shrub that covers about 25% of the area and grows as high as 2m. The third most abundant was *Calotropis procera*, a shrub that grows to about 1m.

There were only 5 trees observed: *Borassus aethiopum* and *Commiphora africana*. *Borassus aethiopum*, a species of the palm tree family, is the tallest plant within this transect, with a height of about 12m. *Commiphora africana* was about 5m high and contains spines on its stem. *Commiphora* are gum-bearing trees. Plate 4.5 shows a cross-section of plants within the area.



Plate 4.5: *Commiphora africana* within the Project Area (Snafhcore Field study 2023)

Plants Species within Transect B

Transect B covers a total area of 1km by 1km and lies to the East of the project site (i.e. area of influence). At the time of the survey, several grasses, shrubs, and trees were observed. Within this transect is an existing artisanal granite quarry. In this transect, a total of 25 plant species belonging to 16 taxonomic families were observed. Naturally occurring plants and food crops were observed in this transect. Table 4.11 presents the naturally occurring plant species found in the area.

Table 4.11: Plants Observed within Transect B

PLANT SPECIES	FAMILY	COMMON NAME	LOCAL NAME	TYPE
<i>Ziziphus mauritiana</i>	Rhamnaceae	Chinese date	Magarya	Tree
<i>Acacia albida</i>	Fabaceae	Anna tree	-	Tree
<i>Acacia nilotica</i>	Fabaceae	Gum Arabic tree	Bagaruwa	Tree
<i>Adansonia digitata</i>	Malvaceae	Baobab	Kuka	Tree

<i>Azadirachta indica</i>	Meliaceae	Neem	Darbejiya, Dogonyaro	Tree
<i>Ziziphus spina-christi</i>	Rhamnaceae	Christ's Thorn jujube	Kándíídà	Tree
<i>Borassus aethiopum</i>	Arecaceae	African fan palm	Giginya	Tree
<i>Phoenix dactylifera</i>	Arecaceae	Date palm	Dúnshe	Tree
<i>Combretum micranthum</i>	Combretaceae	Kinkeliba	Géézàa	Tree
<i>Combretum erythrophyllum</i>	Combretaceae	River bushwillow	-	Tree
<i>Vitellaria paradoxa</i>	Sapotaceae	Shea	Kadanya	Tree
<i>Detarium microcarpum</i>	Caesalpiniaceae	Sweet dattock	Taura	Tree
<i>Combretum micranthum</i>	Combretaceae	-	Geiza	Shrub
<i>Gmelina arborea</i>	Lamiaceae	Beechwood	-	Tree
<i>Guibourtia coleosperma</i>	Fabaceae	African rosewood	-	Tree
<i>Balanites aegyptiaca</i>	Zygophyllaceae	Desert date	Aduwa	Tree

COMMON NAME	LOCAL NAME
Rough-leaved Shepherds	Ànzáá
Slim flower love grass	Durburwa
-	Yàtúúyàtúú
Canary pea	Yar
Nettle tree	Zu
Horseradish tree	Zogale
Bermuda grass	Tsírkiìyár dámóó
Mustard tree	Bento
Basket willow	Ìnáá rúwáánáá



Plate 4.6: Neem Tree within the Project Area (*Snafhcore Field study 2023*)

Trees here are tall, deciduous, and fully grown, providing shade to inhabitants. Shrubs and grasses were also observed. The most abundant trees were *Acacia nilotica*, *Acacia albida*, and *Vitellaria paradoxa*. Collectively, they cover about 30% of the entire transect. These trees were as tall as 20m in height. *Adansonia digitata* (baobab) was found only in this transect. Also common was *Azadirachta indica* (neem tree).

Plants Species within Transect C

Transect C also covers a total area of 1km by 1km and is west of the project site (i.e. within the area of influence). No hamlet was located within this transect. In this transect, 17 plant species belonging to 11 taxonomic families were observed. Grasses, shrubs, and trees were also observed in this transect. Both naturally occurring plants and food crops were observed here. Table 4.12 presents the naturally occurring plant species found in the area. In this transect, tall, scattered

deciduous trees were observed. Some trees noted in Transect B were also seen here. The unique trees here include *Prosopis africana* and *Borassus aethiopum*. *Azadirachta indica* (neem tree) was the most abundant. *Borassus aethiopum* was the tallest tree in the area.



Plate 4.7: *Byrsonima crassifolia* within the Project Area (Snafhcore Field study 2023)

Table 4.12: Plants Observed within Transect C

PLANT SPECIES	FAMILY	COMMON NAME	LOCAL NAME	TYPE	IUCN RANKING
<i>Azadirachta indica</i>	Meliaceae	Neem tree	Darbejiya, Dogonyaro	Tree	-
<i>Acacia albida</i>	Fabaceae	Anna tree	-	Tree	-
<i>Acacia nilotica</i>	Fabaceae	Gum Arabic tree	Bagaruwa	Tree	-
<i>Ziziphus abyssinica</i>	Rhamnaceae	Catch thorn	Magarya	Tree	-
<i>Ziziphus mauritiana</i>	Rhamnaceae	Chinese date	Magarya	Tree	-
<i>Prosopis africana</i>	Fabaceae	False locust	Kiryà	Tree	-
<i>Borassus aethiopum</i>	Arecaceae	African fan palm	Giginya	Tree	-
<i>Combretum micranthum</i>	Combretaceae	-	Geiza	Shrub	-
<i>Vitellaria paradoxa</i>	Sapotaceae	Shea	Kadanya	Tree	Vulnerable

<i>Byrsonima Crassifolia</i>			Murici	Tree	-
<i>Detarium microcarpum</i>	Caesalpiniaceae	Sweet dattock	Taura	Tree	Least Concern
<i>Guibourtia coleosperma</i>	Fabaceae	African Rosewood	-	Tree	-
<i>Olea europea</i>	Oleaceae	Olive tree	Zaytun	Tree	
<i>Boscia Senegalensis</i>	Capparaceae	Rough-leaved shepherds	Ànzáá	Tree	Least Concern
<i>Eragrostis gangetica</i>	Poaceae	Slim flower love grass	Durburwa	Grass	-
<i>Eriosema psoraleoides</i>	Fabaceae	Canary pea	Yar	Tree	-
<i>Cynodon dactylon</i>	Poaceae	Bermuda grass	Tsírkíiyár dámóó	Grass	-
<i>Corchorus tridens</i>	Malvaceae	Jute	Tùrgúnùwáá		

4.10.2 Cultivated Crops

Several farmlands were observed within the study area (i.e. in transects B and C). Community members were actively involved in farming and livestock rearing. Crops cultivated and observed are presented below.

Table 4.13: Cultivated Crops within Study Area

PLANT SPECIES	FAMILY	COMMON NAME	LOCAL NAME	TYPE	IUCN RANKING
<i>Mangifera Indica</i>	Anacardiaceae	Mango	Mangoro, Mangwaro	Tree	Data Deficient
<i>Sorghum bicolor</i>	Poaceae	Guinea corn	Dawa	Grass	-
<i>Pennisetum glaucum</i>	Poaceae	Pearl millet	Zángóó	Grass	-
<i>Paspalum scrobiculatum</i>	Poaceae	Kodo millet	Tùmbín jààkíí	Grass	Least Concern
<i>Zea mays</i>	Poaceae	Maize	Másárá	Grass	-
<i>Anacardium occidentale</i>	Anacardiaceae	Cashew	Físáá	Tree	-



Plate 4.8: Guinea Corn farm within the project area (Snafhcore field work September 2023)

Economical Uses of Flora Resources

Plants mentioned above and within the study area are known to be of high economic importance. Several of these plants have multipurpose uses and play a vital role in the socio-economic development of the people who use them. Plant parts are known to be used for medicinal purposes, livestock feeding, trading, ornaments, etc. The table below presents the plant's economic uses in the study area.

Table 4.14: Economic Uses of Some Plants in the Study Area

PLANT SPECIES	ECONOMICAL USES
<i>Catropis procera</i> (Sodom apple)	<ul style="list-style-type: none"> • The roots and barks are used in medicine for digestive disorders, diarrhoea, constipation, etc; • Used in treating snakebites and boils.
<i>Borassus aethiopum</i> (African fan palm)	<ul style="list-style-type: none"> • Fruits and tender roots produced by young plants are edible; • Fibres are obtained from leaves; • Woods (reputed to be termite-proof) can be used in construction.

<i>Grewia mollis</i>	<ul style="list-style-type: none"> • Bark and root preparations are taken to treat cough, snake bite, ulcer, cut, and sore; • Indigenes have used the mucilage as a thickener in soups; • As food for livestock animals; • The wood used for house construction, bed frames, walking sticks, tool handles, clubs, bows and arrows, shields, spear shafts and whips; • Also used as firewood and made into charcoal.
<i>Grewia villosa</i>	<ul style="list-style-type: none"> • Seeds are pounded and consumed; • Roots are used to treat body pains; • Bark is used in the treatment of wounds, syphilis, and smallpox
<i>Commiphora africana</i> (African myrrh)	<ul style="list-style-type: none"> • Fruits are used for the treatment of typhoid fever and stomach problems; • Powdered bark is mixed with porridge to cure malaria; • Resin is used in sealing and disinfecting wounds, while fumes of burnt resin are used as an insecticide and as an aphrodisiac; • Goats browse leaves, especially at the end of dry season; • Reputation of being termite resistant, though soft. It is used in the construction of local houses, tool handles, beehives, spoons, water troughs, and musical instruments; • Roots, leaves, and fruits are edible, and oil is extracted.
<i>Cynodon dactylon</i> (Bermuda grass)	<ul style="list-style-type: none"> • Used to feed livestock; • Known to be rich in calcium, phosphorous, potash, potassium, sodium, manganese, protein, enzymes, carbohydrates, fibre, flavonoids, and alkaloids; • Used to treat stomach acidity, ulcers, pain, colitis, and infections.
<i>Acacia albida</i> (Anna Tree)	<ul style="list-style-type: none"> • Good for raising bees since its flowers provide bee forage at the end of the rainy season when most other local plants do not; • Seed pods are essential for raising livestock and used as camel fodder; • Wood is strong and used for making canoes, mortars, pestles; • Ashes of wood are used in making soap as a depilatory and tanning agent for hides.
<i>Acacia nilotica</i> (Gum Arabic tree)	<ul style="list-style-type: none"> • Its pods are used as a supplement to poultry rations. • Branches are commonly lopped for fodder; • The plant makes an excellent protective hedge because of its thorns; • The wood is very durable and is used in making boats
<i>Azadirachta indica</i> (Neem tree)	<ul style="list-style-type: none"> • The leaves and bark are used for treating malaria

<i>Adansonia digitata</i> (Baobab)	<ul style="list-style-type: none"> • Leaves are used in the preparation of soup; • The flower is eaten raw; the seeds provide flour, which is rich in vitamin B and protein and used as baby food. • The fruit pulp from the seed provides a refreshing drink when dissolved in water or milk. The spongy and soft nature of the tree makes it easy to store water during the extreme scarcity of water; • The back of the young baobab tree is used in making fishing nets, baskets, mats, and clothes
<i>Moringa oleifera</i> (Horseradish tree)	<ul style="list-style-type: none"> • It is used in medicine for anaemia, arthritis, joint pain (rheumatism), asthma, diabetes, diarrhoea, and epilepsy. stomach pain; • and intestinal ulcers treatment as well as bacterial, fungal, viral, and parasitic infections; • Moringa is also used to reduce swelling, increase sex drive (as an aphrodisiac), prevent pregnancy, boost the immune system, and increase breast milk production. Some people use it as a nutritional supplement or tonic.
<i>Balanites aegyptiaca</i> (Desert date)	<ul style="list-style-type: none"> • Its wood is highly resistant to insects, hence widely used for making wooden handles, bowls, mortars and many household utensils
<i>Vitellaria paradoxa</i> (Shea tree)	<ul style="list-style-type: none"> • Is an important source of edible oil (shea butter) derived from the seed. Shea butter is also used in cosmetics, skin emollients, and pharmaceuticals; • Has been extensively used for timber, firewood, and charcoal production; • The fruits are edible and constitute 50-80% of the whole fruit
<i>Eriosema psoraleoides</i> (Canary pea)	<ul style="list-style-type: none"> • Roots are boiled with water and taken as tea or powder from dried roots. They are taken with porridge to treat malaria and are used as an aphrodisiac.
<i>Corchorus tridens</i> (Jute)	<ul style="list-style-type: none"> • Young tender leaves are cooked into a mucilaginous product that is either used as a sauce or as relish with maize or other cereal; • It is grazed by animals such as livestock; • Its stem fibres are used for rope making;
CULTIVATED PLANTS	
<i>Mangifera Indica</i> (Mango)	<ul style="list-style-type: none"> • Its fruit are fleshy and edible; • It is used in clearing digestion and acidity due to heat; • It is sought for its timber but occasionally preferred
<i>Sorghum bicolor</i> (Guinea corn)	<ul style="list-style-type: none"> • Its grains are used to make flatbreads; • Significantly used as food for animals; • Used as a source for making ethanol fuel; • Reclaimed stalks are used to make a decorative millwork material

Sources: Rulangaranga 1989, Von Maydell 1990; B and P van Wyk, 1997; Mohammed, 2000; Gebauer, 2002

4.10.3 Fauna/Wildlife

Fauna Description

The study area is known for its low fauna composition. This is because of the harsh (dry) environmental conditions that ensure the adaptation and survival of only drought-tolerant animals. In the study area, livestock animals were observed mainly. Water was made available for the livestock through Ponds or boreholes.

The fauna observed or recorded in this area are discussed below. Table 4.15 presents all fauna resources as described by hunters, members of the communities, and those recorded during the study.

Mammals

Ten mammal species were observed or previously recorded in the area. The Greater Cane rat (*Thryonomys swinderianus*) and the Giant Pouched rat (*Cricetomys gambianus*) represented the rodents. Livestock species make up the bulk of the mammalian species.





Plate 4.9: Livestock in the Area (Snafhcore field work September 2023)

Aves

The bird group comprises the Black kite, Francolin, Cattle egret, Finch, Sunbird, Weaver, and White stork. The Vultures once common in the study area have become locally extinct.

Reptiles

The reptile groups include Cobras, Pythons, and Lizards. According to the hunters, snakes have become locally extinct due to overexploitation.

Mammalian species and their IUCN ranking are presented in Table 4.15 below.

Table 4.15: Checklist of Mammalian Groups in the Study Area

ANIMAL SPECIES	FAMILY	COMMON NAME	LOCAL NAME	CURRENT STATUS	IUCN RANKING
MAMMALS					
<i>Thryonomys swinderianus</i>	Thryonomyidae	Greater cane rat	Gafiya	Observed	Least Concern
<i>Cricetomys gambianus</i>	Nesomyidae	Giant pouched rat	Dabba	Reported	Least Concern
<i>Lepus capensis</i>	Leporidae	Brown hare	Zomo	Reported	Least Concern
<i>Lepus microtis</i>	Leporidae	African savanna hare	Zomo	Reported	Least Concern
AVES					
<i>Milvus migrans</i>	Accipitridae	Black kite	Shirwa	Observed	Least Concern
<i>Pternistis bicalcaratus</i>	Phasianidae	Double-spurred francolin	-	Reported	Least Concern

<i>Bubulcus ibis</i>	Ardeidae	Cattle egret	Balbela	Reported	Least Concern
<i>Nig canicapilla</i>	Estrildidae	Negro finch	-	Reported	-
<i>Cinnyris coccinigastrus</i>	Nectariniidae	Splendid sunbird	-	Reported	Least Concern
<i>Ploceus cucullatus</i>	Polceidae	Village weaver	-	Reported	-
<i>Ciconia ciconia</i>	Ciconiidae	White stork	-	Observed	Least Concern
REPTILES					
<i>Naja melanoleuca</i>	Elapidae	Black Cobra			Least Concern
	Elapidae	Black-necked	Kumurci	Reported	
<i>Naja nigricollis</i>		spitting cobra	Kumurci	Reported	Least Concern
<i>Agama agama</i>	Agamidae	Rainbow agama	Kadangare	Observed	-
<i>Python sebae</i>	Pythonidae	Rock python	Muduwa	Reported	-
LIVESTOCK					
<i>Numida meleagris</i>	Numididae	Helmeted guinea fowl	Zabo	Observed	Least Concern
<i>Bos taurus indicus</i>	Bovidae	Cattle	Marai	Observed	Least Concern
<i>Camelus dromedarius</i>	Camelidae	Camel	Rakumi	Observed	Least Concern
<i>Equus africanus asinus</i>	Equidae	Donkey	Jaki	Observed	
<i>Capra aegagrus hircus</i>	-	African dwarf goat	Akuya	Observed	Least Concern

4.11 Socio-Economic Characteristics and Consultation with Stakeholders

Sampling Procedure and Sample Size

The target population for this study were the host community members and examiners residing in the communities during the survey. 360 houses with 2,160 households were identified in the Kayauki community, and 120 in the Fandare community with 720 households. A systematic random sampling was adopted, and 72 households were selected in Kayauki and 24 in Fandare, respectively. However, the systematic sampling technique was used to enumerate community houses for easy administration of questionnaires (as shown in Table 4.16). The procedure for selecting the sample size for the community members was 5.0% in the community

using Creswell (2013) sample size methodology. A total number of 96 questionnaires were administered, and 80 were filled and returned. Regarding the in-depth interview, the informants were purposively selected, and the participants during the focus group discussion were also purposively selected in the study area—the focus group discussion comprised of 1 community leader, 1 farmer and 2 ex-miners in the community.

Table 4.16: Sampling Method Used for the Study

COMMUNITY DISTANCE TO SITE	COMMUNITIES	LGA	SAMPLE SIZE (5.0%)	NO. OF QUESTIONNAIRE DISTRIBUTED	PERCENTAGE OF QUESTIONNAIRE RETURNED (%)	FGD'S
About 1km	Kayauki	Batagarawa	360	72	61 (64%)	1
About 2km	Fandare	Rimi	120	24	19 (20%)	1
		Total	480	96	80	2

Source: Field Survey, 2023

4.11.1 Description of Socio-economic Characteristics of Respondents

Sex Distribution of Respondents

The sex distribution of respondents, as shown in Figure 4.18, reveals that in Kayauki, the males were 85% and females were 15%. In the Fandare community, the males were 73% and 27%. This indicates the dominance of males in farming activities over females. The dominancy of male heads of households could be attributed to the fact that Katsina State is predominantly a conservative Hausa Muslim society in which it is uncommon for females to become heads of household. This indicates that men mainly farm in the study area while women participate in off-farm activities. This aligns with the study of Shortfall (2006) and Mercier and Gier (2007), where gender is critical in making decisions about farming, off-farming, and mining activities.

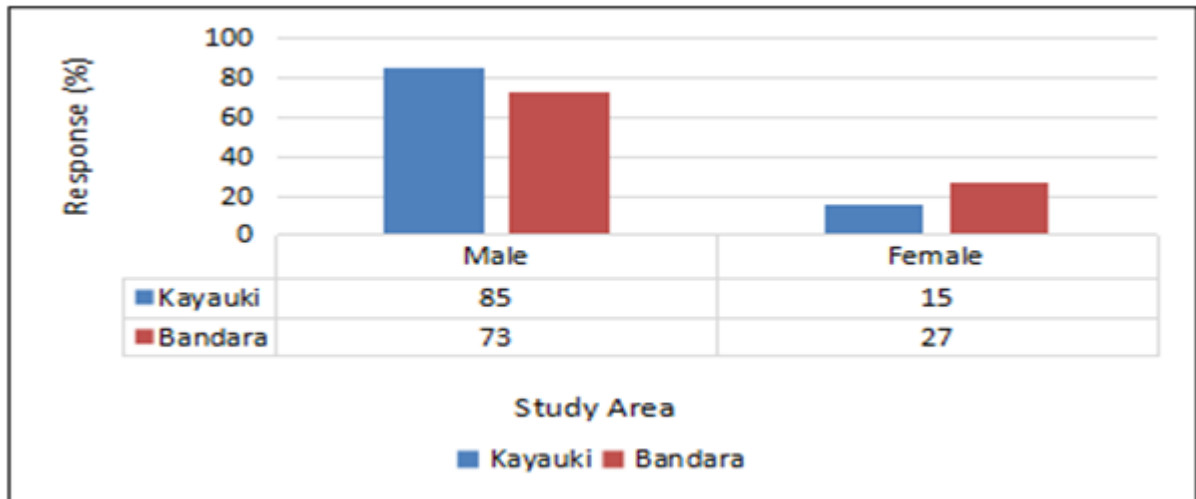


Figure 4.18: Sex Distribution of Respondents Source: Field Survey, 2023

Age Distribution of Respondents

The age distribution revealed that in the Kayauki community, 9.7% of the respondents were between the age bracket of 19-30 years, 30.9% between 30-45 years, 50.5% between 45-60 years and 8.9% were over 60. While in the Fandare community, 13.4% were between 19-30 years of age, 27.8% were between 30-45 years, 56.5% were between 45-60 years, and 2.3% were within the age bracket of over 60 years and above (as shown in Figure 4.19). This implies that most household heads are middle-aged people. These findings coincide with Asif (2007), who reported that the household heads were in the age group of 44 years in rural communities in Pakistan. Similarly, Choudhary *et al.* (2009) and Mesfin *et al.* (2022) state that age is considered in rural communities when making life decisions, especially in working conditions of farming and mining.

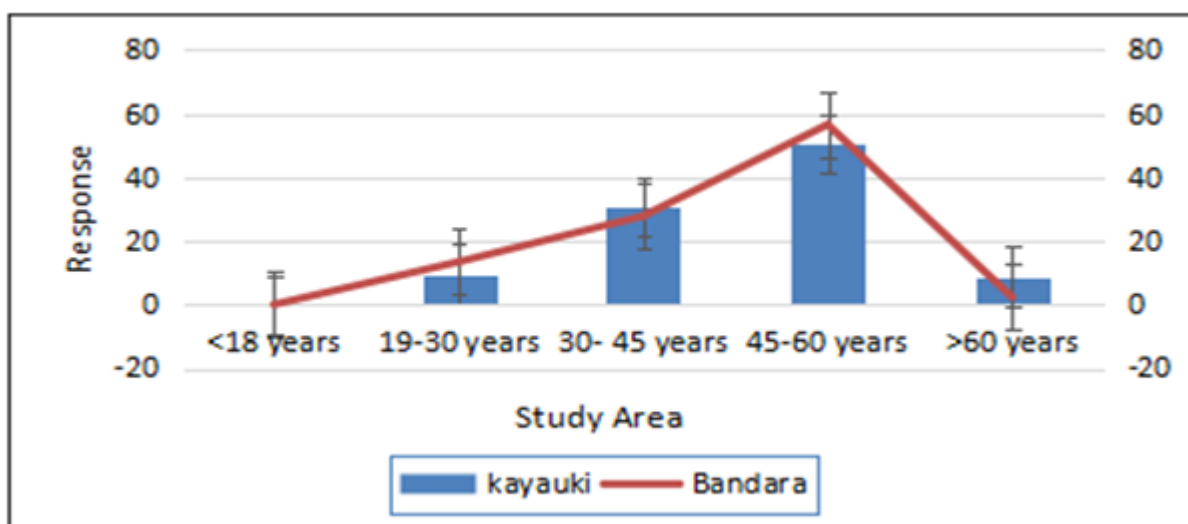


Figure 4.19: Age Distribution of Respondents. Source: Field Survey, 2023

Qualification of Respondents

Education is the most significant element that influences the socioeconomic conditions of a society; an educated household head will manage family affairs better than an uneducated one. Table 4.17 study reveals that 12% of the sampled population in Kayauki village has no education; 30% had primary education, 52% had secondary education, and 5% had vocational training. Moreover, in Fandare village, 3% had no education, 24% had primary education, 60% had secondary education, and 12% had vocational training. This finding corroborates with the study of Cruces and Wodon (2007), who reported that a high job qualification of the household head positively impacts the household's life. Little *et al.* (2008) reported that having a family member with secondary and university education and stable employment in the formal sector can increase the household's income in general.

Table 4.17: Educational Qualification of Respondents

EDUCATION STATUS	KAYAUKI (%)	FANDARE (%)
No education	12	3
Primary education	30	24
Secondary education	52	60
Tertiary education	1	1
Vocational skills	5	12

Source: Field Survey, 2023



Plate 4.10: Schools in the Study Area. Source: Field survey, 2023

Income of Respondents

As presented in Table 4.18, the sampled Kayauki community members that earned less than ₦10,000 (2.1%), ₦11,000 to 30,000 (16.2%), ₦31,000 to 50,000 (40.3%), ₦51,000 to 60,000 (32.4%) and above ₦60,000 (9%) as monthly income. While in the Fandare community, 1.6% earn less than (N10,000), 15.7% earn between (N11,000 to 30,000), 35.3% earn between (₦31,000 to 50,000), 37.1% between (₦51,000 to 60,000) and 10.3% earned above ₦60,000. This implies that 20% of the respondents earn above ₦1500 Nigerian Naira (about USD 2.5) daily. The United Nations poverty level benchmark uses a daily income of US\$ 2 (equivalent to 750 Naira daily). This shows that between 1% and 20% of the respondents have income levels above this limit. This implies that 80% of the respondents are below the poverty line. National poverty incidence surveys conducted between 1996 and 2004 indicated that 65.6% of Nigerians were below the poverty line in 1996, but this declined to 54.4% in 2004 (Omonona, 2010). The Nigeria National Bureau of Statistics (NBS) estimated that about 61% of the population falls below the national poverty line (of less than 2US\$/day), with 78% recorded in the northwest region of the country (NBS, 2012).

Table 4.18: Income of Respondents

INCOME MONTH	PER	KAYUKI	FANDARE
		PERCENTAGES (%)	PERCENTAGES (%)
< ₦10, 000		2.1	1.6
₦11,000-30,000		16.2	15.7

₦31,000-50,000	40.3	35.3
₦51,000, 60,000	32.4	37.1
>₦60,0000	9	10.3
Total	100	100
Mean	20	20
Standard Deviation	16	15.6

Source: Field Survey, 2023

Household Size of Respondents

Household size is the primary factor that influences the socioeconomic conditions of a family. Table 4.19 indicated that 30.7% of the respondents had between 1 and 5 members in their households, 61.2% of the sample respondents had 6-10 household members, and 8.1% had a household size above 10. This shows that most respondents had a large family size with a mean of 5-6 members in the study area. The results are in concurrence with Choudhary *et al.* (2009), who reported that families that live in larger households with an average family size of 8 persons are in the poorest quantile as compared to 6 persons in the non-poor quantile and a similar pattern has been found in many developing countries (Nguyen, 2007; Amara & Sial, 2009).

Table 4.19: House Side Distribution

HOUSEHOLD SIZE	PERCENTAGE (%)
1-5	30.7
6-10	61.2
Above 10	8.1
Total	100
Mean	33.3

Source: Field survey, 2023

Religious Belief of Respondents

Culture and religion firmly grip many human activities, such as farming, mining, trading, etc. Cultural and religious factors greatly influence the adoption of occupation types in Africa, as social norms and beliefs taught during upbringing are modified and stimulated by environmental context, which influences people's choices in life decisions. Table 4.20 reveals that all the sampled population were

Muslims. This study supports the findings of Eneji *et al.* (2012), Olupone (2014), Kotsadam and Tolonen (2016), and Varfolomeeva (2023) that culture and religious belief are the bedrock in which people in rural-urban Africa make career choices.

Table 4.20: Religious Beliefs of Respondents

COMMUNITIES	BELIEFS		
	Christianity (%)	Islam (%)	Traditional (%)
Kayauki	0	100	0
Fandare	0	100	0

Source: Field Survey, 2023



PI

Figure 4.11: Religious Centre (Mosque) in the study area. Source: Field Survey, 2023

Occupational Status of Respondents

Figure 4.20 reveals that respondents in the proposed project area engaged in different occupations. About 54% of the sampled respondents were farmers, 25% were into mining, 3% were artisans, and 35% were engaged in trading.

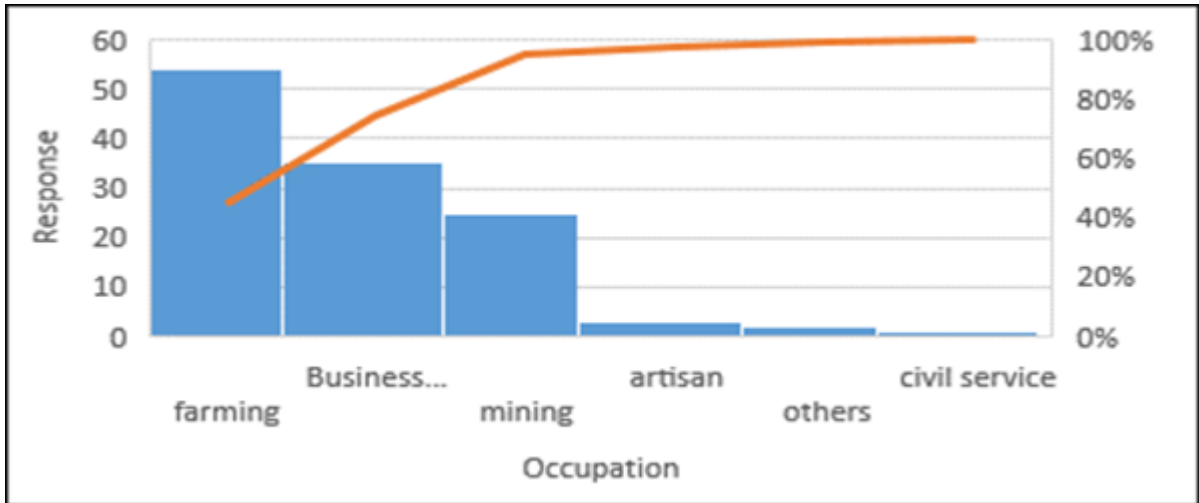


Figure 4.20: Occupational Status of Respondents. Source: Field Survey, 2023



Figure 4.12: Occupation of Residents (Roadside Business) in the Study Area Source: Field Survey, 2023

Building Characteristics of the Respondents

Decent housing is a human right in maintaining a sustainable life. Housing is defined as the first need of vulnerable populations following natural and manufactured disasters (Kissick *et al.*, 2006). Table 4.21 shows that 7.5% of the dwellings in the

proposed project location are constructed using cement blocks, and 92.5% use plastered mud for their walls. Also, 20% used Asbestos slate and 80% used aluminium sheets as roofing. About 3% of dwellings in the study area use pit latrines, and 75% of the houses have a toilet facility outside the building. This implies that the lack of water access has pushed the host communities' residents to use pit latrines. This corroborates the study of Jenkins and Curtis (2005), which states that water within households' aids convenience, comfort, and privacy by influencing the demand for sanitation.

Table 4.21: Type of Building within the Proposed Project Area

BUILDING PARTS	VARIABLES	PERCENTAGE (%)
Construction Material (Wall)	Plastered Mud	92.5
	Mud	0
	Cement Block	7.5
	Total	100
Construction Material (Roofing)	Asbestos Slate	20
	Aluminium sheets	80
	Thatched roof	0
	Total	100
Construction Material (Floor)	Earthen	95
	Cement	5
	Tiles	0
	Other	0
	Total	100
Toilet Facility	Pit latrine	3
	Water system	0
	Toilet facility outside dwelling	97
	None	0
	Other	0
	Total	100

Source: Field Survey, 2023



Plate 4.13: Housing Types in the Study Area. Source: Field Survey, 2023

Land Ownership in the Study Area

Regarding ownership of land, the results of this study, as presented in Table 4.22, showed that 88.7% of the respondents agreed that they owned their land, 8.8% did not own any land, and 2.5% did hire land for farming activities. This shows that most respondents owned land in the mining communities. Thus, land conflicts were settled through negotiations between the parties involved. This result is in accordance with the study of Woods (2009). Woods' holds that traditionally, the class structure of rural society was based on property relations. That is, land ownership brought not just status but also power relations in a rural economy based on the exploitation of land through agriculture, forestry, mining, and quarrying.

Table 4.22: Land Ownership Status of Respondents

LAND OWNERSHIP	FREQUENCY	PERCENTAGE (%)
Owned	71	88.7
Not owned	7	8.8
Rented	2	2.5
Total	80	100

Source: Field Survey, 2023

Farming Experience

Figure 4.21 reveals that 4.3% of the respondents have farming experience of less than 10 years, 26.1% had experience of 10-20 years, 63.5% had between 20-30 years' experience, and 6.1% had more than 30 years of farming experience. This indicated that most respondents had 25 years of mean farming experience, although some were engaged in mining activities. The findings of this study agree with those of Yunana and Banta (2014), who stated that 67% of farmers in Jema'a LGA in Kaduna State had over 20 years of experience in farming.

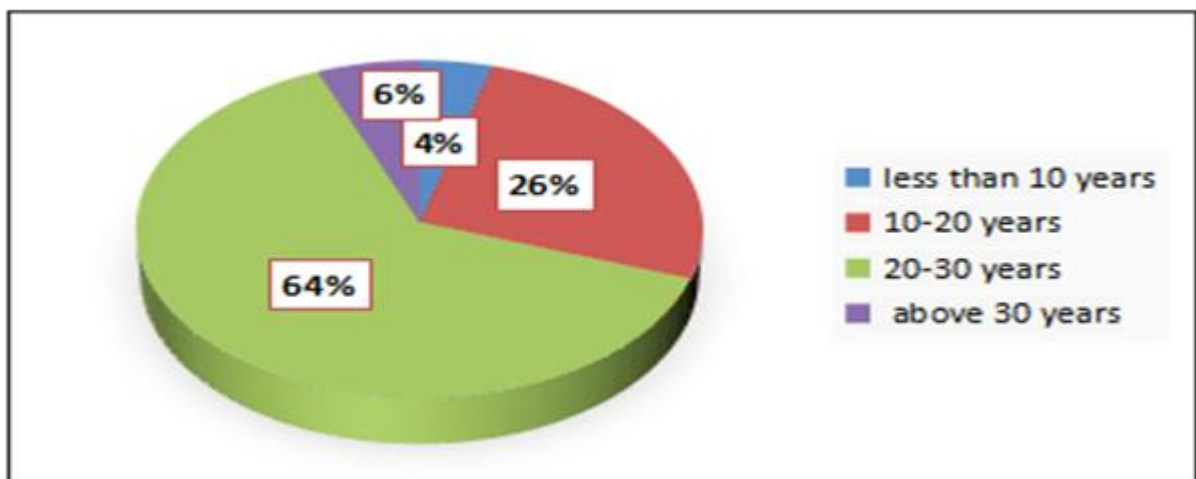


Figure 4.21: Farming experience. Source: Field Survey, 2023

Type of Crop Production

Figure 4.22 reveals that 27% of the sampled population were into sorghum farming, 37% were into maize farming, 24% cultivated millet and 12% farm groundnut. This implies that maize, millet, and sorghum are most produced and grown in the community. This is in line with the Katsina State Community and Social Development Project (KSCSDP, 2012) report, which affirmed that in Katsina State, the cultivation of maize, millet and sorghum are the most produced crops. Furthermore, it conforms with the findings of Inkani (2015), which affirmed that maize and millet are the most consumed staple foods in Katsina State.

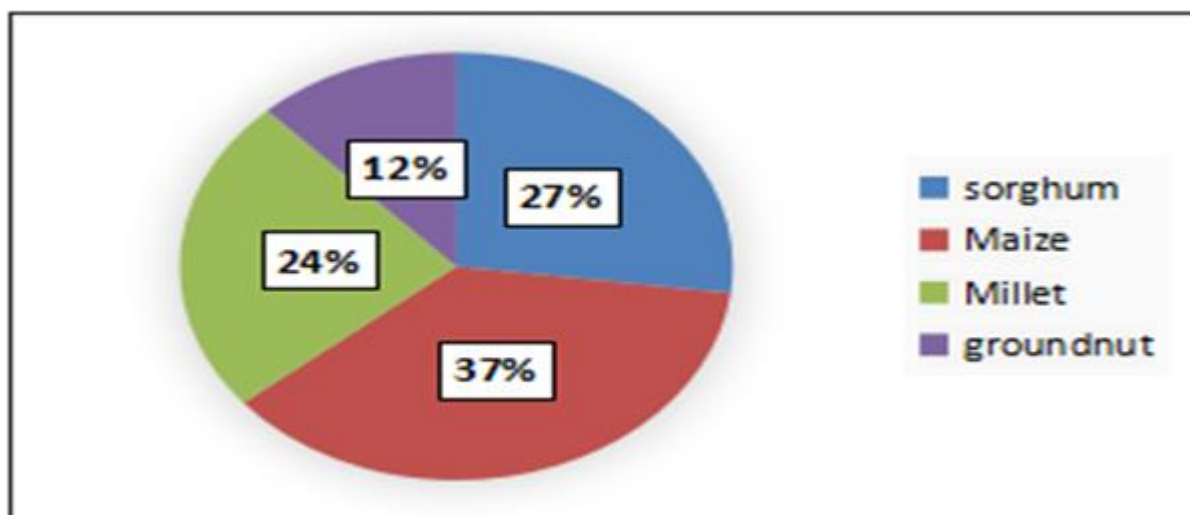


Figure 4.22: Type of Crop Production
Source: Field survey, 2023



Plate 4.14: Farming Activities in the Study Area. Source: Field Survey, 2023

4.11.2 Factors that hinder Farming Activities

The focus group discussion revealed problems in farming activities, including production, marketing, financial, and institution set-up (see Table 4.23). Lack of credit facilities was ranked first, price determination of farm produce ranked second, and lack of adequate farm tools ranked third among the most significant problems farmers face within the host communities.

Table 4.23: Factors that hinder Farming Operation

FACTORS	PERCENTAGES (%)	RANK
Shortage of land	20	8 th
Diseases problem	25	5 th
Inadequate farm implement	50	3 rd
Lack of market	15	4 th

Price setting	50	2 nd
Lack of storage facilities	28	6 th
Lack of credit facility	61	1 st
Transport problem	45	7 th

Note: *percentage was based on multiple responses from the sample population

Source: Field Survey, 2023

Source of Energy and Water across the Area

The primary energy source and water for domestic use in the study area are outlined in Table 4.24. The study revealed that the most common water sources within the communities are wells and boreholes. Water demand and water availability were considered fundamental elements in the computation of water scarcity in rural communities in Nigeria. Energy consumption and usage are firewood for cooking, Kano Electricity Distribution Company (KEDC) and generators for lighting. Also, most inhabitants patronise sachet water as drinking water due to the lack of pipe-borne water within the communities.

Table 4.24: Respondents' Source of Energy and Water

	KAYAUKI VILLAGE	FANDARE VILLAGE
Sources of Energy	<p>Lightning 43.7% of the respondents indicated (KEDC) as their primary source of energy 56.3% of respondents indicated generators as the primary source of energy for lightning</p> <p>Cooking 1.5% of the respondents indicated they use gas for cooking, 10.4% use kerosene, 4.7% electricity, 83.4% firewood</p>	<p>Lightning 97% of the respondents use generators as a means of energy for lighting, while 3% rely on KEDC for lighting.</p> <p>Cooking 75% use firewood for cooking, and 25% use kerosene</p>
Sources of Water	<p>Drinking</p> <ul style="list-style-type: none"> • Borehole 60.1% • Water vendors such as sachet water (16.5%), • Well (23.4%), <p>Bathing and Washing</p> <ul style="list-style-type: none"> • Borehole (85%), • Well (5%), • River/stream (10%) 	<p>Drinking 85.1% get their water from boreholes, 5% from wells and 9.9% from water vendors.</p> <p>Bathing and Washing 70% use boreholes for bathing and washing, 10% use wells, and 20% use the stream.</p>

Source: Fieldwork, 2023

Water is predominantly a limiting factor and is an issue that cannot be ignored as recurrences of droughts and climate variability continue to affect many communities in Sub-Sahara Africa. Water scarcity occurs in space and time (Zakieldeen, 2009;

Ford, 2011). The World Development Goal Indicators for 2005 defines access as the availability of a minimum of 20 litres per person per day or 7.3 m³ per person per year from a water source within 1km of the dwelling (World Bank, 2005). Accessibility measures how well a person can reach a place or a place can be reached (Olujimi, 2007). The Focus Group discussion revealed that 5% and 15% of respondents walk less than 500m and between 500m to 1km, respectively, to get water. This implies that over 80% of respondents walk a longer distance (to Makera quarters: 2km and Makurda 2.5km) to source water (see Table 4.25).

Table 4.25: Water Situation Needs in the Study Area

QUANTITY OF WATER REQUIRED DAILY PER HOUSEHOLD	PERCENTAGES (%)
1-50 litres	6.5
50-100 litres	18.8
100-150 litres	31.8
150-200 litres	42.9
Total	100
Distance to Water Source	
Less than 500 m	5
500m to 1km	15
Above 1km	80
Total	100

Source: Fieldwork, 2023



Plate 4.15: Sources of Water and Energy in the Study Area. Source: Field survey, 2023

4.11.3 Poverty Profiles of the State

The 2013 Katsina State CSDP survey report also revealed a high incidence of poverty among the rural communities of the State. The report revealed that the poverty level varied between about 54.4%-69%. Absolute Poverty, defined in terms of the minimum requirements necessary to afford minimal standards of food, clothing, healthcare and shelter, was above 60% in all the communities surveyed. For the-Dollar per-day measure (referring to the proportion of those living on less than US\$2 per day poverty line), the survey found out that about 50% of the people in the southern and up to about 70% in the northern parts of the state were living below US\$2 per day.

Measurement of Poverty in the Proposed Project Location

The poverty level was measured on a 3-point scale based on severity: very severe, severe, and not severe. Table 4.26 shows that low-income level was ranked as the most severe measurement of household poverty with a mean of 33.3, poor access to good security with a mean of 50, inadequate access to portable water with a mean of 50, poor access to standard health facilities with a mean of 33.3, weak community organisations with a mean of 33.3 and lack of access to credit facilities with a mean of 33.3. This implies that the most severe measurements of poverty were low-income levels and poor access to good security.

Table 4.26: Measurement of Poverty in the study area

VARIABLE	VERY SEVERE	SEVERE	NOT SEVERE	MEAN
Inadequate access to portable water	70.6	29.4	0	50
Poor access to good security	40.9	59.1	0	50
Low-income level	30.1	60.8	9.1	33.3
Poor access to health facilities	40.1	59.5	0.4	33.3
Weak community organisations	3.1	13.8	83.1	33.3
Lack of access to credit facilities	27.7	62.9	9.4	33.3

Source: Fieldwork, 2023

4.11.4 Availability of Dispensary Services

Figure 4.23 reveals that 99% and 95% of the sample respondents in Kayauki and Fandare agreed that there is a dispensary unit (clinic) in the area with 35% and 46% adequacy in service delivery.

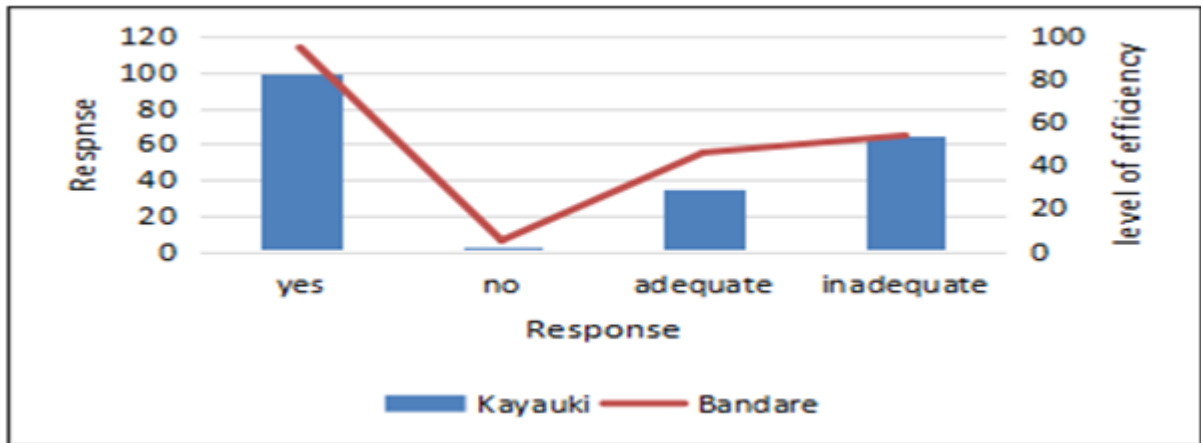


Figure 4.23: Dispensary Services in the Study Area. Source: Fieldwork, 2023

4.11.5 Prevalent Ailment in the Proposed Project Area

Table 4.27 shows that the most common ailments in the study area are malaria and typhoid fever, which account for 78.6% and 15.7%, respectively. There were no reported cases of cardiac problems during the period under study.

Table 4.27: Prevalent Ailment in the Study Area

AILMENT	FREQUENCY	PERCENTAGE (%)
Whooping Cough	-	0.0
Tuberculosis	-	0.0
Asthma	1	1.4
Dysentery	-	0.0
Diarrhoea	-	0.0
Cholera	-	0.0
Pile	-	0.0
Hypertension	1	1.4
Congestive Health Problem	-	0.0
Pneumonia	-	0.0
Epilepsy	-	0.0
Rheumatism	-	0.0
Rashes	-	0.0
Eczema	2	2.9
Ringworm	-	0.0
Eye pains	-	0.0
Cataract	-	0.0
Glaucoma	-	0.0
Typhoid fever	11	15.7
Malaria	55	78.6
Sickle Cell Anaemia	-	0.0

STDs	-	0.0
Total	-	

Source: Fieldwork, 2023

4.11.6 Insecurity Situation in the Study Area

Crime is a threat to the economic, political, and social security of a nation and a significant factor associated with underdevelopment because it discourages both local and foreign investments, reduces the quality of life, destroys human and social capital, damages the relationship between citizens and the states, thus undermining democracy, the rule of law and the ability of the country to promote development. Katsina State is one of the most attractive states and is one of the areas most targeted by criminals in the northwest part of Nigeria. The State battles with criminal acts due to the influx of people (Onoge, 1988; Gulumbe et al., 2012). According to Ahmed, Muhammad, and Muhammed (2013), the city has too many almajiris stranded and neither employed nor employable; this group contributes to crime incidents. From the Focus group discussion, all the respondents stated that robbery, cattle rustling, and kidnapping are the significant problems the community faces. Figure 4.20 shows the spatial distribution of crimes in Katsina and its environs.

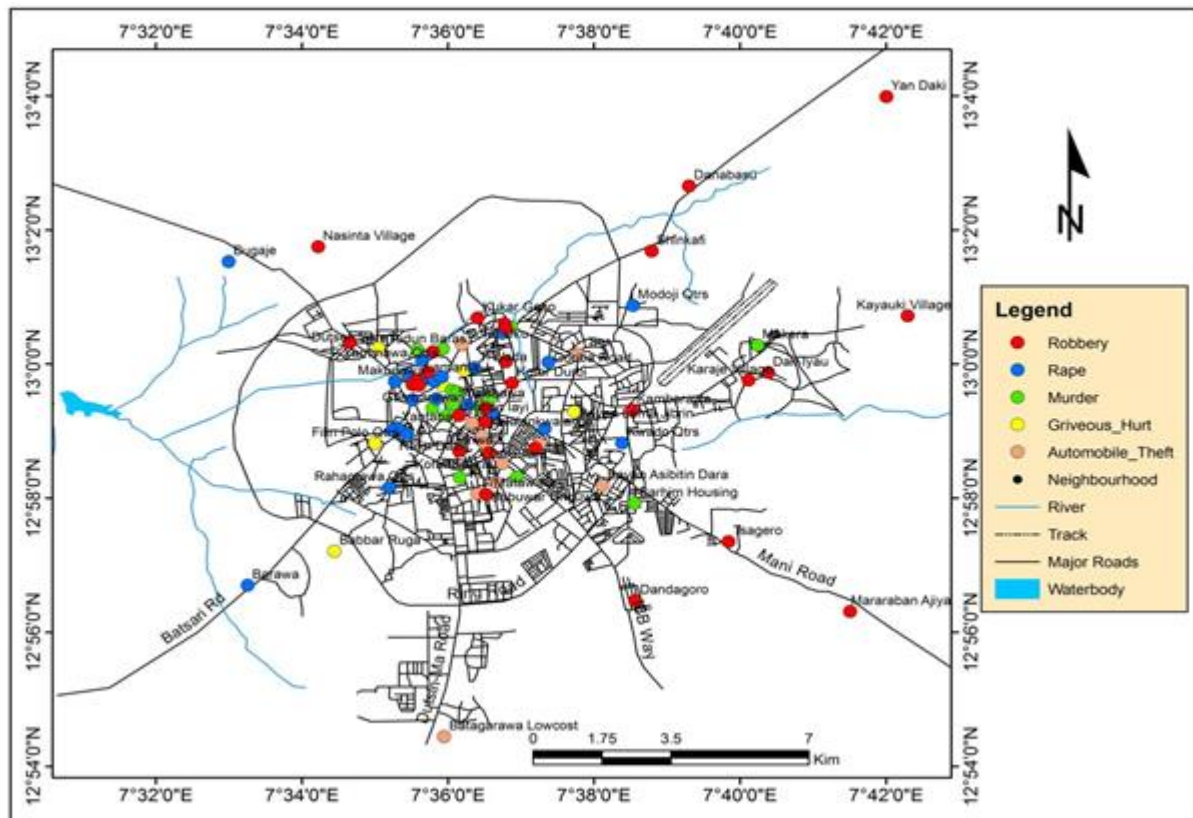


Figure 4.24: Crime Distribution Pattern in Katsina. **Source Adapted from Ahmed, 2018**

4.11.7 Views of the Host Community towards the Proposed Project

As summarised in Table 4.28, 30% of the community members stated that the proposed project would help the host community reduce poverty, 50% stated that the proposed project would help reduce unemployment, 10% believed that the project would bring development to the community, and 10% agreed that the project would improve their livelihood.

Table 4.28: Views of the Respondents

VARIABLES	PERCENTAGES (%)
Poverty	30
Unemployment	50
Community Development	10
Improve in livelihood	10
Total	100

Source: Field survey, 2023

4.11.8 Traffic Condition

Table 4.29 shows that most motorists prefer to travel between 10 a.m. and 4 p.m. daily due to the high level of insecurity in the study area.

Table 4.29: Traffic Flow within and around the Project Area

PERIOD (S)	DONKEY/HO RSE	MOTORCYCLES	BUS	SUV/ SALOON CAR	TRUCK/ TRAILER
8:00 -10:00 am	-	10	-	3	-
10:00-12:00 pm	2	21	1	6	-
12:00-2:00 pm	-	12	-	9	2
2:00-4:00 pm	1	16	2	7	5
4:00-6:00 pm	-	4	1	6	3
Total	3	63	4	31	10

Source: Field Survey, 2023



Plate 4.16: Form of Transportation in the Study Area. Source: Field Survey, 2023

4.12 Stakeholders Engagement

In the EIA process, consultation with stakeholders and participation are essential. EIA is not complete without consultation and participation by stakeholders. The consultation exercise commenced at the very early stage of the environmental impact process and is planned to continue throughout the project. The Stakeholders Engagement process has been designed to comply with regulatory requirements in Nigerian environmental legislation and, where possible, implement international good practices. The process allows stakeholders to evaluate the proposed project

and submit comments to enhance project benefits while minimising the project's adverse effects.

4.12.1 Objectives of the Consultation

The objectives of the consultation of the proposed project are summarised as:

- Creating public awareness and understanding of the proposed project.
- Inform the stakeholders about the proposed project activities and ensure their acceptance.
- Develop and maintain a medium of communication channels between the project proponent and stakeholders' opinions about the Socio-Environmental risks and potential benefits associated with the project and the measures and actions put in place to mitigate any anticipated impact.
- Discuss the nature and scale of any adverse impact the proposed project might cause and lay down the mitigating measures directly and transparently.
- Getting feedback from the stakeholders on issues of concern and expectation about the proposed project to optimise the project.
- Creating a solid social and institutional dialogue to assess the strength and perception of the proposed project's social acceptability.
- Document all the stakeholders' views and opinions about the proposed project and sensitise the community members from cluster level to state level about the project activities and intervening opportunities.

4.12.2 Stakeholders Identification

Key relevant stakeholders were duly consulted. The approach used in the consultation exercise is as follows: issuance of notice of intent to conduct an EIA for the proposed development; terms of reference to regulatory Agencies and potential stakeholders; transparent method of compensation payment to all affected parties; consultation with stakeholders with explanations on critical issues as they arise and affect the people. The primary stakeholders identified for the proposed project are Immediate communities, Local Government, Traditional councils in the project area, and Katsina State Government. Also, the regulatory bodies identified are the Federal

Ministry of Environment Abuja (FMEnv), Katsina State Ministry of Environment, Katsina State Ministry of Resource Development, and the Ministry of Solid Minerals Development. Also, community-based organisations within and around the proposed project environment were consulted.

The consultation team has sought to ensure that all identified stakeholders, including the project-impacted communities, are aware of the proposed Project and the EIA process through extensive community consultation. The stakeholder engagement strategy was designed to attain meaningful participation and involvement that enabled stakeholders and the community to actively contribute to developing new ideas and options as the Project is planned and developed. The list of stakeholders and engagement activities is shown in Table 4.30.

Table 4.30: List Stakeholders and Engagement Activities

STAKEHOLDERS	STAKEHOLDERS LEVEL			ENGAGEMENT ACTIVITY	
	NATIONAL	STATE	LOCAL	MEETING	LETTER
Federal Ministry of Environment (FMEnv)				✓	✓
Katsina State Ministry of Environment				✓	✓
Katsina State Government					✓
Batagarawa LGA				✓	✓
Rimi LGA					✓
Traditional Councils				✓	
Members of Communities				✓	
State Security Services (SSS)				✓	✓
Nigeria Police, Katsina State Command				✓	✓
Vigilante groups				✓	
Women/Youth groups/ CBO's				✓	

Source: Field Survey, 2023

4.12.3 Scoping and Community Engagement Exercise

The scoping workshop of the proposed project was done on the 29th of September 2023, at the project site. State. The objectives of the scoping exercise cover the

identification of stakeholders, formal announcement of the project, provision of project and EIA details and identification of potential project risks. At the same time, the medium used for the scoping was background information on the project, information and presentation of the project, key stakeholder meetings, site verification and feedback. The lead consultant - Mr. Ahmad Sa'ad, gave a presentation during the scoping exercise. The presentations entailed an outline of the project, the environmental assessment process, and the identified main potential issues or impacts. The Minister's Representative (FMEnv Rep) delivered the Opening remark of the programme. He stated that the process is an essential aspect of the EIA process and that the Ministry considered it, so he is present to attend the meeting; he further said he brings greetings from the ministry and the Director, Mr Abbas Suleiman. He further mentioned that the ministry is highly interested in projects like this because they help deliver infrastructure to the people and promote the urbanisation of our cities while addressing critical development issues. Also, He touched on the importance of the scoping workshop as an opportunity to highlight concerns of the project and find practical solutions, stating that no project is without possible environmental impact. He commended the proponent for subjecting the project to the EIA process right from this conceptualisation stage.

Table 4.31: Scoping Workshop Method

STAKEHOLDERS	ISSUES DISCUSSED	DATE
Federal and State Ministry of Environment	Regulatory requirements and involvement	29 th September 2023
Key stakeholders Engagement	Traditional governance, belief systems, conflict management procedures, social structures, infrastructural networks, livelihoods, environmental problems, community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community needs, and development prospects.	29 th September 2023

Source: Field Survey, 2023



Plate 4.17: Scoping and Site Inspection Exercise. Source: Field Survey, 2023

4.12.4 Public Consultation

The public forum with Project Affected Communities, NGOs, CBOs, youth groups, Women organisations, religious organisations, and traditional bodies for the Environmental and Social Impact Assessment (ESIA) was conducted on 29th and 30th September 2023 in line with the FME_{env} requirements, which require that an extensive consultation with relevant stakeholders and community members of the proposed project (Table 4.32). Public consultation is an integral aspect of an ESIA process and the procedure for scoping the proposed project to ensure that all relevant stakeholders, individuals, or organisations register their opinions about the proposed project. The participants of the community consultation are traditional rulers, elders, members of the host community, women, and youths. For the ESIA study, the stakeholders' consultations were divided into primary and secondary stakeholders. The primary stakeholders include those who benefit from the proposed project implementation (i.e., workers, community members and others affected by the project). On the other hand, the secondary stakeholders are the bodies of interest to the proposed project, such as the Local and State Governments, the Ministry of Environment and NGOs. The consultation meeting took place at the palace of Magajin-Garin of the Batagarawa community. The consultation was conducted to ensure the effective participation and awareness of

the people and to document comments, suggestions and concerns raised about the project.

Table 4.32: Scoping and Community Engagement Exercise Schedule

EXERCISE	VENUE AND DATE	LOCATION	NO. OF ATTENDANCE
Federal and State Ministry of Environment	29 th September 2023	Batagarawa, Katsina State	6
Ministry of Solid Minerals Development	29 th September 2023	Batagarawa, Katsina State	6
Batagarawa Traditional Council	Magajin-Garin Palace	Batagarawa, Katsina State	24
Batagarawa Community engagement	30 th September, 2023	Batagarawa, Katsina State	46

Source: Field Survey, 2023



Plate 4.18: Community Engagement Exercise. Source: Field Survey, 2023

4.12.5 Community Expectation

The communities' expectations consist mainly of human capital development and infrastructural facilities, such as creating more employment opportunities, empowering community members through skills acquisition, and infrastructural development in communities regarding providing portable water.

However, the community members were assured by Eso Terra that the project will lead to job creation for both skilled and unskilled individuals in the community and they will be given the opportunity to any job vacancy first except where they do not have requisite skill and qualification. The project will give rise to community development agreement (CDA) that will encompass all form of human capital development, and skills acquisitions. Also in responding to their concern the team

informed them that the CDA will cover the provision of portable water supply to the community.

4.12.6 Community Concern

The primary community concerns about the proposed project were noise pollution from blasting during the operational phase, vibration effects on buildings, and dust that might arise from the project.

The community was assured by the team of experts that their concerns on noise pollution, vibration and dust will be addressed during project implementation and that mitigation measures are being prepared to reduce considerably any form of noise pollution by ensuring blasting is limited to more convenient periods and is scheduled. While the dust generation from crushing and other activities will be suppressed using water sprinklers.

CHAPTER FIVE

POTENTIAL AND ASSOCIATED IMPACT ASSESSMENT

5.1 General

This chapter presents the results of Eso Terra Investment Limited's assessment of the potential and associated environmental impact studies of the proposed 35121QLS Kayauki Quarry. The evaluation covered impacts on the biophysical environment, human health, and safety.

Therefore, the impact assessment approach entailed matching the different onsite activities and project phases described in Chapter 3 with the baseline components of the project environment presented in Chapter 4.

5.2 Impact Assessment Methodology

A modified ISO 14000 approach for assessing environmental aspects and impacts was used to systematically assess the potential and associated impacts of the proposed project. The method entailed the identification/assessment/evaluation of the potential and associated impacts of the proposed project using a three-stage approach. The processes involved, firstly, the extraction of specific project tasks with environmental undertones, then identifying the environmental aspects (elements of the project activities that interact with the environment either positively or negatively) using a screening criterion. The checklist of identified aspects was evaluated for significance using set environmental criteria, which included stakeholder expectations, regulatory requirements, public perception, industry best practices, abatement costs, relative contribution, scientific evidence, and sensitivity to the receiving environment. Following this, the identified significant aspects were recorded. The output (environmental aspects records) in conjunction with various source reference materials to identify and characterise the potential and associated impacts of the proposed project. The identified impacts were evaluated, and mitigation measures were proffered for significant adverse impacts.

The output (environmental aspects records) was used with various source reference materials to identify and characterise the potential and associated impacts of the proposed projects. The identified impacts were then evaluated, and mitigation measures were proffered.

Mitigation measures meant to prevent, reduce, or control adverse environmental effects of a project were developed for the adverse significant potential impacts through a review of industry experience, consultations, and expert discussions with a multi-disciplinary team of engineers and scientists. (**Table 5.1-5.6**)

5.2.1 Impact Identification

The environmental aspects of the proposed projects were obtained from the planned project activities. These aspects were then matched with the existing baseline description of the project environment and used to develop a checklist of cumulative, potential, and associated impacts of the proposed projects

5.2.2 Impact Characterization

The identified impacts of the proposed projects were further characterised, as explained in the items listed below. The characterisation was based on the nature, characteristics, and estimated duration of the various project activities on the ecological components of the project environment as well as human health and safety.

Beneficial Impacts: These have a positive and substantial effect on the environment. Chapter 2 of this report highlights the primary benefits of the proposed projects.

Adverse Impacts: These are impacts that may result in irreversible and undesirable change(s) in the biophysical environment, a decrease in its quality, limitation, restriction, or denial of access to or use of any component of the environment to others, including future generations, and sacrifice of long-term environmental viability or integrity for short-term economic goals.

Direct Impacts: Direct impact occurs through direct interaction of an activity with an environmental, social, or economic component.

Indirect Impacts: Indirect impacts on the environment are impacts that are not a direct result of the project or are at least one step removed from a project activity. They do not follow directly from a project activity.

Short-term Impacts: These are defined as impacts that will last only within the period of a specific project activity.

Long-term Impacts: These effects remain even after a specific project activity.

Reversible Impacts: These impacts can be addressed by applying adequate mitigation measures.

Irreversible Impacts: These are impacts whose effects are such that the subject (impacted component) cannot be returned to its original state even after adequate mitigation measures are applied.

Cumulative Impacts: Cumulative impacts consist of an impact created because the project evaluated in the EIA is combined with other projects causing related impacts. These impacts result from simultaneously interacting between ongoing project activities and other activities.

Incremental Impacts: These progress with time or as the project activity advances.

Residual Impacts: These would remain after mitigation measures have been applied.

5.2.3 Impact Evaluation

Impact evaluation assesses the changes that can be attributed to a particular project. At this stage, the potential and associated impacts identified and characterised at the previous stage of the assessment process (**see Sections 5.2.1 – 5.2.2**) were evaluated. The evaluation was based on clearly defined criteria

(legal/regulatory requirement, risk, impact frequency, importance, and public interest/concern) to determine the significance or otherwise of each impact. The criteria and weighting scale adopted for the evaluation are described below.

Legal/Regulatory Requirements (L)

The project activities that resulted in impacts were weighted against existing legal/regulatory provisions to determine the requirement or otherwise for permits prior to executing such activities. Such legal/regulatory requirements were identified from the laws/guidelines, which have been reviewed in Chapter 1 of this report, and those guidelines in the source references relating to the proposed project activity as presented in Section 5.2 and subsection 5.2.1.

Table 5.1: The Weighting Scale

CONDITION	RATING
No legal/regulatory requirement attached to environmental impact	1= Low
Legal/regulatory requirements associated with environmental impact	3= Medium
A permit is required prior to conducting project activity with environmental aspects, which may result in impact on the environment	5= High

Risk Posed by Impact

The criteria used to categorise the risk posed by the impacts of the proposed projects address the severity of the consequence and its probability or likelihood of occurrence. The consequence criterion considers the project area's environmental and socio-economic (workers/public health and safety) attributes, as shown below in Table 5.2.

Table 5.2: Consequence Criterion

CONSEQUENCE	SEVERITY RATING	ATTRIBUTE ENVIRONMENTAL	– ATTRIBUTE– WORKERS/PUBLIC HEALTH AND SAFETY
Negligible	1	Minor/Little or No Response Needed	<ul style="list-style-type: none"> Slight injury (nomedical/first aid treatment required)
Minor	2	Moderate/Limited Response of Short Duration	<ul style="list-style-type: none"> Minor injury (no lost time)

			<ul style="list-style-type: none"> No impact on public
Moderate	3	Serious/Significant Commitment	<ul style="list-style-type: none"> Major injury (lost time) Limited impact on public
Major	4	Major/Extended Duration/Full-scale Response	<ul style="list-style-type: none"> Single fatality Multiple major injuries Serious impact on public
Severe	5	Multiple Occurrences/Elongated Duration/Larger Scale Response	<ul style="list-style-type: none"> Multiple fatalities Loss of life

These consequence criteria are combined with the probability of occurrence to evaluate and categorise the risks posed by impacts into “high = 5”, “medium = 3”, and “low = 1” risks, as summarised below in **Figure 5.3**.

Table 5.3: Risk Rating

RISK	ATTRIBUTE
1= Low	This means that no further mitigation may be required.
3= Medium	This means that the impact can be mitigated with additional controls and modification
5= High	This means that the impact requires avoidance or major control/mitigation.

Magnitude of Occurrence of Impacts (F)

Evaluation of the magnitude (anticipated nature, duration, and frequency) of occurrence of each impact was also conducted. Magnitude of occurrence was rated as “high,” “medium” or “low” based on the historical records of accidents/incidents, consultation with experts (in the oil and gas industry operations) and professional judgment. The magnitude criterion is summarised below.

Table 5.4: Magnitude Criterion

Magnitude	Attribute – Environmental, Human Health and Safety

5 = High	<ul style="list-style-type: none"> • Major degradation in quality in terms of scale (>1% of the study area or habitat within the study area), appearance, duration (beyond the duration of the project) • Irreversible or only slowly recoverable (change lasting more than one year) in degradation of environmental ecosystem level (population, abundance, diversity, productivity) • High frequency of impact (occur continuously and throughout the project execution period) • Wider geographic extent
3 = Medium	<ul style="list-style-type: none"> • Degradation in quality in terms of scale (>0.1% of the study area, habitat), appearance, duration (a few months) • Effect beyond naturally occurring impacts variability • Slow reversibility (change lasting a few months before recovery), lasting residual impact • Potential for cumulative impact • Intermittent frequency of impact (occurs on only a few occasions during the project execution period) • Limited geographic extent of impact
1 = Low	<ul style="list-style-type: none"> • Minor degradation in quality in terms of scale (<0.1% of the study area, habitat, very localised), appearance, duration (a few days to a month), effect within range of naturally occurring impacts, changes, dynamics • Rapid reversibility (change lasting only a few weeks before recovery), no lasting residual impact of significance • No potential for significant, cumulative impact, low frequency of impact (occur on just about one occasion during the project execution period) • Only very localised geographic extent of impact (e.g. not more than a few meters from impact source point)

Importance of Environmental Component (I)

The importance of the target environmental component with respect to the identified potential impact was also determined and rated as “high,” “medium,” or “low.” The ratings were based on the Consensus of opinions among consulted experts, including project engineers/scientists and other stakeholders of the proposed project. The importance criterion is summarised below (Table 5.5).

Table 5.5: Importance Criterion

Importance	Attribute – Environmental
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5 = High	<ul style="list-style-type: none"> • Highly undesirable outcome (impairment of endangered,protected habitat, species) • Detrimental, extended flora and fauna behavioural change (Breeding, spawning, melting) • Major reduction or disruption in value, function, or service of impacted resource. • Impact during environmentally sensitive periods of continuous non-compliance with the statute
3 = Medium	<ul style="list-style-type: none"> • Negative outcome • Measurable reduction or disruption in value, function, or service of impacted resource • Potential for non-compliance with international best practices
1 = Low	<ul style="list-style-type: none"> • Imperceptible outcome • Insignificant alteration in value, function, or service of impacted resource • Within compliance, no controls are required

Public Interest/Perception (P)

The public's interest in and perception of the proposed project and the identified potential/associated impact were determined through consultation with the proposed project stakeholders. Ratings of "high," "medium," or "low" were assigned based on consensus of opinions among the consulted stakeholders. The public perception/interest criterion is summarised below (**Table 5.6**).

Table 5.6: Public Perception / Interest Criterion

Public Perception	Attribute – Human Health and Safety
• = High	<ul style="list-style-type: none"> • Elevated incremental risk to human health, acute and or chronic • Possibility of endangering life for on-site personnel and nearby residents • Major reduction in social, cultural, and economic value • Continuous non-compliance with statute • Any major public concern among the population in the project area
3 = Medium	<ul style="list-style-type: none"> • Limited incremental risk to human health, acute and chronic • Unlikely life endangered for on-site personnel and residents • Some reduction in social, cultural, and economic value • Possibility of adverse perception among the population • Potential for non-compliance

1 = Low	<ul style="list-style-type: none"> • No risk to human health, acute and or chronic • No possibility of life endangered for on-site personnel and residents • Minor reduction in social, cultural, and economic value • Unlikely adverse perception among the population
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5.2.4 Overall Significance Ranking

The overall significance rating (Level of Significance) assigned to each evaluated impact, as presented in Tables 5.7 and 5.8, is without consideration for mitigation measures, including those controls built into project design. The ratings were based on the following considerations:

High Significance

$(L+R+F+I+P) \geq 15$ or

$(F+I) > 6$ or

$P = 5$

This category's adverse impacts would require avoidance or major control/mitigation.

Medium Significance

$(L+R+F+I+P) \geq 8$ but < 15

This category's impacts are adverse and can be mitigated with additional controls and modifications.

Low Significance

$(L+R+F+I+P) < 8$

Impacts in this category may require no further modification

Table 5.7: Phases of Project Development Activities and Source of Impact

SN	Project Phases	Activities/Source of Impact
1	Mobilisation	<ul style="list-style-type: none"> • Road Traffic in local routes and roads connecting to Katsina to Daura and the proposed 35121QLS in Kayauki quarry site, • Influx of persons into Kayauki/Fandare village and surrounding settlements within Batagarawa LGA
2	Site Preparation	<ul style="list-style-type: none"> • Road Traffic along major and minor roads connecting to Kayauki/Fandare and neighbouring areas within and outside Batagarawa LGA • Bush Clearing affecting areas within the quarry tenements and its effect on the surrounding environment • Waste Disposal • Dust affects Kayauki inhabitants and users of roads, especially the road connecting Katsina and Daura axis. • Land take and grievances from the landowners
3	Quarry Plant Construction	<ul style="list-style-type: none"> • Pilling, Welding, and Painting, resulting in increased waste generation and disposal • Road traffic along the road in Kayauki area and major connecting roads of the area. • Noise generation because of the quarry plant construction Kayauki area and road user in Katsina – Daura road
4	Operation and Maintenance	<ul style="list-style-type: none"> • Blasting, Use of Explosive, Noise, Waste Generation, Influx of Persons, Dust Emissions, Traffic Generation/Accident due to the Kayauki 35121QLS quarry operations and maintenance.
5	Decommissioning and Abandonment	<ul style="list-style-type: none"> • Dismantling and Removal of Equipment/Structures, Waste Disposal, Residual Contamination, Road Traffic/accident due to the decommissioning and abandonment activities in the quarry

5.3. Beneficial Impact

- Improvement of the economic status of landlords and traditional rulers through payment of adequate compensation.
- Mining and producing chippings of various sizes will contribute to government revenue generation.
- Contribute to the country's general economic growth as it would positively or indirectly affect some sectors of our country directly or indirectly.
- Creation of employment opportunities for skilled and unskilled labour employed at different project phases.
- Increase in socioeconomic activities due to the presence of the quarry.
- Chippings of various sizes will be made available for construction activities for the Kano-Maradi Rail Line.
- There will be a transfer of technical knowledge in the mining industry to Quarry workers.

Table 5.8: Identification and Classification of Impact

	Project Phase	Project Activity	Environmental Component	Potential and Associated Impact
Planning & pre-operation	Site Acquisition	Land take	Flora and Fauna, Land use	Restriction of access by the proposed quarry to Kayauki inhabitants and neighbouring communities
			Socioeconomic	Improvement of the economic status of landowners in the Kayauki community, such as farmers, artisans, and traditional rulers, through payment of compensation & livelihood restoration program
				Security challenges are due to the influx of workers to Kayauki and other areas in Batagarawa LGA, including the possibility of kidnapping and community disputes.
				Conflicts due to the displacement of Kayauki artisanal miners from their source of livelihood.
				Conflict due to an unsatisfactory compensation process

	Mobilisation to site	Site Survey	Personnel Health & Safety	Risk of injury to personnel due to exposure in the bushes
		Transportation of equipment/materials/personnel to worksite		Increased traffic volume on the Daura-Katsina Road
				Risk of injury, death, asset damage due to road traffic accidents and incidents
			Air quality and personnel Safety	Adverse effects on the air quality of Kayauki community and others along the road due to the emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts
Quarry Development		Site Clearance	Flora and Fauna, Land use	De-vegetation of the 35121 QL area and loss of local flora and economic trees
		Stripping of topsoil and compaction of same with earth-moving equipment within the proposed project location	Soil and Water	Changes in drainage and hydrological patterns may result in erosion and flooding in and surrounding the 35121 QLS quarry area.
			Air Quality and Personnel Safety	Adverse effects on air quality in the Kayauki community and others along the road due to the emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts
		Construction of Quarry (Quarry Plant Offices, Base camps)	Soil	Soil compaction caused by heavy vehicle movement and excavated material will affect the diversity of soil fauna within the area and alter the drainage pattern.
			Health (Radiation and Heat) of workers	Welders exposed to heat and light radiation, heat rashes, welding flashes leading to eye diseases
			Socioeconomic and Health Impact	An increase in population leads to the transmission of infectious diseases, especially sexually transmitted infections.
				Community conflicts resulting from labour and recruitment issues and compensation leading to security problems
				Creation of job opportunities for locals in Batagarawa LGA and neighbouring areas
			Air Quality & Noise	Adverse effects on air quality due to emission of atmospheric pollutants (CO _x , NO _x , etc.) from earth-moving equipment and localised increase in background noise level

Quarry Operation	Rock Operation (Extraction)	Overburden removal to expose rock, pit development, and hole drilling with the use of drill wagons	Soil and Water	Pollution of soil and groundwater sources around 35121QL quarry from improper management of wastes
		Blasting and loading broken or disintegrated rock with excavators into dump trucks and conveyed to the crushing machine.	Socioeconomic (Health and Safety, Assets, Security)	Risk of injury, death, and asset damage due to accident associated with quarry operation
				Increased demand for existing community health and sanitation infrastructure due to the influx of mine workers and camp followers.
				Threats to community health and safety, including the risk of infectious diseases such as STDs, including HIV/AIDS, from the influx of mine workers
				Indiscriminate disposal of sanitary and domestic wastes during drilling and other operations.
				Management of explosives to ensure no leakages of material.
				Damage to community assets because of blasting (crack in buildings)
			Air Quality & Noise	Localised increase (above baseline values stated in Chapters 4.7 and 4.6) in ambient concentrations of air pollutants (NO ₂ , SO _x , CO _x , C _x H _y , H ₂ S, & SPM)—noise and vibration from machines and blasting.
			Soil, Flora/Fauna, and Water	Damage to ecological resources and environmental degradation by spillages during fuelling of drilling Machines.
				Wildlife migration due to noise and vibration, exposure of soil to weather conditions, fauna habitat loss and injury to wild animals
Geology and Hazard	Risk of geological hazards such as ground quivering, land subsidence			
	Structural damage to nearby buildings.			
Rock Processing Stage (Rock Crushing)	Dumping of the material conveyed by the dump truck to crushers.	Socioeconomic (Health and Safety)	Injury/death/assets damage due to accidents during dumping of materials from the point of the quarry to the feed hopper. Reduction in cases of dumping of materials within and around crushing locations.	
	Crushing and		Health-related hazards on operational staff due to constant inhalation of	

		Screening. Stockpiling		crushing materials Kidnap/forceful abduction of operation staff	
		Haulage of granite aggregates to the required area along the railway alignment			Increased traffic volume/delays due to the daily movement of work trucks and personnel to the site
					Risk of injury, death, and asset damage due to road traffic accidents and incidents
			Air Quality		Adverse effects on air quality due to emission of atmospheric pollutants (CO ₂ , PM2.5, PM10, NO _x , etc.) from internal combustion engines/exhausts during personnel movement
		Maintenance and general operations of the facility	Soil and Water		Pollution of soil and groundwater sources around the facility from improper management of wastes meant for incineration and ash residue.
			Socioeconomic (Health and Safety)		Fire outbreak, destruction of facility, loss of life of personnel due to malfunctioning of facility or operators' fault
		Storage of Dangerous Goods	Soil and Water		Accidental discharge of explosives. Accidental spills
					Generation of Domestic and production waste. Incorrect disposal of soil and water pollution and health risks. Un-kept environment.
		Waste Management			
		Post Quarry	Demobilisation (Movement of vehicles and personnel)	Transportation of equipment, materials, and personnel to worksite	Socioeconomic (Health and Safety)
Risk of injury, death, and asset damage due to road traffic accidents and incidents					

			Air Quality & Noise	Adverse effects on air quality due to emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from earth moving Equipment and localised Increase in background noise level
	Decommissioning /Abandonment	Decommissioning /Abandonment and Rehabilitation of ancillary facilities	Soil and Water	Soil and groundwater contamination from wastes abandoned at the site
Socioeconomic (Health and Asset)			Risk of poor management of decommissioned facilities Risk of the improperly abandoned quarry site, e.g. drowning of humans and animals, particularly children, in mining pits, environmental degradation, etc	
			Availability of land for alternative uses	

5.4 Result of Impact Assessment

The results of the impact assessment exercise, as discussed in the previous sections, are presented in Table 5.9. The table presents the various project phases, planned activities, the proposed project's environmental aspects, and the identified associated and potential impacts. Also included in the table are the impact significance evaluation criteria: legal/regulatory requirements (L), risk posed by the impact (R), magnitude of occurrence (M), Importance of affected environmental component (I) and Public Perception (P). In addition, the overall ratings of impact significance (High, Medium, or Low) of each impact considered have been included. These were based on the summations already described.

Table 5.9: Potential and Associated Impact Assessment of the Proposed Project

	Project Phase	Project Activity	Environmental Component	Potential and Associated Impact	Impact Characterization	Impact Significance Evaluation						Overall Significance Rating
						L	R	M	I	P	Total	
Planning & Pre-Operation	Site Acquisition	Land take	Flora and Fauna, Land use	Restriction of access by the proposed quarry to Kayauki inhabitants and neighbouring communities	Adverse, direct, long-term, normal	0	1	3	3	3	10	Medium
			Socioeconomic	Improvement of the economic status of landowners in the Kayauki community, such as farmers, artisans, and traditional rulers, through payment of compensation & livelihood restoration program	Beneficial, direct, normal, short-term, incremental	-	-	-	-	-	0	Beneficial
			Security challenges are due to the influx of workers to Kayauki and other areas in Batagarawa LGA. Possibility of kidnapping and community disputes.	Adverse, indirect, abnormal, Long-term	0	3	3	3	5	14	High	

				Conflicts due to the displacement of Kayauki artisanal miners from their source of livelihood.	Adverse, indirect, abnormal, short-term	0	3	3	3	5	14	High
				Conflict due to an unsatisfactory compensation process	Adverse, indirect, abnormal, short-term	0	3	3	3	5	14	High
		Site Survey	Personnel Health & Safety	Risk of injury to personnel due to exposure in the bushes	Adverse, direct, abnormal, short-term, residual	0	1	3	3	3	10	Medium
	Mobilisation to site	Transportation of equipment/materials/personnel to worksite		Increased traffic volume on the Daura-Katsina Road	Adverse, direct, normal, short-term, reversible,	0	5	1	1	3	10	Medium
				Risk of injury, death, and asset damage due to road traffic accidents and incidents	Adverse, direct, abnormal, short-term or long-term, residual	3	5	1	1	5	15	High

			Air quality and personnel Safety	Adverse effects on air quality of the Kayauki community and others along the road due to the emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts	Adverse, direct, normal, short-term	3	1	1	1	1	7	Low
	Quarry Development	Site Clearance	Flora and Fauna, Land use	De-vegetation of the 35121 QL area and loss of local flora and economic trees	Adverse, direct, normal, long-term	3	1	3	3	3	13	Medium
		Stripping of topsoil and compaction of same with earth-moving equipment within the proposed project	Soil and Water	Changes in drainage and hydrological patterns may result in erosion and flooding in and surrounding the 35121 QLS quarry area.	Adverse, direct, short-term, abnormal,	0	3	3	3	3	12	Medium

		location	Air Quality and Personnel Safety	Adverse effects on air quality in the Kayauki community and others along the road due to the emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts	Adverse, direct, normal, Short- Term	3	1	1	3	1	9	Medium
		Construction of Quarry (Quarry Plant, Offices, Base camps)	Soil	Soil compaction caused by heavy vehicle movement and excavated material will affect the diversity of soil fauna within the area and alter the drainage pattern.	Adverse, direct, short-term, abnormal,	0	3	3	3	3	12	Medium
			Health (Radiation and Heat) of workers	Welders exposed to heat and light radiation, heat rashes, welding flashes leading to eye diseases	Adverse, direct, normal, short-term	0	1	3	3	3	10	Medium

			Socioeconomic and Health Impact	An increase in population leads to the transmission of infectious diseases, especially sexual transmission infections.	Adverse, direct, abnormal, short-term, residual	0	1	3	3	3	10	Medium
				Community conflicts resulting from labour and recruitment issues and compensation leading to security problems	Adverse, direct, abnormal, short-term or long-term, residual	3	5	1	1	5	15	High
				Creation of job opportunities for locals in Batagarawa LGA and neighbouring areas	Beneficial, direct, normal, short-term, incremental	-	-	-	-	-	0	Beneficial
			Air Quality & Noise	Adverse effects on air quality due to emission of atmospheric pollutants (CO _x , NO _x , etc.) from earth-moving equipment and localised increase in background noise level	Adverse, direct, normal, Short-Term	3	1	1	3	1	9	Medium

Quarry Operation	Rock Operation (Extraction)	Overburden removal to expose rock, pit development, and hole drilling with the use of drill wagons	Soil and Water	Pollution of soil and groundwater sources around 35121QL quarry from improper management of wastes	Adverse, direct, normal, short-term, incremental, cumulative	3	1	1	1	1	7	Low
	Blasting and loading broken or disintegrated rock with excavators into dump trucks and conveyed to the crushing machine.		Socioeconomic (Health and Safety, Assets, Security)	Risk of injury, death, and asset damage due to accident associated with quarry operation	Adverse, direct, abnormal, long-term, irreversible, residual	3	5	1	5	5	19	High
				Increased demand for existing community health and sanitation infrastructure due to the influx of mine workers and camp followers.		0	1	1	1	1	4	Low

				Threats to community health and safety, including the risk of infectious diseases such as STDs, including HIV/AIDS, from the influx of mine workers		0	1	1	1	1	4	Low
				Indiscriminate disposal of sanitary and domestic wastes during drilling and other operations.	Adverse, direct, abnormal, short-term, reversible	0	1	1	1	1	4	Low
				Management of explosives to ensure no leakages of material.	Adverse, direct, abnormal, long-term, irreversible, residual							Medium
				Damage to community assets because of blasting (crack in the building)	Adverse, direct, abnormal, long-term, irreversible, residual	3	5	1	5	5	19	High

			Air Quality & Noice	Localised increase (above baseline values stated in chapters 4.7 and 4.6) in ambient concentrations of air pollutants (NO ₂ , SO _x , CO _x , C _x H _y , H ₂ S, & SPM)—noise and vibration from machines and blasting.	Adverse, direct, normal, short-term, cumulative, residual	3	3	1	3	1	11	Medium
			Soil, Flora/Fauna, and Water	Damage to ecological resources and environmental degradation by spillages during fuelling of drilling Machines.	Adverse, direct, abnormal, short-term	0	1	1	3	1	6	Low
				Wildlife migration due to noise and vibration, exposure of soil to weather conditions, fauna habitat loss and injury to wild animals	Adverse, direct, long-term, reversible	0	5	5	3	5	18	High
			Geology and Hazard	Risk of geological hazards such as ground quivering, land subsidence	Adverse, direct, abnormal, short-term, irreversible	0	1	1	3	1	6	Low

	Rock Processing Stage (Rock Crushing)	Dumping of the material conveyed by the dump truck to crushers.	Socioeconomic (Health and Safety)	Injury/death/assets damage due to accidents during dumping of materials from the point of the quarry to the feed hopper. Reduction in cases of dumping of materials within and around crushing locations.	Adverse, direct, abnormal, short- term or long-term, Residual	3	5	1	5	5	19	High
		Crushing, Screening, Stockpiling		Health-related hazards on operational staff due to constant inhalation of crushing materials Kidnap/forceful abduction of operation staff	Adverse, direct, abnormal, short- term or long-term, Residual	3	5	1	5	5	19	High
		Haulage of granite aggregates to the required area along the railway alignment		Increased traffic volume/delays due to the daily movement of work trucks and personnel to the site	Adverse, direct, normal, short-term, reversible,	0	5	1	1	3	10	Medium
				Risk of injury, death, and asset damage due to road traffic accidents and incidents	Adverse, direct, abnormal, Short-term, or long-term residual	3	5	1	1	5	15	High

			Air Quality	Adverse effects on air quality due to emission of atmospheric pollutants (CO ₂ , PM2.5, PM10, NO _x , etc.) from internal combustion engines/exhausts during personnel movement	Adverse, direct, normal, short-term, reversible,	0	5	1	1	3	10	Medium
	Maintenance and general operations of the facility		Soil and Water	Pollution of soil and groundwater sources around the facility from improper management of wastes meant for incineration and ash residue.	Adverse, indirect, abnormal, short –or long-term	0	3	3	3	5	14	High
			Socioeconomic (Health and Safety)	Fire outbreak, destruction of facility, loss of life of personnel due to malfunctioning of facility or operators' fault	Adverse, direct, abnormal, long-term, irreversible	3	5	1	5	5	19	High
				Accidental discharge of explosives. Accidental spills	Adverse, direct, abnormal, Short-term, or long-term, Residual	3	5	3	5	5	21	High

		Storage of Dangerous Goods Waste Management	Soil and Water	Generation of Domestic and production waste. Incorrect disposal of soil and water pollution and health risks. Un-kept environment.	Adverse, direct, abnormal, Short-term, or long-term, Residual	3	5	3	5	5	21	High
Post Quarry Operation	Demobilisation (Movement of vehicles and personnel)	Transportation of equipment/materials/personnel to worksite	Socioeconomic (Health and Safety)	Increased traffic volume and delays due to daily movement of trucks and personnel along the Daura-Katsina Road and major roads connecting the area	Adverse, direct, normal, short-term, reversible,	0	5	1	1	3	10	Medium
				Risk of injury, death, asset damage due to road traffic accidents and incidents	Adverse, direct, abnormal, Short-term, or long-term, Residual	3	5	1	1	5	15	High
			Air Quality & Noise	Adverse effects on air quality due to emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from earth moving Equipment and localised Increase in background noise level	Adverse, direct, normal, short-term	3	1	1	1	1	7	Low
	Decommissioning/Abandonment	Decommissioning/Abandonment and	Soil and Water	Soil and groundwater contamination from wastes abandoned at the site	Adverse, direct, abnormal, long-term	3	3	1	3	3	13	Medium

		Rehabilitation of ancillary facilities	Socioeconomic (Health and Asset)	Risk of poor management of decommissioned facilities	Adverse, direct, abnormal, long-term	0	3	1	3	3	10	Medium
				Risk of the improperly abandoned quarry site, e.g. drowning of humans and animals, particularly children, in mining pits, environmental degradation, etc	Adverse, direct, abnormal, short – or	3	3	3	3	3	15	High
				Availability of land for alternative uses	Beneficial, direct, normal, long-term	-	-	-	-	-	0	Beneficial

Impact Significance Criteria

IMPACT VALUE	CUT OFF VALUES	IMPACT RATING
L+R+F+I+P	<8	Low
L+R+F+I+P	≥8 but <15	Medium
L+R+F+I+P	≥15	High
F + I	>6	
P	= 5	
Positive		Beneficial

L = Legal/Regulatory requirement P = Public Perception/Interest R = Risk posed by impact M = Envisaged magnitude of impact

5.5 Summary of Impact Significance on Ranking

The proposed project's impact assessment (i.e., the interaction of different Project Phases and Project Activities/Environmental Aspects) resulted in 27 impacts with different impact significance ratings: Beneficial, Low, Medium, and High. The summary is presented in Table 5.10 below.

Table 5.10. Summary of Impact Significance Ranking

Project Phase	Project Activity/Environmental Aspect	Number of Identified Impacts	Impact Significance Ranking			
			Beneficial	Low	Medium	High
Site Acquisition	Land Take and Site Survey	5	1	-	1	3
Site preparation		1	-		1	
Mobilisation	Transportation of equipment and personnel to and from the site	3	-	1	1	1
Quarry Development	Site clearance, stripping of topsoil, and compaction of earth-moving equipment are also needed. Construction of Quarry (Quarry Plant, Offices, Base camps	9	1	-	7	1
Rock Quarrying (extraction) process	Overburden removal is done to expose rock/rock drilling for pit development/holes using an air or hydraulically-powered drilling machine. Crushing plant installation/Blasting and loading of broken or disintegrated rock fragments with excavators into dump trucks and conveyed to the crushing machines.	11	-	7	1	3
Rock Processing Stage	The dump truck dumps the material into the crushing machine and then into the feed hopper of the primary jaw crusher. Crushing and Screening of the materials. Haulage of granite aggregates to required area along the railway alignment. Maintenance and general operations of the facility.	9	-	-	3	6
Abandonment/Decommissioning	Decommissioning/abandonment of Quarry Plant and other ancillary facilities	7	1	1	3	2
Summary (Total Number of Impacts)		45	3	9	17	16
% Significance			6.66	20.00	37.77	35.55

The summary of the Impact Significance Rating above shows that approximately 6.66% of the identified impacts fall within Beneficial, Low Impacts is approximately 20%. Notably, the percentage fall within the High Significance category is 35.55%.

Mitigation measures for all medium and high-significance effects are provided in Chapter 6 of this report.

CHAPTER SIX

IMPACT MITIGATION MEASURES

6.1 General

The primary purpose of this Impact Assessment Report is to examine the environmental impacts, both beneficial and adverse, of a proposed project and to ensure that these impacts are considered in project design. An Environmental Impact Assessment's principal and most important objective is developing and establishing suitable actions (mitigation measures) for the identified significant and adverse impacts of a proposed project. In presenting the mitigation measures, the primary objectives were:

- Prevention by ensuring that significant and adverse potential impacts and risks do not occur.
- Reduction by ensuring that the effects or consequences of those significant potential and associated impacts that cannot be prevented are reduced to as low as reasonably practicable (ALARP).
- Control by ensuring that residual significant impacts are reduced to ALARP.

Again, as in reduction measures for potential and associated impacts, reasonable practicability was determined based on best industry practice and economic, environmental, technical, health, and safety considerations.

Some potential and associated impacts are anticipated during rock quarrying, processing stage, crushing of the rocks, operation, and decommissioning. The nature of the identified impacts has been described in Chapter 5. The proposed mitigation measures for high and medium-significance adverse impacts are presented in Table 6.1. Thus, all low impacts, which are non-adverse, were dropped. (i.e., no mitigation is proffered to them).

Table 6.1: Proposed Mitigation Measure for Significant Impacts

	Project Phase	Project Activity	Environmental Component	Potential and Associated Impact	Impact Characterization	Significance Rating Before Mitigation	Mitigation Measures	Significance Rating After Mitigation
Planning & Pre-Operation	Site Acquisition	Land take	Flora and Fauna, Land use	Restriction of access by the proposed quarry to Kayauki inhabitants and neighbouring communities	Adverse, direct, long-term, normal	Medium	<ul style="list-style-type: none"> Eso Terra Investment will limit its land take to the acquired 35121QL and the portion owned and purchased from Batagarawa LGA. Where it is necessary to use beyond the acquired area, Eso Terra shall engage with the owner and ensure adequate compensation. Engage in temporary arrangement that will ensure return of the land to the owner after completion of the project Eso Terra shall develop mechanism for adequate evaluation and compensation based on land use, crop yield. Appendix 7 has provided similar arrangement that was agreed by the community and settled by Eso Terra Limited 	Low

			Socioeconomic	Improvement of the economic status of landowners in the Kayauki community, such as farmers, artisans, and traditional rulers, through payment of compensation & livelihood restoration program	Beneficial, direct, normal, short-term, incremental	Beneficial	<ul style="list-style-type: none"> Eso Terra Investment Limited shall ensure that all issues about land take are adequately discussed with the landowners and adequate compensation is paid for the acquired land. 	Low
				Due to the influx of workers to Kayauki and other areas in Batagarawa LGA, there is a security challenge. Kidnappings and community disputes are also possible.	Adverse, indirect, abnormal, Long- term	High	<ul style="list-style-type: none"> Eso Terra, in conjunction with police, local vigilantes and internal security architecture, shall provide 24-hour security within the site. 	Low
				Conflicts due to the displacement of Kayauki artisanal miners from their source of livelihood.	Adverse, indirect, abnormal, short-term	High	<ul style="list-style-type: none"> Eso Terra shall ensure that the local artisanal miners are engaged in the quarry workforce or develop alternative livelihoods for those unwilling to take jobs in the quarry. 	Low
				Conflict due to an unsatisfactory compensation process	Adverse, indirect, abnormal, short-term	High	<ul style="list-style-type: none"> Eso Terra Investment Limited shall ensure that all issues about land take are adequately discussed with the landowners and that adequate compensation is paid for the acquired land. 	Low

							<ul style="list-style-type: none"> Eso Terra Quarry shall identify the traditional ruling structure of the community, The CDC, youth organisation and actual landowners of the area; they shall be adequately consulted at each stage of the proposed project 	Low
							<ul style="list-style-type: none"> Eso Terra shall develop and implement Rehabilitation Action Plan (RAP) 	Low
							<ul style="list-style-type: none"> Eso Terra shall ensure that the local artisanal miners are engaged 	Low
	Site Survey		Personnel Health & Safety	Risk of injury to personnel due to exposure in the bushes	Adverse, direct, abnormal, short-term, residual	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure personnel make use of PPEs while on-site Safety measures are adhered to 	Low
Mobilisation to site	Transportation of equipment/materials/personnel to worksite			Increased traffic volume on the Daura-Katsina Road	Adverse, direct, normal, short-term, reversible,	Medium	<ul style="list-style-type: none"> Eso Terra & Quarry Managers shall strictly ensure that the movement of heavy equipment & vehicles follows the traffic management plan to avoid or reduce accidents. Ensure the placement of proper signage in critical areas to educate road users. Deploy traffic management personnel in critical areas on the Daura-Katsina Road 	Low
							<ul style="list-style-type: none"> Eso Terra Quarry shall ensure that all drivers and operators are certified competent before movement with vehicles is allowed. 	Low

					<ul style="list-style-type: none"> Eso Terra Quarry shall maintain an efficient journey management plan to reduce the risks of accidents. 	Low
					<ul style="list-style-type: none"> Eso Terra & Quarry Managers shall ensure that all vehicles are pre-mobilized and certified fit before transporting equipment, materials, and personnel. 	Low
		Risk of injury, death, asset damage due to road traffic accidents and incidents	Adverse, direct, abnormal, short- term or long-term, residual	High	<ul style="list-style-type: none"> Eso Terra Quarry shall ensure that drivers/operators adhere to the speed limit, which shall be equipped in all operational and support vehicles. 	Low
					<ul style="list-style-type: none"> Eso Terra Quarry shall prohibit night movement. 	Low
					<ul style="list-style-type: none"> Eso Terra Investment Limited shall check the health status of personnel regularly. 	Low
	Air quality and personnel Safety	Adverse effects on air quality of the Kayauki community and others along the road due to the emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts	Adverse, direct, normal, short-term	Low	<ul style="list-style-type: none"> Eso Terra Quarry shall ensure vehicles and utilities mobilised for the project adhere to strict environmental guidelines 	Low

Development	Quarry Development	Site Clearance	Flora and Fauna, Land use	De-vegetation of the 35121 QL area and loss of local flora and economic trees	Adverse, direct, normal, long-term	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure that equipment used in excavation, compaction and consolidation of soil is confined to areas acquired for the proposed rock quarrying and processing project. Eso Terra investment shall develop a flora and fauna management plan to minimise damage and protect existing vegetation 	Low
		Stripping of topsoil and compaction of same with earth-moving equipment within the proposed project location	Soil and Water	Changes in drainage and hydrological patterns may result in erosion and flooding in the area within and surrounding the 35121 QLS quarry area	Adverse, direct, short-term, abnormal,	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure materials and foreign bodies do not enter the aquatic system. Eso Terra shall ensure vehicles and utilities mobilised for the project adhere to strict environmental guidelines. Eso Terra investment shall ensure that vehicles carrying materials are fit and suitable for the environment. Ensure regular service and maintenance of equipment 	Low
			Air Quality and Personnel Safety	Adverse effects on air quality in the Kayauki community and others along the road due to the emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts	Adverse, direct, normal, Short- Term	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure that equipment and operational vehicles are serviced based on manufacturer specifications. Eso Terra Investment shall ensure all personnel operating machines and vehicles are appropriately kitted with PPEs 	Low

	Construction of Quarry Plant, Offices, Base camps)	Soil	Soil compaction caused by heavy vehicle movement and excavated material will affect the diversity of soil fauna within the area and alter the drainage pattern.	Adverse, direct, short-term, abnormal,	Medium	<ul style="list-style-type: none"> Eso Terra ensures that the movement and operation of heavy vehicles are restricted to the quarry site and avoid green areas. Eso Terra shall ensure the use of erosion-resistant material for the access road in the 35121QLS quarry The quarry manager shall ensure the development of drainages for adequate stormwater management 	Low
		Health (Radiation and Heat) of workers	Welders exposed to heat and light radiation, heat rashes, welding flashes leading to eye diseases	Adverse, direct, normal, short-term	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure all personnel operating welding equipment and machines are adequately kitted and use PPEs. Eso Terra shall ensure regular safety meetings/talks where staff are reminded of the need to use the PPEs. Eso Terra shall put a mechanism in place to impose the use of PPEs. 	Low
		Socioeconomic and Health Impact	Increase in population leading to transmission of infectious diseases, especially sexual transmission infections	Adverse, direct, abnormal, short-term, residual	Medium	<ul style="list-style-type: none"> Eso Terra shall create awareness among personnel on infectious diseases and STDs Put a mechanism for early detection through regular health check 	Low
			Community conflicts resulting from labour and recruitment issues and compensation lead to security problems	Adverse, direct, abnormal, Short-term, or long-term residual	High	<ul style="list-style-type: none"> Eso Terra Investment shall ensure continuous community engagement and fair labour practice. Eso Terra shall ensure full implementation of its grievances redress mechanism 	Low

			Creation of job opportunities for locals in Batagarawa LGA and neighbouring areas	Beneficial, direct, normal, short-term, incremental	Beneficial	<ul style="list-style-type: none"> Eso Terra shall prioritise local hiring for temporary and permanent job opportunities in the Kayauki quarry project. Eso Terra shall provide a training program to equip Kayauki community members with the necessary skills and qualifications to fill the newly created position. 	Low
		Air Quality	Adverse effects on air quality due to emission of atmospheric pollutants (CO _x , NO _x , etc.) from earth-moving equipment and localised increase in background noise level	Adverse, direct, normal, Short- Term	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure the scheduling of equipment movement by planning and scheduling the movement of equipment during off-peak hours to minimise disruption to nearby residents or sensitive areas. Eso Terra shall implement a noise barrier policy by installing physical barriers, such as walls or fences, to help block and reduce noise levels from equipment movement. Eso Terra shall ensure that equipment is well-maintained to reduce emissions and noise levels. Regular maintenance will help improve equipment efficiency and reduce its environmental impact. Eso Terra shall ensure the implementation of monitoring systems to track noise levels and emissions from equipment movement; this data can help identify areas for improvement and track progress over time. 	Low

Quarry Operation	Rock Operation (Extraction)	Overburden removal to expose rock, pit development , and hole drilling using drill wagons	Soil and Water	Pollution of soil and groundwater sources around 35121QL quarry from improper management of wastes	Adverse, direct, normal, short-term, incremental, cumulative	Low	<ul style="list-style-type: none"> Eso Terra shall ensure proper storage and containment of overburdened waste on the Kayauki quarry site to designated areas that are lined and adequately contained to prevent contaminants from leaking into the soil and groundwater. 	Low
		Blasting and loading broken or disintegrated rock with excavators into dump trucks and conveyed to the crushers.	Socioeconomic (Health and Safety, Assets, Security)	Risk of injury, death, and asset damage due to accident associated with quarry operation	Adverse, direct, abnormal, long-term, irreversible, residual	High	<ul style="list-style-type: none"> Eso Terra shall ensure continuous safety training for all personnel involved in the blasting and loading operations. These personnel shall receive proper training on safety procedures, including handling explosives, operating equipment, and emergency response protocols. Use of proper alarm system during blasting Eso Terra shall require all workers to wear appropriate PPEs, such as hard hats, safety glasses, hearing protection, gloves, and high-visibility clothing, to reduce the risk of injury. Eso Terra shall establish and enforce safe exclusion zones around the blasting and loading areas to prevent unauthorised personnel from entering the danger zone. 	Low

			Increased demand for existing community health and sanitation infrastructure due to the influx of mine workers and camp followers.	Low	<ul style="list-style-type: none"> • Eso Terra shall engage with the local community to raise awareness about the situation and encourage them to take prompt measures to reduce the strain on existing infrastructure, including promoting good hygiene practices, waste management, and responsible use of health services. • Eso Terra shall develop and implement emergency response plans to quickly address any spikes in demand for health and sanitation services. This can help ensure a coordinated and effective response to sudden increases in demand. • Eso Terra shall prioritise health as part of community development interventions. 	Low
			Threats to community health and safety, including the risk of infectious diseases such as STDs, including HIV/AIDS from the influx of mine workers	Low	<ul style="list-style-type: none"> • Eso Terra shall ensure the implementation of health education programs to educate workers on preventive measures to reduce the risk of illness and disease. This can help reduce the risk of health challenges and exposure to STDs and HIV/AIDS by promoting healthier and risky behaviours. 	Low

			Indiscriminate disposal of sanitary and domestic wastes during drilling and other operations.	Adverse, direct, abnormal, short-term, reversible	Low	<ul style="list-style-type: none"> Eso Terra shall properly dispose of hazardous waste and treat contaminated soil and groundwater using appropriate methods such as bioremediation, soil washing, or chemical treatment. Eso Terra shall implement spill prevention measures such as berms, secondary containment systems, and spill response plans to prevent accidental spills from contaminating soil and groundwater. 	Low
			Management of explosives to ensure no leakages of material.	Adverse, direct, abnormal, long-term, irreversible, residual	High	<ul style="list-style-type: none"> Eso Terra shall ensure adherence to rules and regulations governing the use of explosives as provided in the Nigerian Explosive Act of 1951, Minerals and Mining Act 2007 and Guidelines for Minerals and Mining Sector 2011. Put mechanisms for checks and balances in place by engaging security apparatuses in every stage of explosive handling. 	
			Damage to community assets because of blasting (crack in the building)	Adverse, direct, abnormal, long-term, irreversible, residual	High	<ul style="list-style-type: none"> Eso Terra shall use proper blasting techniques and design to minimise the risk of fly rock, ground vibration and air blast overpressure that could cause injury or damage to the Kayauki community and nearby assets. Eso Terra shall continuously monitor and record blast vibrations, air overpressure, and ground movement to ensure compliance with safety standards 	Low

						complaints.		
			Soil, Flora/Fauna, and Water	Damage to ecological resources and environmental degradation by spillages during fuelling of drilling Machines.	Adverse, direct, abnormal, short-term	Low	<ul style="list-style-type: none"> Eso Terra shall implement Spill Prevention Measures, such as spill containment berms, secondary containment systems, and spill response plans, to prevent accidental spills contaminating soil, groundwater, and Fauna. Put adequate monitoring facilities to detect problems at the early stage 	Low

			Wildlife migration due to noise and vibration, exposure of soil to weather conditions, fauna habitat loss and injury to wild animals	Adverse, direct, long-term, reversible	High	<ul style="list-style-type: none"> Eso Terra shall identify and avoid sensitive areas or critical habitats, breeding grounds, and migration routes of wild animals while sitting in the blast area. Eso Terra shall employ time restrictions by scheduling noisy activities when wildlife is less active, such as avoiding construction during breeding or migration. 	Low
		Geology and Hazard	Risk of geological hazards such as ground quivering, land subsidence	Adverse, direct, abnormal, short-term, irreversible	Low	<ul style="list-style-type: none"> Eso Terra shall conduct thorough geological surveys and assessments to identify areas prone to these hazards. Eso Terra shall implement proper land-use planning and zoning regulations to restrict development in high-risk areas. Eso Terra shall Develop emergency response plans and evacuation procedures in case of a hazardous event. 	Low
			Structural damage to nearby buildings.		Low	<ul style="list-style-type: none"> Eso Terra shall develop emergency response plans and evacuation procedures in case of a hazardous event. Eso Terra shall ensure protective measures by installing vibration isolation systems, adding structural reinforcement, or using blast mats to mitigate the effects of blasting on nearby structures. Ensure adequate compensation where damage is confirmed on the Kayauki inhabitants and surrounding area 	Low

Rock Processing Stage (Rock Crushing)	Dumping of the material conveyed by the dump truck to crushers.	Socioeconomic (Health and Safety)	Injury/death/assets damage due to accidents during dumping of materials from the point of the quarry to the feed hopper. Reduction in cases of dumping of materials within and around crushing locations.	Adverse, direct, abnormal, short- term or long-term, Residual	High	<ul style="list-style-type: none"> Eso Terra shall develop and communicate an emergency response plan that outlines procedures for responding to accidents, injuries, fires, or other emergencies that may occur during the dumping of materials and loading operations. 	Low
	Crushing and Screening. Stockpiling		Health-related hazards on operational staff due to constant inhalation of crushing materials Kidnap/forceful abduction of operation staff	Adverse, direct, abnormal, short- term or long-term, Residual	High	<ul style="list-style-type: none"> Eso Terra shall develop and communicate an emergency response plan that outlines procedures for responding to accidents, injuries, fires, or other emergencies that may occur during the crushing of materials. 	Low
	Haulage of granite aggregates to the required area along the railway alignment		Increased traffic volume/delays due to the daily movement of work trucks and personnel to the site	Adverse, direct, normal, short-term, reversible,	Medium	<ul style="list-style-type: none"> Eso Terra shall develop comprehensive transportation plans considering the impact of increased traffic volumes and truck movements on road networks and communities. Eso Terra Traffic shall ensure the Implementation of traffic management strategies such as signal optimisation, lane management, and speed limit enforcement to reduce congestion and improve traffic efficiency. 	Low

			Risk of injury, death, and asset damage due to road traffic accidents and incidents	Adverse, direct, abnormal, short-term or long-term, residual	High	<ul style="list-style-type: none"> Eso Terra shall ensure route planning: Establishing designated truck routes and enforcing restrictions on truck movements in residential areas or sensitive zones to minimise the impact of heavy vehicles on local communities. Eso Terra shall ensure truck safety measures: Implementing truck safety measures such as weight restrictions, speed limits, and mandatory safety inspections to reduce the risk of accidents and damage to infrastructure and environmental considerations 	Low
		Air Quality	Adverse effects on air quality due to emission of atmospheric pollutants (CO ₂ , PM _{2.5} , PM ₁₀ , NO _x , etc.) from internal combustion engines/exhausts during personnel movement	Adverse, direct, normal, short-term, reversible,	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure that equipment is well-maintained to reduce emissions and noise levels. Regular maintenance will help improve equipment efficiency and reduce its environmental impact. Eso Terra shall ensure the Implementation of monitoring systems to track noise levels and emissions from equipment movement; this data can help identify areas for improvement and track progress over time. 	Low
	Maintenance and general operations of the facility	Soil and Water	Pollution of soil and groundwater sources around the facility from improper management of wastes meant for incineration and ash residue.	Adverse, indirect, abnormal, short –or long-term	High	<ul style="list-style-type: none"> Eso Terra shall ensure proper disposal and management plus treatment: Dispose of hazardous waste properly and treat contaminated soil and groundwater using appropriate methods such as bioremediation, soil washing, or chemical 	Low

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treatment and incineration



			Socioeconomic (Health and Safety)	Fire outbreak, destruction of facility, loss of life of personnel due to malfunctioning of facility or operators' fault	Adverse, direct, abnormal, long-term, irreversible	High	<ul style="list-style-type: none"> • Eso Terra shall conduct regular fire risk assessments to identify potential hazards and implement necessary controls. • Install and maintain fire detection and suppression systems such as smoke detectors, fire alarms, sprinkler systems, and fire extinguishers. • Develop and communicate emergency evacuation plans and conduct regular drills to ensure all employees are familiar with evacuation procedures. • Keep fire exits clear and easily accessible at all times. • Store flammable materials properly and keep them in designated areas away from ignition sources. Implement security measures to prevent unauthorised access to the facility, which can help reduce the risk of arson. • Regularly inspect and maintain the facility's infrastructure, electrical systems, and equipment to prevent potential fire hazards. 	Low
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			Health-related hazards on operational staff due to constant inhalation of crushing materials	Adverse, direct, short-or long-term, reversible	Medium	<ul style="list-style-type: none"> • Eso Terra shall implement proper ventilation systems to ensure good indoor air quality and reduce the risk of inhalation of harmful substances. • Provide respiratory protection equipment to employees working in areas with a risk of exposure to hazardous fumes or gases. • Store chemicals and other hazardous materials in well-ventilated areas and ensure proper handling procedures are followed to minimise the risk of inhalation exposure. 	Low
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			Kidnap/forceful abduction of operation staff	Adverse, direct, abnormal, short-term, reversible	High	<ul style="list-style-type: none"> Eso Terra shall provide security training: Staff will be trained on personal security awareness, including recognising, and responding to potential threats. Travel safety protocols: Implement strict travel safety protocols for staff travelling to high-risk areas, including pre-travel risk assessments, secure transportation arrangements, and communication procedures. Security escorts for staff when travelling in high-risk areas or during high-risk activities. Eso Terra shall equip staff with communication devices such as satellite phones or GPS trackers to quickly signal for help in an emergency. Eso Terra shall conduct background checks: Conduct thorough background checks on staff and contractors to identify potential security risks. Eso Terra shall secure facilities by implementing physical security measures at offices and accommodations to prevent unauthorised access and enhance staff safety. 	Low
	Storage of		Accidental discharge of explosives.		High	<ul style="list-style-type: none"> Eso Terra shall ensure storage areas are accessible 	

		dangerous goods	Accidental spills		<ul style="list-style-type: none"> to emergency crews. Eso Terra shall maintain an accurate inventory of dangerous goods. Eso Terra shall store, handle and label chemicals, liquids, and explosives according to national regulations. Quarry management shall train staff in correct usage and spill procedures. Report spills and accidental detonations immediately. Maintain all equipment (including emergency equipment) in good working condition. Place guards at explosives storage sites;
		Waste Management	<p>Generation of Domestic and production waste. Incorrect disposal of soil and water pollution and health risks. Un-kept environment.</p>		<ul style="list-style-type: none"> Provide waste bins around the site and practice good housekeeping. Establish an appropriate frequency of cleaning activities. Collect waste oil in steel Containers for appropriate disposal. Use waste rocks as fill materials for access roads and eroded sections around the quarry. Compost organic waste if necessary.

						<ul style="list-style-type: none">• Dispose of hazardous wastes to State Environmental Protection Board Licensed carrier/facility.• Collect waste oils and solvents for recycling or/and dispose according to State Environmental Protection Board regulations.• Capture runoff from workshops by drainages.• Do not discharge solvent/detergent-contaminated waters to the environment.• Place rocks and blocks away from water bodies.• Clean up accidental oil spills and drips immediately.• Trap silt and other debris around water bodies using silt settlement techniques.	
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Post Quarry Operation	Demobilisation (Movement of vehicles and personnel)	Transportation of equipment/materials/personnel to worksite	Socioeconomic (Health and Safety)	Increased traffic volume and delays due to daily movement of trucks and personnel along the Daura-Katsina Road and major roads connecting the area	Adverse, direct, normal, short-term, reversible,	Medium	<ul style="list-style-type: none"> Eso Terra shall ensure truck route planning: Establishing designated truck routes and enforcing restrictions on truck movements in residential areas or sensitive zones to minimise the impact of heavy vehicles on local communities. 	Low
				Risk of injury, death, and asset damage due to road traffic accidents and incidents	Adverse, direct, abnormal, Short-term, or long-term, Residual	High	<ul style="list-style-type: none"> Eso Terra shall ensure truck safety measures: Implementing truck safety measures such as weight restrictions, speed limits, and mandatory safety inspections to reduce the risk of accidents and damage to infrastructure and the risk of death 	Low
			Air Quality & Noise	Adverse effects on air quality due to emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from earth moving Equipment and localised Increase in background noise level	Adverse, direct, normal, short-term	Low	<ul style="list-style-type: none"> Eso Terra shall Raise awareness among workers and the public about the importance of minimising noise and vibration impacts on the environment and emission of pollutants by ensuring vehicles are maintained according to manufacturer specifications. Eso Terra shall use equipment to produce lower noise and emissions levels. This can include electric or hybrid vehicles and equipment with noise-reducing features. 	Low

	Decommissioning/Abandonment	Decommissioning/Abandonment and Rehabilitation of ancillary facilities	Soil and Water	Soil and groundwater contamination from wastes abandoned at the site	Adverse, direct, abnormal, long-term	Medium	<ul style="list-style-type: none"> Eso Terra shall implement Best Management Practices (BMPs) by Following best management practices, such as covering waste piles, using impermeable liners, and implementing proper drainage systems to prevent contamination. Ensure adherence to the EPRP guideline provided by MSMD. 	Low
			Socioeconomic (Health and Asset)	Risk of poor management of decommissioned facilities	Adverse, direct, abnormal, long-term	Medium	<ul style="list-style-type: none"> Eso Terra shall develop a comprehensive decommissioning plan: Create a detailed plan that outlines the steps and processes involved in decommissioning the facility; this plan should include timelines, responsibilities, and budget estimates. Eso Terra shall ensure proper waste and hazardous materials management and develop a plan for managing and disposing of waste and dangerous materials generated during the decommissioning process. It shall also ensure that all waste is managed and disposed of following regulations. 	Low
				Risk of the improperly abandoned quarry site, e.g. drowning of humans and animals, particularly children, in mining pits, environmental degradation, etc	Adverse, direct, abnormal, short – or long-term, reversible	High	<ul style="list-style-type: none"> Eso Terra shall implement a proper reclamation plan: Develop a comprehensive reclamation plan before starting quarry operations. This plan should outline how the site will be restored and reclaimed once quarrying 	

						<ul style="list-style-type: none"> activities are completed. Eso Terra shall involve local communities and stakeholders in the planning and monitoring of quarry operations. This can help ensure that concerns are addressed and the site is abandoned correctly to benefit the community. 	
			Availability of land for alternative uses	Beneficial, direct, normal, long-term	Beneficial	<ul style="list-style-type: none"> Eso Terra shall support and encourage land conservation programs to preserve natural habitats, agricultural land, or open spaces. These programs may offer incentives or tax benefits to land users who agree to use their land in alternative ways. Eso Terra shall ensure Land trusts: Support land trusts that work to acquire and protect land for conservation purposes. Donating or selling land to a land trust can ensure that land property will be preserved and used for alternative purposes instead of abandonment 	Low

6.2. Ranking After Mitigation

Notably, all impacts associated with the proposed project were reduced to MEDIUM-LOW after mitigation. This is based on the following:

- The area proposed for the quarry is a secondary forest with very sparse vegetation and wildlife. Thus, the impact on biodiversity is minimal.
- Issues associated with fire outbreaks and risks associated with safety within the facility will be adequately handled by design and firefighting and ancillaries, which will be installed within the facility yard.
- Eso Terra Investment Limited management shall ensure effective and continuous consultation and interaction with the landlords and the entire community to prevent crises arising from the acquisition of the quarry site.

However, Chapter 7 (Environmental Management Plan) has been provided to ensure that each case's prescribed mitigation measures to reduce the impacts to zero work out.

6.3 Grievance Redress Mechanisms

As part of the FMEEnv requirement, GRM is recommended to be established as part of the process so that the stakeholders involved are given freedom to raise their concerns to relevant representatives at no cost or threat of any negative repercussions; those concerns arising during project implementation are adequately addressed in a timely and respectful manner; and that participation in the grievance process does not preclude pursuit of legal remedies under the laws of the country. In regard to FMEEnv guidelines, the project proponent will set up and train its staff and beneficiaries in addressing GBV. So, as to reduce and mitigate the risks of GBV especially during and after project implementation. The purpose of establishing Grievance Redress Mechanism (GRM) is thus:

- Ensure transparency and accountability throughout the implementation of projects and programmes amongst the relevant stakeholders including project beneficiaries.

- Address complaints, grievances and enhance conflict resolution arising from, and during programme implementation and
- Resolve any emerging environmental and social issue within project areas and foster effective communication skills/ relationship between project implementers, executers and beneficiaries.

The project proponent will up measures to address GBV and Sexual Exploitation Abuse (SEA) within its proposed project supported area. Such measures and actions are:

- Mandatory contractors code of conduct on sexual harassment
- Community and workers' sensitization on GBV/SEA.
- Setting up team monitor GBV/SEA for its proposed project location.
- Develop Codes of Conduct for contractors with prohibitions against GBV/SEA,
- Hire a resolute GBV/SEA specialist or training of its social safeguard officer on project induced GBV/SEA
- Building capacity knowledge and conflict resolution mechanism amongst local communities and other relevant stakeholders to address the risks of GBV/SEA by developing and providing guidance, training, awareness, and dissemination of relevant information through radio, TV, print and social media. Therefore, GRM does not deal with grievances relating to internal communication or disputes between the project team, implementing agency, other agencies; nor intra/inter-community conflicts that are not project related. The project proponent grievance resolution process will involve four key phases.
 - Receive/ Assess the potential risks.
 - Investigate and capacity building.
 - Respond
 - Follow up/Review.

During the FGDs, the community elders and youth explained that conflicts in the community are resolved at the level of the traditional ruler palace. However, setting-up of GRM for a project such as mining is imperative. Grievances may not be limited to but can arise from any of the following; involuntary resettlement and

compensation issues, violence extremism, exclusion from project benefits and non-compliance of the contractual agreement.

The likelihood of dispute is much reduced because the few affected persons due to the quarry project have been extensively consulted. Nevertheless, if grievances arise, this redress mechanism has been prepared. The affected persons have already been helped to appreciate that there are provisions for addressing complaints or grievances. The grievance procedure will further be made available to the affected person through project implementation.

The significant grievances that might require mitigation include:

- Dispute between contractors and the stakeholders;
- Dispute between contractors and the host community;
- Losses not identified correctly;
- Inadequate assistance;
- Dispute about ownership;
- Delay in disbursement of assistance and improper distribution of assistance;
- PAPs not listed;

Grievances and Appeals Procedure

To forestall the lengthy litigation process, which could affect the project's progress, it is in the best interest of all parties to provide a forum locally to receive, hear, and resolve disputes. Therefore, setting up a Grievance Redress Committee early during project implementation is desirable.

For the Batagarawa Quarry project, a complaint is a notification (in written, verbal, or electronic form) regarding project activities and the conduct of staff, consultants, partners, and subcontractors directly or indirectly supporting the project or associated with its implementation that the complainant believes is wrong, either under the law or on the grounds of unacceptable behaviour.

The complainant(s) need not be personally aggrieved or impacted and may be acting merely in accordance with a sense of civic duty in bringing an occurrence to the attention of project authorities.

In defining the levels of grievance redress, priority was given to aligning with the existing mechanism and strengthening it as required. This mechanism was designed based on consultation and stakeholder inclusion while preparing the EIA report.

Grievance Redress Process

There is no ideal model or one-size-fits-all approach to grievance resolution. The best solutions to conflicts are generally achieved through localised mechanisms that take account of the specific issues, cultural context, local customs, and project conditions and scale. In its simplest form, grievance mechanisms can be broken down into the following primary components:

- Receiving and registering a complaint.
- Screening and assessing the complaint.
- Formulating a response.
- Selecting a resolution approach.
- Implementing the approach.
- Announcing the result.
- Tracking and evaluating the results.
- Learning from the experience and communicating back to all parties involved.
- Preparing a timely report to management on the nature and resolution of grievances.

Court Resolution of Grievance Matters

The possibility of seeking a grievance resolution in court may be a last resort but should be expected, especially where the complainant felt dissatisfied with the GRC's resolution.

The GRM provision for this project is that grievances concerning non-fulfilment of contracts, levels of compensation, or seizure of assets without compensation shall be addressed to the state local courts system of administration of justice. The court hierarchy would, in ascending order, therefore, be land dispute tribunals/chiefs, followed by magistrate courts and then finally, the high courts. The state's high court is designated the highest appellate court to settle grievances.

Admittedly, this is a costly and time-consuming procedure. Nevertheless, affected persons will be exempt from administrative and legal fees incurred under this grievance redress procedure.

Awareness of GRM

Eso Terra will create an effective awareness program to educate the PAPs on the following:

- Members of GRC and its location
- Method of complaining or reporting the grievance
- Taking part in the GRC meeting (are any companions of the complainant allowed)
- The steps of resolving the process and timeline adopted in this mechanism.
- Needed documents and evidence to support the complaint.

This information should be part of a simple brochure that explains the different grievance redress possibilities for PAPs.

Grievance Redress Mechanism will be implemented to ensure that all complaints from local communities are dealt with appropriately, with corrective actions being implemented, and the complainant being informed of the outcome. It will be applied to all complaints from affected parties or PAPs. Eso terra will maintain a Complaints Database, which will contain all the information on complaints or grievances received from the communities or other stakeholders. This would include: the type of complaint, location, time, actions to address these complaints, and final outcome. Eso Terra, shall set-up a grievance redress committee that will address any

complaints during project implementation. Grievances should be resolved within 15 working days.

The grievances, influenced by their physical, situational (e.g., employment), and/or social losses, can surface at different stages of the project cycle. Some grievances may arise during the project design and planning stage, while others may come up during project implementation. Not only should affected persons (AP's) be able to raise their grievances and be given adequate hearing, but also satisfactory solutions should be found that mutually benefit both the APs and the Eso Terra.

Members Of the Grievance Redress Committees (GRC)

The GRC members shall comprise of qualified, experienced, and competent personnel who will be able to interact and gain the trust of the AP's in their communities. The GRC should consist of both male and female representatives. They should be able to accept complaints, provide relevant information on the process, discuss the complainants' situations with AP's, and explore possible approaches for resolution.

The committee will include the following members:

- The Resettlement Action Plan (RAP) Consultant
- Social Safeguard officer of the AfDB;
- A representative of women residing in the affected Project study area;
- A representative from the Private sector (if a private company is located within the affected area);
- A representative of a voluntary organization, NGOs;
- A representative of the AfDB;
- A representative of Local Government Area Council of the affected area;
- A representative appointed by the Community head.

The Grievance Redress Committee will be responsible for:

- Communicating with the Affected persons (AP's) and evaluate if they are entitled to recompense;
- Making the list of affected persons public and the established grievance redress procedure.

- Recommending to the Social Safeguard Officer of the project solutions to such grievances from affected persons;
- Communicating the decisions to the AP's; to acknowledge appeals from persons, households or groups who rightfully will not be affected by the project manager, but claim to be, and to recommend to the project officer whether such persons should be recognized as AP's, and to communicate back the decisions to the Claimants.

Community Expectations When Grievances Arise

The members of the community will expect that their grievances will be addressed by the project manager especially at the local level, which will be achieved through the GRC. When local people present a grievance, they generally expect to receive one or more of the following:

- A concession in recognition of their problem
- An honest response to questions about the proposed activities
- An apology
- Compensation when applicable
- Modification of the activities that caused the grievance
- Some other fair remedy.

Setting up of Grievance Redress Committee

The following are the steps needed to address GRM that may arise as a result of the proposed project.

Step One: GRC at the Site/Community Level

The first step or channel for filing grievance shall be through the site supervisor/community or district heads. The benefit of this approach is that the leadership system within the host community prove to be a cordial and notable channel for conflict resolution. The community or district shall be the head committee while membership of the committee will consist of:

- The district head or representative (Chairman)

- The village/ward head (member)
- The woman and youth leader in the community (member)
- The representative of PWD/ PAP in the community (member)
- Representative of the quarry company (member)
- Representative of the Local Government Authority (member)

Step Two: GRC at the Company Level

The second channel for filing grievances shall be at the level of the company organisation. The project or site coordinator shall constitute a team which shall receive, hear and address complaints that may have not be resolved at community or district level GRCs. The project coordinator shall head this committee while membership of the committee shall be:

- Communication officer/ Public relations officer; Environmental officer (Secretary);
- Monitoring and Evaluation officer, and the project Engineer (member)
- Representative of quarry workers (member)
- Representative of the community or NGO (member)
- Representative of the Local Government Authority (member)

Step Three: GRC at the State Steering Committee Level:

The committee at this level shall be headed by the Permanent Secretary of the State Ministry of Mines while the project coordinator shall serve as the secretary of the committee. Membership of the GRC at this level shall constitute as follows:

- The Permanent Secretary Katsina State Ministry of Mines or representative (Chairman);
- Director Katsina State Ministry of Land & Survey or representative (Member)
- Director Katsina State Ministry of Environment or representative (Member)
- A witnessing NGO

Informing Parties on Levels and Channels of Grievance Uptake

During public consultation meetings held within the host community members have been sufficiently informed that there will be three (3) levels at which aggrieved persons can channel his/her complaints for redress. These shall include:

- The project site/community level,
- The Company level and
- The State Steering Committee level.

The community members were also informed that the process of grievance redress shall be free seamless to the aggrieved/complainant for redress. The PAPs have also been informed that it is their right to seek redress in the court of law as the last resort if they felt dissatisfied with the judgments obtained from the grievance redress committees set up.

CHAPTER SEVEN

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.1 General

An Environmental and Social Management Plan (ESMP) is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of a project's design, construction, operation, decommissioning, and maintenance are prevented and that the positive benefits of the projects are enhanced. It also defines the legal requirements for the project and identifies the regulatory permits and licenses required for construction activities. To this end, an EMP ensures that impact mitigation and enhancement measures outlined in the EIA report form the basis for the actual implementation of the proposed project.

This EMP provides the program for achieving the environmental protection/conservation objectives of the proposed rock quarrying and processing Project. The programme includes the designation of responsibility and means of achieving these objectives during the project's life.

Effective implementation of the ESMP ensures increased efficiency, improved compliance assurance, enhanced environmental security and global stabilisation. Below is a summary of the EMP for the proposed project.

7.1.1 ESMP Objectives

The objectives of this ESMP for the proposed project are to:

- i. Ensuring compliance with regulatory authority stipulations and guidelines.
- ii. Demonstrate that a systematic procedure has been established to ensure that all project activities are executed in compliance with applicable legislation/guidelines and relevant Eso Terra Investment Limited policies.
- iii. Ensure progressive reduction of the project activities' impacts on the biophysical, health, and social environment to eliminate them.

- iv. Ensure that all mitigation and enhancement measures prescribed in the impact assessment document are fully implemented to eliminate or minimise the adverse project impacts and optimally enhance the benefits.
- v. Ensure that appropriate recovery preparedness is in place if control is lost during the implementation of the proposed project.
- vi. Provide part of the basis and standards needed for overall planning, monitoring, auditing, and environmental performance review throughout the project life cycle.

7.1.2 Scope of the ESMP

The scope of this EMP includes health, safety, environment (HSE), and social considerations and will address the activities at the facility that can potentially have impacts on the following:

- ambient air quality.
- soil and land use.
- physical environment of the area.
- natural resources (including groundwater) and biological environment.
- socioeconomics; and
- workplace conditions.
- health and workplace status

This EMP is a dynamic working tool, and it shall consider possible changes in prevailing circumstances, environmental regulations, guidelines, and policies. It shall also be reviewed to consider changes in the regulatory regime. In the event of new policies or guidelines from FMEnv, other governmental agencies or Eso Terra Investment Limited, additions shall be made to reflect these changes. If necessary, the EMP shall be updated and revised during the project life cycle to incorporate better environmental technologies, management systems and economic policies.

7.2 Resourcing and Responsibilities

Resourcing

The HSE manager shall handle all environmental, health, and socio-economic matters related to the project implementation to ensure compliance with regulatory standards.

To ensure effectiveness in managing environmental, Health and socio-economic issues and commitments, Eso Terra Investment Limited HSE Head shall supervise the Quality Assurance Engineer (QAE), the site project Engineer, the site HSE officers and the community relations officer. These resource persons shall be approved by Eso Terra Investment Limited's management and supervised by the HSE. The organogram showing the line of authority for implementing the EMP guidelines is shown in Figure 7.1.

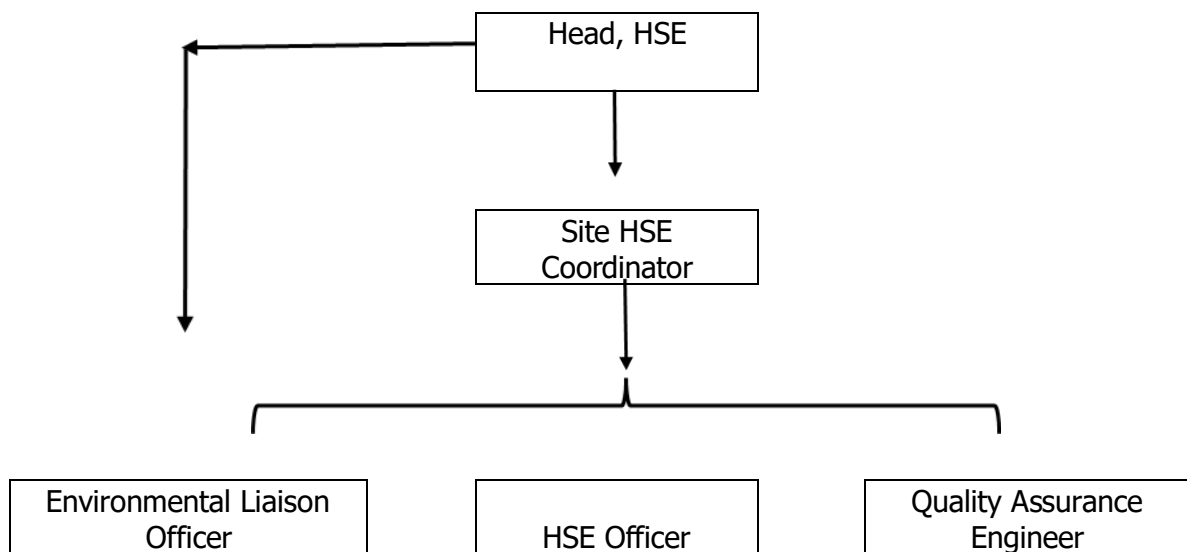


Figure 7.1: EMP Implementation Organogram

Responsibility

Eso Terra Investment Limited shall ensure that environmental and social commitments are met throughout the proposed project implementation. The company shall establish a schedule for responsibility and training on biophysical and socio-economic environmental matters. Environmental and social issues shall be a line responsibility for which all levels of personnel are accountable. Responsibility for

environmental management shall lie with top management, ensuring that all environmental and social considerations are integrated into project execution. The HSE Unit shall be required to offer expert advice on protection measures and monitor performance. Also, the relevant regulators shall be consulted at all project phases.

Eso Terra Management

The management is the final decision maker; they are to be contacted in case of any possible setbacks, even those concerning significant environmental, ecological, and archaeological discoveries.

Eso Terra Health, Safety and Environment (HSE) Manager

The Company HSE Manager consults with relevant regulatory agencies. He coordinates the project HSE managers and collaborates with an Environmental Consultant. He ensures that the company's HSE policy is adhered to and complies with national/international regulations. He informs the management of relevant progress reports.

Project Manager

The Project Manager ensures that all arms of project development and monitoring run smoothly. The project HSE Manager also reports to him.

Project Health Safety and Environment (HSE) Manager

Each company project shall have an HSE manager responsible for ensuring that company policies and relevant regulatory and legislative guidelines of environmental and HSE protections are adhered to during all project stages.

Project Maintenance Manager

The project Maintenance Manager shall ensure adequate housekeeping in the project area. He shall be responsible for collecting, sorting, and correct disposal of

project waste (executing an efficient waste management plan) and facilitating a good maintenance culture in the project.

Environmental Consultants

The client shall be required to employ environmental consultants to advise the project manager and the HSE manager on appropriate mitigation measures. They may also consult with national regulatory bodies.

Environmental Committee

The Environmental Committee shall be composed of all company departments. The company's HSE manager shall head it and ultimately oversee the formulation of HSE plans, policies, and procedures. In effect, it shall constitute a platform whereby the company (and all its projects) shall continuously adhere to internal, national, and international HSE rules and regulations.

7.3 EMP Guidelines

Table 7.1 below presents the detailed preliminary EMP guideline covering the project activities/environmental aspects, impacts of the activities, mitigation/enhancement measures, and designated responsibility for implementation.

7.4 Training and Capacity Needs

The implementation of this ESMP shall require the committee and stakeholders possess the appropriate capacity. During the public consultation, capacity assessment of the PAPs and community representatives were assessed in the area of community conflict/Grievance Redress and E & S process. The effective functioning of the above mentioned is compromised by limited knowledge on the ESIA process and other components that is covered in the ESMP. Thus, knowledge barriers include Limited knowledge on the principles of GRM, Resettlement Action Plan, Monitoring & Evaluation of ESMP Implementation, Conflict Management and Resolution in RAP implementation as well as ESMP implementation and monitoring. This capacity building plan has been taken into consideration in Table 7.X.... below

Table 7.1: Training Modules on Environment and Social Management

Programme	Description	Participants	Form of Training	Duration	Training Conducting Agency	COST ((\$) 1\$=1500 Naira
Sensitization Workshop	<ul style="list-style-type: none"> • Introduction to the environment: • Basic concepts of the environment and sustainable development. • Environmental regulations and statutory requirements in Nigeria, AfDB, IFC 	GRM Chairman & community representative, Implementing Agency and Project Manager, & Other relevant groups	Workshop	½ day	Safeguards Specialists, external agency engaged for capacity building.	1,000
Module I	<ul style="list-style-type: none"> • Review of the ESIA, ESMP & RAP and their integration into the project implementation: • ESIA methodology • Environmental provisions. • Implementation arrangements • Methodology of assessment and pollution monitoring. • Methodology for site selection of waste disposal area etc. • GRM implementation at community level 	GRM Committee, ESMP implementing Agencies	Lecture and field visit	½ day	Safeguards Specialists of Design Consultant/external agency engaged for capacity building.	1,000
Module II	<ul style="list-style-type: none"> • Monitoring and reporting system, community participatory monitoring and evaluation 	Community representatives, implementing Agency, SMeNV, & relevant MDAs, Community leaders/CBOs/N GOs		1 day	Safeguards Specialists of Design Consultant/external agency engaged for capacity building	1,500
Module III	<ul style="list-style-type: none"> • Gender and GBV Awareness Creation • Gender mainstreaming in transport operations • GBV prevention, mitigation and response 	Chief Engineer/ Superintending Engineers of Implementing Agency and Project Coordinator, Safeguards unit, Procurements & other relevant groups	Workshop	3 days	AfDB /Partner NGO	1,200
Total						4,700

Table 7.2. Environmental and Social Management Plan for the Quarry

	Project Phase	Project Activity	Environmental Component	Potential Impact	Management Action	Responsibility		Mitigation Cost (\$)
						Implementation	Supervision	1\$ = ₦1500
Planning & Pre-Construction	Site Acquisition	Land take	Socio-economic	Land acquisition	<ul style="list-style-type: none"> There shall be Transparent and fair compensation and compensation processes within one month of acquisition. Development leasing arrangement that would fairly and adequately evaluated and compensated for based on land use and returns 	Eso Terra Quarry Management	Katsina State Ministry of Land & Survey, Batagarawa LGA	4,000
				Dispute over land	<ul style="list-style-type: none"> Limit land acquisition Provision of security 		Lands and Survey, Katsina State, Batagarawa LGA	
					Site Survey		Personnel Health & Safety	
	Mobilisation to site	Transportation of equipment/materials/personnel to worksite	Air quality and personnel Safety	Adverse effects on air quality of the Kayauki community and others along the road due to emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts	<ul style="list-style-type: none"> Vehicles carrying materials must be fit and suitable for the environment. All vehicles and utilities mobilised for the project must adhere to strict environmental guidelines. 	Eso Terra Quarry Management through Maintenance Department, HSE Department	FMEnv, NESREA, Katsina State Ministry of Environment	2,000

Development	Quarry Development	Site Clearance	Flora and Fauna, Land use	<p>Loss of vegetation and humus soil. Loss of medicinal and rare species. Erosion of exposed land surfaces. Risk of dumped stripped soil blocking surface water channels. Risk of encroachment into culturally important land</p>	<ul style="list-style-type: none"> • Shall conduct vegetative surveys to identify medicinal plants and culturally significant land. • Rare and medicinal species shall be cultivated for replanting purposes. • Shall clear only areas required for immediate needs. • Shall return topsoil directly to rehabilitation areas, if possible, to avoid stockpiling. • Shall remove topsoil only when dry to appropriate depths. • Shall re-vegetate with local species as soon as possible. • Shall develop designated dump and stockpile sites. • Stockpile vegetative material, trees, and rocks for use during rehabilitation. • Do not disturb 	Eso Terra Quarry Management. Cultural/Archaeological National Commission of Museums and Monuments (For Finds).	FMEnv, NESREA, Katsina State Ministry of Environment, State Culture and Tourism Board	6,000
		Stripping of topsoil and compaction of same with earth-moving equipment within the proposed	Soil and Water	Erosion of exposed land surfaces.	<ul style="list-style-type: none"> • Shall clear only areas required for immediate needs. • Develop an adequate drainage system 		FMEnv, NESREA, Katsina State Ministry of Environment, Katsina State Ministry of Land & Survey	

		project location						
		Construction of Quarry (Quarry Plant, Offices, Base camps)	Soil	Risk of dumped stripped soil	<ul style="list-style-type: none"> Shall return topsoil directly to rehabilitation areas, if possible, to avoid stockpiling. 	Eso Terra Quarry Manager.	Eso Terra Management	
Quarry Operation	Rock Operation (Extraction)	Overburden removal to expose rock, pit development, and hole drilling with the use of drill wagons	Soil and Water	Blocking surface water channels and undercutting into the water table.	<ul style="list-style-type: none"> Shall remove topsoil only to appropriate depths & reuse. 	Eso Terra Quarry Management	FMEEnv, KASEPA	3,000
				Risk of encroachment into culturally important land	<ul style="list-style-type: none"> Shall limit removal of topsoil in the area except where necessary 	Eso Terra Quarry Management	FMEEnv, NESREA, State Culture and Tourism Board	1,000
		Blasting and loading broken or disintegrated rock with excavators into dump trucks and conveyed to the crushing machine.	Socioeconomic (Health and Safety, Assets)	Risk of damage to community assets because of blasting (crack in the building)	<ul style="list-style-type: none"> Proper blasting techniques and design to minimise the risk of fly rock, ground vibration and air blast overpressure that could cause injury or damage 	Eso Terra Quarry Management through HSE/Production Departments	MSMD through Mines Environmental Compliance, FMEEnv, Katsina State Ministry of Environment	2,000
			Visual impact	Destruction of site aesthetics	<ul style="list-style-type: none"> Stage developments and locate screening to reduce visual impacts. Rehabilitate benches as soon as possible. Carry out 	Eso Terra Quarry Management through HSE/Production Departments	Katsina State Ministry of Environment Environmental Consultants	2,500

				<p>progressive rehabilitation if possible.</p> <ul style="list-style-type: none"> • Re-vegetate the area, including the facilities and settlement areas, with native species as soon as possible; 			
		Air Quality & Noise	Localised increase (above baseline values in ambient concentrations of air pollutants (NO ₂ , SO _x , CO _x , C _x H _y , H ₂ S, & SPM)—noise and vibration from machines and blasting.	<ul style="list-style-type: none"> • Implement controlled blasting techniques & timing the blasts to minimise the impact on nearby residents or sensitive structures & reduce noise. • Use a water sprinkler to control dust where necessary 	Eso Terra Quarry Management	FME _{Env} , NESREA, Katsina State Ministry of Environment	2,000
Rock Processing Stage (Rock Crushing)	Dumping of the material conveyed by the dump truck to crushers.		Injury, death, and asset damage due to accidents during the dumping of materials from the point of the quarry to the feed hopper.	<ul style="list-style-type: none"> • Reduction in cases of dumping of materials within and around crushing locations & outlines procedures for responding to accidents, injuries or emergencies that may occur during dumping of materials and loading operations. 	Eso Terra Quarry Management	FME _{Env} , NESREA	3,000

Crushing and Screening. Stockpiling	Socioeconomic (Health and Safety)	Health-related hazards on operational staff due to constant inhalation of crushing materials Kidnap/forceful abduction of operation staff	<ul style="list-style-type: none"> Reduction in cases of dumping of materials within and around crushing locations & outlines procedures for responding to accidents, injuries or emergencies that may occur during crushing and processing of materials. Eso Terra Quarry shall issue appropriate penalties to staff defaulting on using PPEs. 	Eso Terra Quarry Management	FMEnv, NESREA	3000
		Project operations could attract hawkers and peddlers. Increase in criminal activities and possible illegal transactions between workers and the public. Disregard of warning signs.	<ul style="list-style-type: none"> Shall assign a designated area for hawkers and peddlers near the site. Employ 24-hour security guards on site. Periodic reporting of security guards on activities. Daily inventory of stock. Increased presence of law enforcement 	Eso Terra Quarry Management & Head of Security	Quarry Security, Police & other Agent	1000
	Haulage of granite aggregates to the required area along the railway alignment	Air Quality	Risk of injury, death, asset damage due to road traffic accidents and incidents Adverse effects on air quality due to emission of atmospheric	<ul style="list-style-type: none"> Establishing designated truck routes and enforce restrictions on truck movements in residential areas or sensitive zones to minimise accident Use proper signage and protective cover of aggregates when 	Eso Terra Quarry Management, Quarry HSE Department	FMEnv, Katsina State Traffic Management Authority

			pollutants (CO ₂ , PM2.5, PM10, NO _x , etc.) from internal combustion engines/exhausts during personnel movement	driving on major roads to flying rocks	Eso Terra Quarry Management through the Maintenance Department, HSE Department and Production Department	Maintenance Department, HSE Department, DSS, Police, MSMD through the Mines Inspectorate Office	2,000
	Maintenance and general operations of the facility	Soil and Water	The improper management of wastes meant for incineration and ash residue pollutes soil and groundwater sources around the facility.				
	Storage of dangerous goods		Accidental discharge of explosives. Accidental spills	<ul style="list-style-type: none"> • Shall ensure storage areas are accessible to emergency crews. • maintain accurate inventory of dangerous goods. • Store, handle and label chemicals, liquids, and explosives according tonational 	Eso Terra Quarry Management through the Maintenance Department, HSE Department and Production Department	Maintenance Department, HSE Department, DSS, Police, MSMD through the Mines Inspectorate Office	1,000

			<ul style="list-style-type: none"> regulations. • Train staff in correct usage and spill procedures. • Report spills and accidental detonations immediately. • Maintain all equipment (including emergency equipment) in good working condition. • Place guards at explosives storage sites; 			
	Waste Management	<p>Generation of Domestic and production waste. Incorrect disposal of soil and water pollution and health risks. Un-kept environment.</p>	<ul style="list-style-type: none"> • Provide waste bins around the site and practice good housekeeping. • Establish an appropriate frequency of cleaning activities. • Collect waste oil in steel • Containers for appropriate disposal. • Use waste rocks as fill materials for access roads and eroded sections around the quarry. • Compost organic waste if necessary. • Dispose of hazardous wastes to State Environmental Protection Board 	Eso Terra Quarry Management through Maintenance Department, HSE Department	FMEEnv, NESREA, Katsina State Ministry of Environment, KEPA	1,000

					<p>Licensed carrier/facility.</p> <ul style="list-style-type: none"> • Collect waste oils and solvents for recycling or/and dispose according to State Environmental Protection Board regulations. • Capture runoff from workshops by drainages. • Do not discharge solvent/detergent-contaminated waters to the environment. • Place rocks and blocks away from water bodies. • Clean up accidental oil spills and drips immediately. • Trap silt and other debris around water bodies using silt settlement techniques. 			
Post Quarry Operation	Demobilisation (Movement of vehicles and personnel)	Transportation of equipment/materials/personnel to worksite	Socioeconomic (Health and Safety)	Risk of injury to personnel due to exposure in the bushes. Work-related accidents. Public safety (during decommissioning);	<ul style="list-style-type: none"> • Provision of PPEs & Adequate safety training • Shall educate all staff on company HSE policy and procedures and ensure adherence. • Place warning signs prominently in dangerous areas. • Erect perimeter fencing at least 1m high and regularly 	Eso Terra Quarry Management	FMEEnv, Katsina State Road Traffic Agency	2,500

				<ul style="list-style-type: none"> place prominent signs along the edges. • Place danger signs prominently in dangerous areas. • Provide triangular reflectors on vehicles. • Enforce traffic regulations, both on-road and off-site; • Provide readily available on-site first aidequipment and medics. • Traffic control at project access points. • Carry out project activities away from facilities. • Provide appropriate PPEsand enforce usage. • Check and double-checkequipment. 			
		Air Quality & Noise	Adverse effects on air quality of the Kayauki community and others along the road due to the emission of atmospheric pollutants (CO ₂ , CO, NO _x , etc.) from internal combustion engines/exhausts	<ul style="list-style-type: none"> • All vehicles and utilities mobilised for the project demobilisation must adhere to strict environmental guidelines. 	Eso Terra Quarry Management	FMEnv, NESREA, Katsina State Ministry of Environment	4,000

	Decommissioning/Abandonment	Decommissioning/abandonment and Rehabilitation of ancillary facilities	Risk of Hazard/Health & Safety	Unstable post-quarry slopes. Erosion. Visual impacts. Reduce public safety. Menace from scavengers	<ul style="list-style-type: none"> Adhere to company and national regulations regarding decommissioning and rehabilitation. Station security guards ensure no trespassing or scavenging. Re-vegetate using native species of shrubs, grasses, and trees. Favour species with strong germination rates. 	Eso Terra Quarry Management	FMEnv, NESREA, MSMD, Katsina State Ministry of Environment, AfDB	15,000
			Risk of the improperly abandoned quarry site, e.g. drowning of humans and animals, particularly children, in mining pits, environmental degradation, etc		<ul style="list-style-type: none"> Eso Terra shall implement a proper reclamation plan: Develop a comprehensive reclamation plan before starting quarry operations. This plan should outline how the site will be restored and reclaimed once quarrying activities are completed. Eso Terra shall involve local communities and 	Eso Terra Quarry Management	FMEnv, NESREA, MSMD, Katsina State Ministry of Environment	10,000

					stakeholders in the planning and monitoring of quarry operations. This can help ensure that concerns are addressed and the site is abandoned correctly to benefit the community.			
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Table 7.3. Summary Budget for ESMP Implementation

Item	Responsibility	Cost Estimate	Cost Estimate
		NGN (₦)	USD (\$)
Mitigation	Eso Terra	₦8,000,000.00	\$5,333.33
Monitoring	FMEEnv, MSMD, Katsina State Departments/Ministries, Consultancy for Compliances	₦82,500,000.00	\$55,000.00
Capacity Building	Eso Terra Management, Community Leaders/CBOs /NGOs	₦10,250,000.00	\$6,833.33
Grievance Redress Mechanism	Eso Terra Management, Grievance Redress Committee	₦7,050,000.00	\$4,700.00
Community Development Agreement/CSR	Eso Terra, FMEEnv, Batagarawa LGA	₦105,000,000.00	\$70,000.00
Environmental Protection & Rehabilitation Plan	Eso Terra, MSMD, FMEEnv	₦101,544,333.95	\$67,696.22
Sub- Total		₦314,344,333.95	\$209,562.89
Contingency (Add 5% of Sub Total)		₦15,717,216.70	\$10,478.14
Total		₦330,061,550.65	\$220,041.03

Currency Unit = Nigerian Naira

US\$1 = ₦1500

7.5 Environmental Monitoring Programme

The Eso Terra Investment Limited shall strictly operate a monitoring programme that would lead to a sustainable project-environment relationship. The monitoring programme shall commence from the site preparation through rock quarrying, crushing/installations stages, and operations and decommissioning/ abandonment stages to keep track of the entire project's activities and performance. The monitoring programme provides information on the impacts compared with prediction. By so doing, provide advanced warning of any adverse changes in the biophysical and socio-economic environment.

Specifically, the objectives of the monitoring programme shall be to:

- Determine the effectiveness of the mitigation and enhancement measures for adverse and beneficial impacts, respectively.
- Provide a basis for recommending additional mitigation/enhancement measures.
- Ensure that the established transparent procedures for conducting the proposed project are sustained.
- Determine whether any detected environmental changes are caused by the project or other natural factors.
- Monitor alterations in the existing biophysical characteristics of the environment.
- Monitor and control emissions and discharges and ensure compliance with local, national, and international standards.
- Ensure sustenance of accountability and a sense of local ownership through the project lifecycle
- Provide early warning on any potentially serious problems.
- Measure long-term impacts.

Eso Terra Investment Limited shall comply with the FMEEnv regulatory controls and monitor specific environmental parameters during the proposed project activities.

The HSE department shall be responsible for ensuring that the monitoring programme is implemented. The key stakeholders for the monitoring programme should be the Kayauki/Fandare communities, Batagarawa LGA, Department/Ministries of Environmental, Waste management, Mining in Katsina state, African Development Bank through bi-annual inspection visits.

Periodic reviews shall also be conducted to check the monitoring programme's effectiveness and to redefine frequency, responsibilities, etc., as necessary. The monitoring programme designed for the proposed project is shown in Table 7.2.

Table 7.4. Environmental Monitoring Programme

COMPONENTS	IMPACT INDICATOR	LOCATION /METHOD OF MONITORING	FREQUENCY	RESPONSIBILITY
Biodiversity (Vegetation and wildlife)	Abundance and diversity of native plant and animal species, presence of exotic plant species, Type, density.	Within the facility	Yearly	Regulators/ Department HSE
Socio-economic and Health	Settlements and housing types, population and population distribution, income levels, social infrastructures/ Health records from previous studies and current studies	Kayauki Community	Yearly	Community Liaison Officer
Aquatic Life	<i>Fisheries</i> • Diversity and abundance	Within the quarry pits and the Kayauki earth pond	Yearly	Regulators/ Department HSE
Air Quality and Noise Level	• CO, SO ₂ , NO ₂ , VOC, CO ₂ , Wind direction, Wind speed, Temperature, Relative humidity, SPM • Noise Level dB (A)	Within the facility and 500m away from the circumference outside the facility along the predominant wind direction	Daily, Monthly, Quarterly, yearly	Regulators/ Department HSE
Soil Quality	pH, Temperature, EC, DO, COD, Hardness, Alkalinity, Chloride, Nutrient characteristics, Metals, Oil and Grease, TPH, Microbial characteristics etc.	Scattered around the facility area and immediately after the perimeter fence	Monthly, Quarterly, yearly	Regulators/ Department HSE
Surface Water Quality	pH, Conductivity., TDS, BOD, COD, Turbidity, Oil and Grease, Colour, Temperature, DO, Salinity, TSS, TPH, TOG, Metals, THB, THF, HUB,	Within the quarry pits and the Kayauki earth pond	Monthly, Quarterly, yearly	Regulators/ Department HSE

	HUF			
Sediment Characteristics	pH, Temperature, EC, DO, COD, Hardness, Alkalinity, Chloride, Nutrient characteristics, Metals, Oil and Grease, TPH, Microbial characteristics etc.	Within the quarry pits and the Kayauki earth pond	Monthly, Quarterly, yearly	Regulators/ Department HSE
Groundwater	pH, Cond., TDS, BOD, COD, Turbidity, Oil and Grease, Colour, Temperature, DO, Salinity, TSS, TPH, TOG, Metals, THB, THF, HUB, HU	Within the quarry pits and the Kayauki earth pond	Monthly, Quarterly, yearly	Regulators/ Department HSE

7.6 Guideline for Consultation

Eso Terra Investment Limited recognises the importance of consultations in all phases and activities of the proposed project. This is because appropriate and adequate consultations will ensure smooth project implementation and guarantee economic and commercial sustainability of future development in the area. Consultations, which began during the baseline data gathering in the project area, would continue throughout the project life cycle via an initiative-taking and structured approach, namely, interviews, administration of questionnaires, courtesy calls, and meetings with landlords, which also incorporate some components of the RAP (Appendix 3). The objectives of consultations are to:

- Ensure that all stakeholders are given early and adequate information on the activities involved in the proposed project.
- Provide a framework for improving the understanding of the proposed project's potential impacts on the socioeconomics and biophysical environment.
- Include stakeholders' views and concerns in the EIA execution, especially regarding potential impacts.
- Identify contentious issues in the proposed project execution.
- Establish transparent procedures for conducting the proposed project.

Eso Terra Investment Limited shall apply the following consultation techniques: Hold informal field visits with the immediate residents and other stakeholders to discuss the effectiveness of the project and its impact on the lives of the people and other concerns about the project. The consultation programme that Eso Terra Investment Limited will adopt for the proposed project is presented in Table 7.3, and the proposed stakeholder for consultation is presented in 7.4.

Table 7.5. Consultation Programme

BODY	CONSULTATION GOAL	DURATION
Stakeholder community/landlords	<ul style="list-style-type: none"> Identify concerns/opinions Identify areas of conflict Formation of appropriate mitigation /enhancement measures 	Throughout the project lifecycle

Table 7.6. Proposed Stakeholders for Consultation Activities

BODY	COMPUTATIONAL GOAL	DURATION	RESPONSIBILITY
Federal Ministry of Environment (FMEEnv)	Environmental procedures and standards	Throughout the Project life cycle	HSE coordinator
Ministry of Mines and Solid Minerals Development (MMSD)	Mining Procedure and Standard	Throughout the Project life cycle	General manager
African Development Bank	Implementation Support	Twice per annum	Compliance & Safety Department
Katsina State Key Stakeholders	Determine stakeholder concerns.	Throughout the Project life cycle	General manager
Host Communities	<ul style="list-style-type: none"> Identification of concern Identify areas of conflict Formation of appropriate Mitigation measures 	Throughout the Project life cycle	CLO/Administrative manager, Community Youth Organization, Traditional Leader, Religious Leaders, Political Leaders Women Group

7.7 Guideline for Waste Management

These guidelines apply to projects that generate, store, or manage any quantity of waste. A waste is any solid, liquid, or contained gaseous material discarded by disposal, recycling, burning or incineration. The way wastes are managed, stored, and disposed of is dictated by the nature of the waste; this waste management guideline considers the nature of all wastes generated during the proposed project. The standard for the guideline includes the regulations of the Department of Petroleum Resources (DPR) and other national and international environmental agencies, and these standards are binding on all staff and contractors involved in the proposed project with respect to them;

- Emission or release of pollutants, exhaust, and fugitive gases.
- Discharge or spill of effluent into surface water or land.
- Discharge solid wastes (including domestic waste) into surface water or land.
- Generation of noise and vibration.

7.7.1 Waste Handling Guidelines

Waste disposal/handling can sometimes be complicated and expensive, and regulations designed to ensure proper waste disposal have dramatically increased. For proper handling and disposal, wastes shall be well defined at a source, and the definition will be transmitted along with the waste to the final disposal points. Eso Terra Investment Limited shall define and document all waste generated during work. Basic information that must be provided, as a minimum, for adequate definition of wastes include:

- Waste type identification.
- Proper waste categorisation.
- Waste segregation information; and
- Recommended management practices.

7.7.2 Waste Minimization Guidelines

Waste minimisation implies reducing the volume or toxicity of waste materials to the minimum extent possible. It involves a set of processes and practices intended to reduce the amount of waste produced. By reducing or eliminating the generation of harmful and persistent waste, waste minimisation supports efforts to promote a more suitable society. The four principles of the waste minimisation process: recycle, reduce, reuse, and recovery shall be adopted as applicable. Opportunities to achieve significant waste volume reductions during the proposed project include activity level, age depreciation and maintenance level of facilities and operating equipment. In addition, all oil, hydraulic fluids, oily sump water, etc., shall be recycled or treated before disposal at any government-approved site in Katsina State.

7.7.3 Waste Segregation Guidelines

This process separates waste into different elements (dry or wet), which could occur manually or automatically in materials recovery facilities or mechanical biological treatment systems. To effectively implement appropriate waste disposal methods, wastes must be segregated, preferably at source, into designated bins at strategic locations. Particular attention shall be given to work areas where various wastes are generated, such as scrap metals, pigging waste, cans, drums, etc.

7.7.4 Waste Disposal Guidelines

All debris, spoil materials, rubbish, and other waste shall be disposed of at government-approved dump sites. Instructions on material safety handling shall be strictly adhered to and form the basis for the disposal of waste related to such products. Wastes on transit shall be accompanied and tracked by consignment notes. The waste consignment notes shall contain the following information as a minimum:

- Date of dispatch.
- Description of waste.

- Waste quantity/container type.
- Designated disposal site and method.
- Consignee /driver name and means of transportation; and
- Confirmation of actual disposal (time and date).

7.7.5 Operational Wastes and Disposal Methods

Eso Terra Investment Limited's waste management manager (or his equivalent) shall be responsible for production and domestic waste management in and around the project site. The company and the appointed district waste collectors shall coordinate waste collection and disposal.

The main objectives of the waste management plan are:

- Progressive reduction of all waste with the target of having control over all emissions/discharges which harm the environment
- Ensuring that all activity planning addresses waste management issues for domestic and industrial waste to recycle non-hazardous waste as much as practicable and
- Ensuring that staff and contractors (if applicable) are responsible for effectively managing and transporting waste from source to disposal/recycling facilities.

The management shall ensure that this commitment is translated into the necessary resources to develop, operate, and maintain an effective waste management system.

The HSE (and waste manager) shall ensure full implementation of the company's waste management policy objectives by overseeing the day-to-day handling and appropriate disposal of waste generated.

The section head/manager/supervisors are responsible for ensuring that all waste generated within their units is appropriately sorted out, weighted, or received before final disposal. They shall ensure that good housekeeping is maintained at all sites.

The waste management plan shall be developed and adopted during the various phases (preparation, operation to abandonment) of the project as follows:

Waste Management during Site Preparation

The top humus soil shall be carefully stripped and stored during site development for future re-vegetation. Other excavated materials shall be used as fill and backfilling materials for erosion control and reclamation after de-commissioning.

Waste Management during the Operational Phase

Eso Terra Investment Limited shall be responsible for monitoring, controlling, and disposing (working with an appointed state waste collector) of all waste (both production and domestic) generated during the operational phase. A waste inventory shall be kept to guarantee data integrity. The HSE manager shall work with the maintenance manager to ensure the waste plan is fully implemented at the site. He/she shall collect data for all the departments and operations (quarry and non-quarry related activities) to manage waste effectively.

Waste Management in Abandonment

Abandoned machines, equipment, and containers shall be sold as scrap metal or reused in other projects. Standing buildings, if any, shall be carefully disassembled to salvage reusable materials like doors, metals and aluminium frames, blocks, and roofing sheets.

Specifically, the waste management to be generated from the proposed development project is articulated in Table 7.5 below.

Table 7.7. Waste Management Plan

WASTE TYPE	HANDLING METHODS	FREQUENCY OF COLLECTION	RESPONSIBILITY
Broken blocks	Collected for reuse	Daily	HSE/maintenance manager
Hardened waste cement	Collected for onward disposal in designated dumpsites	Daily	HSE/maintenance manager
Metal scraps	Stored, reused, or	Daily	HSE/maintenance

	resold		manager
Paper waste	Collected in bins and disposed of in a designated dump site.	Daily	HSE/maintenance manager
Clinical waste (scalpers, soaked blood cloth, bandages, syringes, blades)	Collected in containers and incinerated on site.	daily	HSE/waste manager
Contaminated soil	Remediation by appropriate clean-up techniques	Weekly	HSE/SMENV
Explosives (when used)	Collected in boxes and marked explosives, returned to the vendor.	Daily or after blasting activities	Project manager/explosive handler
	Recovered and reused	Daily	HSE/maintenance manager
Waste plastics	Collected and recycled where possible	Daily	HSE/maintenance manager
Empty drums	Stored for reuse or sold to community people	Weekly	HSE/maintenance manager
Excavated earth/topsoil/ overburden	Heaped for backfilling and re-vegetation purpose	Weekly	HSE/maintenance manager/ project manager
Kitchen and other biodegradable waste	Collected for composting.	Daily	HSE/maintenance manager
Waste rocks and quarry fine	Collected for re-use or sales.	Daily	HSE/project manager

7.8 Noise Minimisation Guidelines

Noise and vibration generated by facilities and equipment shall meet the ergonomic requirements of Eso Terra Investment Limited and other national and international standards, codes of practice and statutory regulations. Where the noise level exceeds the stipulated limits, it shall be treated as a nuisance. Eso Terra Investment Limited shall implement adequate mitigation measures to address the situation appropriately. All personnel working long hours in high-noise areas (e.g., welding and generator areas) shall always be required to use earmuffs. Permanent warning

signs shall be posted at the boundaries of these restricted areas. The HSE Manager, through the Site Environmental and HSE Officers at work sites, shall ensure the full implementation of this plan.

7.9 Transport Operations

This plan is developed to mitigate the increased traffic due to the influx of the proponent's vehicles on local roads, especially if that area already has high traffic density.

This plan is as follows: -

- All vehicles and equipment operators shall be acquitted with the national highway codes and traffic rules and regulations and shall be mandated to obey
- Vehicles and motor equipment shall use recommended routes as shall be pre-defined by the transportation manager
- Where construction or project development activities are likely to impede traffic, temporary detours shall be required to be built adjacent to these sites. Where construction is impossible, the contractor shall plan works such as controlling single-lane traffic to serve road users before completion.
- A traffic warden shall be used to control traffic at the entry and exit points of the site if deemed necessary
- If traffic signs are to be placed by the proponent, they shall conform to national/international standards and form
- Traffic signs shall be placed on or about critical points along the project site
- Along narrow dirt roads, safe pedestrian and non-vehicular traffic access shall be provided along haulage access routes.
- Barricades and other movable concrete barriers shall be placed only after consultation with the FRSC
- Underaged and unfit drivers shall not be employed or used by the proponent
- Drivers or operators of construction vehicles shall have valid Nigerian Driver's Licenses, which shall be appropriate to the vehicle in question.

- Drivers shall have their schedule designed in such a manner that shall eliminate fatigue or the need for speed.

7.10 Prevention of Workplace Accidents/Incidents

Prevention of workplace accidents and incidents during the proposed project shall be achieved using the Job Hazard Analysis (JHA) tool and written work procedure. Consequently, the engineering team must conduct JHA for all operations and develop written and explicit work instructions. The work instructions shall integrate the JHA's recommendations. Only upon submission of the written work instructions and the supporting JHA or risk assessment document will the HSE Manager or site HSE Coordinator/Officer consider the project activity for approval. Project activities may only be approved if the HSE Manager or site HSE coordinator / Officer is objectively convinced that the work instructions are practical, safe, and following regulatory requirements.

7.11 Plan for Training and Awareness

To assure HSE competence and awareness, the project team headed by HSE and Construction Managers shall ensure that the company employees and other parties that will be involved in the project have the appropriate training and competence for various aspects of the project, including HSE critical activities, e.g., welding, loading, and offloading, etc. The competency requirements for contractor staff shall be stipulated in the contract document. The project team shall be subjected to periodic competence gap analysis from which training needs can be derived for the current job. The programme shall be reviewed on an ongoing basis as the project progresses by the HSE and Project Managers (based on reports from the site EHS officer) and shall, among others, include the following aspects:

- HSE induction course.
- Emergency response drill, including.
- First aid.

7.12 Communication Plan

Eso Terra Investment Limited and its contractors shall maintain effective two-way communication regarding HSE issues at all project phases. This will include an awareness programme to motivate staff and contractors. The site HSE Coordinator/Officer shall make available to the entire project team necessary HSE information and experiences to facilitate improvement in HSE performances. HSE personnel at all levels shall be made aware of the importance of compliance with the HSE policy and objectives and their roles and responsibilities in achieving it. They shall be made aware of the risks and hazards of their work activities, the preventive and mitigation measures, and the emergency response procedures that have been established. They shall also be made aware of the potential consequence(s) of departure from agreed operating procedures.

A duty officer's programme shall be established to manage and maintain effective communication. Contractors shall set up appropriate lines of communication to manage HSE issues, e.g., direct access to the nearest clinic and emergency services.

The Eso Terra Investment Limited management already has an established HSE performance scheme to promote staff HSE performance improvements, e.g., personal recognition, suggestion schemes, HSE performance bonus schemes for specific performance or at the end of a recognisable milestone, or a small give-away for recognisable performance. These shall apply during the proposed project.

7.13 Emergency Response / Contingency Plan

Compliance with regulatory standards, codes, specifications, and HSE guidelines shall form the basis for executing the proposed project. However, emergencies could still occur because of equipment failure, negligence, and sabotage. Consequently, Eso Terra Investment Limited shall develop a contingency plan, an organised and predetermined course of action to be pursued in the event of an accidental occurrence, as a backup to other containment systems to be put in place to manage such occurrences. At a minimum, the contingency plan (with responsible

parties for actions to be taken), which shall apply to both Eso Terra Investment Limited and contractors, addresses the following:

- Fires and explosions.
- Serious injury or illness.
- Hydrocarbon or chemical spills.
- Road accidents and
- Security issues.

Emergency Response Plan Framework

Eso Terra Investment Limited shall implement its Emergency Response Plan and other applicable national guidelines or legislations as given by relevant government agencies. For emergency response, the following measures are also recommended:

-

Training Needs

The training needs of the various categories of staff must be assessed and provided. This shall ensure the efficiency and applicability of the plan itself. Staff emergency response training shall be tailored towards: -

- Familiarity with the aims and objectives of the plan
- Familiarity with the implementation procedures of the plan
- Identifying emergencies or what constitutes an emergency
- Familiarity with emergency contact numbers and appropriate respondents
- Ensuring immediate or timely staff response to situations
- Proper documentation
- Availability and knowledge of areas where relevant items are stored, of all necessary materials needed for quick response to an emergency

Line of Respondents

The following is a proposed outline of the line of respondents.

First on the Scene

Any person or persons who first sight or identify an emergency shall be responsible for alerting all workers near the incident and reporting to the HSE Manager (or equivalent personnel).

HSE Manager

The HSE Manager must be able to identify the type of emergency and determine the hazards posed to human health, safety and environment, the likelihood and potential severity of harm, and the appropriate emergency procedures applicable to the situation.

Site Medics and Emergency Response Units

Injuries and other health issues that can be treated on-site shall be referred to the site medical personnel, and incidents like fires and collapsed structures shall be the responsibilities of the firefighting units (an effort should be made to make such readily available on-site) and engineers.

Hospitals and Relevant Agencies

Severe injuries and health hazards that cannot be treated on-site shall be promptly referred to the nearest hospitals (affiliated with Eso Terra Investment Limited if necessary) and relevant agencies, such as the National Emergency Management Authority (NEMA).

Emergency Response Procedures

The plan's procedure must be such that all the staff quickly understands it. It must be effective during implementation such that it affords the management a fast and efficient means of evacuating people and prompt means of arresting a situation. In ensuring the health and safety of people on site, the HSE officer shall:

- Ensure that workers are conversant with the procedure.
- Ensure that more than one health worker is readily available.
- Determine safe evacuation routes, which shall be well known to all.
- Establish an emergency safe zone away from the site.
- Provide emergency contact numbers.

- Develop an effective means of emergency reporting and documentation.

7.14 Environmental Audit and Review

To assure that environmental and social commitments and management procedures are being adhered to, as well as ensure that the project phases and activities are performed following laid down procedures/standards and that appropriate controls are in place, audits and reviews shall be conducted at predetermined milestones as management checkpoints throughout the project lifespan. Independent Environmental and Social Audits shall follow NESREA regulations and reports shared with AfDB. The cost for this activity should be factored into the ESMP cost. Eso Terra Investment Limited shall constitute a team led by the HSE Manager or his designate to embark on periodic audits of the proposed project activities as they progress to:

- Identify prevalent environmental issues.
- Evaluate periodic management practices and monitor standards.
- Compare environmental status with established baseline conditions and national/international regulatory standards and requirements; and
- Recommend areas of improvement in the EMP.

The Environmental audit shall be conducted in liaison with NESREA or FMEnv. Figure 7.2 shows the procedure for conducting an environmental audit with the FMEnv.

In implementing the audit programme, activities or structures in the project area perceived as having high environmental risks shall be thoroughly investigated, and recommendations made for improving the operation's management system where it is found wanting.

Audit recommendations shall be used to conduct a review and improve the operation management system where shortcomings are found.

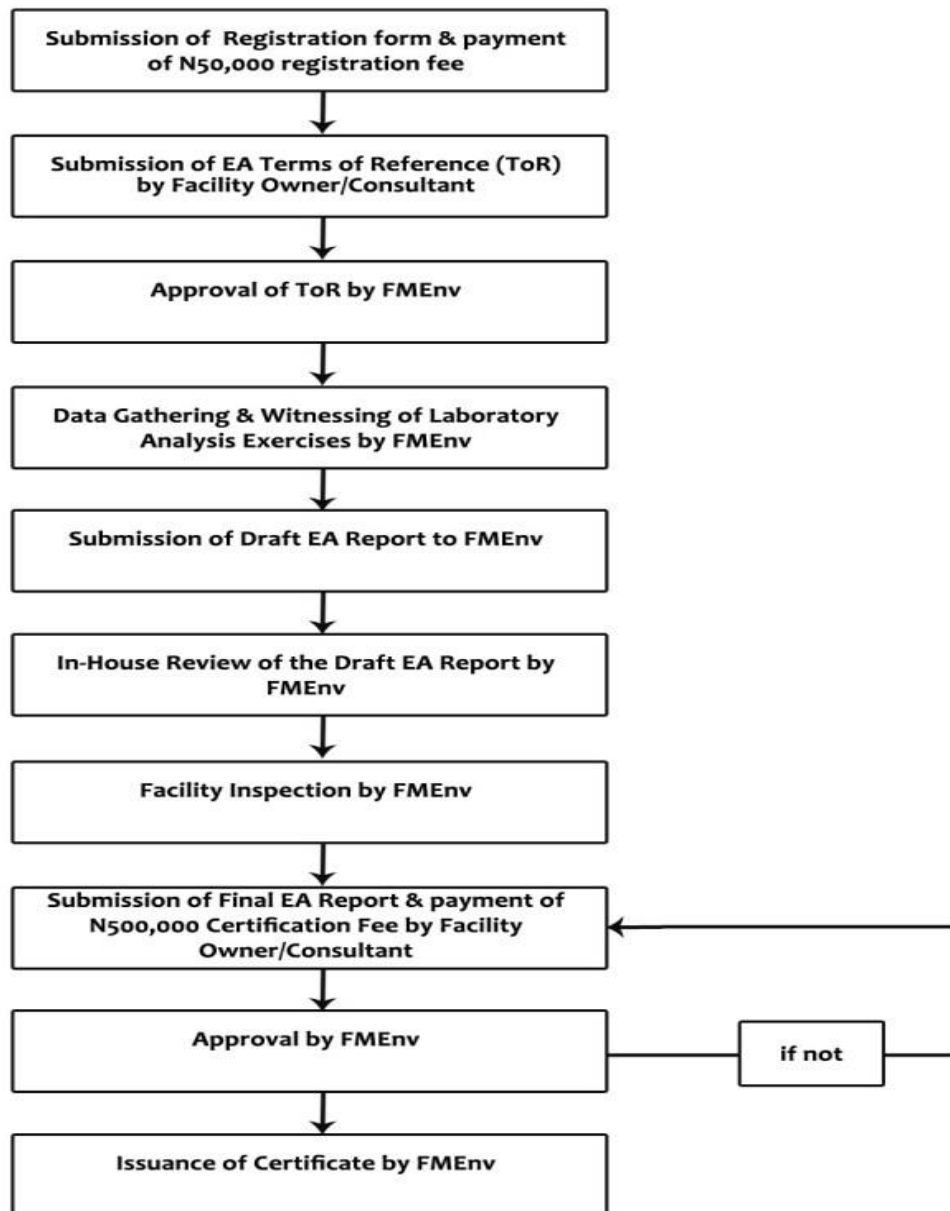


Figure 7.2: Environmental Audit Process

CHAPTER EIGHT

DECOMMISSIONING AND RECLAMATION FRAMEWORK

8.1 General

This framework shall be used as a guideline by the proponent when developing their decommissioning and reclamation plan. These measures aim to ensure security, health and safety, and protection of the natural and human environment after the discontinuance of quarrying operations. Emphasis shall be put on safety, re-vegetation, and backfilling.

8.2 Abandonment and Restoration Plan

At the expiration of the mine, Eso Terra Investment Limited shall fence the site using wire gauze and put the area under a lock. A preliminary abandonment and restoration plan shall be developed by Eso Terra Investment Limited and reviewed by the relevant regulatory bodies. The plan shall consider all technically feasible options for restoration, decommissioning, and abandonment, including alternative uses for the asset, following company policy and government regulations. Such considerations shall include:

- Restoration of land to conditions capable of prior land use, equivalent uses, or environmentally acceptable uses.
- Uses of overburden and topsoil for reclamation.
- Re-contouring of slopes of more than 300 to minimise erosion and run-offs.
- Contouring of slopes to minimise erosion and run-offs.
- Planting native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem on the reclaimed land.

8.2.1 Decommissioning

Before removing items of equipment, the contractor shall ensure that the equipment has been approved for decommissioning by reviewing the equipment decommissioning note. After that, Eso Terra shall be consulted for their decision regarding the disposal of the equipment after removal.

8.2.2 Demolition

All relevant international and national best practices standards shall be employed in the civil demolition. Structures such as camps and site offices which cannot be handed over to the adjoining communities or stakeholders for use shall be demolished. Buildings shall not be demolished until all the equipment has been removed.

8.3 Restoration

A detailed site survey will be conducted to assess the condition of the soil. Any polluted soil will be treated in situ or removed from the site and treated/disposed of safely and in an environmentally acceptable manner. All cement, steel or wooden structures not being left to others for use will be removed. It is, however, not envisaged that the quarry site would be abandoned in the future.

For the site restoration, Eso Terra Investment Limited shall implement the following.

- Survey the site for contamination.
- All equipment and debris shall be removed from the environment.
- All cleared spaces resulting from the decommissioning and removal of associated structures shall be re-vegetated using native species.
- All excavated routes shall be reinstated to their original topographical status to minimise negative impacts such as erosion.
- A good waste management plan would be put in place

- Building used for administrative and residential functions shall be leased out for other purposes.

8.4 Reclamation Activities

All stakeholders shall thoroughly discuss and agree upon land use after reclamation.

The alternatives that shall be considered shall include: -

1. Agriculture

- Arable use
- Livestock grazing
- Specialist food production (fishponds, nurseries etc)

2. Forestry

- Utilization of food crops for commercial production

3. Amenity

- Informal recreation (outdoor sport, camping, picnic, gathering, etc.)
- Planned water reservoir

4. Building Development

- Residential
- Commercial (shopping centres, markets, motor stations etc)
- Recreational (indoor facilities)

5. Landfill

- City waste dump (controlled bio-degradable waste)
- Construction waste (inert)

8.5 Labour Demobilization

Eso Terra shall implement the following.

- Consult with labour at least one year before commencement of decommissioning
- Embark on a retraining process to enable labour to acquire other skills
- Project workers shall either be adequately paid off or shall be relocated to other areas for employment
- Appropriate pension schemes shall be established for project workers' upkeep when the project is closed or decommissioned.

8.6 Environmental Protection and Rehabilitation Programme (EPRP)

A detailed EPRP has been developed in line with the Mining Act of the Federal Republic of Nigeria and shall be implemented appropriately.

The EPRP outlines practical procedures required for all project activities and personnel (i.e., employees, contractors, and suppliers) to reduce or eliminate the potential environmental effects associated with the mining site's development, operations, and post-operational phases.

The purpose of the EPRP includes but is not limited to the following:

- ensuring that commitments to reduce environmental effects are met.
- documenting environmental concerns and appropriate protection measures.
- provide a reference document for personnel when planning and conducting specific activities.
- provide direction for developing contingency plans for accidental events.
- communicating changes in the program through the revision process.
- provide a reference to and instructions for and understanding applicable legal and other requirements.

- including a quick reference for both project personnel and regulators to monitor compliance and recommend improvements, such as regular air and water quality monitoring, noise level checks, and biodiversity assessments; and
- provide corporate direction to ensure commitments made in policy statements are implemented and monitored.

CHAPTER NINE

CONCLUSION

The EIA of the proposed Quarry in Kayauki Community, Batagarawa LGA, Katsina State, conducted by Eso Terra Investment Limited, plays a crucial role in identifying and predicting the likelihood of the impact of this project on the recipient environment (ecological and socio-economic). The status and sensitivities of the project environment's various ecological and socio-economic components have been carefully established and assessed through literature research, field sampling and measurements within the proposed project axis, using a multi-disciplinary team of experts.

The study revealed that the air quality indices were within regulatory limits. The noise levels were below the tolerable noise limit (90 dBA). The pH of the water samples from the quarry pits was slightly alkaline; the value was consistent with the underground water sample, whose pH was slightly acidic. The water samples show the presence of E. coli in the quarry pits.

The biodiversity (microflora, macroflora, microfauna, and macrofauna life) was low. Identifying wildlife species in the project area includes amphibians, reptiles, birds, and mammals. Adherence to the EMP will reduce the negative impact of the Quarry activities in this area.

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APPENDICES

APPENDIX 1. AIR QUALITY AND LABORATORY RESULT

EIA Sampling Point Coordinates for Eso Terra Invst Ltd Proposed Granite Quarry (35121 QL) at Batagarawa LGA, Katsina State										
COORDINATES POINTS										
SN	SAMPLE CODE	LOCATION	LAT (N)			LONG (E)				
			DEG	MIN	SEC	DEG	MIN	SEC		
1	EBQS 1	Batagarawa	13	0	28.8	7	43	13.2		
2	EBQS 2	Batagarawa	13	0	33.8	7	43	10		
3	EBQS 3	Batagarawa	13	0	34.1	7	43	7.6		
4	EBQS 4	Batagarawa	13	0	24.6	7	43	2		
5	EBQS 5	Batagarawa	13	0	23.24	7	43	10.9		
6	EBQS 6	Batagarawa	13	0	33.9	7	43	20.2		
7	EBQS C	Batagarawa	13	0	50.7	7	42	22.9		

AIR QUALITY & NOISE SAMPLE POINTS																						
S/N	SAMPLE CODE	LOCATION	LAT (N)			LONG (E)			TVOC	HCHO	O ₂	CO	CO ₂	H ₂ S	CH ₄	pm 2.5	pm 10	Temp	Noise	R.Humidity	WS	WD
			DEG	MIN	SEC	DEG	MIN	SEC														
1	EBQ AN 1	Batagarawa	13	0	28.8	7	43	13.2	0.014	0.004	20.8%	1.0	408ppm	0.0	0%	30	39	32.0°C	62.5db	72%	2.02m/s	S-W
2	EBQ AN 2	Batagarawa	13	0	33.8	7	43	10	0.008	0.006	20.9%	1.0	408ppm	0.0	0%	28	36	30.0°C	61.7db	66%	1.72m/s	S-W
3	EBQ AN 3	Batagarawa	13	0	34.1	7	43	7.6	0.011	0.004	20.8%	1.0	405ppm	0.0	0%	23	30	34.0°C	71.4db	66%	1.54m/s	S-W
4	EBQ AN 4	Batagarawa	13	0	24.6	7	43	2	0.018	0.007	20.9%	1.0	408ppm	0.0	0%	28	36	32.0°C	57db	66%	2.56m/s	S-E
5	EBQ AN 5	Batagarawa	13	0	23.24	7	43	10.9	0.002	0.001	21.0%	2.0	410ppm	0.0	0%	21	27	31.0°C	58.9db	61%	1.65m/s	S-W
6	EBQ AN 6	Batagarawa	13	0	33.9	7	43	20.2	0.007	0.009	20.8%	2.0	404ppm	0.0	0%	28	36	35.0°C	55.2db	66%	2.78m/s	S-E
7	EBQ AN C	Batagarawa	13	0	50.7	7	42	22.9	0.015	0.008	20.9%	2.0	406ppm	0.0	0%	30	39	37.0°C	57db	55%	0.28m/s	S-E

RIVER WATER SAMPLE POINT												
SN	SAMPLE CODE	LOCATION	DEG	MIN	SEC	DEG	MIN	SEC	pH	TDS	EC	WATER TEMP
1	EBQ Pond	Batagarawa	13	0	28	7	43	6.7	8.8	0092ppm	0186	31°C
2	EBQ SW	Batagarawa	13	0	57.2	7	42	22.5	10.2	0181ppm	0364	32°C
3	EBQ BH	Batagarawa	13	1	1.6	7	42	28.2	8.4	0594ppm	1210	30.°C



MINISTRY OF ENVIRONMENT, KANO STATE (GREEN HOUSE)

BLOCK 5, AUDU BAKO SECRETARIAT, P.M.B 3022

Hon. Commisioner ☎ : 064- 668371 Perm. Secretary Fax: 669413

Our Ref: _____ Your Ref: _____ Date: _____

CLIENT: ESO TERRA INVESTMENT LIMITED NO.2 WAZIRI IBRAHIM CRESCENT ABAKPA GRA, KADUNA
CONSULTANT: SNAFHOCORE LTD
PROJECT NAME: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR PROPOSED GRANITE QUARRY (35121 QUARRY LEASE)
PROJECT ADDRESS: AT BATAGARAWA L.G.A, KATSINA STATE

DATE OF ANALYSIS: 30TH - 7TH OCTOBER 2023

WATER ANALYSIS RESULT

We certify that water samples were analysed, and below are our findings on the condition submitted to the laboratory.

SN	PARAMETERS	UNIT	EBQ Quarry WATER	SW1 Pit	EBQ Pond WATER	SW2	EBQGW BOREHOLE	FMENT LIMIT
1	Latitude	N	13028.6		13057.2		1311.6	-
2	Longitude	E	102974136.7		74222.5		74228.2	-
PHYSICO CHEMICALS								
3	Colour	PtC ₀ U	Clear		Clear		Clear	Clear
4	Odour	-	Odourless		Odourless		Odourless	Unobjectionable
5	Taste	-	Tasteless		Tasteless		Tasteless	Unobjectionable
6	Ph	-	7.85		8.92		7.72	6.5-8.5
7	Electrical conductivity	s/cm μ	263		160		799	1000
8	Total dissolved solids	ppm	174		98		566	500
9	Temperature	°C	27.9		28.5		28.5	Ambient
10	Total suspended solids	mg/l	131		59		18	30
11	Dissolve oxygen	mg/l	2.9		3.2		4.7	2-8
12	Turbidity	NTU	15		3		0	5
CHEMICAL PARAMETERS								
13	Nitrate (NO ₃ ²⁻)	mg/l	19.7		12.3		2.9	50
14	Phosphate (PO ₄ ²⁻)	mg/l	4.2		3.9		1.6	NS
15	Sulphate (SO ₄ ²⁻)	mg/l	33		12		7	100
16	Chloride (cl ⁻)	mg/l	5.736		5.008		0.341	25
17	Ammonium (NH ₄ ⁺)	mg/l	1.113		0.694		0.326	0.25
18	Calcium (ca ²⁺)	mg/l	4.8		3.3		21.7	200
19	Potassium (K ⁺)	mg/l	1.3		1.0		5	2.0
20	Total Hardness	mg/l	39.4		21.9		296.0	150
21	Magnesium (mg ²⁺)	mg/l	0.9		0.2		4.4	200
HEAVY METALS								
22	Lead (Pb ²⁺)	g/ μ	0.000		0.000		0.000	0.01
23	Mercury (Hg ⁺)	g/ μ	0.000		0.000		0.000	0.001
24	Zinc (Zn ²⁺)	mg/l	2.043		2.000		1.532	3
25	Chromium (Cr ³⁺)	mg/l	0.004		0.020		0.000	0.05
26	Iron (Fe ²⁺)	mg/l	1.362		1.024		0.922	0.3
27	Copper (Cu ²⁺)	mg/l						
MICROBIOLOGICAL TEST2								
28	E. coli	Cfu/ml	3		2		0	0
29	Total coliform	Cfu/ml	19		8		0	0

SOIL ANALYSIS RESULTS

Sequel to the analysis conducted below are the soil analysis results on the conditions submitted to the laboratory.

S N	PARAMETERS	UNIT	EBQ SAMPLE1	EBQ SAMPLE2	EBQ SAMPLE3	EBQ SAMPLE4	EBQ SAMPLE5	EBQ SAMPLE 6	EBQ CONTROL SAMPLE
	Latitude	N	13028.8	13033.8	13.034.1	13024.6	13023.24	13033.9	13050.7
	Longitude	N	74313.2	74310	7434.6	7432	74310.9	74320.2	74222.9
PHYSICO-CHEMICAL									
1	Colour	PtC ₀ U	Yellowish brown	Yellowish brown	Yellowish brown	Dark Yellowish-brown	Dark Yellowish-brown	Yellowish brown	Yellowish brown
2	Temperature	°C	30.1	29	28	28	29	28	29
3	PH	-	7.55	7.83	7.64	7.87	7.97	8.09	8.16
4	Electrical Conductivity	cm μ	2178	2200	2086	2170	2170	2192	2184
EXCHANGEABLE CATION									
5	Ammonium (NH ₄ ⁺)	mg/kg	2.402	2.113	0.820	1.926	0.931	1.420	1.114
6	Potassium (K ⁺)	mg/kg	0.03	0.82	0.62	0.06	1.28	1.04	0.69
7	Magnesium (mg ²⁺)	mg/kg	2.22	0.96	1.49	2.82	2.32	2.01	2.27
8	Calcium (Ca ²⁺)	mg/kg	6.64	4.01	5.00	6.32	6.29	6.41	6.78
9	Sodium (Na ⁺)	mg/kg	15	19	23	14	14	14	15
EXCHANGEABLE ANION									
10	Sulphate (SO ₄ ²⁻)	mg/kg	1.3	0.7	0.3	1.2	1.2	1.0	1.6
11	Chloride (cl ⁻)	mg/kg	0.08	0.03	0.11	0.09	0.15	0.06	0.07
12	Nitrate (NO ₃ ²⁻)	mg/kg	9.83	11.47	33.90	17.03	4.81	27.16	15.19
13	Nitrite (NO ₂ ⁻)	mg/kg	0.000	0.000	0.006	0.001	0.000	0.000	0.000

3									
1	Phosphate (Po ³⁻)	mg/kg	0.2	2.8	1.7	1.2	0.7	2.0	2.1
4									
D	ORGANICS								
1	Phenols	mg/kg	0.0130	0.0004	0.0030	0.0060	0.0000	0.0110	0.000
5									
1	Benzene	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6									
1	Oil and Grease	mg/kg	0	0	0	0	0	0	0
7									
1	Toluene	mg/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8									
1	2,4,6- Trichlorophenol	mg/kg	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9									
E	SOIL CHARACTERISTICS								
2	Sand	%	75	63	69	59	68	29	50
0									
2	Silt	%	10	20	19	39	33	64	33
1									
2	Clay	%	15	17	12	2	0	7	17
2									
2	Porosity	mm	2.3	2.2	2.2	3.4	3.0	0.3	2.6
3									
2	Permeability	cm/hr	15	13	14	10	14	4	8
4									
F	MICROBIOLOGICAL								
2	E. coli	cfu/g	0	0	0	0	0	0	0
5									
2	Fungi	cfu/g	14	28	56	13	16	7	26
6									
G	HEAVY METALS								
2	Arsenic (As ³⁺)	g/kg μ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7									
2	Zinc (Zn ²⁺)	mg/kg	4.8732	9.771	2.831	0.641	0.972	3.666	4.327
8									
2	Lead (Pb ²⁺)	g/kg μ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9									
3	Iron (Fe ²⁺)	mg/kg	16.532	29.400	0.289	1.380	1.009	1.478	1.020
0									
3	Copper (Cu ²⁺)	mg/kg	0.306	0.001	0.047	0.053	0.010	0.003	0.001
1									
3	Manganese (Mn ²⁺)	mg/kg	0.0008	0.0000	0.0002	0.0020	0.0000	0.0000	0.0000
2									
3	Chromium (Cr ³⁺)	mg/kg	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000

KEYS:

EBQ: - Eso Terra Batagarawa Quarry

mg/l: - milligram per litre

mg/kg: - milligram per kilogram

g/l: - microgram per μ

s/cm: micro-Siemens μ

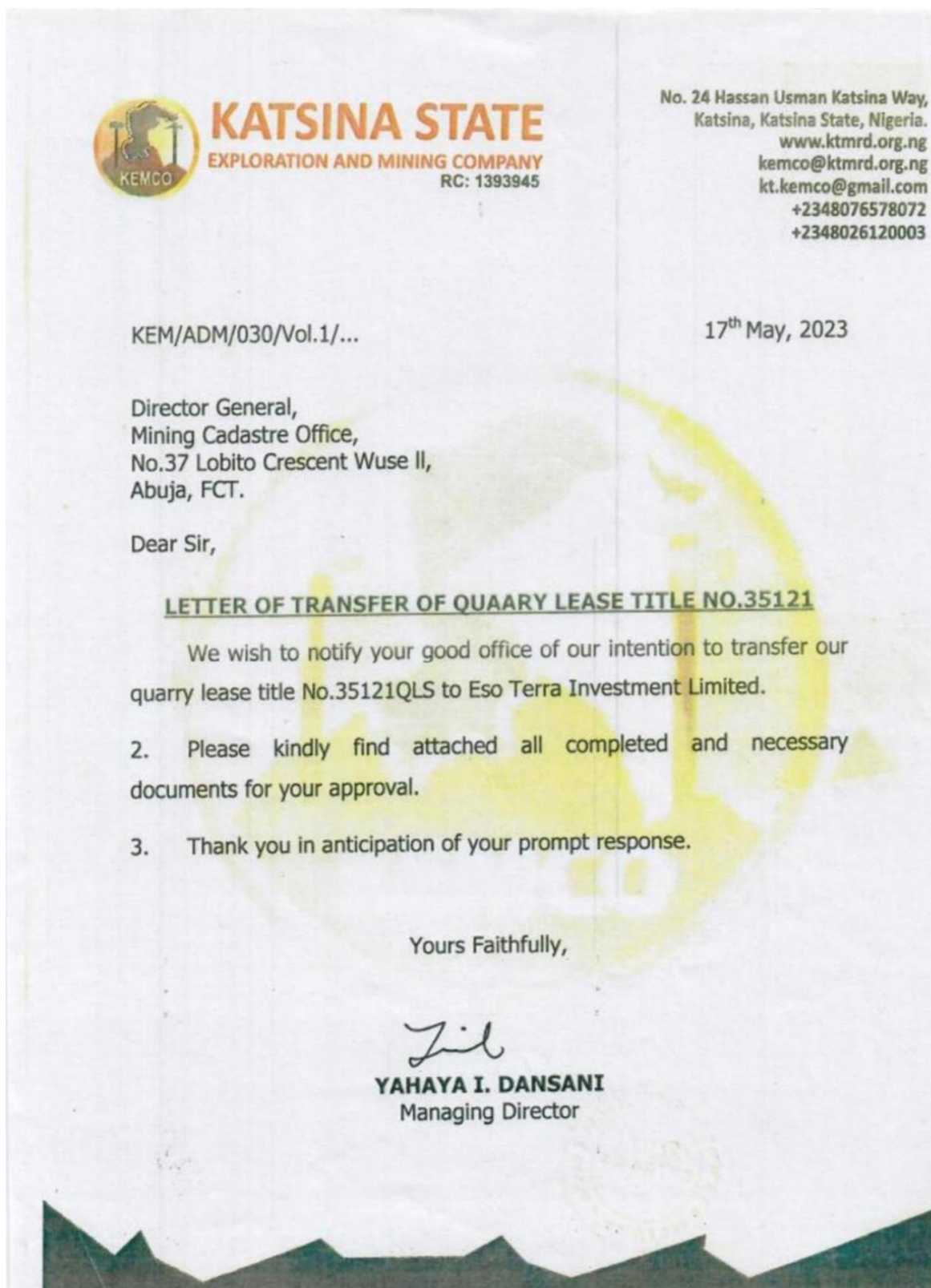
ppm: - part per million

PtCoU: - platinum cobalt unit

Best wishes


ABDULKADIR H. UMAR
 Principal Scientific Office

APPENDIX 2. 34083 QUARRY LEASE





Federal Republic of Nigeria
MINING CADASTRE OFFICE

No. 37, Lobito Crescent, Off Adetokunbo Ademola Crescent,
P.M.B. 107, Wuse II, Abuja. Tel: +2348164101937
Email: info@miningcadastre.gov.ng, Website: miningcadastre.gov.ng

MCO/REG/35121 QLS/83

Date: 8th June, 2023

The Managing Director

Katsina State Exploration & Mining Company Limited
Moh'D Bello Road,
Katsina State.

**RE:APPLICATION FOR THE FULL TRANSFER/ASSIGNMENT OF QUARRY LEASE
NO. 35121 QLS FROM KATSINA STATE EXPLORATION & MINING COMPANY
LIMITED TO ESO TERRA INVESTMENT LIMITED**

I am directed to convey the Director-General's approval of the Full Transfer/Assignment of **Quarry Lease No. 35121 QLS** from **Katsina State Exploration & Mining Company Limited** to **Eso Terra Investment Limited** with effect from **8th June, 2023**.

2. I am further directed to inform you that the approval of your Full Transfer/Assignment of **Quarry Lease No. 35121 QLS** is subjected to the full payment of **₦1,000,000:00 (One Million Naira)** only for **2 Cadastre Unit** at the rate of **₦500,000:00 (Five Hundred Thousand Naira)** per Cadastral Unit as Transfer Transaction Fee. The Amount should be paid within **fourteen (14) days** from the date of the receipt of this letter in line with the Provisions of Nigerian Minerals and Mining Act, 2007 and the Regulations made pursuant to it.

3. Furthermore, you are required to register your Transfer Agreement with the Nigeria Mining Cadastre office and also forward a copy of the transfer transaction fee receipt together with the original copy of your licence certificate/instrument for endorsement of the said transfer in line with the provisions of the Nigerian Minerals and Mining Act, 2007 and the Regulations made pursuant to it.

4. Please acknowledge receipt.


Ibrahim A. J.
For: Director General





FEDERAL REPUBLIC OF NIGERIA
MINISTRY OF MINES AND STEEL DEVELOPMENT
MINING CADASTRE OFFICE

Quarry Lease

No.: 35121, QLS.....

(Granted under the Nigerian Minerals and Mining Act, 2007)

A Quarry Lease is hereby granted to:

KATSINA STATE EXPLORATION AND MINING COMPANY LIMITED

for the following mineral(s):
*****GRANITE*****

The Perimeter of the lease is delineated by geographic coordinates (Longitude/Latitude, Degree/Minute/Second) on Topographic map sheet of 1:50,000 scale (as in the plan annexed to this lease).

Number of Cadastral Units (CU): 2

Area (km²): 0.4

Local Government Area(s): **BATAGARAMA**

State(s): **KATSINA**

The Quarry Lease is valid for a period of Five(5) years and is renewable. The holder of this Quarry Lease is required to perform his obligations in accordance with the provisions of the Nigerian Minerals and Mining Act, 2007, and its Regulations.

Effective Date: 24TH AUGUST, 2021

Expiry Date: 23RD AUGUST, 2026


Director General

Date: 18-10-2021

Warning: Failure to comply with the statutory obligations by the holder of this licence may lead to cancellation / revocation
Note: Renewals and endorsements are shown overleaf

(FOR OFFICIAL USE ONLY)

RENEWALS

Duration.....
Effective Date.....
Expiry Date.....

Duration.....
Effective Date.....
Expiry Date.....

ENDORSEMENT/TRANSFER OR ASSIGNMENT

Type: **TRANSFER**

Remarks:

ENDORSEMENT OF TRANSFER OF QL35121 FROM KATSINA STATE EXPLORATION MINING COMPANY LIMITED TO ESO TERRA INVESTMENT LIMITED



Date: **15-06-2023**

Type:

Remarks:

Date:.....

Type:

Remarks:

Date:.....

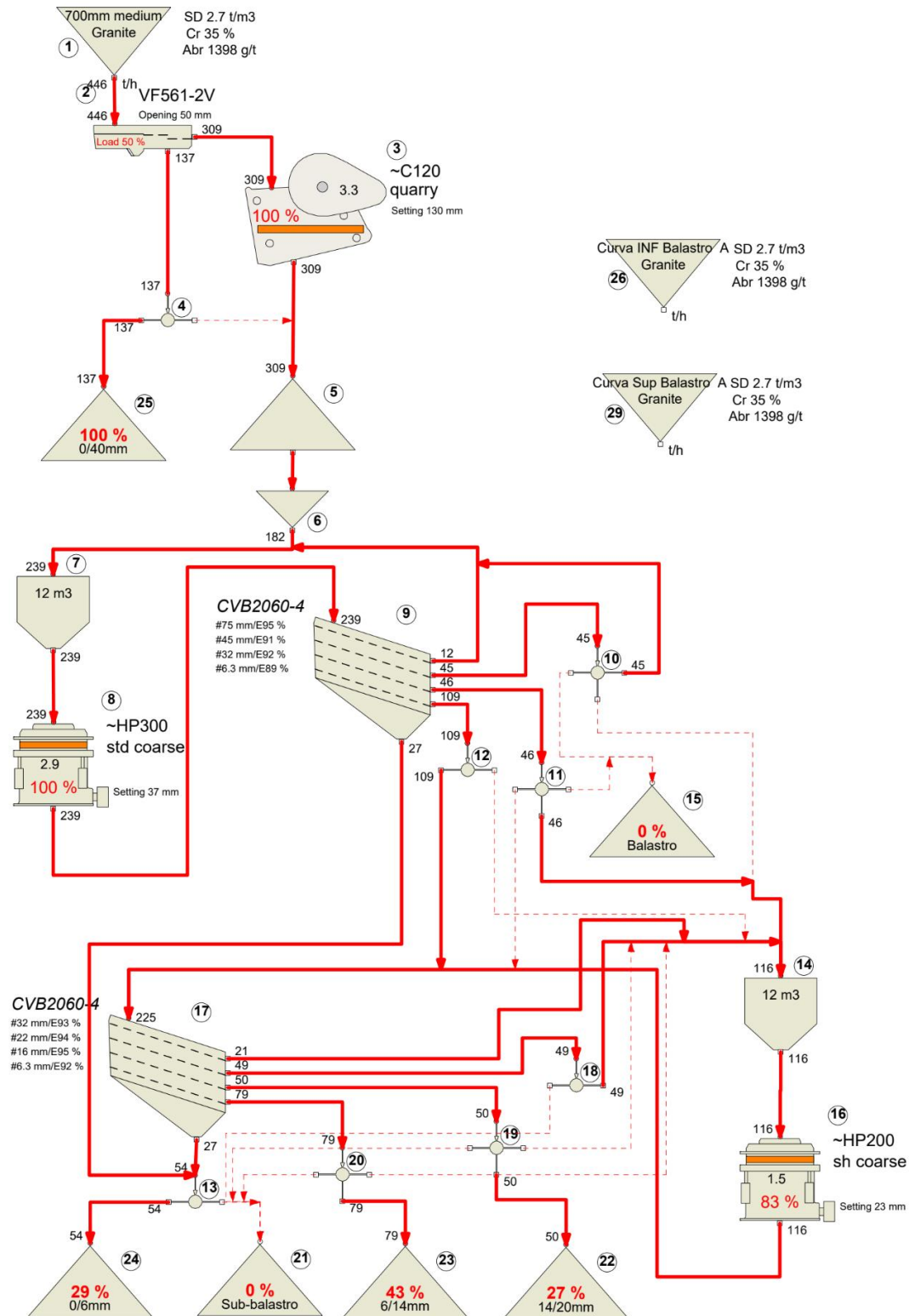
Type:

Remarks:

Date:.....

APPENDIX 3. QUARRY DESIGN

Domingos Silva



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27 SubBal Superior Granite SD 2.7 t/m3
Cr 35 %
Abr 1398 g/t
t/h

28 SubBal Inferior Granite SD 2.7 t/m3
Cr 35 %
Abr 1398 g/t
t/h

30 Curva INF Balastro Granite C SD 2.7 t/m3
Cr 35 %
Abr 1398 g/t
t/h

32 Curva INF Balastro Granite F SD 2.7 t/m3
Cr 35 %
Abr 1398 g/t
t/h

31 Curva Sup Balastro Granite C SD 2.7 t/m3
Cr 35 %
Abr 1398 g/t
t/h

33 Curva Sup Balastro Granite F SD 2.7 t/m3
Cr 35 %
Abr 1398 g/t
t/h

APPENDIX 4. SOCIO-ECONOMIC QUESTIONNAIRE



Shafcore Limited
INC 180778

QUESTIONNAIRE ON SOCIO-ECONOMIC CHARACTERISTICS OF SETTLEMENT/NEIGHBORHOOD (S) FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

SOCIOECONOMIC

Please take time to complete this questionnaire. The questionnaire will NOT be used to provide the basis for gain or compensation to any individual or the community. So, kindly provide realistic answers that are as close to the correct situation as possible.

SECTION A

EIA Project.	<input type="text"/>	Community	<input type="text"/>
Date	____ / ____ / ____ Time ____	LGA	<input type="text"/>
State	<input type="text"/>	Major Community	<input type="text"/>
Name of the major community association	<input type="text"/>		
Chairperson	<input type="text"/>	Functions of Association	<input type="text"/>
Vice Chairperson	<input type="text"/>		
Secretary	<input type="text"/>		

SECTION B

HISTORY, TRADITIONAL AND ADMINISTRATIVE STRUCTURE OF COMMUNITY/GROUP OF COMMUNITIES

Is the village part of a clan? <input type="checkbox"/> Yes <input type="checkbox"/> No	Name the ethnic group(s) that founded the village/Community
Name of clan: If yes <input type="text"/>	<input type="text"/>
When was the community founded? <input type="text"/>	Who is the overall/Highest traditional and administrative ruler of the community:
Traditional chiefs of the village /group of villages. Provide Titles, Name and Rank (after the highest traditional ruler)	Title <input type="text"/>
Is there a Council of Chiefs? <input type="checkbox"/> Yes <input type="checkbox"/> No	Name <input type="text"/>
State Functions of the Council of Chiefs <input type="text"/>	Where does he reside? <input type="text"/>
	Is there a Council of Chiefs? <input type="checkbox"/> Yes <input type="checkbox"/> No
	Name <input type="text"/>
	Title <input type="text"/>

SECTION C

CULTURAL, RELIGION AND ARCHEOLOGICAL

Please complete

Name of shrine/Deity Worshipped in community	Location, e.g., House, farm, road junctions, etc.	Material used for worshipping	Time of year/Frequency for worshipping
1			
2			
3			

Name of sacred forests and their locations

Name of Sacred Forests	Locations

Name forest reserve (s) within the nearby community.

Name sites of archaeological interest, e.g., for digging the ground to study the culture of the area

Name two major social clubs in the community.

Name of Festival	Time of Year Celebrated

Name of lakes

Name of River/Streams

Name community-based improvement schemes/organisations, including community banks or monthly contributions paid per household

Give the name and type of religion observed in the community

Islam

Christianity

Traditional

Others

SECTION D

DEMOGRAPHY

Give an estimate of:

Male

Female

Children

Total

Ethnic population of the community:

SN	Ethnic group	Total Population
1		
2		
3		
4		
5		
6		
7		
8		

Age distribution. Give an estimate of age groups in the community.

	Male	Female	Total
Number below 10 years			
Number between 10-20 years			
Number between 21-30 years			
Number between 31-40 years			
Number between 41-50 years			

Number 50 years and above			
Total			

Gender Issues

Do you think males and females should have equal rights? Yes No

Do you think it is right for a married couple to have an equal say in important house decisions? Yes No

Do you think that parents should encourage their daughters to aspire to professional positions in life? Yes No

If you were to choose, what sex of children would you prefer? Yes No

Do you think women should have the same opportunities as men in leadership? Yes No

Do you think a woman can make good decisions on important matters? Yes No

Household Facility Ownership

Which of these facilities do you own, and (are available in community and in use)?

Radio Television Refrigerator Telephone GSM Phone Wristwatch Bicycle Motorcycle Motor Car

Others

Transportation

What is the major means of transportation in the community?

Motor Car/Lorry/Truck Bicycle Motorcycle Others

Means of Communication

Which of these telecommunication services are available in your community, or what means of communication are in use?

MTN GLO ETISALAT MULTI-LINKS STARCOM Others

SECTION E

ECONOMY

Occupation/Employment Profile of community and income

Occupation type	Number of people	Amount earned per month
Farming		
Trading		
Casual labourers		
Chemist storekeepers		
Contractors		
Craft making		
Canoe building		
Domestic servant /Houseboy/H. girl		
Drivers (commercial motor)		
Drivers (Okada)		
Canoe ferrying		
Electrician		
Food cooking for selling		
Firewood collection for sale		
Fishing activities		
Hunting		

Occupation type	Number of people	Amount earned per month
Local gin brewing for sale		
Lumbering/timber extraction		
Livestock breeding for selling		
Mechanic		
Medical doctor		
Native doctor		
Night security guard/security		
Nursing		
Public servant/LGA worker		
Privately employed		
Sand collection/selling		
Teaching		
Trading/petty selling /marketing		
Unemployed		
Total		

Major crops grown in the community

i. ii. iii.

iv. v. vi. vii.

Major Livestock Reared in the community

i. ii. iii.

iv. v. vi. vii.

Fishing Equipment?

- Cast Net Hooks on thread and stocks Fishponds Basket traps Fish Fences Pensioning fish with chemicals

SECTION F

INDUSTRIAL

Name companies/industries present in the area.

Name	Address or location
a	
b	
c	
d	
e	
f	

Name and address/locations of hotels and guest houses within or near the community.

Hotels/Guest House

Address

Name of banks in or near community/communities

Hotels/Guest House

Address

SECTION G

EDUCATION

Name, address, and ownership of educational institution in the area

Nursery/Primary School

Address

Secondary/Commercial

Address

Technical School

Address

SECTION H
HEALTH FACILITIES

Is there a healthcare facility in your community? Yes No

What kind of health facility do you have? First Aid Clinic Health Centre Maternity Ward Hospitality

Does the health facility have qualified health personnel? Yes No

Does it have adequate medical supplies? Yes No

Do you visit the clinic whenever you or any other household member falls sick? Yes No

What are the sources of the medical supplies?

How long does it take to reach the facility from your house? <15min 15-30min 30-45min >60 min

If no to question 77, why is it so? Poor and inadequate drugs Too far from my house Health staff over-stretched

Others

Which diseases are most prevalent in your community?

State major environmental problems envisaged in the area with the proposed project. Tick, where appropriate.

- Flooding: _____
 ii. Deforestation: _____
 iii. Wildlife disappearance: _____
 iv. Air pollution: _____
 v. Soil erosion: _____
 vi. Solid waste disposal: _____
 vii. Water pollution: _____
 viii. Unfertile soil: _____
 ix. Plant/crop diseases: _____
 x. Water supply: _____
 xi. Others: _____

What type of toilet do you use in your household? Pit Latrine Near Bush Water Closet

How does this household dispose of its rubbish (solid wastes?)

- Collected by Government Buried by Household Public Approved Dump Unapproved Gump Site Dispose to farmlands Burning Family Refuse Dump

SECTION I
ENERGY SOURCES

What type of energy/fuel (source) do you use in your house for lighting? Electricity Gas Kerosine Candle Solar

Others

What type of energy/fuel (source) do you use in your house for cooking? Sand Dust Cornstalk Rice Chaff Charcoal Sugarcane wastes

- Firewood Kerosene Animal Dump

Others

WATER SUPPLY

Which of these water sources is available to you for domestic and livestock consumption? Pipe Bone Borehole Open well Stream Earth Dam

Others

How long does reaching the source (to and from) take you? <20min 20 - 40min 40 - 60min >60min

- <20min 20 - 40min 40 - 60min >60min



SECTION H
ENVIRONMENTAL IMPACT OF THE PROJECT ON COMMUNITY

How do you think the proposed project will affect the community based on the following?

		Adverse	Decrease	Increase	Positive	Beneficial	None
1	Population of community						
2	Employment opportunities						
3	Income						
4	Traditional rulers/village headship						
5	Settlement pattern						
6	Sacred shrine						
7	Medicinal plants						
8	Religious Worship						
9	Sacred forest						
10	Water bodies						
11	Festivals/celebrations						
12	Ethnic composition						
13	Age distribution of comm.						
14	Fisheries						
15	Wildlife						
16	Farming						
17	Companies/other estates						
18	Educational institutions						
19	Literacy level of the community						
20	Housing						
21	Transport						
22	Electricity supply						
23	Roads and drainage						
24	Health institutions						
25	Water						
26	Land						
27	Air quality						
28	Communication system						
29	Fuel for households						
30	Community security						

SECTION I

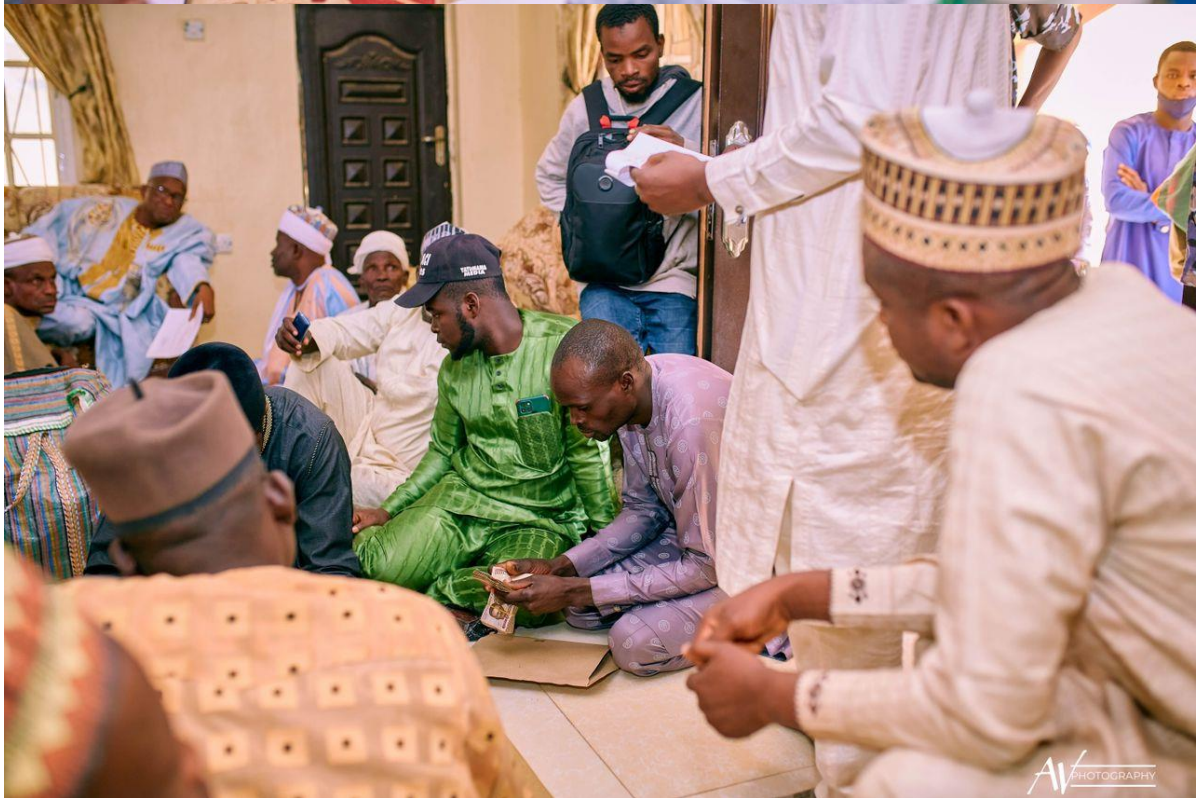
What are the community concerns regarding this proposed project?



APPENDIX 5. COMMUNITY ENGAGEMENT PHOTOS


























APPENDIX 6. COMMUNITY ENGAGEMENT, SCOPING & DATA GATHERING ATTENDANCE


Snaitcore Limited
 Project Title: EIA FOR THE PROPOSED GRANITE QUARRY (35121QL)
 Proponent: ESO TERRA INVESTMENT LIMITED
 Location: KAYAUKI VILLAGE, BATAGARAWA LGA KATSINA STATE
 SCOPING LIST AND SOCIO-ECONOMIC DATA GATHERING
 Date: 29/09/2023

S/N	NAME	ORGANIZATION	DESIGNATION	PHONE NUMBER	EMAIL	SIGNATURE
1	Said A. Bello	Snaitcore Ltd	Director	08036316255	sa@snaitcore.com	
2	A. B. Maina	fm Survey Africa	CEO	08036129096	maina@surveyafrica.com	
3	ZUBARU PALAU	Kayauki village		08063560046		
4	Abdu Usman			0806102024		
5	RARE BELLO			08038330108		
6	Allyya Zubeiru			08168629481		
7	Uba Abdulkali			09114325863		
8	Yusuf Ibrahim			09116014441		
9	SULE AMAT	Kayauki village		08035093390		
10	Yusuf Ali			08035526126		
11	Yusuf Ali			08065522951		
12	Yusuf Ali			09038588328		
13	Saidi Seal			09120203841		
14	AMMANI TURKUR	Kayauki village		08038961955		
15	AMMANI SAIDU			08030894424		
16	Muhammad Kassi			09062244142		
17	Muhammad Saidu			08060986531		
18	Muhammad Saidu	Snaitcore Ltd	Consultant	07034954334	muhammad@snaitcore.com	
19	Yakubu H. Omala	ESO Terra		08133950642	h.omala@eso-terra.com	
20	Sayeed Tijunwa			07031154409		
21	Ahmed	Kayauki village		08036949588		
22	Ahmed M. Dategarwa			08036949588		



Snahcore Limited

Scoping List Study Socio-Economic Data Interview

SHE VERIFICATION ATTENDANCE SHEET

Project Title: EIA FOR THE PROPOSED GRANITE QUARRY (35121QL)
Proponent: ESO TERRA INVESTMENT LIMITED

Date: 29/09/2023

Location: KAYAYUKI VILLAGE, BAIAGARAWA LGA KATSINA STATE

S/N	NAME	ORGANIZATION	DESIGNATION	PHONE NUMBER	EMAIL	SIGNATURE
27	Sana Suddun Aluhaka	Kayayuki village	Work	09168484162		
24	Muhammadi Fajalu	—	—	010608792221		
25	Saidul Isah	Kayayuki village	—	09120205841		
26	Zahra Bin Abubakar	Kayayuki village	—	07085500556		
22	Musa Sulhas	—	—	09029932222		
28	Abdullah Mandullahi	Kayayuki village	—	08102719064		
29	Yusuf Mammuan	—	—	08167999468		
30	Yasar Bala	—	—	04042262444		
31	Tashem Aliyu	Kayayuki village	—	08035576176		
31	Zahra Bin Aluhaka	—	—	0915500596		
32	Halima Abdullahi	—	—	08102219064		
33	Ali. Salau Fulewa	—	—	08065298463		
24	Muhammad Ladan	—	—	08065298463		
35	Alam Suddun Fajalu	—	—	08035376090		
36	Yasiru Bala	—	—	0406578872		
37	HAWWAN ZUBARU	—	—	08168639481		
38	HATIBU HAMISA	—	—	08032116981		
39	Sani Musa	—	—	0806986531		
40	Saniwun Tukur Dubawa	—	—	0806986908		
41						

APPENDIX 7. COMMUNITY LAND LEASING

DEED OF LEASE

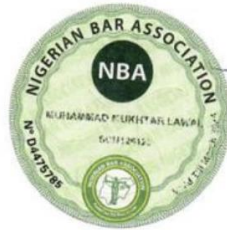
BETWEEN:

77 ANNEXED PERSONS
(LESSORS)

AND

ESO TERRA INVESTMENT LTD
(LESSEE)

Prepared by:



Muhammad Mukhtar Lawal, Esq.
Ahmad Sani KaiKai Esq.
Barrister and Solicitor
ELAN SOLICITORS.
Flat. 2 Galadimel Plaza,
Off Yarinci Crescent,
Katsina, Katsina State
08134559973

THIS DEED OF LEASE AGREEMENT made this 30th Day of December 2023,
BETWEEN:

THE 77 PERSONS ANNEXED TO THIS AGREEMENT all of Fandare, Rimi LGA and Batagarawa LGA, Katsina, Katsina State, Nigeria (hereinafter referred to as "THE LESSORS") which expression shall where the context admits includes his heirs, executors, administrators, assigns personal representatives, successors in title, administrators of the one part.

AND:

Eso Terra Investment Ltd, Private Company with a registered office situated at No. 20, Ali Akilu Road Kaduna, Nigeria, (hereinafter referred to as "THE LESSEE") which expression shall where the context admits includes his heirs, executors, administrators, assigns personal representatives, successors in title, administrators of the other part.

0.1. RECITAL

- a. The Lessors are the owners of Land lying and situate at the above known address.
- b. The said land and the surface underneath thereof are a quarry site legally fit mining granite.
- c. The Lessors been the Bonafide owners are willing to lease same to the Lessee for a period of three years (3).
- d. And the Lessee are desirous of leasing same for the period above.
- e. The lease shall be for a period of 3 years starting from the 30th December 2023 to 30th December 2026 with an option for renewal.
- f. That at the expiration of the lease agreement, the Lessee shall to the best of its ability make the land farmable.

0.2. NOW THIS DEED WITNESSES AS FOLLOWS:

1. In pursuance of the said agreement between the Lessors and the Lessee and in consideration of the sum of N18,566,184.00 (Eighteen Million, Five Hundred and Sixty-Six Thousand, One Hundred and Eighty-Four Naira) only now to be paid by the Lessee to the Lessors for the period of three (3) years, the receipt whereof the Lessors hereby acknowledges dividable to

lessors as contained in the annexure of the lease agreement), the Lessors as beneficial owner of the Land annexed to this agreement HEREBY LEASES to the Lessee, their interest and or title in the said property for a period of three (3) years, commencing on the 30th December, 2023 and to expire on 30th December, 2026. To hold the same unto the Lessee for all the said term.

IT IS HEREBY EXPRESSLY AGREED BETWEEN THE PARTIES AS FOLLOWS :-

1. That the Lessee shall have full control of the Land, may quietly hold and enjoy the Land during the term of this lease purposely for mining granite and other related activities thereto, and the Lessors shall not disturb or interrupt the Lessee or any person claiming through or in trust for them.
2. The Lessee shall ensure that best effort is put on the Land to be fit for proper usage after the expiration of the lease agreement.
3. The Lessee shall use the Land as quarry site to carry out mining activities and other related or incidental matters without any interference from the Lessors.
4. The lessee shall be entitled to bring equipment's, tools and articles to carry out quarry operations on the said Land.
5. The lessee shall be allowed to construct temporarily or permanently as may be required in convenient place on the said Land.
6. Lessors covenant with the Lessee not to alter option of reversionary right.
7. This lease shall be subject to renewal upon the mutual agreement of the parties hereto.

Intending to be legally bound, the parties hereto have hereunto executed this agreement on the day and year first above written.

SIGNED, SEALED AND DELIVERED BY ALL THE 77 PERSON ANNEXED TO THE SAID LEASE AGREEMENT OF THE WITHIN-NAMED LESSORS

In the Presence of:-
NAME: MUHAMMAD MUHAMMAD LAMAL
ADDRESS: 1 LAMAMA HOUSE
GALADANGHI
OCCUPATION: BUSINESSMAN
SIGNATURE/DATE: _____
PHONE No. 08036587986




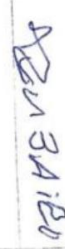




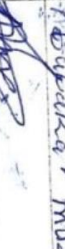



The seal of the within named Companies
ESO TERRA INVESTMENT NIG LTD is affixed hereunto




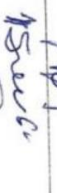
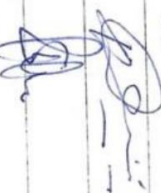








In the presence of





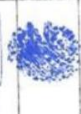

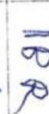



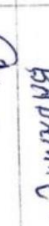




Abdullahi
DIRECTOR












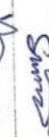


[Signature]
SECRETARY













QUARRY AFFECTED FARMLANDS

SN	NAME	PHONE	Area		Rate (NGN) Per Ha	Rent Duration		SIGNATURE
			m ²	Hectare		1 Year	3 Years	
1	ZUBAIRU FALALU	08063560046	2,564	0.26	260,000	66,664	199,992	
2	MUHAMMAD FALALU	07060879224	2,637	0.26	260,000	68,562	205,686	
3	SHAMSUDDIN FALALU	08035376090	3,291	0.33	260,000	85,566	256,698	
4	ABDU USMAN	08016102024	4,399	0.44	260,000	114,374	343,122	
5	ZUBAIRU RABIUU	07086121557	1,565	0.16	260,000	40,690	122,070	
6	HAUWAU ZUBAIRU	08168639481	348	0.03	260,000	9,048	27,144	
7	RAHILA ZUBAIRU	08168639481	328	0.03	260,000	8,528	25,584	
8	HAIYA ZUBAIRU	08168639481	432	0.04	260,000	11,232	33,696	
9	BELLO ZUBAIRU	08168639481	810	0.08	260,000	21,060	63,180	
10	MUHAMMAD ABDULAZIZ CUSTOM	08033896954	2,055	0.21	260,000	53,430	160,290	
11	ABUBAKAR MUSA	09125691294	2,650	0.27	260,000	68,900	206,700	
12	RABE BELLO	08038330108	6,363	0.64	260,000	165,438	496,314	

13	ISA ABDULLAHI	09114375863	895	0.09	260,000	23,270	69,810	
14	SALISU USMAN	08065408426	3,939	0.39	260,000	102,414	307,242	
15	ABDULLAHI NURA	09121041134	1,846	0.18	260,000	47,996	143,988	
16	ISYAKA MAMMAN	08167979468	3,940	0.39	260,000	102,440	307,320	
17	KABIR BALA	08063767448	3,021	0.30	260,000	78,546	235,638	
18	SUNUSI LADO SAULAWA	08106877009	3,080	0.31	260,000	80,080	240,240	
19	SAADU HALADU	08065461880	2,327	0.23	260,000	60,502	181,506	
20	YUSUF IBRAHIM	09116014441	2,794	0.28	260,000	72,644	217,932	
21	SULE LAVAL	08035093390	293	0.03	260,000	7,618	22,854	
22	MUHAMMAD TUKUR	07063024090	3,081	0.31	260,000	80,106	240,318	
23	ABDULAZIZ MUHAMMAD	09033055833	4,115	0.41	260,000	106,990	320,970	
24	ABDURRASHID MUHAMMAD	08162510486	3,516	0.35	260,000	91,416	274,248	
25	MUSA IBRAHIM	09027933834	4,679	0.47	260,000	121,654	364,962	
26	ABDURRASHID TUKUR	07048654337						

27	SAMSUDDIN ABUBAKAR	09168484162	2,303	0.23	260,000	59,878	179,634	
28	SA'ADU ISAH	09120203841	759	0.08	260,000	19,734	59,202	 
29	ZAHRA BIN ABUBAKAR	07085500596	1,363	0.14	260,000	35,438	106,314	 
30	HALILU ABDULLAHI	08102719064	341	0.03	260,000	8,866	26,598	
31	IBRAHIM ILIYA	08035576176	1,779	0.18	260,000	46,254	138,762	
32	DANLADI ABUBAKAR	07037277732	1,416	0.14	260,000	36,816	110,448	
33	ALH UMAR ILIYASU	08034628148	18,245	1.82	260,000	474,370	1,423,110	
34	LAWAL IBRAHIM	08065527051	13,342	1.33	260,000	346,892	1,040,676	
35	ILYASU MUHAMMAD	09038588376	8,652	0.87	260,000	224,952	674,856	
36	MAL BADAMASI IBRAHIM	07010264586	8,598	0.86	260,000	223,548	670,644	
37	DALHA SANI	08101172888	1,671	0.17	260,000	43,446	130,338	
38	AMADU TUKUR	08038961955	2,972	0.30	260,000	77,272	231,816	
39	ALH KABIR SANI	08036032424	8,118	0.81	260,000	211,068	633,204	

40	HAMISU HALADU	08069501131	2,879	0.29	260,000	74,854	224,562	
41	SAMINU ABDU	07030874811	1,357	0.14	260,000	35,282	105,846	
42	BISHIR SAIDU	08068079826	963	0.10	260,000	25,038	75,114	
43	ALH SA'IDU FANDARE	08069298843	6,493	0.65	260,000	168,818	506,454	
44	ALH KABIR MAKURDA	07080223592	11,265	1.13	260,000	292,890	878,670	
45	ABBA METURARE	08067428743	1,490	0.15	260,000	38,740	116,220	
46	HALADU HAMISU	08032116381	2,470	0.25	260,000	64,220	192,660	
47	AMINA HANNI	08037463159	2,355	0.24	260,000	61,230	183,690	
48	ALH ISAH ABDU	08165239527	1,770	0.18	260,000	46,020	138,050	
49	BISHIR IBRAHIM	09168923520	867	0.09	260,000	22,542	67,626	
50	AMINU AHMADU	08038961955	4,917	0.49	260,000	127,842	383,526	
51	BADAMASI ABDULLAHI	08068987908	3,806	0.38	260,000	98,956	296,858	
52	SANI TUKUR SULAIMAN	08033066953	833	0.08	260,000	21,558	64,974	
53	ALH KABIR SANI	08036032424						

54	ALH SHUABU ISAH	08030411645	4,237	0.42	260,000	110,162	330,486	
55	ALH ALI HAMISU	08073635665	5,245	0.52	260,000	136,370	409,110	 29/12/2023
56	ALH MAHADI ABDULLAHI SAIDU	08073635665	4,111	0.41	260,000	106,886	320,658	
57	MANHIR LAWAN	07065744142	1,293	0.13	260,000	33,618	100,854	 MN n 7
58	SANUSI ABDULLAHI	08037927392	1,176	0.12	260,000	30,576	91,728	
59	LAWAL SABIU	08063560046	3,122	0.31	260,000	81,172	243,516	 L Sabiu
60	ISAH RABIU	09129169889	2,182	0.22	260,000	56,732	170,196	
61	ILIYA ABDULKADIR	08069521111	3,222	0.32	260,000	83,772	251,316	
62	SANI ILIYA	08036360456	584	0.06	260,000	15,184	45,552	
63	HALLIRU BELLO (MOP UP)	07065785472	1,096	0.11	260,000	28,496	85,488	
64	NAFIU SUNUSI (MOP UP)	08037037900	494	0.05	260,000	12,844	38,532	
65	SANI MUSA (MOP UP)	08060785531	644	0.06	260,000	16,744	50,232	
66	MUHAMMAD FALAU (MOP UP)	07060879224	191	0.02	260,000	4,966	14,898	

67	MARYAM SAIDU (MOP UP)	08060786531	766	0.08	260,000	19,916	59,748	<i>Maryam Saidu</i>
68	SAMINU TUKUR SULAIMAN	08068987908	2,008	0.20	260,000	52,208	156,624	<i>Saminu Tukur Sulaiman</i>
69	ALHAJI SHUAIBU ISA	08030411645	4,695	0.47	260,000	122,070	366,210	<i>Alhaji Shuaibu Isa</i>
70	RABIU SAIDU	07031283325	569	0.06	260,000	14,794	44,382	<i>Rabiu Saidu</i>
71	AHMAD MUHAMMAD BATAGARWA	08036947588	3,245	0.32	260,000	84,370	253,110	<i>Ahmad Muhammad</i>
72	LAWAN SAIDU	08030894434	2,963	0.30	260,000	77,038	231,114	<i>Lawan Saidu</i>
73	UMAR AHMAD	08036947588	1,157	0.12	260,000	30,082	90,246	<i>Umar Ahmad</i>
74	ALHAJI KABIR KOFAR SAURI	07080223592	8,001	0.80	260,000	208,026	624,078	<i>Alhaji Kabir Kofar Sauri</i>
75	SALISU HABIBU	07068800354	2,669	0.27	260,000	69,394	208,182	<i>Salisu Habibu</i>
76	MANNIR LAWAI	07062744142	4,055	0.41	260,000	105,430	316,290	<i>Mannir Lawai</i>
77	IBRAHIM SANUSI	08031944943	574	0.06	260,000	14,924	44,772	<i>Ibrahim Sanusi</i>
	TOTAL		238,028	24	20,020,000	6,183,728	18,566,184	

APPENDIX 8. CORRESPONDENCE WITH FMEnv.



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja-FCT.

Email: info@ead.gov.ng, www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

FMEnv/EA/EIA/7296/Vol.1/33

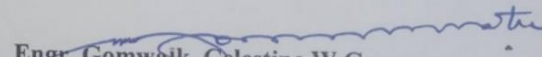
29th September, 2023.

The Managing Director,
ESO Terra Investment Limited,
No. 20, Ali Akilu Road,
Kaduna,
Kaduna State.

RE: APPLICATION FOR REGISTRATION OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED GRANITE QUARRY (35121QL) IN BATAGARAWA LGA, KATSINA STATE

Please refer to your letter dated 11th September, 2023 on the above proposed project.

2. I am directed to inform you that the Ministry shall witness the Data Gathering and Laboratory Analysis exercises of the collected samples.
3. Accordingly, you are to pay the sum of Five Hundred Thousand Naira (₦500,000.00) only for the two exercises. You are also requested to kindly provide necessary logistics to ensure a hitch free exercises.
4. You may wish to contact the undersigned on GSM number 08037869670 or Ladula, H.D. (08020910889) to confirm the receipt of this letter and for any clarification, please.
5. Thank you for your Co-operation.


Engr. Gomwalk, Celestine W.G.
For: Honourable Minister.



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja-FCT.

Email: info@ead.gov.ng, www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

Ref: FMEnv/EA/EIA/7296/Vol.1/41
Date: 9th November, 2023.

The Managing Director,
Eso Terra Investment Limited,
No. 20, Ali Akilu Road,
Kaduna,
Kaduna State.

**RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED GRANITE QUARRY IN
BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE.**

Please refer to your letter dated 11th September, 2023 and the Ministry's letter Referenced FMEnv/EA/EIA/7296/Vol.1/31 dated 29th September, 2023 on the above subject.

2. Following the conclusion of the EIA Site Verification exercise, I am directed to inform you that the Ministry has placed the project in EIA Category One (1) with one (1) Season Baseline Data Gathering exercise. Accordingly, you are requested to conduct Scoping Workshop involving the relevant Stakeholders including Regulators from the Ministry and Katsina State Ministry of Environment.
3. Furthermore, you are kindly requested to conduct Baseline Data Gathering exercise with officials of the Ministry in attendance. The samples to be collected should be analyzed in a FMEnv. accredited Laboratory. Please notify the Ministry in good time to enable adequate participation in the exercise. You are also to ensure Quality Assurance/Quality Control (QA/QC) measures for the laboratory analyses in line with standard practices.
4. The following should be forwarded to the Ministry before submission of the draft EIA report: -
 - i. Evidence of laboratory accreditation with the Federal Ministry of Environment where the samples collected shall be analyzed.
 - ii. Chain of custody for the samples collected.
 - iii. Certificate of samples analyzed duly stamped and signed by the Laboratory Manager.
 - iv. Evidence of Laboratory analyses witnessing by official of the Federal Ministry of Environment.
5. Upon completion of the EIA study, you are required to submit to the Ministry Five (5) hard and two (2) electronic copies of the draft EIA report to the Ministry, email to eia@ead.gov.ng and copy info@ead.gov.ng
6. Thank you for your co-operation.

Engr. Gomwalk, Celestine W.G.
For: Honourable Minister



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja-FCT
Email: info@ead.gov.ng, www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

Ref: FMEnv/EA/EIA/7296/Vol.1/47

Date: 5th March, 2024

The Managing Director,
Eso Terra Investment Limited,
No. 20, Ali Akilu Road,
Kaduna
Kaduna State

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED GRANITE
QUARRY (35121QL) AT KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT
AREA, KATSINA STATE

I am directed to inform you that Snafhcore Limited has registered the above-mentioned project with the Federal Ministry of Environment for an EIA permit.

2. The EIA process is on-going, the EIA Draft Report has been submitted and displayed for public/stakeholder's comments. You may therefore wish to give the company any necessary assistance pending the conclusion of the Environmental Impact Assessment (EIA) process for the issuance of Environmental Impact Assessment Permit.
3. Thank you for your cooperation.

Dr. Abbas .O. Suleiman
Director, Environmental Assessment Department
For: Honourable Minister.



14/2/2024

FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja - FCT.

Email: info@ead.gov.ng. www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

Ref:FMEnv/EA/EIA/7296/Vol.I/44

Date: 29th January, 2024

The Managing Director,
Eso Terra Investment Limited,
No. 20, Ali Akilu Road,
Kaduna,
Kaduna State

PUBLIC DISPLAY EXERCISE ON THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED GRANITE QUARRY (351210L) AT KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE

Above refer please.

2. I am directed to inform you that the Honourable Minister of Environment has approved the following process for the Environmental Impact Assessment (EIA) of the project.
 - * 21 working days public display
 - * Review exercise.
3. The public display exercise will take place from 5th February – 4th March, 2024. You are please requested to place the enclosed newspaper adverts (quarter page) on or before 4th February, 2024 in the following newspapers:
 - Daily Trust
 - Leadership
4. You are further requested under this arrangement to place radio announcements at prime time on Katsina State Radio Station for the first and last five (5) days of the display. A sample of the newspaper advert and radio announcement are attached herewith. The evidence of the advertisement and radio announcement should be submitted to the Honourable Minister, Federal Ministry of Environment, Abuja.
5. The dates, venue and your Company's responsibilities for the review exercise shall be communicated to you in due course.
6. Thank you for your co-operation.

Dr. Musa Gashau
For: Honourable Minister.



**PUBLIC NOTICE
FEDERAL MINISTRY OF ENVIRONMENT**

PUBLIC DISPLAY EXERCISE ON THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED GRANITE QUARRY (35121QL) AT KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE BY ESO TERRA INVESTMENT LIMITED

In accordance with the provisions of the Environmental Impact Assessment (EIA) Act CAP E12 LFN 2004, which makes it mandatory for proponents of all new major development activities to carry out Environmental Impact Assessment (EIA) of their proposed projects, the Federal Ministry of Environment hereby announces twenty-one (21) working days Public Display for the draft EIA report submitted by Eso Terra Investment Limited. This Display is to enable the public to make inputs that shall facilitate informed decisions on the project's EIA by the Ministry.

Brief Project Description:

The proposed project involve crushing of granite into chipping for use in construction industry on a 2 No. of cadastral units (0.4km²) at Kayauki village in Batagarawa Local Government Area, Katsina State

The Display Centers Are:

- i. Headquarters, Batagarawa Local Government Area, Batagarawa, Katsina State
- ii. Katsina State Ministry of Environment, State Secretariat, Katsina.
- iii. Federal Ministry of Environment, Office Katsina, Katsina State
- iv. Federal Ministry of Environment, Environment House (Brown Building), Independence Way, Central Business District, Abuja-FCT

Duration of Display:

Date: 5th February – 4th March, 2024

Time: 8:00am – 4:00pm Daily.

ALL COMMENTS RECEIVED SHOULD BE FORWARDED TO THE HON. MINISTER, FEDERAL MINISTRY OF ENVIRONMENT HEADQUARTERS, MABUSHI, ABUJA-F.C.T ON OR BEFORE 11th March, 2024.

**SIGNED
PERMANENT SECRETARY
FOR: HONOURABLE MINISTER.**

RADIO ANNOUNCEMENT

PUBLIC DISPLAY EXERCISE ON THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED GRANITE QUARRY (35121QL) AT KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE BY ESO TERRA INVESTMENT LIMITED

In accordance with the provisions of the Environmental Impact Assessment (EIA) Act CAP E12 LFN 2004, which makes it mandatory for proponents of all new major development activities to carry out Environmental Impact Assessment (EIA) of their proposed projects, the Federal Ministry of Environment hereby announces twenty-one (21) working days Public Display for the draft EIA report submitted by Eso Terra Investment Limited. This Display is to enable the public to make inputs that shall facilitate informed decisions on the project's EIA by the Ministry.

Brief Project Description:

The proposed project involve crushing of granite into chipping for use in construction industry on a 2 No. of cadastral units (0.4km²) at Kayauki village in Batagarawa Local Government Area, Katsina State

The Display Centers Are:

- i. Headquarters, Batagarawa Local Government Area, Batagarawa, Katsina State
- ii. Katsina State Ministry of Environment, State Secretariat, Katsina.
- iii. Federal Ministry of Environment, Office Katsina, Katsina State
- iv. Federal Ministry of Environment, Environment House (Brown Building), Independence Way, Central Business District, Abuja-FCT

Duration of Display:

Date: 5th February – 4th March, 2024

Time: 8:00am – 4:00pm Daily.

ALL COMMENTS RECEIVED SHOULD BE FORWARDED TO THE HON. MINISTER, FEDERAL MINISTRY OF ENVIRONMENT HEADQUARTERS, MABUSHI, ABUJA-F.C.T ON OR BEFORE 11th March, 2024.

**SIGNED
PERMANENT SECRETARY
FOR: HONOURABLE MINISTER.**



PUBLIC NOTICE FEDERAL MINISTRY OF ENVIRONMENT

PUBLIC DISPLAY EXERCISE ON THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED GRANITE QUARRY (35121QL) AT KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE BY ESO TERRA INVESTMENT LIMITED

In accordance with the provisions of the Environmental Impact Assessment (EIA) Act CAP E12 LFN 2004, which makes it mandatory for proponents of all new major development activities to carry out Environmental Impact Assessment (EIA) of their proposed projects, the Federal Ministry of Environment hereby announces twenty-one (21) working days Public Display for the draft EIA report submitted by Eso Terra Investment Limited. This Display is to enable the public to make inputs that shall facilitate informed decisions on the project's EIA by the Ministry.

Brief Project Description:-

The proposed project involve crushing of granite into chipping for use in construction industry on a 2 No. of cadastral units (0.4km²) at Kayauki village in Batagarawa Local Government Area, Katsina State

The Display Centers Are:-

- * Headquarters, Batagarawa Local Government Area, Batagarawa, Katsina State
- * Katsina State Ministry of Environment, State Secretariat, Katsina.
- * Federal Ministry of Environment, Office Katsina, Katsina State
- * Federal Ministry of Environment, Environment House (Brown Building), Independence Way, Central Business District, Abuja-FCT

Duration of Display:-

Date: 5th February - 4th March, 2024

Time: 8:00am-4:00pm Daily

ALL COMMENTS RECEIVED SHOULD BE FORWARDED TO THE HON. MINISTER, FEDERAL MINISTRY OF ENVIRONMENT HEADQUARTERS, MABUSHI, ABUJA-F.C.T ON OR BEFORE 11th March, 2024.

Signed

PERMANENT SECRETARY

For: Honorable Minister



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja - FCT.

Email: info@ead.gov.ng. www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

Ref: FMEnv/EA/EIA/7296/Vol.I/130

Date: 8th July, 2024.

The Managing Director,
Eso Terra Investment Limited,
No. 20, Ali Akilu Road,
Kaduna,
Kaduna State.

RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED GRANITE QUARRY (35121QL) KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE.

Please refer to your letter dated 14th February, 2024 on the above stated project.

2. Following the conclusion of the review meeting, I am directed to inform you that the draft Environmental Impact Assessment (EIA) report for the project has been evaluated and was adjudged satisfactory.
3. I am further directed to inform you of the following matters to be handled by your organization: -
 - (a) Submission of five (5) hard copies of the final EIA addressing the Ministry's comments and observation from the review meeting (herewith attached) within three (3) months from the date of the receipt of the Ministry's harmonized comments.
 - (b) Submission of an electronic copy of the final EIA report to registry@ead.gov.ng
 - (c) Payment of the Final Assessed Charge to the Ministry (as per the attached invoice).
4. Kindly note that this is not an approval letter; and that the EIA Approval letter shall only be issued on confirmation that items 3 (a-c) above have been satisfactorily complied with.
5. Thank you for your co-operation.

Dr. Abbas O. Suleiman
Director, Environmental Assessment Department
For: Honourable Minister.



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja - FCT.

Email: info@ead.gov.ng, www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

Ref: FMEnv/EA/EIA/7296/Vol.I/131

Date: 8th July, 2024.

The Managing Director,
Eso Terra Investment Limited,
No. 20, Ali Akilu Road,
Kaduna,
Kaduna State.

INVOICE

RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED GRANITE QUARRY (35121QL) KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE.

S/No.	ITEM DESCRIPTION	AMOUNT (₦)
1.	Impact Mitigation Monitoring (IMM) for the first exercise (Operational)	500,000.00
2.	Assessed Charge for the Proposed Granite Quarry on QL No: 35121 at Kayauki Village, Batagarawa LGA, Katsina State @ 500,000.00 Payment of (30%) Government Revenue	150,000.00
3.	Assessed Charge for the Proposed Granite Quarry on QL No: 35121 at Kayauki Village, Batagarawa LGA, Katsina State @ 500,000.00 Payment of (70%) Operational Charge	350,000.00
	Final Assessed Charge	1,000,000.00

2. The total amount payable as Final Assessed Charge (FAC) to the Federal Ministry of Environment for issuance Environmental Impact Assessment (EIA) Approval and Certificate is One Million, Naira (₦1,000,000.00) only, as follows:-

- Project Assessed Charge (Revenue): One Hundred and Fifty Thousand Naira (₦150,000.00) only.
- Project Assessed Charge (Operational): Three Hundred and Fifty Thousand Naira (₦350,000.00) only.
- First Impact Mitigation Monitoring (IMM) exercise (Operational): Five Hundred Thousand Naira (₦500,000.00) Only.

3. The payments should be made separately into the Federal Government's Treasury Single Account (TSA) in favour of the Federal Ministry of Environment via Remita Platform @ www.remita.net.

4. The evidence of the payments should be forwarded to the Federal Ministry of Environment's Headquarters at Mabushi, Abuja-FCT.

Dr. Abbas O. Suleiman
Director, Environmental Assessment Department
For: Honourable Minister.



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja - FCT.

Tel: 09-2911 337 Email: ea@ead.gov.ng, www.ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

FMEEnv/EA/EIA/7296/Vol.I/141

24th July, 2024.

The Managing Director,
Eso Terra Investment Limited,
No. 20, Ali Akilu Road,
Kaduna,
Kaduna State.

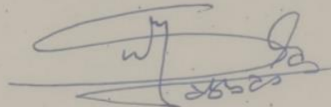
ENVIRONMENTAL IMPACT ASSESSMENT (EIA) APPROVAL FOR THE PROPOSED GRANITE QUARRY (35121QL) PROJECT AT KAYAUKI VILLAGE, BATAGARAWA LOCAL GOVERNMENT AREA, KATSINA STATE.

Please refer to your application for an EIA certificate for the above project dated 1st September, 2023.

2. In accordance with Section 42 of the EIA Act CAP E12 LFN, 2004, I hereby convey the Honourable Minister of Environment's approval for the issuance of Environmental Impact Assessment Certificate for the proposed Granite Quarry Project with Lease No. 35121QL at Kayauki Village, Batagarawa Local Government Area, Katsina State.
3. In addition to the implementation of the mitigation measures outlined in the project's EIA report, this approval is granted with the following conditions:
 - a. The Federal Ministry of Environment (FMEEnv) shall be notified of any change in the project design(s) for further environmental considerations and approval.
 - b. Undesirable environmental and social impacts arising from the implementation of this project, but not foreseen at the time of undertaking the EIA studies should be mitigated.
 - c. Energy-efficiency measures should be adopted during project implementation.
 - d. An Environmental Protection and Rehabilitation Programme (EPRP) for the project approved by the Ministry of Solid Minerals Development should be developed. Evidence of the approval must be submitted to the Federal Ministry of Environment.
 - e. A Memorandum of Understanding (MoU) should be signed with the project's host community.
 - f. The project's host communities and relevant regulatory authorities should be consulted regularly.

Continuation.

4. An Environmental Management System (EMS) shall be in place for the project.
5. The Federal Ministry of Environment in collaboration with other relevant Regulatory authorities shall carry out EIA Impact Mitigation Monitoring (IMM), Environmental Audits (EAu) and Compliance Monitoring exercises on the project.
6. The Environmental Impact Assessment (EIA) Certificate shall be issued in due course.

A handwritten signature in blue ink, appearing to read 'Dr. Abbas O. Suleiman', with a date '28/5/23' written below it.

Dr. Abbas O. Suleiman, fnes.
Director, Environmental Assessment Dept.
For: Honourable Minister.