Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Environmental Health and Social Impact Assessment Study on Granite Quarries in Sierra Leone (Case Study of Kaporta Quarries SL Ltd)

Mohamed Syed Fofanah (Phd)
Associate Professor, Department of Industrial Technology, Njala University

Eldred Tunda Taylor (Phd)
Department of Environmental Management & Quality Control, Njala University

Haja Isata Abdulai-Kamara (Msc.)
Research Associate & Gender Specialist - Ceratec Engineering, Research & Project Management Consultancy Group - Freetown

ABSTRACT
The Environmental and social impact assessment (EHSIA) study was done on the KAPORTA granite quarry project based on guidelines and regulations provided by SLEPA in the Environment Protection Act (EPA), 2008; The Mines and Minerals Act, 2009; National Minerals Agency Act 2012; The Forestry Act, 1998; Sierra Leone Roads Authority Act, 2010; The Factories Act, 1974; The Domestic Violence Act, 2007; The Local Government Act, 2004 and also in accordance with the safeguard policies expressed in the regional and international agreements and conventions relevant to the project. The international agreements and conventions were also considered.

Assessments included review of existing relevant studies, site visits and surveys, including discussions with local people impacted by the proposed project. Environmental assessments during the scoping revealed no major negative environmental impacts that would prevent the implementation of any component of the proposed project. Measures to mitigate the negative impacts were suggested.

Assessment of social impacts did reveal the need to give a keen consideration to gender issues and youths involvement in the proposed project implementation. Furthermore, the study revealed positive socio-economic benefits due to the implementation of the proposed project. Some of the benefits would include: increase in income of beneficiaries, good road network within the project area, improved health and sanitation, and improved food security.

The ESIA Report presented a detailed evaluation of the impacts resulting from implementation of a quarry project.

***Keywords*: Granite quarry, environment protection agency, impact assessment, environmental management plan,**

INTRODUCTION

Granite is one of the most abundant building materials and is quarried in locations all over the world, from Brazil to India to China and even the United States. Many active quarries in the United States can be found in Vermont and New Hampshire. Granite stone is used for a variety of structural and decorative purposes. Both the ancient and modern worlds bear evidence of the importance of granite as a building material. Today, granite is commonly used in the making of roads, pavements, public buildings, bridges, and to build anything from kitchen counter-tops, wall cladding and paneling, paving stones, flooring, and walling materials in your home to some of the world's most famous monuments.

Quarries are created by removing topsoil, followed by drilling and blasting to extract minerals and sedimentary rocks. Hence, granite industries are considered unfriendly to the environment. Noise, air and water pollution, erosion, and sedimentation are the major impacts of granite quarries on environment.

There are many examples of completed or ongoing quarry restoration projects, such as rewilding or reinventing quarries into parks and safe lakes. The traditional cement industry in Europe has been involved in many of these projects. But these efforts should also be reinforced with a more holistic approach. According to the biodiversity mitigation hierarchy, avoiding biodiversity loss should be the default over rehabilitation and restoration.

In Sierra Leone aggregate production using rudimentary technology (hammer and chisel) is one of the most significant employers in the informal sector; providing employment for mainly urban and rural youths living along granite rich environment.

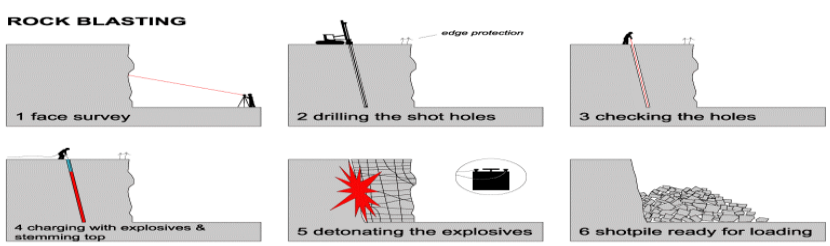
Granite mining operators, in conjunction with cognizance resource agencies in Sierra Leone, must work to ensure that aggregate quarries are operated in a responsible manner inorder to mitigate significant damage to the environment and its associated biota and to the adjacent land, as well as creating conflict with other users of the land. These impacts are of paramount concern for the Sierra Leone Environmental Protection Agency. Therefore, an Environmental Permit is required by the Agency for the proposed development to fully operate.

This study presents an Environmental and Social Impact Assessment (ESIA) for a typical aggregate quarry project in Sierra Leone.

Overview of Granite Quarry Operation

Stone quarrying is the multistage process by which rock is extracted from the ground and crushed to produce aggregate, which is then screened into the sizes required for immediate use, or for further processing, such as coating with bitumen to make bituminous macadam (bitmac) or asphalt.

Figure 1 presents rock blasting processes as described by Northstone (NI) Ltd. Quarry & Asphalt Division. The process begins with a detailed three-dimensional survey of the quarry face probably by an explosives engineer to ensure that plotting is done precisely where the shot holes should be drilled for safety and efficient blasting as well as so showing if there are any bulges or hollows in the face. Hollow areas require less explosive than normal. The placement of explosives is professionally planned to ensure that the required fragmentation of the rock is achieved with the minimum environmental impact.



Source: Northstone (NI) Ltd. Quarry & Asphalt Division

Figure 1: Rock blasting processes

After the face survey, drilling of the required number of shot holes commence using an air operated drilling rig, After the shot holes have been drilled, they are surveyed to check that they correspond to the blast design and the two surveys are combined to allow the blast engineer to work out how each shot hole is filled with explosives. Detonator cord is placed in each hole and the holes are then loaded with explosives to within a few metres of the top. The remaining depth is "stemmed" with quarry dust or fine aggregate. The site is cleared. Sirens are sounded to make sure that everyone nearby is warned. The detonators are connected to the electric trigger wire and the circuit is checked. A final safety check is carried out before the shotfirer set off the explosives. A single blast can fragment up to 20,000 tonnes of rock.

After the blast, the face and shotpile (sometimes called the muck-heap) are inspected to check that all the shot holes have fired correctly. The broken pieces of rocks are transported by dump trucks to the crusher.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Crushing can be done in three or four stages, primary (first stage), secondary (second stage), tertiary (third stage) and, in some quarries, a quaternary (fourth stage). Crushed rock, or product, is transported along the process line on conveyor belts to the pick up area by trucks.

Problem Analysis

Every stage of a quarry's life cycle comes at an enormous environmental cost: loss of natural carbon sinks, eradication of biodiversity, noise and air pollution, and disruption of natural streams and springs. And these losses can never be reversed, even after quarries are inevitably abandoned. Quarries are temporary, but their environmental impacts are forever (Thea Lyngseth & Katarzyna Krokes, Oct 2023).

Dust from quarrying creates respiratory problems for workers and residents, as researchers have pointed to an increase in PM10 levels in the proximity of granite quarries. Additionally, chemicals used in the mining processes facilitate pollution of water, both surface and groundwater.

These harmful effects are not only felt by the local flora and fauna, but also by people. In certain cases,local population have ever been permanently displaced. After there is nothing left to be extracted, or extraction becomes unprofitable, quarries often become filled with rainwater creating dangerous lakes with sharp rocks and cliffs or, worse still, are used as landfills.

Many studies demonstrated that the effects of granite quarrying on human health include respiratory problems from inhaling quarry dust, hearing loss due to constant noise, and potential health risks from water pollution.There is high prevalent rate of diseases caused as a result of these quarry industries which include cough and cold, dyspnoea, inflammation of nasal, Asthma and hearing impairment due to noise pollution were the most prevalent.

The Social drawbacks of granite stone quarrying, in addition to noise and dust pollution from blasting and machinery that can disrupt local communities, are the changes to the local landscape that can negatively impact the appeal of an area to tourists or locals. The destruction of habitats during the quarrying process can reduce biodiversity in the area.

This ESIA study presents a final assessment of KAPORTA QUARRIES project which identified the likely significant environmental, health and social impacts this project might have in its operational communities of Beguama and Waterloo in the Western-Rural District of Sierra Leone.

Aim and Objectives of the Study

The aim of this study is to establish relevant database concerning the environmental and social impacts of granite/aggregate quarry projects, which could help relevant authorities, like EPA-SL, to reinforce environmental compliance for the safety of workers and the communities impacted by these projects.

The following objectives are pertinent to this study (a) to assess and compare the impacts of granite quarry projects in relation to relevant national and international requirements and guidelines. (b) To guide the process of obtaining "Environmental Permits" for proposed quarry projects, which complies with the environmental procedures of the Sierra Leone Environmental Protection Agency (SLEPA).

Background of Kaporta Quarries SL Ltd.

Kaporta Quarries SL Ltd is a Sierra Leonean owned company registered in 2013 and is situated at Cherry's Villa, Police Beach, by Milton Margai College of Science and Technology at Goderich, Freetown, Sierra Leone. Kaporta (SL) Ltd has a granite/aggregate production facility or quarry off Benguma, Waterloo Peninsula in the Western Rural District of Sierra Leone.

The primary aim of Kaporta Quarries is to solve the problem of granite or aggregate scarcity as huge demand for this material, for various construction purposes, far outweighed the supply in the country, especially in Freetown and other bigger cities; hence making these local materials unaffordable. A single 5 ton trip of granite or aggregate is presently sold at NLe12,000 (approximately $500).

The main objective, of the project, therefore, is to construct and operate a nominal 320 ton per hour granite manufacturing plant.

The study was carried out during the conceptual stage of project development in June to August 2021, with a view to identify and evaluate the potential beneficial and adverse impacts, so that these could be taken into account in subsequent planning and, where possible, appropriate adverse impact mitigation and beneficial impact enhancement measures could be incorporated in the final scheme.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

EIA Phases

Four major phases were considered in this study; namely Screening, Scoping, Impact Assessment and Public Disclosure as required by EPA-SL. Figure 1 presents a graphical representation of the EIA process.

Screening Phase

According to the SLEPA Environmental Act, proposed development projects must be categorized based on their environmental impacts on the communities they serve. Therefore, the initial phase of the EIA is screening. The purpose of the screening phase is to decide if an Environmental Impact Assessment (EIA) is required for the proposed project. In essence, screening confirms the need (or otherwise) for an ESIA by appraising the type of project and its associated activities throughout its lifecycle in the context of its biophysical, socio-economic, policy and regulatory environments. A critical screening process of the level of planned activities and various locations KAPORTA QUARRIES done by the research team, led SLEPA to make a decision that the project should carry out an ESIA. EPA-SL has three project categories (A, B, and C) which determine the extent of the required environmental analysis. From the result of the Screening process of KAPORTA QURRIES' granite project, EPA-SL classified it as "Category A".

Scoping Phase

The scoping phase started by outlining all major activities of the proposed project that could impact the environment. A preliminary discussion was held by the Research Team and project stakeholders in the proposed project communities on each of these activities with emphasis on environmental and social conditions that may be impacted by the Project. This scoping process was guided by reference to the IFC Performance Standards and to the EU Guidance on EIA Scoping.

The Impact Assessment Phase

The Impact Assessment phase characterized the baseline (pre-project) environment, assesses the significance of the potential impacts identified including cumulative effects, and recommends mitigation measures that could minimize negative impacts and/or enhance benefits.

During this impact assessment phase, Environmental and Social Management Plans (ESMPs) were prepared to ascertain that environmental and social issues are properly managed during the construction, operation, and restoration phases of the Project. The ESMPs include Environmental Management and Monitoring Plans, a Social Management Plan, a Community Health and Safety Plan, a Culture Heritage Plan, and an Emergency Response Plan.

Disclosure Phase

During the Disclosure Phase, the results of the ESIA was submitted to KAPORTA QUARRIES (SL) Ltd) and presented to the public, who were given the opportunity to review and comment. Public access to the document was provided through several venues during this phase. The public was able to review the full text of the report and full details of the analysis was provided to the local media. A public meeting was also held during this time and was attended by representatives of EPA-SL, KAPORTA QUARRIES (SL) Ltd), and affected communities. Affected communities were given the opportunity to make their recommendations which were incorporated in the Final Report. This final report was submitted to KAPORTA and then delivered to EPA-SL by KAPORTA for approval leading to the issuance of the Environmental Permit to operate the granite quarry after payment of Environmental Permit fee to EPA-SL. Figure 2 presents a schematic diagram of the EIA process.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

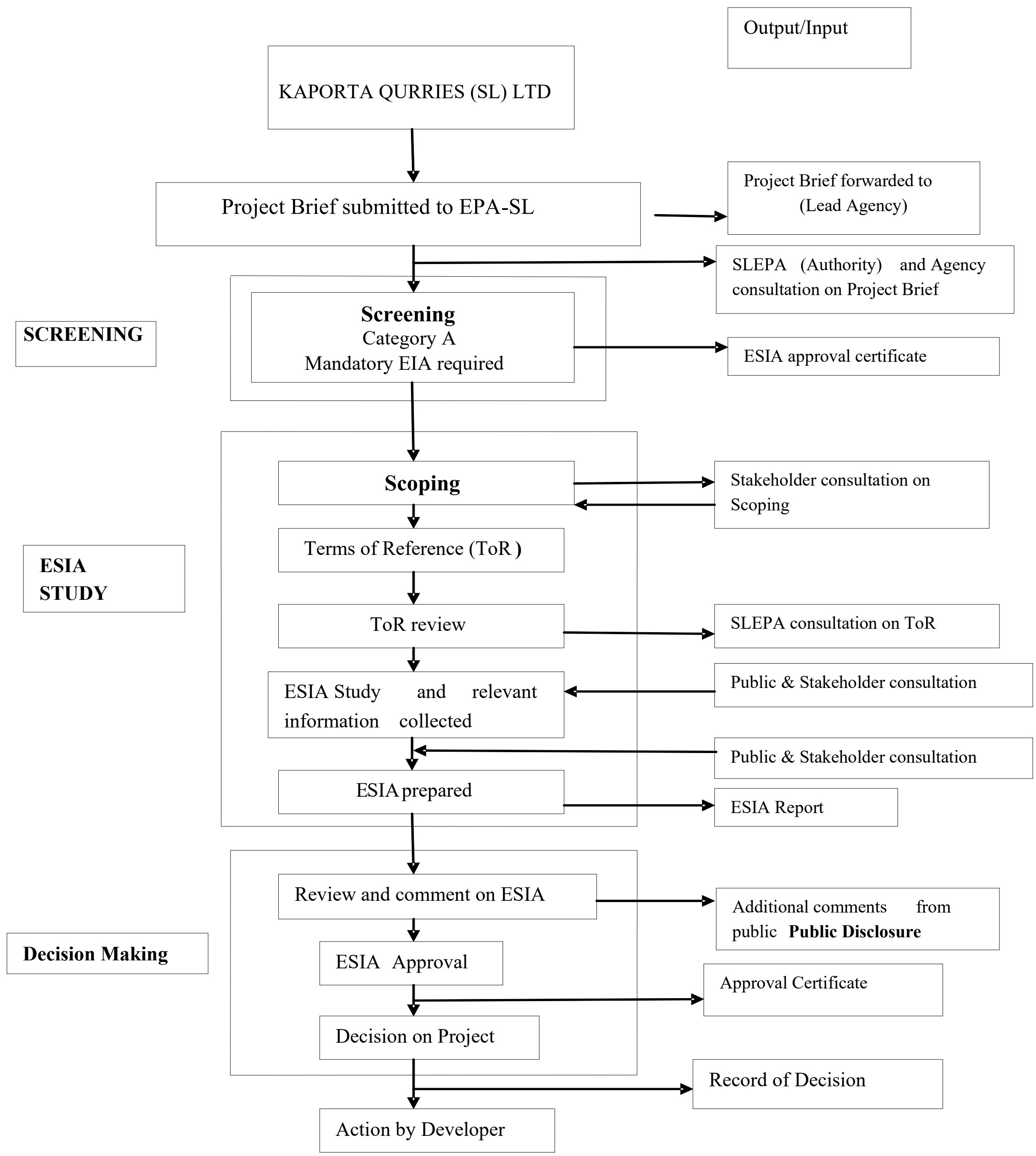


Figure 2: Graphical representation of the EIA process

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

METHODOLOGY

Project Location

The Kaporta granite quarry project studied is situated at Aggia Town others call it Jamat Farm closed to the Western Rural Peninsula Mountain approximately 5km from Bengeuma Barracks in the Western Rural District of Sierra Leone and approximately 35km from Freetown. Figure 2 shows the project site and surrounding communities.

The granite quarry is located on two (2) parcels of land in relatively close proximity (2 kilometers) to each other. The one parcel of is the quarry plant site whiles the other the Administrative buildings and staff quarters. The parcels of land are strategically located within a region rich with granite deposits for mining with easy access to the major road to Freetown,

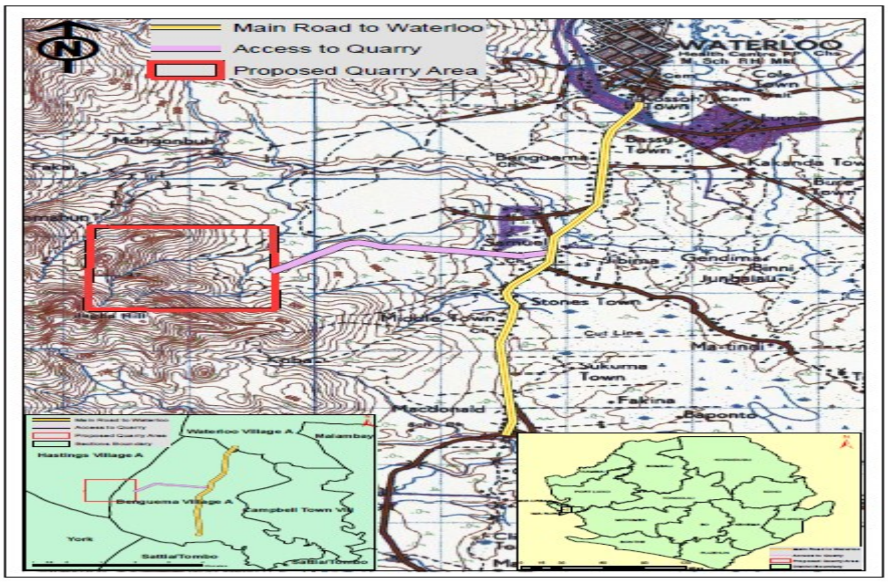


Figure 3: Map showing affected communities of proposed Development

Communities directly impacted by the Kaporta project

The various communities that are directly impacted by the project are presented in Figure 3 and Table 1.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Table 1: Communities directly impacted by the proposed project

Region	District	Communities directly impacted by the proposed project	Activities
Western	Western-Rural	Benguema	Granite mining Rock blasting Granite crushing Transportation
		Samuel Town	Granite mining Rock blasting Granite crushing Transportation
		Sampa Town	Granite mining Rock blasting Granite crushing Transportation
		One House	Granite mining Rock blasting Granite crushing Transportation
		Waterloo	Granite mining Granite crushing Transportation
		Campbell Town	Granite mining Granite crushing

Data Collection

A desk review was conducted to collect secondary information relevant to the project followed by field visits to the project communities were carried out to supplement the secondary information. During the field visits, information on physical resources, ecological resources, socio-economic aspects, health and cultural aspects and other attributes were collected using qualitative methods chiefly focus group discussion and One-on-one meetings with key members of local communities focusing on specific issues of the project.

Community surveys using quantitative methods were conducted in which a diverse group of community members were invited to participate in the surveys. These consisted of focus group discussion/meetings with local authorities, traditional leaders, opinion leaders, local council representatives, youths and women's groups. The surveys gathered consensus information about key existing conditions, such as community infrastructure, socio-economic status, and gender issues, social and cultural institutions of the communities covered by KAPORTA QUARRIES.

The national legislative and institutional framework, policies, procedures and guidelines were further reviewed.

Physical Environment

Baseline data collection on the study area was conducted and included climate, hydrology, geology, noise, air quality, traffic, topography, socioeconomic, flora and fauna.

All issues pertaining to the site, such as rainfall, groundwater pollution incidents, flooding incidents, and other critical facilities were reviewed within a three (5) kilometer radius of the site.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Geology

Sierra Leone is 75% underlain by Archean rocks of Precambrian age comprising a granite greenstone terrain on the edge of the West African Craton (FAO 1981, Pollet 1951). The rocks of Sierra Leone consist of a granitic basement containing elements of early sedimentary and mafic formations and a group of supracrustal greenstone or schist belts with banded ironstone and detrital sediments (Pollet 1951). Four classic greenstone belts are preserved namely the Kambui Hills, the Sula Mountains/Kangari Hills belt, the Nimini Hills and the Gori Hills. These schist belts host important mineralisation including gold, chromite, tin, copper, antimony, arsenic and iron ore.

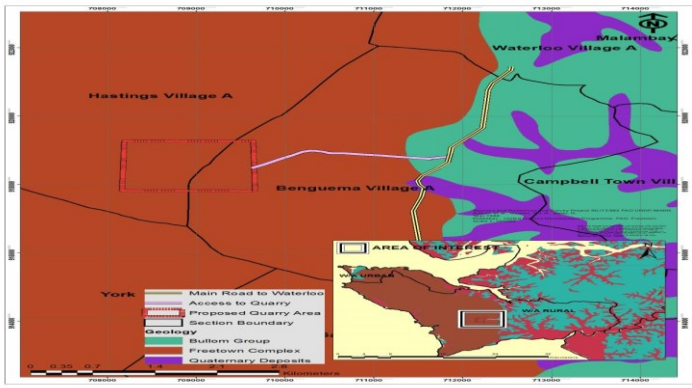


Figure 4: Geology of the Project Area

Land Use within 2 km radius of the Proposed Project Area

The present land use within 2km radius of the proposed project area include laterite soil excavation, charcoal production, fuel wood collection, collection of herbal medicines, military training field and vegetable production on neighboring inland valley swamps. These swamps are wet all year round since they are naturally irrigated by the discharged water from the spring water course passing through the proposed development for protection.

Charcoal production Wood fuel collection Vegetable production Drinking Water collection

Figure 5: Land use patterns in the proposed project site

Air Quality

Little or no data is presently available for air quality for the project districts. Therefore, Levels of ambient and indoor air quality are not known. Air quality in the proposed project area is not considered a major environmental hazard at this time. The national ambient air quality standard put forward by the US Environment Protection Agency (USEPA) could be used as a baseline.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Water Quality

Grab surface water samples were collected at two sampling points namely; upstream and downstream and analyzed for basic water quality indicators such as pH, total dissolved solids, dissolved oxygen, turbidity, nitrate etc. at the National Water Quality Laboratory, Tower Hill, Freetown, Sierra Leone. The results of the various indicators would be presented in the later report.

Noise

The proposed KAPORTA QUARRY's project has the potential to cause increase in noise and vibration directly through quarry operations. The resulting activities from the project can result in low to moderate to elevated noise for nearby receptors and such impacts can be assessed in terms of noise change resulting from operations. Hence the need to carry out noise impact assessment during the implementation stage of the proposed project is significant.

Biological Environment (Fauna and Flora)

During scoping, a detailed and comprehensive observation of the granite site was undertaken to ensure a proper coverage of all possible fauna and flora. The proposed site for the granite plant is badly disturbed by human activities and would not likely support any significant fauna and flora. The quarry site exhibits no significant disturbance, but due to charcoal production activities for the most part has been re-colonized by secondary forest.

A detailed walk through the sites was done to determine the presence of any fauna of significance. Burrows were seen in several project areas during the reconnaissance visit to the project area, indicating the presence of the small mammals such as monkeys, squirrels, antelopes, mice and moles. Reptiles such as snakes, lizards and chameleons, and amphibians (frogs and toads) and different avian life forms are also known to exist in the area.

DISCUSSION OF RESULTS

Both positive and adverse environmental and socio-economic impacts could arise due to Kaporta project's activities during the site preparation, construction and the operational phases of the granite quarry. An impact is any change to the existing condition of the environment caused by human activity or an external influence. In this discussion section, key parameters that could be impacted by the project were discussed.

Surface Water Quality Parameters

Studies of water quality are largely concerned with basic physiochemical parameters which are in many cases measured in situ using a portable water tester and the following parameters were measured and reported at two points along the water course (upstream and downstream). The surface water quality parameters considered in the study are discussed below:

Temperature

There is no significant variation in water temperature between upstream and downstream locations.

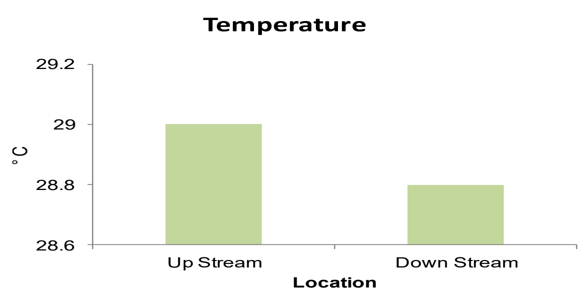


Figure 6 Results of temperature level at upstream and downstream along the watercourse

PH

The pH is the measure of hydrogen ion concentration in the water. The observed values for upstream and downstream are statistically not different. And the pH of natural waters can vary and change dramatically through the day and seasonally. But the reported pH levels range between 6.5 - 8.5 which fall in the recommended threshold.

pH

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

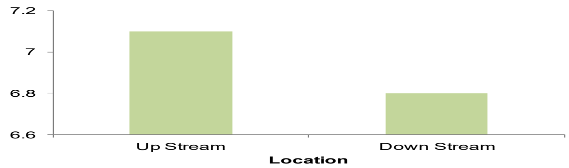


Figure 7: Results of pH level at upstream and downstream along the watercourse

Turbidity

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates. The more total suspended solids in the water, the murkier it seems and the higher the turbidity. Results indicate that the problem is much evident downstream which could be the result of increased activities from nearby water users.

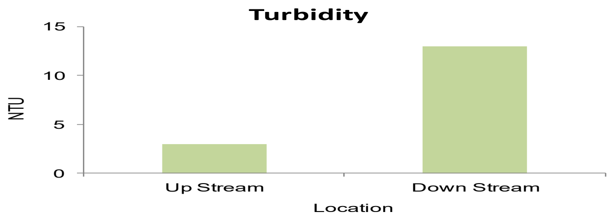


Figure 8: Results of turbidity level at upstream and downstream along the watercourse

Electrical Conductivity

Electricity conductivity is a measure of the ability of an aqueous to conduct electricity and the measured levels are significantly elevated downstream than upstream which is largely attributed to increased anthropogenic activities.

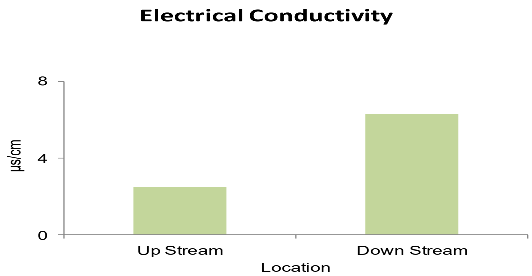


Figure 9: Results of electrical conductivity level at upstream and downstream along the watercourse

Total Dissolved Solids

Total dissolved solids (TDS) comprise of inorganic salts and small amount of organic matter dissolved in water. In general, it is the sum of cations and anions in the water. Significant elevated levels were observed downstream relative to upstream indicating agricultural activities as the likely sources of these ions.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

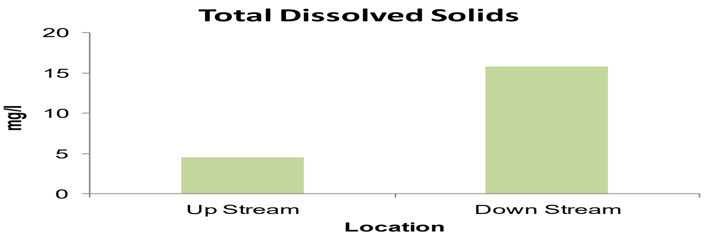


Figure 10: Results of total dissolved solids level at upstream and downstream along the watercourse

Dissolved Oxygen

Dissolved oxygen is very important for life for aquatic organisms. It is an indicator of corrosivity of the water and photosynthetic activity. High noticeable levels of DO was observed upstream relative to downstream indicating the tendency of reduced living activity of aquatic animals relative to upstream.

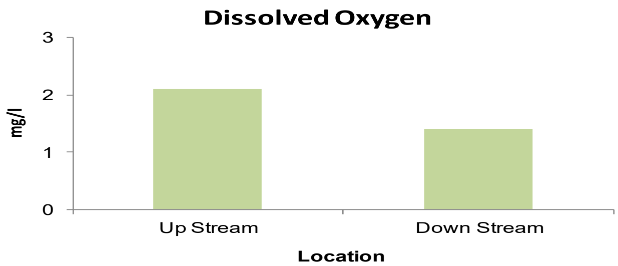


Figure 11. Results of dissolved oxygen level at upstream and downstream along the watercourse

Nitrate

Nitrate is one of the most common contaminant in surface and ground waters primarily due to increased level of agricultural activities. Excess of it could cause 'blue baby' disease in young children and not in older ones or adult. Significant levels were recorded downstream than upstream indicating the likelihood of more agricultural activities.

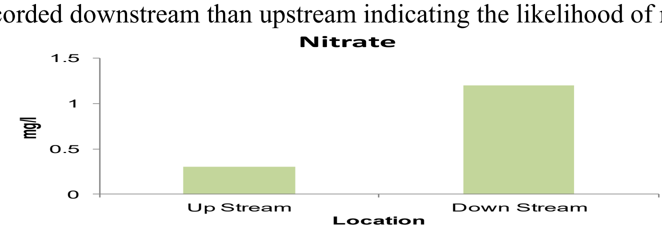


Figure 12: Results of nitrate level at upstream and downstream along the watercourse

Phosphate

Phosphate again is a common contaminant in ground and surface waters and being regulated. A noticeable increase in phosphate in water could be an indication of pollution from sewerage or agricultural sources and a noticeable increase in phosphate levels were observed downstream relative to upstream.

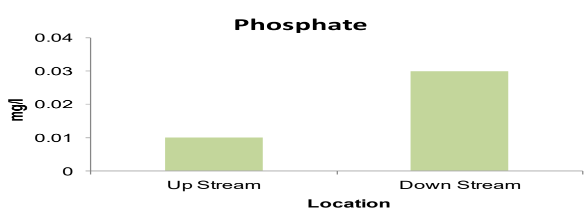


Figure 13: Results of phosphate level at upstream and downstream along the watercourse

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Sulphate

Sulphate occurs in natural water with wide range of concentrations and this is reflected in the observed results between upstream and downstream, an indication of more sulphate sources downstream other than geologic activity.

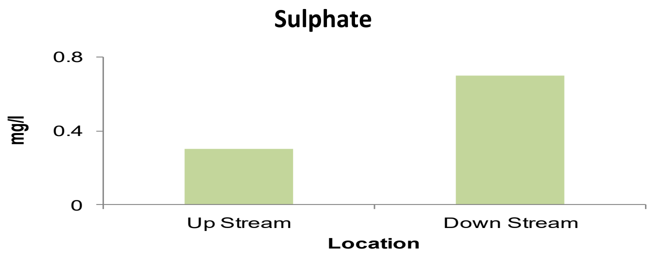


Figure 14: Results of sulphate level across upstream and downstream along the watercourse

Potential Negative Environmental Impact

Table 6.1 outlines the main activities undertaken for each phase of this project and associate negative impacts identified during scoping.

Table 6.1 Main activities and associated negative impacts

Phase	Activity	Aspect	Negative Impact
Construction	1. Land clearing 2. Construction (plant, conveyor and road) 3. Transportation of heavy equipment and construction materials 4. Operation of heavy equipment 5. Fuel storage and dispensing for heavy equipment	Noise	• Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)
		Dust emissions	• Air pollution • Respiratory problems • Increased sediment loads and degradation of natural aquatic receptors
		Vehicular emissions	• Air pollution • Respiratory problems
		Solid waste (top soil, vegetation, construction debris, garbage)	• Land and water pollution • Decreased availability of land fill
		Human waste	Land and water pollution
		Use of fuel	Depletion of (oil) resources
		Removal of vegetation	• Habitat destruction • Disruption of ecosystems
		Soil erosion	• Movement of sediment and pollutants into water courses • On-site impact is the reduction in soil quality which results from the loss of the nutrient-rich upper layers of the soil
		Increased traffic movement	• Traffic congestion • Motor vehicle accidents

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

		Use of water	• Depletion of water resources • Effluent
		Spills	Land and water pollution
		Construction work	Accidents causing death or injury
		Land use	Possible displacement of communities
		Foreign work force	• Temporary population increase • Foreign worker health problems • Foreign/Local interactions • Camp disturbance • Local community disturbance • Transmitted diseases
Operational	1. Access and opening of the quarries 2. Mining and Crushing Operations 3. Granite Plant Operation 4. Transport and Stockpiling of raw materials 5. Transport of aggregate to users. 6. Power Plant Operation 7. Fuel storage and dispensing	Noise	• Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)
		Dust emissions	• Air pollution • Respiratory problems • Increased sediment loads and degradation of natural aquatic receptors
		Vehicular emissions	• Air pollution • Respiratory problems
		Solid waste (top soil, vegetation, construction debris, garbage)	• Land and water pollution • Decreased availability of land fill
		Human waste	Land and water pollution
		Use of fuels and lubricants	• Depletion of oil resources • Greenhouse gas emissions (CO2) • Air emissions (NOX, SOX, CO, Particulate
		Removal of vegetation from the quarry	• Habitat destruction • Disruption of ecosystems
		Soil erosion	• Movement of sediment and pollutants into water courses • On-site impact is the reduction in soil quality which results from the loss of the nutrient-rich upper layers of the soil
		Increased traffic movement	• Traffic congestion • Motor vehicle accidents
		Use of water	• Depletion of water resources • Effluent
		Spills	Land and water pollution

		Construction work	Accidents causing death or injury
		Land use	Possible displacement of communities
		Vibration	• Nuisance to persons • Habitat disturbance
		Foreign work force	• Temporary population increase • Foreign worker health problems • Foreign/Local interactions • Camp disturbance • Local community disturbance • Transmitted diseases
Decommissioning	1. Dismantling and removal of equipment 2. Re-vegetation of land and quarries	Noise	• Nuisance to persons • Habitat disturbance • Hearing impairment (temporary,permanent)
		Fugitive dust emissions	• Air pollution • Respiratory problems
		Vehicular emissions	• Air pollution • Respiratory problems
		Solid waste (decommissioning debris, garbage)	• Land and water pollution • Decreased availability of land fill
		Human waste	• Land and water pollution
		Use of Fuels & Lubricants	• Depletion of (oil) resources
		Spills/Fuels & Lubricants (Oil spills/leaks)	• Land and water pollution
		Decommissioning	• Accidents causing death or injury

Potential Positive or Beneficial Environmental Impacts

Among the potentially beneficial impacts envisaged on the environment for the various project activities from construction, operation to decommissioning phase include (a) Job creation: Employment for locals and increased commercial activities in the area. As a result of the increase in commercial activities the standard of living is expected to increase which will eventually lead to increased earnings. (b) Capacity building of staff through skills transfer of foreign experts. (c) Improvement in infrastructure – buildings, health centers, schools, roads etc. (d) Utilization of waste materials from other industries such as used tyres for heating granite prior to drilling. (e) Possible lower granite or aggregate prices in Freetown. (f) Increase tax revenue.

Environmental Impacts Perceived by Local People and Potential Employees during the Operation Phase

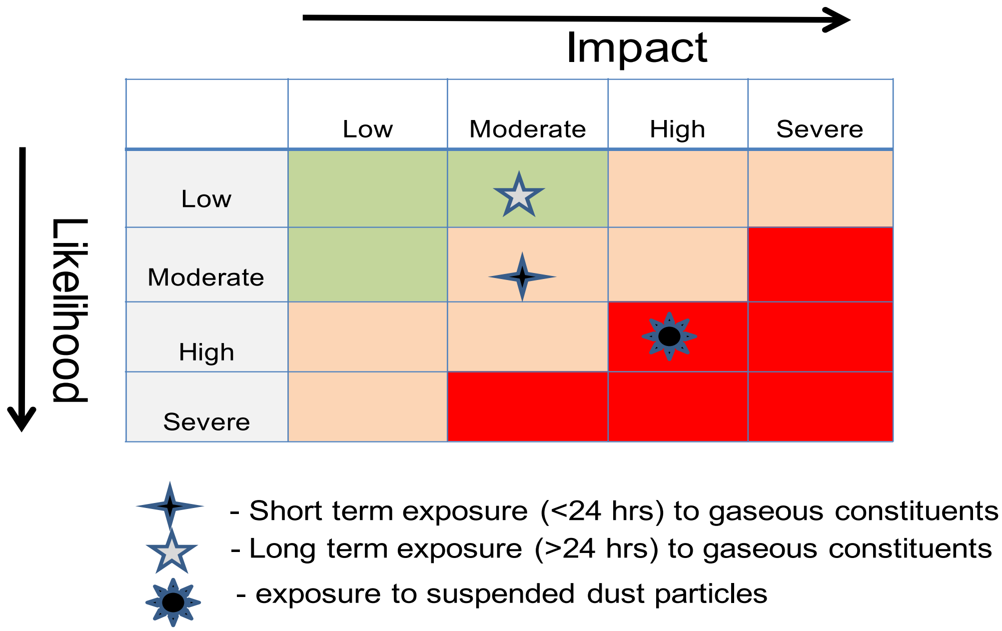
The following under mentioned environmental impacts are presented according to the responses given by local residents and potential employees around the proposed quarry site.

Air Quality

The impact of air pollution is expected to be moderate in the short term but dust emission is a serious environmental problem envisaged by the local people. Although many believed that the process is reversible in the long term, mitigation measures should be a watch word of KAPORTA quarry company Ltd.

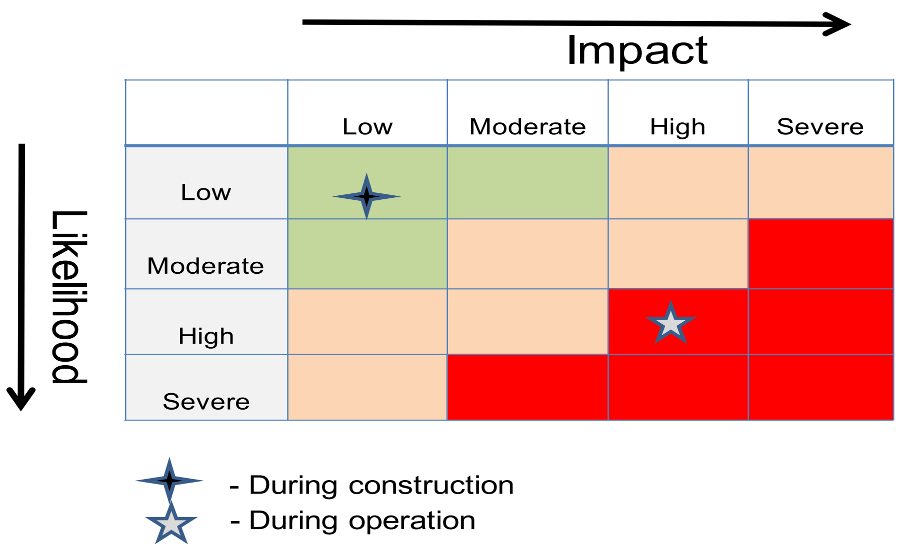
Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024



Noise severity

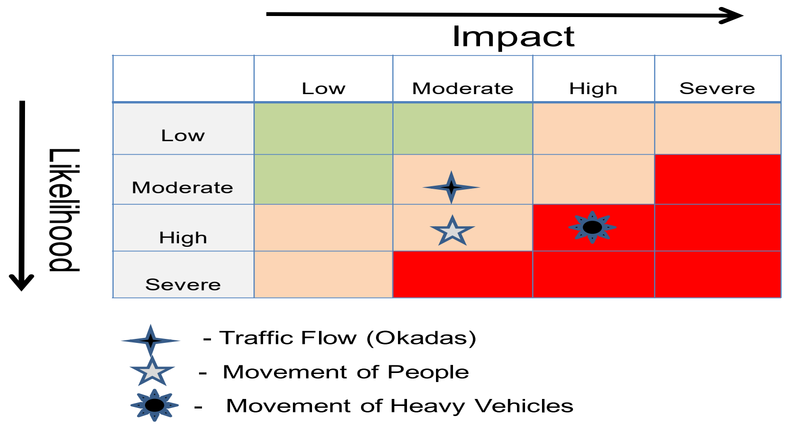
The residents around the proposed quarry site considered noise nuisance as not a serious environmental concern given their proximity to the site of about a kilometer during the construction phase but a high likelihood of noise nuisance during the operation phase as a result of blasting activities.



Traffic Flow

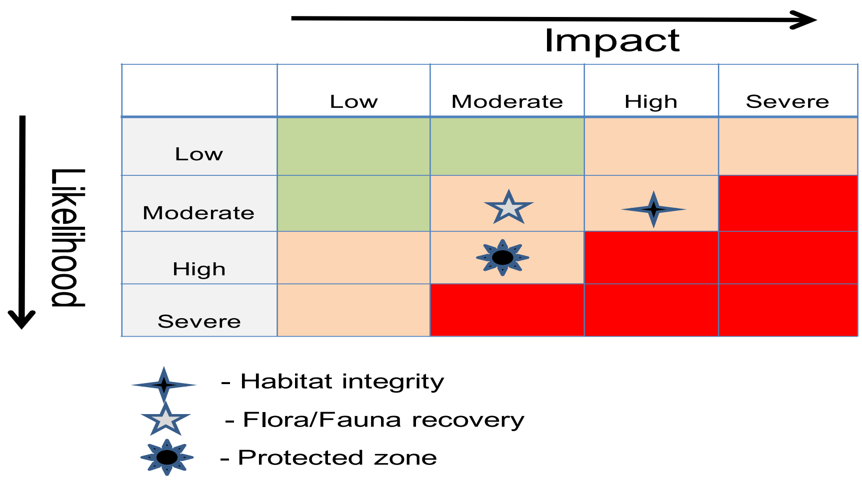
It is highly likely that heavy duty vehicles will stream through the narrowly constructed road transporting finished granites to suitors. Such activity absolutely warrants a mitigation measure as indicated.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024



Ecological Consequences

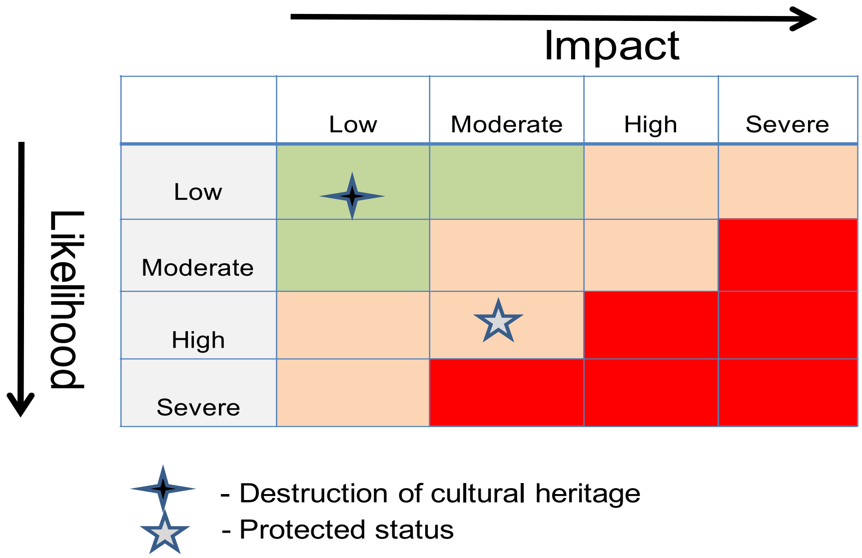
There is a high likelihood of the proposed quarry company (Kaporta) would roll over into the protected zone of the Western Area Peninsula Mountains beyond their concession areas that is around the periphery of the protected forest reserve. Loss of fauna was considered to have a moderate impact as animals would easily migrate to nearby virgin areas.



Cultural Heritage

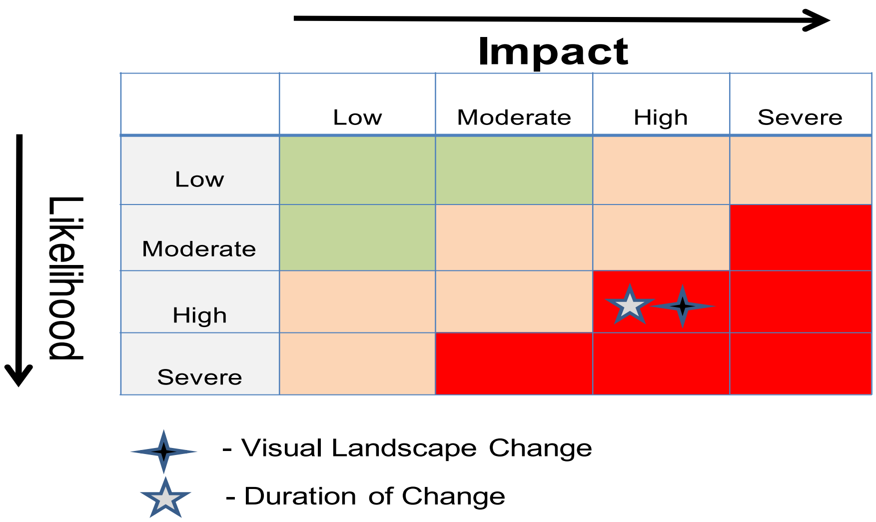
There is high tendency for Kaporta quarry Ltd to expand beyond its concession area during its operation and no likely issue on protected cultural heritage within the vicinity of the project area.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024



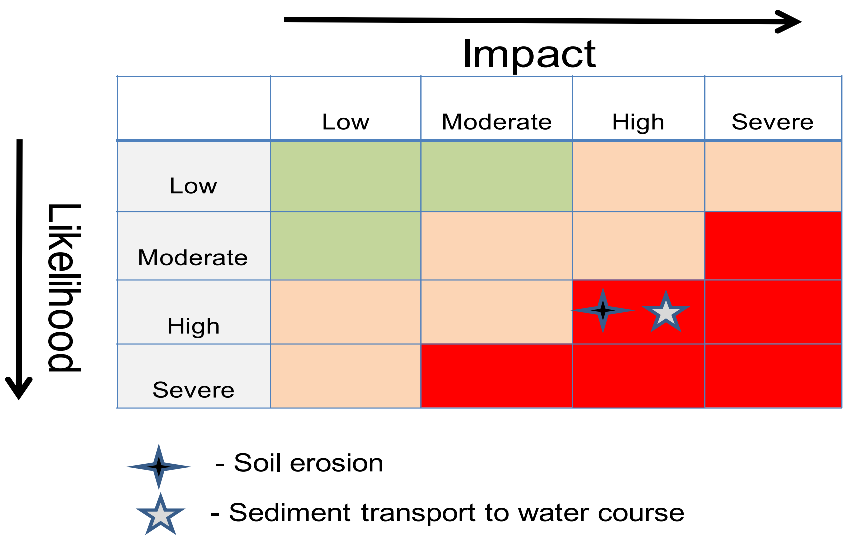
Visual Landscape

Both the construction and operation phases of the project would highly disturbed the landscape of the concession area which is an indication of adopting mitigation strategy.



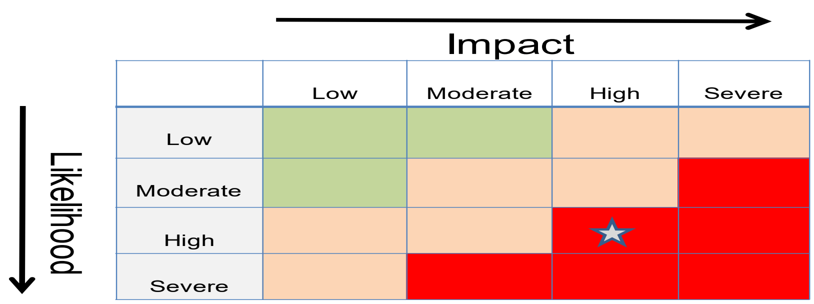
Severity on Soil

There is a very high possibility of soil erosion in the project development area due to the initial clearing of the vegetation which eventually leaves the soil exposed to the agents of erosion thus rendering the land susceptible to erosion and degradation. The impact could be manifested in other environmental media such as surface water and even ground level air pollution.



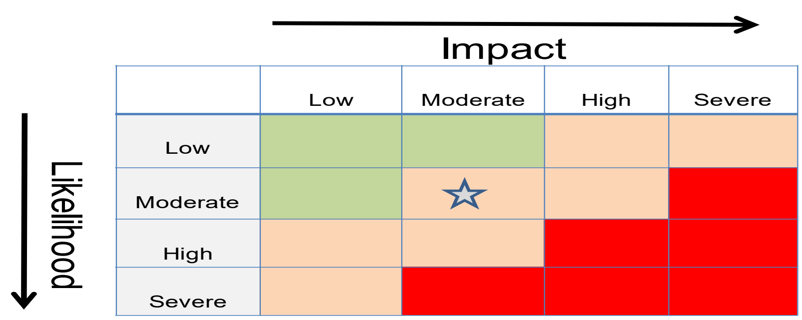
Surface water

The baring of the topsoil by the removal of vegetation has high potential impact to cause siltation of the water course of the project area. A water course is evident in the immediate environment of the project area which could be impacted by sediment discharge from runoff from the slopes of the quarrying site.



Ground water

There is moderate chance of ground water pollution should any leakage or spillage of petroleum products and chemicals stored or used during the operation stage may lead to contamination of ground water.



International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Environmental Impact Mitigation Measures

Negative environmental impacts can be mitigated by implementing measures during the construction, operating, maintenance and decommissioning phases to eliminate or significantly reduce them. Mitigation measures to address the potential negative impacts are outlined below:

Noise

Advise institutions and residents in the surrounding communities of construction date and times when high noise activity will occur. Good site management; appropriate choice of machinery; methods of working; hours of working and efficient material handling could help in managing the noise. Define access routes to the site with the smallest number of properties in proximity to it so as to keep vehicle movements to a minimum. Once link roads are completed, all construction traffic to/from the quarry site should only use the link roads to avoid the populated communities around the quarry site. Construction workers should wear personal protective equipment.

Dust and Vehicular Emissions

Mitigation measures for dust and vehicular emission include but not limited to cover haulage vehicles transporting aggregate, cover onsite stockpiles of aggregate, cement, soil, etc. Ensure proper stock piling/storage and disposal of solid waste and wetting of cleared land areas regularly and enforcement of speed limits. Provide workers with the necessary Personal Protective Equipment (PPE) e.g. dust masks and ensure that they are worn. Operate well maintained vehicles and equipment.

Solid Waste (top soil, vegetation, construction debris, garbage)

Contain garbage and construction debris and dispose of at the approved municipal disposal site. Landscape project sites with top soil excavated

Soil Erosion

Implement proper drainage and mining plans and only clear top soil from areas to be used. Place berms around stockpiles of top soil

Oil Spills

Store fuel with secondary spill containment infrastructure and utilize proper dispensing equipment. Have spill containment and cleanup equipment on site and dispose of waste in accordance with best practices/

Destruction of Water Courses

Protect and conserve water courses. This could be down by construction of water dam, fencing of water route across the project site and protecting the natural habitat of the water course.

Construction work

Implement Emergency Preparedness and Response Program, Environmental Health & Safety Program and prearranged quality curative treatment in Hospital for all emergencies. Furthermore, erect signs during construction activities and provide workers with the necessary Personal Protective Equipment (PPE). Train construction personnel in good safety practices and emergency preparedness and response measures could help.

Land Use

Agreement should be reached with farmers for their relocation adjacent to the quarry plant boundary. Financial and employment assistance should be provided to affected communities. Security fence should be erected to protect the inhabitant, especially children.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

Mitigation Measures for Impacts on Environmentally Sensitive Areas or Species

There is evidence of significant impacts on the environmentally sensitive areas (Forest reserves) by the proposed project. Protective measures must be put in place to ensure that these sensitive areas are protected throughout the proposed project life span. Measures such as: Fencing of the areas. Briefing of contractors/workers on the need to protect these sensitive areas and the consequences involved for any violation of the local authorities laws relating to the protection of these areas. Encouraging active community participation in the planning, monitoring and implementation of the proposed project.

Mitigation Measures for Project Impacts on Natural Resources

The construction phase of the proposed project, may use lot of local water supply, fossil fuels (diesel and petrol), and gases from mechanical operations. Some of these natural resources like water could be recycled by sewage treatment, filtration and removal of wastewater solids, sediments.

The site has a historical water course that provides spring water for mostly drinking needs of the communities, this water course must be protect and utilized for the benefit of the affected communities. This could be through construction of dams for provision of pipe borne water to the communities which could be used either for drinking or irrigation purposes.

Figure Natural habitat of the spring water course

Figure GIS Expert mapping out water course area to be protected

Such mitigation action will not only satisfy water needs but a great source of income through sales from packet spring water and vegetables, especially during the dry season.

Furthermore, the site is much closer to the forest reserve of MAFFS so care must be taken to protect trees and wildlife. This could be done by fencing the project site and employment of forest rangers to guard the conserved forest.

CONCLUSION

The EIA was done on the proposed granite quarry project based on guidelines and regulations provided by SLEPA in the Environment Protection Act (EPA), 2008; The Mines and Minerals Act, 2009; National Minerals Agency Act 2012; The Forestry Act, 1998; Sierra Leone Roads Authority Act, 2010; The Factories Act, 1974; The Domestic Violence Act, 2007; The Local Government Act, 2004 and also in accordance with the safeguard policies expressed in the regional and international agreements and conventions relevant to the proposed project.

The Environmental and social impact assessment included review of existing relevant studies, site visits and surveys, including discussions with local people impacted by the project. Environmental assessments during the scoping revealed no major negative environmental impacts that would prevent the implementation of any component of the proposed project. Measures to mitigate the negative impacts were suggested.

Assessment of social impacts did reveal the need to give a keen consideration to gender issues and youths involvement in the full project implementation. Furthermore, the scoping revealed positive socio-economic benefits due to the implementation of the project. Some of the benefits would include: increase in income of beneficiaries, good road network within the project area, improved health and sanitation, and improved food security.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

RECOMMENDATIONS

Based on the ESIA investigation, five key recommendations were made:

1. The proposed project should be implemented in compliance with the relevant legislation, policy and guideline requirement of the Sierra Leone Environment Protection Agency.
2. Mitigation measures to be put in place to ensure that the adverse impacts of the proposed project on the environment are kept to a minimum level.
3. There is a need for the development of a concise Environmental and Social Management Plans (ESMP). The consultants should provide a draft Environmental Management Plan that should set out what actions need to be taken in each phase of the project to implement: mitigation measures; monitoring requirements; management requirement; training needs; and institutional capacity building. The plan should indicate how, where, when and duration of the actions, who should be responsible, and reference standards or guidelines for carrying out the activities (such as national regulations, international standards, specific guidance documentation and protocols).
4. The study recommends timely implementation of the project with strict adherence to the proposed Environmental Management and Social Management Plans.
5. The project should exploit all possible means to meet its corporate social responsibility.

REFERENCE

1. African Development Bank's Final ESMP reports for Cote d'Ivoire, Liberia, Sierra Leone and Guinea
2. African Development Bank's Public & Private Sector Operations 2001, Environmental and Social Assessment Procedure
3. CT Center and UKRENERGO, July 2013: Scoping Report (Initial Report) On the environmental and social impact assessment for the Facility "Installation of second 750 kV autotransformer at SS 750 kV "Kyivska" July 2013
4. Environmental Coalition on Standards. https://ecostandard.org
5. Environmental and Social Management Plan Summary - Sierra Leone Rural Water Supply and Sanitation Project: P-SL-E00-003.
6. ESIA & RAP Summary – Sierra Leone Matotoka Sefadu Road Rehabilitation Project Project Number: P-SL-DB0-005
7. European Commission Guidance on EIA Scoping; June 2001. http://ec.europa.eu/environment/eia/eia-guidelines/gscoping.
8. FAO. 1981. Land resources survey project DP/SIL/73/002. Final report
9. Frank Dixey (Feb 1925) The Geology of Sierra Leone Quarterly Journal of the Geological Society, v. 81:195-220.
10. International Finance Corporation (IFC), Environment and Social Development Department (2002). Handbook for Preparing a Resettlement Action Plan. Washington, DC.
11. http://www.daco-sl.org/encyclopedia/7_lib/7_2j_pl.htm
12. http://www.nationsencyclopedia.com/Africa/Sierra-Leone CLIMATE.html#
13. IFC, Environment, Social and Governance Department (2010), Environmental and Social Review Procedures Manual. Washington, DC, September.
14. IFC (2010). Performance Standard 4-V2—Community Health, Safety and Security. Washington, DC.
15. International Finance Corporation; Performance Standards on Social & Environmental Sustainability; April 2006. http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards
16. Jump up ^ "World Gazetteer: Northern - administrative divisions (per geographical entity)". Archived from the original on 19 September 2012.
17. Jump up ^ "World Gazetteer: Northern - administrative divisions (per geographical entity)". Archived from the original on 19 September 2012.
18. Jump up ^ http://www.health.sl/drwebsite/publish/page_109.shtml
19. Millennium Challenge Corporation (2010). Due Diligence Environmental and Social Assessment, March 9, 2010.
20. Millennium Challenge Corporation (2006). Gender Policy, Fiscal Year 2007 Guidance for Compact Eligible Countries, Chapter 14. Updated December 2006.
21. Millennium Challenge Corporation (2006). Guidelines for Environmental and Social Assessment, Fiscal Year 2007 Guidance for Compact Eligible Countries, Chapter 20. Updated October 2006.
22. Morel, S. W. (Nov. 1979) The geology and mineral resources of Sierra Leone Economic Geology, v. 74, p. 1563-1576, doi:10.2113/gsecongeo.74.7.1563
23. Odell R. T and Dijkerman J. C (1974). Characteristics, Classification and Adaptation of Soils in selected Areas in Sierra Leone, West Africa. USL:Njala University Press, p:10-11
24. Pollet, J. D (1951). The Geology and Mineral Resources of Sierra Leone. Colonial Geology and Mineral Resources (2) p3:-28
25. Pujehun; World Gazetteer. 2010. Retrieved 23 February 2011

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 07, July-2024

26. Report to DGXI, European Commission, Construction and Demolition Waste Management Practices,and Their Economic Impacts, Final Report, February 1999, Report by Symonds, in association with ARGUS, COWI and PRC Bouwcentrum, http://ec.europa.eu/environment/waste/studies/cdw/cdw_report.htm, 2009.
27. SCP Project ESIA Georgia, April 2002: Environmental and Social Impact Assessment Methodology Draft for Disclosure.
28. Sierra Leone Roads Authority Act, 2010
29. The National Environmental Policy (1994) for Sierra Leone
30. The Constitution of Sierra Leone, 1991; Section 7: (1) a & c
31. The Environment Protection Act (EPA), 2008 of Sierra Leone
32. The Forestry Act, 1998 of Sierra Leone
33. The National HIV/AIDS Policy for Sierra Leone, 2002
34. The Sierra Leone Vision (2025)
35. The Factories Act, 1974 of Sierra Leone
36. The Local Government Act, 2004 of Sierra Leone
37. The Land National Policy, 2004 of Sierra Leone
38. The Mines and Minerals Act, 2009
39. The National Health Policy, 2002 of Sierra Leone
40. The Poverty Reduction Strategy Paper (PRSP-2008-2010) for Sierra Leone
41. The National Population Policy, 2002 of Sierra Leone
42. Thomas, Christopher (1994). People's participation programme in Pujehun, Sierra Leone: post-project study. Food and Agriculture Organization of the United Nations. p. 5. ISBN 978-92-5-103466-8.
43. Tetra Tech (2011). Environmental Scoping Report Lusaka Water Supply, Sanitation and Drainage Project Lusaka, Zambia. Report submitted to US Army Corp of Engineers and Millennium Challenge Corporation, Framingham MA, June 27, 2011.
44. Trans Adriatic Pipeline, Nov.2012: Scoping Report for the ESIA (Environmental and Social Impact Assessment) TAP Greece - East Section
45. World Health Organization (2007). Economic and health effects of increasing coverage of low cost household water supply and sanitation interventions to countries off-track to meet MDG target 10. Background document to the Human Development Report 2006, prepared by Guy Hutten, Lawrence Haller and Jamie Bartram, Geneva.