THE GOVERNMENT OF THE REPUBLIC OF SIERRA LEONE/WORLD BANK

REPUBLIC OF SIERRA LEONE MINERAL SECTOR TECHNICAL ASSISTANT PROJECT
(MTAP)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY

FINAL REPORT

BY

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<td>Artisanal of the Environmental</td>
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<td>CSSL</td>
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<td>DACDF</td>
<td>Diamond Area Community Development Fund</td>
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<td>DOE</td>
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<td>EMP</td>
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<td>Emergency Needs Facility</td>
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<td>EPA</td>
<td>Environmental Protection Agency</td>
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<td>ESMP</td>
<td>Environmental and Social Management Plan</td>
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<td>ERP</td>
<td>Emergency Response Plan</td>
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<td>FESS</td>
<td>Foundation for Environmental Security and Sustainability</td>
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<td>GME</td>
<td>Government Mining Engineer</td>
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<td>GOSL</td>
<td>Government of Sierra Leone</td>
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<td>IDA</td>
<td>International Development Association</td>
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<td>KHR</td>
<td>Koidu Holding Limited</td>
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<td>LMS</td>
<td>Large Scale Mining Sector</td>
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<td>MAFFS</td>
<td>Ministry of Agriculture Forestry and Food Security</td>
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<td>MOEP</td>
<td>Ministry of Energy and Power</td>
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<td>MOHS</td>
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<td>MOIALGRD</td>
<td>Ministry of Internal Affairs Local Government and Rural Development</td>
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<td>MOLHCPE</td>
<td>Ministry of Labour Social Security and Employment</td>
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<td>MTL</td>
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<td>MML</td>
<td>Majestic Mining Limited</td>
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<td>MMO</td>
<td>Mines Monitoring Officer</td>
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<td>MMR</td>
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<td>MSDS</td>
<td>Material Safety Data Sheet</td>
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<td>MTAP</td>
<td>Mineral Sector Technical Assistance Project</td>
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<td>NaCEF</td>
<td>National Commission for Environment and Forestry</td>
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<td>NEPB</td>
<td>National Environment Protection Board</td>
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<td>NGO</td>
<td>Non Governmental Organization</td>
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<td>NMJD</td>
<td>Network Movement for Justice and Development</td>
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<td>SESA</td>
<td>Strategic Environmental and Social Assessment</td>
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<td>PAD</td>
<td>Project Appraisal Document</td>
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<td>PAP</td>
<td>Project Affected Persons</td>
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<td>PSC</td>
<td>Project Steering Committee</td>
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<td>Project Support Team</td>
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<td>PRSP</td>
<td>Poverty Reduction Strategy Paper</td>
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<td>RSPB</td>
<td>Royal Society for the Protection of Birds</td>
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<td>RPF</td>
<td>Resettlement Policy Framework</td>
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<td>RUF</td>
<td>Revolutionary United Front</td>
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<td>SALWACO</td>
<td>Sierra Leone Water Company</td>
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<td>Description</td>
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<td>SLDC</td>
<td>Sierra Leone Development Company</td>
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<td>SLMTAP</td>
<td>Sierra Leone Mineral Sector Technical Assistant Project</td>
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<td>SLPRSP</td>
<td>Sierra Leone Poverty Reduction Strategy Paper</td>
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<td>SMP</td>
<td>Social Management Plan</td>
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<td>SRL</td>
<td>Sierra Rutile Mines</td>
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<td>SSM</td>
<td>Small Scale Mechanized Mining</td>
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<td>SMHL</td>
<td>Sierra Mineral Holdings Limited</td>
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<td>SIEROMCO</td>
<td>Sierra Ore and Metal Company</td>
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<td>TOR</td>
<td>Terms of Reference</td>
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<td>TSS</td>
<td>Transitional Support Strategy</td>
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EXECUTIVE SUMMARY

The Government of Sierra Leone (GOSL) has received Project Preparatory Facility (PPF) from the International Development Association (IDA) of the World Bank for the preparation of the Mineral Sector Technical Assistant Project (MTAP) to support the development of the Mineral Resources sector.

An Environmental and Social Impact Assessment (ESIA) has been prepared for the MTAP for the Ministry of Mineral Resources (MMR).

The scope and contents of this document are contained in 14 chapters.

Description of the proposed MTAP
The project objectives and project description are as follows:

Higher Level Objectives of the Project
The project will support the Bank’s Country Assistance Strategy (CAS) objectives “To improve governance, security and peace” by strengthening capacity of the government to monitor the extractive industries sector, and supporting of anti-corruption measures applicable to mining sector through establishment and making operations transparent and non-discretionary mining cadastre system and supporting transparency of extractive industries revenues.

MTAP will form the nexus of ongoing complementary actives by: (i) being coordinated with a broader reform framework in the country (including the ongoing development policy grants) (ii) continuing to build upon and align with other donor’s efforts most notably in the implementation of a five-year institutional reform and capacity building plan development by DIFID and (iii) ensure that mineral sector reform fits within the regional context and is aligned with the regional objectives (such as Mano River Union, and, on a broader scale, ECOWAS, and Africa Region). The project also supports the objectives of the Africa Action Plan.

Project Development Objectives
The project development objectives as outlined in the draft Project Appraisal Document (PAD) are:
(i) Increase efficiency and transparency of the mining sector management by the Government;

(ii) Facilitate contribution of mining sector into local economic development.

Project Components
The MTAP has five (5) components.

Component A. Increasing Extractive Industries Revenues
The component would assist the government with preparatory work in mining concessions review and building negotiations capacity building. Capacity will also be built in the development of model mineral development agreements and at the National Revenue Authority (NRA) making it more efficient as a taxation agency.

Key activities to be supported under this component include:
- Preparation for mineral agreements review;
- Developing mineral development agreement;
- Strengthening revenue collection (through NRA and regional offices housed with in MMR regional officers including:
  - Develop and implement financial models to estimate various rents and taxes due from the mining operations;
  - Build capacity of tax offices for technical audit of mining royalties and taxes and assessment/collection of revenues.

Component B. Increasing Extractive Industries Benefits
Using mining as a catalyst for regional economic growth, strong pro-poor mining policy reforms are needed, such that mining stimulates shared road, rail, power and ports that can in-turn facilitate other sustainable land-use developments. This component will build governments capacity (i) to approach large-scale mining projects and facilitate dialogue between private sector and government in developing private – public partnerships (PAPs) around large-scale mining development; and (ii) assess potential and developing a roadmap for “growth poles” around mining areas. The main outputs will be (a) at least one shared infrastructure agreement around mine development under negotiations; and (b) at least one growth-pole concept around at least one mining area being developed.
The project will assist in setting up and making operational a PPP team at the MMR for the facilitation and coordination of the said projects.

The proposed large-scale mining projects in Port-Loko/Marampa areas and Sierra Rutile Limited will be used as pilot projects to assess potential and propose strategy for increasing benefits form mining and boost local economic growth.

This component will also finance environmental and social safeguard assessments for a selected shared infrastructure project, including public consultations, as well as assist with setting up a community development fund (CDF) as a benefit sharing mechanism for selected areas.

**Component C. Regulatory Capacity Building for Growth**

To ensure good sector governance such that mining activities are implemented in sustainable manner and promote growth and development; this component will focus on building government’s capacity to regulate mining sector including issuance, renewal and revocation of licenses and monitoring compliance of operations with regulations (operational, health, safety, environmental and social)

The project will finance the development of mining regulations and further strengthening of the licensing regime by the establishment and strengthening of a fully operational mining cadastre system nation-wide.

The project will support implementation of key recommendations of the Strategic Environmental and Social Assessment (SESA) and the Environmental and Social Impact Assessment (ESIA).

Key institutions such as MMR, EPA local government, civil society will be strengthened and capacity built to enable them to carry out environmental management, monitoring and enforcement of compliance.

**Component D. National Coordination and Project Management**

This component will finance activities required to (i) provide national policy level support and coordination in regards to the mining sector reform and its linkage with broader economic reforms
and other sector development; and (ii) implement the project activities in accordance with Bank guidelines. There are two sub-components.

(i) **National Policy coordination.** This sub-component will be implemented by an inter-ministerial Project Steering Committee (PSC) of the MTAP. National policy level decisions and coordination of donor funded activities shall form part of the activities of the PSC.

(ii) **Project Implementation Support.** This sub-component will assist in ensuring proper implementation and coordination of the project activities including financial management, disbursements, procurement, safeguards, and monitoring and evaluation requirements. To this end, the Project Support Team (PST) has been established within the MMR.

The MTAP will finance cost associated with operations and incremental cost PSC and PST. Funding will also be provided for capacity building to management implementation and coordination of project activities.

**Component E. Emerging Needs Facility**

The project will keep a provision for emerging needs around sector development. Eligible activities will include consultant’s services, goods, training and consultations to assist the government with ensuring broad economic impact of mining sector reform.

The PSC will be incharge of selection and the Emerging Needs Facility (ENF)

The project is carried out by the MMR. The main goal of this project is to focus on governments commitment to strengthen institutional and regulatory framework for mining, support institutional reform, offer uniform and non-discretionary mineral cadastre system and support sustainable development at the local level.

The objective of the ESIA study are to examine the 3 categories of mining: (a) Large Scale production of non-precious and precious minerals; (b) Small scale mechanized; and (c) artisanal production of precious minerals.
The ESIA identifies key environmental and social issues and impacts associated with future increase in mining activities and to propose effective mitigation measures in the form of an Environmental and Social Management Plan.

The specific objectives of the Environmental and Social Impact Assessment (ESIA) are:

- Identify environmental and social issues and impacts that need to be addressed through the Environmental and Social Management Plan (ESMP).
- Recognize key stakeholders and their respective roles and functions for mining sector management and control, especially for effective implementation of ESMP;
- Assess institutional capacity of the government and key stakeholders for environmental and social impact analysis and the ESMP implementation;
- Propose an operation Environmental and Social Mitigation Plan; and
- Propose measures to enhance capacity of Ministry of Mineral Resources (MMR), Environmental Protection Agency (EPA) and other key stakeholders for effective implementation of the ESMP.

The ESIA, has identified the environmental and social impacts of a future expansion of the activities of the mineral sector and the challenges.

The MTAP is a technical assistant project which will respond to these challenges by financing various components of the project that will make MMR, and other institutions more efficient.

The MTAP will lead to the laying down of policy, legislative and regulatory frameworks for mining. There will be support to institutional support and strengthening that will lead to sustainable development.

**Legal Background**

Further to the 1991 constitution, which proclaims the right of every Sierra Leonean citizen to a clean and healthy environment, three legal documents were prepared.

- The National Environmental Policy (1994)
- The National Environmental Protection Act (2000)
In 2000, the Department of the Environment (DOE) prepared detailed procedures and guidelines applicable to EIAs. These categorize projects into three groups. Those projects with the most significant potential impacts (category A) and those with less significant potential impacts category (B) and those with little or no impacts (category C). The Large Scale mining activities and small scale mechanized mining activities fall under category A. The Artisanal Mining Sector (AMS) falls under category B. Both category A and B require EIA and EMP to be established on a case-by-case basis.

As World Bank (WB) funding is being considered the MTAP will also comply with applicable WB safeguard policies; namely OP 4.01, BP 4.01 (Environmental Assessment), OP 4.04, BP 4.04 (National Habitats), OP/BP 4.12 (Involuntary Resettlement), OP/BP 4.36 (Forests), OP/BP 4.37 (Safety of Dams) and OPN. 11.03 (Management of Cultural Property).

The legal background is presented in chapter 3 of this document. The World Bank Safeguard Policies are described in section 5.

The Proposed Environmental Management Process
As the MTAP fall under schedules 1 and 2, they would undergo a full ESIA process, as per Sierra Leone EIA guideline and WB OD 4.01. Projects categorized as A will usually have to be redesigned, to minimize environmental impacts through a better design or relocation of some of their components. Projections categorized as B will have to comply with a site-specific EMP, to be developed on a case-by-case basis as part of the detailed project.

Details on the Environmental Management Process is presented in chapter 4. WB safeguards and Sierra Leonean laws compare very well except in disclosure and compensation requirements.

Institutional Managements Related to the Environment
This is presented in section 6 which briefly describes the role of the line ministries and NGOs in Environmental Management. The role of the following ministry were elaborated:

- Ministry of Lands, Housing Country Planning and the Environment (MLHCPE);
- Ministry of Transport and Aviation (MOTA);
- Ministry of Mineral Resources (MMR);
- Ministry of Agriculture, Forestry and Food Security (MAFFS);
- Ministry of Fisheries and Marine Resources (MFMR);
- Ministry of Tourism and Culture (MOTC);
- Ministry of Works and Infrastructure (MOWI);
- Ministry of Internal Affairs, Local Government and Rural Development (MOIALGRD); and
- Ministry of Education Youths and Sports (MOEYS).

The overlapping and cross-cutting mandates of various institutions makes coordination difficult. The role of the newly established Environmental Protection Agency (EPA) has also been discussed. EPA has both a coordinating as well as an implementing role in environmental management. Guidelines and standards for Environmental Management are yet to be developed by EPA.

**Mining Section Overview**

An overview of the mining sector is given in section 7. Case studies on the methodology in the 3 categories of mining are also presented in section 7. Sierra Mineral Holdings (SMHL), Sierra Rutile (SRL), Cluff Gold Mining Sierra Leone (CGMSLL) and Koidu Holding (KHL) are presented as examples of Large Scale Mining (LSM) and Small Scale Mechanized Mining (SSM) are discussed under Milestone (MTL). Tongo Fields, Kono and Baomohun areas are presented for artisanal diamond and gold mining sectors. Each mining procedure is discussed under Exploration, Development, Extraction, Beneficiation and Processing. Bauxite and diamond mining involves dry ore extraction. KHL employs blasting for kimberlite diamonds. Rutile is mined using wet extraction techniques.

**The Potential Project Impacts and Mitigation**

The ESIA considers the environmental and social impacts of two broad categories, of mining activities in section 8.

- Mechanized Mining (Large Scale and Small Scale); and
- Artisanal Mining (Section 12).

The environmental and social impacts of proposed actions for which mitigation measures have been recommended are considered for Dry and Wet extractions separately.
The projects under the MTAP will impact the physical, biological and social environment. Mining will result in the depletion of non-renewable resources. Reclamation and revegetation of the mined out area may create conditions conducive to agricultural development.

The environmental consequences and mitigation measures are given below as given the Environmental and Social Management Plan (ESMP).

**Climate**
The increased area of surface water bodies will result in increased evaporation in the immediate area of the ponds themselves. This may impact the microclimate of the project area by lowering temperatures in the site area. Increased exposure of the area formerly below the vegetative cover may result in temperature increases.

**Geology**
Mining operations will result in the removal of the soil and rock present at the site. Mining will consequently result in an alteration of the surficial soil at the site. Mining will result in changes in the topographic height, slope relief intensity, degree of shaping and exposure of the area. The project will alter surficial geology within the area mined and reclaimed. Slopes created by the operations will be more stable than those currently occurring as the possibility of slope failures will be significantly decreased.

**Air Quality**
Air quality will be impacted by clearing and exposure of vegetation and by emissions from mining operations, vehicular traffic and spoil piles onsite. Noise levels above the alert threshold of 86 decibels and hazard threshold of 95 decibels will be produced from heavy-duty machines operations and blasting. Continuous noise may disrupt acoustic communication between fauna. Dust control measure, use of energy efficient machines and vehicles equipped with appropriate noise limiting devices could be used to mitigate some of the effects.

**Water Resources**
Processing water when discharged into streams or rivers will impact surface water quality. Construction of tailings ponds and wet mining ponds will interfere with the existing ground water flow regime. The presence of dissolved minerals in the groundwater can change the pH of
groundwater in the area. Site clearing will produce increased discharges to surface water. Surface runoff from mining waste containing large amounts of water-soluble substances or heavy metals can result in degradation of surface water quality. Sustainable reclamation drainage plans will be in place. Run off and sediment control procedures will be in place as well as waste water treatment facilities. Groundwater supply systems will be provided to communities where surface water sources are affected.

**Land Use**
The projects will result in significant changes in vegetation cover. This may increase soil erosion, soil compaction and nutrient leaching from the surficial soils. Habitat fragmentation will alter living conditions for flora and fauna. Erosion control measures including revegetation, adherence to an erosion and sediment control plan will be implemented. Reclamation to restore sustainable biological communities will be undertaken.

**Biodiversity, Flora and Fauna**
Clearing of large tracts of vegetation for mining, will make plant regeneration difficult. Leaching will deplete the soil nutrients leading to the appearance of opportunistic species. Flora composition will also be altered. There will be restoration of vegetation and reclamation of terrestrial and aquatic habitats, as much as possible. Agroforestry programs for local residents will be introduced to reduce dependence on natural habitats.

Clearing will also fragment the area and reduce the space available to the movement of wildlife. The installation of facilities including tailings and mining ponds will form temporary barriers to the movement of animals. Pollution by contaminated surface runoff will result in an environment less conducive to fishes. Many water fowls are attracted to water bodies where they are likely to come into contact with contaminated and polluted environment. There will be reclamation of terrestrial and aquatic habitats as much as possible. Reclamation to connect fragmented habitats will be undertaken. Water quality protection measures will be introduced including, design, lining of tailings storage facilities and recycling of all waste rock, ore stockpile and plant site runoff.

Project will introduce some traffic into the area leading to congestion and accidents. Roads will be upgraded and widened. Speed limits, driver education, public education, vehicle scheduling and vehicle maintenance will be carried out.
**Socio-economic Conditions**

There will be loss or reduced access to land (agricultural and grazing) as well as to natural resources. There will be displacement of people and disruption of livelihood. There will be increased pressure on existing social and physical infrastructure from displaced persons and migrants. (See Resettlement Policy Framework (RPF) document)

There will be increase in transmission of diseases including HIV/AIDS as well as increased public safety due to influx of large imported workforce. There will also be an increase in social conflicts within host communities.

Among the mitigation measure are comprehensive compensation and resettlement schemes. An appropriate hiring policy favouring host communities will be required. Economic and social programs will be introduced including provision of social amenities, training and employment opportunities. Dispute resolution mechanisms will also be introduced. Disease prevention and management programs will be given special attention.

**Cultural Resources**

Any cultural or sacred resources when impacted shall be mitigated in line with traditional rites and national laws.

**Environmental and Social Management Plan (ESMP)**

An appropriate ESMP has been developed to mitigate and minimize the environmental consequences of identified actions. These are presented in section 9. A matrix is presented in Table 7.

The range of issues considered include the following:

- Terrestrial resources management;
- Open pit management;
- Water management;
- Tailings management;
- General waste management;
- Land reclamation;
- Air quality, dust and noise;
- Employee Health and Safety;
- Fuel Oil management;
- Spill contingency plan; and
- Socio-economic impact management

An Emergency Response Plan (ERP) has also been presented.

**Institutional Responsibilities for the Management of the Environmental and Social Management Plan (ESMP)**

Institutional responsibilities for the management of ESMP has been described in section 10. The roles and responsibilities of some key agencies are giving including:

- Mining Companies;
- Environmental Protection Agencies (EPA) and Line Ministry (Ministry of Lands, Housing, Country Planning and the Environment (LHCPE);
- Ministry of Mineral Resources (MMR);
- Higher Institutions of Learning;
- Local Government Structures;
- NGOs;
- Contractors
- Consultants; and
- World Bank

The roles and responsibilities are summarized in the matrix below.
## Summary of Institutional Responsibilities for ESMP

<table>
<thead>
<tr>
<th>Level</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mining Company/Agency</strong></td>
<td>• Environmental Department Setup (Mining Engineer, Civil Engineer, Environmental Scientist)</td>
</tr>
<tr>
<td></td>
<td>• Environmental Team ensures that facilities conform to the design requirements and standards. Team also monitors:</td>
</tr>
<tr>
<td></td>
<td>▪ Solid Waste and Sewerage</td>
</tr>
<tr>
<td></td>
<td>▪ Surface and groundwater</td>
</tr>
<tr>
<td></td>
<td>▪ Coordinates health and safety programs</td>
</tr>
<tr>
<td></td>
<td>• Laboratories setup (Large Scale Mining over periods exceeding 10 years). Monitors ground and surface water for heavy metals, BOD, Temperature etc;</td>
</tr>
<tr>
<td></td>
<td>• Provide funds for environmental monitoring;</td>
</tr>
<tr>
<td></td>
<td>• Community Affairs Department set up to attend to socio-economic concerns:</td>
</tr>
<tr>
<td></td>
<td>▪ Community expectations and aspirations</td>
</tr>
<tr>
<td></td>
<td>▪ Compensation, relocation and resettlement</td>
</tr>
<tr>
<td></td>
<td>▪ Provision of social services</td>
</tr>
<tr>
<td></td>
<td>▪ Administration of Community Development Funds</td>
</tr>
<tr>
<td></td>
<td>• Implements ESIA</td>
</tr>
<tr>
<td><strong>Environmental Protection Agency (EPA) and Line Ministries (MLHCPE)</strong></td>
<td>• EPA facilitates coordination and cooperation among government ministries and agencies at national regional and international levels</td>
</tr>
<tr>
<td></td>
<td>• Receives national and sectorial Environmental Policies and EIAs.</td>
</tr>
<tr>
<td></td>
<td>• Sets standards, promotes training and education</td>
</tr>
<tr>
<td></td>
<td>• Sets up environmental Database.</td>
</tr>
<tr>
<td><strong>Higher Institution of Learning</strong></td>
<td>• The Universities will provide training of more Geologists and Mining Engineers</td>
</tr>
<tr>
<td></td>
<td>• Shall provide monitoring equipment and analyse samples</td>
</tr>
<tr>
<td><strong>Local Government Structure</strong></td>
<td>• Employment of trained and qualified staff by local councils.</td>
</tr>
<tr>
<td></td>
<td>• Training of Environmental committees by MMR.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>NGOs</td>
<td>• NGOs with capabilities will carry out independent environmental Audits</td>
</tr>
<tr>
<td></td>
<td>• Acquires funds from GOSL, Mining agencies and private foundations.</td>
</tr>
<tr>
<td>Contractors</td>
<td>• Implement the Environmental Mitigative measures prescribed under the ESIA and other EIAs at construction, operation and closure.</td>
</tr>
<tr>
<td>Consultants</td>
<td>• Carry out Environmental Assessment, Development Site Specific Environmental Impact Assessment (EISs) and Environmental Monitoring Plans (EMP)</td>
</tr>
<tr>
<td>World Bank/Donors</td>
<td>• Review draft ESIA and EIAs</td>
</tr>
<tr>
<td></td>
<td>• Monitor overall implementation of this ESIA</td>
</tr>
<tr>
<td></td>
<td>• Review annual reports presented by MMR.</td>
</tr>
</tbody>
</table>

**Monitoring Plan**

Monitoring plan has been presented in 11. The parameters to be monitored include; Terrestrial Resources, Overburden, Water, Tailings, Hazardous Material, Solid Waste, Reclamation, Air Quality and Socio-Economics.

**Environmental Management Process**

Before mining licenses are granted the following process will be followed:

- Presentation of an ESIA acceptable to the Environmental Protection Agency (EPA). ESIA will contain all elements contained in this ESIA report to include:
  - Environmental and Social Management Plan (ESMP)
  - Emergency Response Plan (ERP)
  - Environmental Monitoring Plan
  - Time Bound Reclamation Plan
  - Sustainability Plan
- Posting of Reclamation Guarantee Bond in the form of funds to MMR.
Artisanal Mining Sector Impacts
These are presented in section 12. Artisanal mining occurs in 80 Districts involving an estimated 500,000. Some 2,300 acres of land could be mined annually.

Clearing of vegetation leads to loss of surficial soils and erosions. There is uncontrolled pit digging with no routine backfilling. Landscape degradation is very high with a loss of flora and fauna. Artisanal mining occurs in depressed and poor communities. Social amenities including water and sanitation facilities, schools and medical facilities are inadequate. Overcrowding will lead to increase in crime, drug and substances abuse, increase in prostitution and sexually transmitted diseases including HIF/AIDS. The main mitigation measures include land
reclamation. The cost of reclamation is usually high (USD 3000 - 6000) and is undertaken mostly by GOSL, and NGO groups.

Socio-economic mitigation measures include:
- Provision of social amenities through community infrastructures;
- Awareness raising campaigns;
- Training in technology and environment;
- Increased participation of local stakeholder groups; and
- Legislative reviews.

**Recommendations and Conclusions**

The recommendations and conclusions presented in section 13 has been considered under the following:
- Institutional Strengthening for MMR, EPA, Local Government structures and NGOs;
- Environmental Management Tools; and
- Coordination Issues

The most potent environmental management tool is the legislative review of key policies and legislative frameworks including
- Mines and Minerals act (1996);
- Core Mineral Policy;
- Forestry Act (1988) and
- Convention on Biodiversity.

Strengthening of key institutions is strongly advocated including MMR, EPA, Local Government structures and NGOs. This could be done through recruitment of trained staff, training and provision of more resources. The MTAP will provide funds under components A, B and C during year 1 of project.

There is a need for more coordination among policy and implementing bodies including EPA and MMR as well as agencies whose activities are likely to conflict with mining. The latter includes Forestry and Agriculture. This coordinating activities will be undertaken by the Project Steering Committee (PSC) under components D during life of MTAP.
Documents

The major documents consulted are listed in section 14. This documents were critically examined and used as basis for the ESIA document
1.0 INTRODUCTION AND PROJECT BACKGROUND

1.1 Preparation of Environmental and Social Impact Assessment Report

In line with the guidelines provided in the Terms of Reference (TOR) Appendix I the Government of Sierra Leone (GOSL) has received Project Preparatory Facility (PPF) from the International Development Association (IDA) World Bank for the Preparation of the Mineral Sector Technical Assistant Project (MTAP) to support the development of the Mineral Resources sector and intends to apply part of the proceeds for consultancy services.

The Ministry of Mineral Resources (MMR) has appointed a consultant (Dr. E.T. Ndomahina) to carry out an Environmental and Social Impact Assessment (ESIA) to provide a framework for taking effective steps and measures to mitigate adverse environmental and social impacts during project implementation. The ESIA summarizes the anticipated significant adverse effects during MTAP implementation. The work as per TOR is deemed to have started 7 days after Signing of contract.

The contract was signed on the 9th May, 2008 and effectively started on the 12th May, 2008

1.1.1 Methodology

This report is based largely on study of available literature and Interviews conducted with many stakeholders in Freetown including officials of the Ministry of Mineral Resources (MMR), Ministry of Lands Housing County Planning and the Environment (MOLHCPE), Ministry of Agriculture Forestry and Food Security (MAFFS), Ministry of Internal Affairs, Local Government and Rural Development (MOIALGRD), Ministry of Labour, Social Security and Employment (MOLSSE). Other stakeholders consulted or to be consulted include, United Mine Workers Union, Cemmats Group Ltd, National Commission for the Environment and Forestry (NaCEF), Peace Diamond Alliance and NGOs including Network Movement for Justice and Development (NMJD). The consultation are ongoing. Those interviewed so far are been annexed as Annex I.

Visits were made to sites identified by the MMR as representatives of categories of three mining subsectors:

a) Large Scale production of non-precious minerals – Rutile, Bauxite and Diamonds;

b) Mechanized small-scale mines, mostly diamonds and possible gold; and

c) Artisanal production of precious minerals – Diamonds and gold.

Places visited and the time schedule is given in Table 1.
Table 1: Field Visits

<table>
<thead>
<tr>
<th>District</th>
<th>Town/Villages</th>
<th>Target</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moyamba</td>
<td>Gondama</td>
<td>Sierra Mineral Holdings (SMHL)</td>
<td>23/05/2008</td>
</tr>
<tr>
<td>Bonthe</td>
<td>Mining Site</td>
<td>Sierra Rutile LtD (SRL)</td>
<td>23/05/2008</td>
</tr>
<tr>
<td>Bonthe</td>
<td>Moriba Town</td>
<td>Communities (Local)</td>
<td>24/05/2008</td>
</tr>
<tr>
<td>Bonthe</td>
<td>Mogbwemo</td>
<td>Communities (Local)</td>
<td>24/05/2008</td>
</tr>
<tr>
<td>Kenema</td>
<td>Kenema Town</td>
<td>Government Officials</td>
<td>25/05/2008</td>
</tr>
<tr>
<td>Kenema</td>
<td>Tongo Fields</td>
<td>Artisanal Miners, Kimberlite Pits. Dealers, Mines Monitoring Officers</td>
<td>25/05/2008</td>
</tr>
<tr>
<td>Bo</td>
<td>Bo Town</td>
<td>Government Officials</td>
<td>26/05/2008</td>
</tr>
<tr>
<td></td>
<td>Bawomahun</td>
<td>Artisanal Gold Miners</td>
<td>26/05/2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local Communities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cluff Gold SL LtD.</td>
<td>26/05/2008</td>
</tr>
<tr>
<td>Kono</td>
<td>Koidu New</td>
<td>Government Officials</td>
<td>27/05/2008</td>
</tr>
<tr>
<td></td>
<td>Sembehun</td>
<td>Koidu Holdings LtD (KHL)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tefeya</td>
<td>Milestone Trading LtD (MTL)</td>
<td>27/05/2008</td>
</tr>
</tbody>
</table>

Consultations were held with Mining Company officials, Local Communities, Chiefs Project and Affected Persons (PAPs). Conducted tours were undertaken to assess both the environmental and social impacts of the activities. In the artisanal sector, interviews and discussions were held with diggers, license holders, agents, dealers and exporters. Mines Monitoring Officers (MMO), Mines Wardens, and Engineer were also interviewed. Among the communities were Local Council representatives, Chiefs Women’s groups, Youth groups and NGOs. The list of places and community members met is attached as Annex I.

For the consultations a letter of introduction of the lead consultant and team were given to the team by the Director of Mines and the task spelt out. In each region the Government Mining Engineer (GME) was telephoned to inform the companies about the date and impending visits. Chiefs and communities were contacted through Local Government structures and NGOs. After discussions
with MMR including GME the companies were visited. At each mining company or agencies the
organisational structure of the company was confirmed, key personnel were interviewed and
discussions were held usually individually and also latter together. The key personnel interviewed
included the General Manager or Representative, the Mining Engineers, Safety Personnel,
Community Development Officer and Laboratory Personnel. The Environment Assessment (EA)
reports were looked at and in some cases copies made.

Although members of the team had agreed on some formats yet the members were free to ask
questions and discuss freely.

Discussion centred around;

- Organizational structure
- Mining procedures
- Environmental impacts
- Mitigation Measures (short term and Longterm) including
  - Community and Social Relations

Community consultative meetings were arranged involving a wide range of stakeholders (Chiefs,
Elders, Project Affected Persons, Local Councils, Youth Group, Women’s groups, Farmers, NGOs
etc). The views were sought about a range of issues including:

- Knowledge of mining operations
- Social Amenities
- Expectations
- Relocation and Resettlements
- Compensations
- Information flow between stakeholders
- Constraints
- Future outlook.

The participants were encouraged to discuss freely after assurances that the team did not represent
the companies. The discussions were held in the presence of mining company representatives
Dialogue was encouraged. The views were recorded and has been summarized in Annex I.

The team also made some un-announced visits to households and institutions (Schools, health
post). Some members of the public (on streets) were engaged in discussion.
Constraints
The timeframe for the assignment was rather short (6-7 weeks). This includes preparation of Inception Report and field visits.

The attempt to bring into a single document (ESIA) the diversity of Environmental and Social Impacts has been challenging. Each Large scale and Small Mechanized Mining company requires a site specific EIA. It was difficult to locate some very important documents. Although the Government officials were very cooperative some stakeholders tried to be elusive or indifferent. The consultants have had to contend with these challenging circumstances.

1.2 Project Background
During the civil unrest (1995-1999) the country’s physical infrastructure, suffered widespread destruction and lack of maintenance. In the mining sector large scale mining of rutile and bauxite as well as mechanized small scale mining were stopped when the rebels of the Revolutionary United Front (RUF) invaded the productive areas.

In the artisanal diamond mining sector there was indiscriminate mining in areas where Government machinery had collapsed.

Many diagnostic studies have revealed major constraints to improve the performance in the mining sector.
The mining sector of Sierra Leone contributes 20% GDP to the national economy and 90% of registered exports.

This sector provides livelihood for some 200,000 to 300,000 people. The mineral sector in Sierra Leone is made up of three sectors: (a) Large Scale production of non-precious and precious minerals – rutile, bauxite and diamonds; (b) mechanized small scale miles, mostly diamonds; and (c) artisanal production of precious minerals diamonds and to much lesser extend gold.

Among the challenges facing the Government are (i) a fiscal regime that has not attracted and retained a large number of quality investments into the sector; (ii) a regulatory regime that has no checks and balances against the potential for the non-transparent, discretionary authority in granting mineral rights; (iii) existence of large numbers of unlicensed; informal artisanal mining,
thus forgoing revenues to the country; (iv) significant environmental and social impacts and the need for capacity in revenues management and benefits sharing.

In 2003 a sector reform initiative was launched with donor support. The activities that took place include:

   a) Development in a core mineral policy;
   b) Basic geo-data collection and dissemination;
   c) Improved administration and management and mineral rights in Kono;
   d) Improvement of productivity, safety and environmental mining conditions;
   e) Diamond area community development fund;
   f) Improvement in system and improvement of regime for mining; and
   g) A strategic Environmental and Social Assessment (SESA) studies for mining sector.

Sierra Leone has successfully made the transition from post conflict country to one with a fully developed Poverty Reduction Strategy Paper (PRSP). The PRSP (2005-2007) is based on three pillars;

   i. Good governance, security and peace;
   ii. Pro-poor, sustainable economic growth for food security and job creation; and
   iii. Human resource development.

The project support the SLPRSP of the mining sector in a key element.

The project would also directly support the Bank’s Transitional Support Strategy (TSS) under the “Accelerating Economic Growth” pillar.

Inspite of all the positive strides the Government of Sierra Leone (GOSL) recognizes that major reforms are needed to improve sector governance, increase, transparency, and mitigate against the potential for misuse of the nations natural resources. The proposed MTAP will focus on governments commitment to strengthen institutional and regulatory framework for mining, support institutional reform, offer uniform and non-discretionary mineral cadastre system, and support sustainable development on local level.
1.3 The Higher Level Objective

The project will support the Bank’s Country Assistance Strategy (CAS) objectives “To improve governance, security and peace” by strengthening capacity of the government to monitor the extractive industries sector, and supporting of anti-corruption measures applicable to mining sector through establishment and making operations transparent and non-discretionary mining cadastre system and supporting transparency of extractive industries revenues.

MTAP will form the nexus of ongoing complementary actives by: (i) being coordinated with a broader reform framework in the country (including the ongoing development policy grants) (ii) continuing to build upon and align with other donor’s efforts most notably in the implementation of a five-year institutional reform and capacity building plan development by DIFID and (iii) ensure that mineral sector reform fits within the regional context and is aligned with the regional objectives (such as Mano River Union, and, on a broader scale, ECOWAS, and Africa Region). The project also supports the objectives of the Africa Action Plan.

The Higher Level Objective of the MTAP project is to respond to the aspiration of the Government of Sierra Leone (GOSL) PRSP framework of the governance reform Growth, Food Security and Job creation as well as Human Development.

The PRSP aims to revive the economy through implementation of sector programs, among then the mining sector.

1.4 The Purpose and Requirement of the Environmental and Social Impact Assessment (ESIA) Studies

The main objective of the scope of work is to identify key environmental and social issues and impacts associated with future increase in mining activities and to propose effective mitigation measures in the form of an Environmental and Social Management Plan (ESMP). The specific objectives under the Environmental and Social Impact Assessment (ESIA) are:

- Identify environmental and social issues and impacts that need to be addressed through the ESMP;
- Recognize key stakeholders and their respective roles and functions for mining sector management and control, especially for effective implementation of ESMP;
- Assess institutional capacity of the government and key stakeholders for environmental and social impact analysis and ESMP implementation;
- Propose an operative Environmental and Social Mitigation Plan; and
- Propose measures to enhance capacity of MMR, NaCEF and other key stakeholders for effective implementation of ESMP.

As per TOR, the ESIA will build on the recommendations of the Strategic Environmental and Social Assessment (SESA) studies especially in the development of Social Management Plan (SMP)

The following are also included in TOR:
- Literature Review of the mining sector and its environmental and social impacts;
- Identify Import Biodiversity Areas which may be impacted by the activities under the proposed MTAP;
- Compliance with WB Safeguard Policies;
- Recommendation for Project – Specific EIA; and
- Monitoring and Evaluation.

The organization and presentation of the report shall be as per TOR

2.0 PROJECT CONTEXT
2.1 Project Objectives
The project development objectives as outlined in the draft Project Appraisal Document (PAD) are:

(iii) Increase efficiency and transparency of the mining sector management by the Government;

(iv) Facilitate contribution of mining sector into local economic development.

2.2 Project Components
Project Components
The MTAP has five (5) components.

Component A. Increasing Extractive Industries Revenues
The component would assist the government with preparatory work in mining concessions review and building negotiations capacity building. Capacity will also be built in the development of
model mineral development agreements and at the National Revenue Authority (NRA) making it more efficient as a taxation agency.

Key activities to be supported under this component include:

- Preparation for mineral agreements review;
- Developing mineral development agreement;
- Strengthening revenue collection (through NRA and regional offices housed with in MMR regional officers including:
  - Develop and implement financial models to estimate various rents and taxes due from the mining operations;
  - Build capacity of tax offices for technical audit of mining royalties and taxes and assessment/collection of revenues.

Component B. Increasing Extractive Industries Benefits

Using mining as a catalyst for regional economic growth, strong pro-poor mining policy reforms are needed, such that mining stimulates shared road, rail, power and ports that can in-turn facilitate other sustainable land-use developments. This component will build governments capacity (i) to approach large-scale mining projects and facilitate dialogue between private sector and government in developing private – public partnerships (PAPs) around large-scale mining development; and (ii) assess potential and developing a roadmap for “growth poles” around mining areas. The main outputs will be (a) at least one shared infrastructure agreement around mine development under negotiations; and (b) at least one growth-pole concept around at least one mining area being developed.

The project will assist in setting up and making operational a PPP team at the MMR for the facilitation and coordination of the said projects.

The proposed large-scale mining projects in Port-Loko/Marampa areas and Sierra Rutile Limited will be used as pilot projects to assess potential and propose strategy for increasing benefits form mining and boost local economic growth.
This component will also finance environmental and social safeguard assessments for a selected shared infrastructure project, including public consultations, as well as assist with setting up a community development fund (CDF) as a benefit sharing mechanism for selected areas.

**Component C. Regulatory Capacity Building for Growth**

To ensure good sector governance such that mining activities are implemented in sustainable manner and promote growth and development; this component will focus on building government’s capacity to regulate mining sector including issuance, renewal and revocation of licenses and monitoring compliance of operations with regulations (operational, health, safety, environmental and social)

The project will finance the development of mining regulations and further strengthening of the licensing regime by the establishment and strengthening of a fully operational mining cadastre system nation-wide.

The project will support implementation of key recommendations of the Strategic Environmental and Social Assessment (SESA) and the Environmental and Social Impact Assessment (ESIA).

Key institutions such as MMR, EPA local government, civil society will be strengthened and capacity built to enable them to carry out environmental management, monitoring and enforcement of compliance.

**Component D. National Coordination and Project Management**

This component will finance activities required to (i) provide national policy level support and coordination in regards to the mining sector reform and its linkage with broader economic reforms and other sector development; and (ii) implement the project activities in accordance with Bank guidelines. There are two sub-components.

(iii) **National Policy coordination.** This sub-component will be implemented by an inter-ministerial Project Steering Committee (PSC) of the MTAP. National policy level decisions and coordination of donor funded activities shall form part of the activities of the PSC.

(iv) **Project Implementation Support.** This subcomponent will assist in ensuring proper implementation and coordination of the project activities including financial
management, disbursements, procurement, safeguards, and monitoring and evaluation requirements. To this end, the Project Support Team (PST) has been established within the MMR.

The MTAP will finance cost associated with operations and incremental cost PSC and PST. Funding will also be provided for capacity building to management implementation and coordination of project activities.

**Component E. Emerging Needs Facility**
The project will keep a provision for emerging needs around sector development. Eligible activities will include consultant’s services, goods, training and consultations to assist the government with ensuring broad economic impact of mining sector reform.
The PSC will be incharge of selection and the Emerging Needs Facility (ENF)

2.3 **Overriding Project Principles**
The overriding project principles are expressed in the Core Mineral Policy and summarized below GOSL (2004)
- Review and amend mining laws, regulations and associated laws to make them as attractive as possible for investment here rather than in neighbouring countries with similar mineral potential;
- Strengthen the institutions and administer, regulate and monitor the mineral industry in Sierra Leone to allow the mining industry, especially with respect to the diamond industry to be turned around to become a positive for Sierra Leone;
- Attract private investments into the mineral sector Encourage private investment to use the implementation of the Kimberley process as a positive at the forefront of selling diamonds for peace and development properly registered by the Kimberley Process;
- Develop and strengthen human resources in the minerals sector;
- Improve the regulation and efficiency of artisanal and small-scale mines;
- Minimise and Mitigate the adverse impacts of mining operations on health, communities and the environment;
- Promote improved employment practices, encourage participation of women in the mineral sector and prevent the employment of children in mines;
- Ensure that Sierra Leone's mineral wealth supports national economic and social developments;
- Add value to mineral products and facilitate trading opportunities for mined products; and
- Add value to mineral products and facilitate trading opportunities for mined products; and
- Improve the welfare and benefits of the individuals and communities participating in and affected by mining.

3.0 DESCRIPTION OF AREA OF INFLUENCE

COUNTRY PROFILE

3.1 The Bio-Physical Environmental Features

Sierra Leone is a small West African Country located at latitude 8° 3' N and longitude 11° 3' W, boarded on the north and east by Guinea for about 652 km, on the south by Liberia for about 306 km and on the west by the Atlantic Ocean.

Sierra Leone has a total surface area of 71,740 sq. km of which the total land area is 71,620 sq. km and 120 sq. km is water.

The Country got its name from the 15-century Portuguese explorer, who was the first to sight and map Freetown harbour. The original Portuguese name of Serra Lyoa (Lion Mountains) referred to the range of hills that surrounds the harbour.

Sierra Leone can be divided into four distinct physical regions, which are:

- The Coastal Swamp region extends into the Atlantic for about 320 km. It is flat, low lying and frequently flooded plain that is between 32 and 64 km wide and is composed mainly of sands and clays. Its numerous creeks and estuaries contain mangrove swamps. Parallel ridges, often separated by silting lagoons, are common and sometimes form the actual coast.

- The Sierra Leone Peninsula, which is the site of Freetown, is a region of thickly wooded mountains that run parallel to the sea for about 40 km. The Peninsula Mountains rise from the coastal swamps and reach 888 m at Picket Hill.
Inland from the coastal plain is the interior plains region. In the north it comprises featureless grasslands (savannah) that are known as “Bolilands” (Boli being a Temne word for those lands that are flooded in the rainy season and hard in the dry season and on which only grass can grow). In the South the plains comprise rolling wooded country where isolate hills rise abruptly to more than 200 m. The interior contains a variety of landforms ranging from savannah-covered low plains to rocky scarp and hill country. The plateau region, encompassing roughly the eastern half of the country, is composed mainly of granite with a thick laterine (iron-bearing) crust; to west it is bounded by a narrow outcrop of mineral-bearing metamorphic rocks known as the Kambui Schists. Rising above the plateau are a number of mountain masses.

In the northeast the Loma Mountains are crowned by Mount Loma Mansa (Mount Bintimani) at 1,948 m (the highest point in Sierra Leone) and the Tingi Hills rise to 1,824 m at Sankanbiriwa Peak.

### 3.1.1 Climate

The climate is tropical and is characterized by the alternation of the rainy and dry seasons. Conditions are generally hot and humid. Mean monthly temperatures range from 25º to 28º C in low-lying coastal areas; inland the range may be from 23º C to 28º C. In the northeast, where extremes of temperature are greater, mean daily minimums fall to 13º C in January, and mean daily maximums rise to 32º C in March.

During the rainy season, from May to October, humid air masses from the Atlantic dominate. Precipitation is greater on the coast than inland, with as much as 5,080 mm of rainfall annually on the Peninsula Mountains, while the northeast receives about 2,032 mm a year.

The dry season, from November to April, is characterized by the harmattan that blows from the Sahara. The rainy season tends to have cooler daily maximum temperature than the dry season by about 6º C. The relative humidity, however, may be as high as 90% for consideration periods, particularly during the wettest months, from July to September.

### 3.1.2 Soils and Hydrology
The Country’s drainage pattern is dense. Numerous rivers rise in the well-waters of the Fouta Djallon highlands of Guinea and flow in a general northeast to southwest direction across Sierra Leone. Their middle courses are interrupted by rapids that restrict navigability to only a short distance inland. River levels show considerable seasonal fluctuations.

The drainage system has nine major rivers and a series of minor coastal creeks and tidal streams. From North to South, the principal rivers are the Great Scarcies, Little Scarcies, Rokel, which is known in its lower courses as the Sierra Leone River, Gbangbaia, Jong, Sewa, Wanje, Moa, and Mano. The Great Scarcies and Moa form portions of the border with Guinea, while the Mano river forms much of the country’s frontier Liberia.

In most areas, the dominant soils are of the weathered and leached lateritic (iron-bearing) type. Red to Yellow-brown in color, they contain oxides of iron and aluminum and are acidic. Kaolin clays are important in some areas, and when cultivated a light, readily workable, free-draining soil results, whose productivity depends largely on the nutrients provided from the vegetation previously cleared and burned. In coastal plains lateritic soils developed on sandy deposits are agriculturally poor, but those derived from basic igneous rocks are somewhat better.

3.1.3 Natural Resources
Sierra Leone is a country blessed with abundant mineral resources which include diamonds, chromite, rutile (among the largest reserves in the world), iron ore, titanium ores, bauxite, columbite (a black mineral of iron and columbium) pyrochlore, gold, platinum, and monazite. Forests cover more than one-fourth of the country the most important area of which is the Gola Forest Reserve, a tract of primary tropical rain forests, near the Liberian border.

3.1.4 Wetlands
The Convention on Wetlands came into force for Sierra Leone on 13 April 2000. Sierra Leone presently has 1 site designated as a Wetland of International importance, which is the Sierra Leone River Estuary, with a surface area of 295,000 hectares.

The Estuary, near Freetown Peninsula, is dominated by mangrove swamps, with lowland coastal plains to the north.
As it enters the Atlantic Ocean, the estuary widens to about 11km, and deepens to form a natural harbor said to be third largest in the world. 19% of Sierra Leone’s total mangrove is included within the site.

The site exceeds the 1% threshold for at least eight bird species, namely Ringed and Kentish Plovers, Sanderling, Curlew Sandpiper, Whimbrel, Greenshank and Redshank, and Western Reef Heron; and is a breeding habitat for some of these birds.

3.1.5 International Conventions and Treaties

Sierra Leone is a signatory to numerous international conventions related to environmental management, notably:

- UN Framework convention of climate change (1997)
- Convention on Biological Diversity (1992)
- Convention combat of Desertification (1994)
- Vienna convention on protection of Ozone layer (1987).
3.2 SOCIAL ENVIRONMENTAL FEATURES

Sierra Leone is one of the poorest countries in the world. Sierra Leone’s population of 4.9 million in 2002, which is growing by about 2% annually, is made up of many ethnic groups, the largest and prominent among them are the Mende, Temne, Limba, Kuranko, Susu, Yalunka, Loko, Mandika, Kono, Kisi and the Creoles.

In 2002 Agriculture accounted for more than 50% of GDP, and is the primary economic activity for more than 80% of the population living in rural areas.

Following the conflicts of the 1990s, Sierra Leone has made remarkable strides in re-establishing peace and the demobilization of combatants was completed in January 2003. Government has established its authority nationwide, many refugees have returned, and presidential and parliamentary elections have occurred and local elections were concluded in 2004. There has been a change of regime following the recently concluded election (2007).

<table>
<thead>
<tr>
<th>Selected Demographic and Social Indicators¹</th>
<th>Sierra Leone</th>
<th>Sub-Saharan Africa (1993-1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population in millions (2001)</td>
<td>4.9</td>
<td>642</td>
</tr>
<tr>
<td>Urban Population (1999)</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Population growth</td>
<td>2.6</td>
<td>2.4</td>
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<tr>
<td>GDP per Capital in US$</td>
<td>142</td>
<td>500</td>
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<tr>
<td>Stunting (Children Under five, 1999)</td>
<td>34</td>
<td>38.5</td>
</tr>
<tr>
<td>Child Malnutrition (% of children under 5)</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Infant mortality rate (per 1000, in 2000)</td>
<td>170</td>
<td>91.8</td>
</tr>
<tr>
<td>Child mortality rate (per 1000, in 2000)</td>
<td>286</td>
<td>151</td>
</tr>
<tr>
<td>Maternal Mortality (per 100,000, in 2000)</td>
<td>1,800</td>
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</tr>
<tr>
<td>Life expectancy at birth (years, 1998)</td>
<td>38</td>
<td>50.4</td>
</tr>
<tr>
<td>HIV/AIDS prevalence</td>
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<td></td>
</tr>
<tr>
<td>Access to sanitation (2000)</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>Access to health services (2000)</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Access to an improved water source (% of population)</td>
<td>57</td>
<td>58</td>
</tr>
<tr>
<td>Literacy rate (2000)</td>
<td>20</td>
<td>61</td>
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<tr>
<td>Male</td>
<td>31</td>
<td>69</td>
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<tr>
<td>Female</td>
<td>19</td>
<td>53</td>
</tr>
<tr>
<td>Gross primary enrolment (2000)</td>
<td>42</td>
<td>78</td>
</tr>
<tr>
<td>Male</td>
<td>52</td>
<td>85</td>
</tr>
<tr>
<td>Female</td>
<td>38</td>
<td>71</td>
</tr>
</tbody>
</table>

¹Word Bank.
4.0 DESCRIPTION OF THE LEGAL, REGULATORY AND ADMINISTRATIVE FRAMEWORKS

Organisational Structure of Environmental Management at National and Local levels

4.1 Ministry of Lands, Housing, Country Planning and the Environment (MLHCPE)

There is an overall institutional and legal framework for the management and protection of our environmental in the national context. The responsibility for the management and protection of the environment formerly lay with the Department of the Environment of the Ministry of Lands, Housing, Country Planning and the Environment. The political head of the Department of the Environment was the Minister of Lands, Housing, Country Planning and the Environment.

The Administrative head was the permanent Secretary who was responsible for co-ordinating the function of the departments within the Ministry viz. department of Land and Country Planning (DLCP), Department of surveys and Lands (DSL) and the Department of the Environment, (DOE). He was also the Principal Adviser to the Minister and the Vote Controller of the Ministry’s budget.

In 2005 the GOSL created the National Commission for the Environment and Forestry (NaCEF) and appointed a commissioner. The Forestry Division of the MAFFS and the Department of the Environment (DOE) of the Ministry of Lands, Housing, Country Planning and the Environment (MLCPE) now function essentially within the NaCEF framework. The administrative structures and staff have been taken over by NaCEF.

4.2 Department of the Environment

The then Department of the Environment (DOE) has in 1995 developed with World Bank Support, the National Environmental Action Plan (NEAP). This plan is presented in two volumes. Volume 1 analyses the environmental issues in Sierra Leone and the recommended interventions. Volume 2 contains the environmental proposals. A National Environmental Policy (NEP) has been prepared in 1994. The goals, objectives and strategies of the (NEP) are outlined below:
4.3 Policy Goals

The goal of the National Environmental Policy is to achieve sustainable development in Sierra Leone through sound environmental management.

4.4 Objectives

- To secure for all Sierra Leoneans a quality of environment adequate for their health and well being;
- To conserve and use the environmental and natural resources for the benefit of present and future generations;
- To restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere; to preserve biological diversity and the principle of optimum sustainable yield in the use of living natural resources and ecosystems; and
- To raise public awareness and promote understanding of the essential linkages between environment development and to encourage individual and community participation in environmental improvement efforts.

4.5 Strategies

The following strategies will be pursued in order to achieve the policy goals and objectives.

(a) To establish and/or strengthen environmental protection standards, monitor changes in, and publish relevant data on, environmental quality and resource use;

(b) To make prior environmental impact assessment (EIA) of proposed activities which may significantly affect the environment or use of a natural resource and to provide relevant information, in a timely manner, to persons likely to be significantly affected by a planned activity and to grant them equal access and due process in administrative and judicial proceedings; and

(c) To promote environmental management through the creation of administrative and infrastructural support with appropriate financial backing;

(d) To cooperate in good faith with other countries and agencies to achieve optimal use of transboundary natural resources and effective prevention or abatement of transboundary environmental protection.

The legal basis for the implementation of the NEAP and for environmental Management and protection in Sierra Leone is the Environmental Protection Act, 2000.
4.6 The Environmental Protection Act

The environmental protection Act (EPA) 2000 empowered the then Department of the environment to perform the following tasks amongst others:

- Screen projects for Environmental Impact Assessment (EIA);
- Issue environmental Impact Assessment Licenses; and
- Formulate or promote the formulation of, and monitor the implementation of environmental policies, programmes, projects, standards and regulations.

4.7 National Environment Protection Board

The EPA 2000 also provides for the establishment of an environmental protection Board. This Board which has now been set up has the following functions:

(a) Facilitates coordination, cooperation and collaboration among government ministries, local authorities and other agencies in areas of environmental protection;

(b) Review national and sectoral policies and make such recommendations or proposal it may think necessary to the Minister.

(c) Review environmental impact assessments prepared pursuant to this Act and make appropriate recommendations to the Director.

(d) Investigate or cause to be investigated, any activity, occurrence or transaction which it considers is likely to have or result in harmful consequences to the environment and advise on measures necessary to prevent or minimize such consequences;

(e) Advise the Minister on areas of environmental protection and control requiring special or additional measures indicating the priorities and specific goals to be achieved;

(f) Undertake or cause to be undertaken specific studies and research aimed at developing strategies for the protection of the environment and make appropriate recommendations to the Minister; and

(g) Consider any other matters which may be referred to it by the Minister and make appropriate recommendations or proposal thereon.

The functions of this Board has to be redefined when the Act establishing NaCEF is passed.

Other sector instruments for the management of the environment include:

3. The Fisheries Management Act (1994)
4. The Public Health Act (1993)

4.8 Local Level
At the local level, the environmental Sanitation functions are carried out by provincial officers of the DOE (now under NaCEF) of the then MLHCPE through its Assistant Environmental officers in the Northern, Southern, Eastern Provinces and an officer for the Western Area. At present the main tasks of the Assistant Environmental officers operating at provincial levels basically include monitoring of environmental programmes and projects, evaluation of environmental degradation and completion of reports.

With the inception of the City and Town Councils in 2005 part of the Environmental Planning, Monitoring and Evaluation has been devolved to the councils.

City and Town Councils are charged with the responsibility of Environmental Sanitation. Assistant Environmental Health Officers are attached to the councils to offer professional advice and training on the cleaning and physical removal of garbage and disposal by council employees. Council provides logistic support in the form of tools, protective gargets and vehicles.

Sanitary officers and chiefdom police are empowered to enforce chiefdom byelaws rigorously. Training for chiefdom staffs are provided by EHU and NGO’s.

4.9 EIA Procedure and Guidelines
The DOE had issued in July 1999 EIA procedures and EIA guideline documents for Environmental Impact Assessment. These documents state the objectives, outlines the procedures for an Environmental Impact Assessment, and guidelines which proponents should follow to carry out such assessments. The EIA processes are outlined as follows:

- Integration of environmental considerations in development planning processes, in order to make use of natural resources in a responsible manner; and
- Protection and enhancement of the quality of all life forms;
4.9.1 Responsibilities in Dealing with EIAs – Competent Agency

The guidelines define the competent Agency as the agency that will have to take responsibility for the EIA process, including the review of the initial proposal, of the reports and of the final decision on the acceptability of the submitted EIA.

It affirmed the role of the DOE as the competent department at the National level in Sierra Leone and the role, in the long term, of regional environmental offices when they are established, in dealing with EIAs at the national level. According to the Presidential directive of 2005, NaCEF is now the competent Agency and the DOE now functions under the new entity.

4.9.2 EIA Processes and Procedures

The processes as described by the guideline are the following:

- Application;
- Prescreening;
- Screening;
- Scoping;
- EIA and Environmental Impact Report; and
- Review and decision by the Competent Agency.

4.9.3 Pre-Screening

At Pre-Screening, the project proponent should establish contact with the competent Agency, establish an official contact person, and provide an initial description of the proposed activity. The competent Agency will register the application.

4.9.3.1 Screening

From screening into the further stages of the process, the proponent is recommended to appoint an independent consultant to assist in the process. The screening phase should decide the following amongst others:

- The need for and level of assessment;
- The level of Government to be responsible;
- The acceptability of the proposed consultant; and
- The public participation process;
At this phase, the proponent is to submit a screening report to the Competent Agency. The Agency may require the proponent to advertise its application.

4.9.3.2 Scoping

The scoping process is intended at ensuring that the EIA focuses on the right issues. It will be sanctioned by a scoping report, which is basically meant to be the Terms of Reference for carrying out the EIA. Although not clearly a requirement as per the guideline, it is also recommended that public consultation be undertaken at this stage, to make sure that relevant stakeholders have a say in identifying the issues and impacts that will further be assessed during the EIA.

4.9.3.3 EIA and EIS

The guideline provides a template structure for the EIA report (or EIS Environmental Impact Statement), as follows:

* Executive Summary
* Project Description
* Description of the Environment
* Description of Project Impacts
* Description of Alternatives Considered
* Assessment of the legal implications of the impacts
* Description of Expected Benefits of the Project
* Description of Methodology
* Evaluation of Impacts
* Mitigating Measures
* Identification of Information Gaps
* Other
* List of Participants
* List of References

4.9.3.4 Categorization of Projects

The NEPA 2000 categorizes projects into three “schedules” according to their potential impacts:

- Schedule I includes “projects requiring Environmental Impact Assessment License”.
- Schedule 2 outlines factors for determining whether a project requires an Environmental Impact Assessment
- Schedule 3 outlines contents of Environmental Impact Assessment (EIA).
The National Environmental Protection Board (NEPB) which is still technically operational has been screening projects. The NEPB as pointed out is under-funded and understaffed and cannot carry out the roles assigned to it under the EA without support from the MMR. This support will take the form of training some of their staff and recruiting service providers to assist them to carry out their roles of reviewing and clearing sub-projects and of monitoring. Those service providers would be hired by NaCEF and the MTAP secretariat as and when required.

Since MLHCPE has been reinstated, the status of NaCEF must be sorted out.

5.0 WORLD BANK SAFEGUARD POLICIES

The ESIA has been designed so that all investments under the SL-MTAP will comply with all the laws of Sierra Leone and the environmental and social safeguards policies of the World Bank. This section discusses the Banks safeguard policies and their applicability.

The World Bank safeguard policies are as follows:

- Environmental Assessment (OP4.01, BP4.01, GP4.01)
- National Habitats (OP4.04, BP4.04, GP4.04)
- Post Management (OP4.09)
- Involuntary Resettlement (OP/BP 4.12)
- Forests (OP 4.36, GP 4.36)
- Safety of Dams (OP 4.37, BP 4.37)
- Projects on International Waterways (OP 7.50, BP 7.50, GP 7.50)
- Management of Cultural Property (OPN 11.03)
- Indigenous Peoples (OD 4.20)
- Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)

In preparing this ESIA, consideration of the type of future investments planned against the requirements of the Bank safeguard policies, has led to the determination that the following Banks policies are triggered by the project:

- Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)
- Natural Habitats (OP 4.04, BP 4.04, GP 4.04)
- Forests (OP 4.36)
- Involuntary Resettlement (OP/BP 4.12)
5.1 **Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)**

This policy requires environmental assessment (EA) of projects/investments proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus improve decision making. The depth and type of analysis of the EA process depend on the nature, scale, and potential environmental impact of the activities proposed for funding under the MTAP. The EA process takes into account the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, cultural property) and transboundary and global environmental aspects.

The environmental and social impacts of the MTAP will come from activities and investments to be made under component 2.2: Improving Management of mining activities. Development of ancillary facilities (access roads, buildings) and associated income generating activities may have negative environment impacts.

However since the exact technical details are yet to be known, the EA process calls for the Government of Sierra Leone (GOSL), represented by MTAP secretariat to prepare an ESIA report which will establish a mechanism to determine and assess future environmental and social impacts of the proposed MTAP. The EA then sets out mitigation, monitoring and institutional measures to be taken during implementation and operation of the project investments to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

The policy further calls for the MTAP as a whole to be environmentally screened to determine the extent and type of the EA process. The SL-MTAP has thus been screened and assigned an EA category A for Large Scale mining and small scale mechanized. The Artisanal Mining Sector (AMS) is assigned category B.

Therefore, this ESIA sets out to establish the EA process to be undertaken during implementation of project activities in the proposed MTAP when they are being identified and implemented.
OP 4.01 further requires that the EA report must be disclosed as a separate and stand alone document by the GOSL and the World Bank as condition for appraisal of the MTAP. The disclosure should be both in Sierra Leone where it can be assessed by the general public and at the Infoshop of the World Bank and that the date for disclosure must precede the date for appraisal of the project.

5.2 Natural Habitats (OP 4.04, BP 4.04, GP 4.04)

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats.

Natural Habitats are land and water areas where (i) the ecosystems biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the areas primary ecological functions. All natural habitats have important biological, social, economic and existence value. Important habitats may occur in tropical humid, dry and cloud forest; temperate and boreal forest; Mediterranean-type shrub lands; natural arid and semi-arid land, mangrove swamps, coastal marshes, and other wetlands; estuaries sea grass beds, coral reefs, freshwater lakes and rivers; alpine and sub alpine environments, including herb fields, grasslands, and paramos; and tropical and temperate grasslands.

Therefore the Natural Habitats policy may be triggered in certain cases because the investments proposed under this project (component 1.4.2) may have largely through ancillary activities potential adverse impacts on Wetland, rivers and forest which contribute to the sustainability of critical ecosystems. Therefore, this OP requires that any activities funded under the MTAP that adversely impacts these ecosystems are successfully mitigated so that the balance of the ecosystems are enhanced or maintained. This would require that the implementing agencies and their partners design appropriate conservation and mitigation measures to remove or reduce adverse impacts on these ecosystems or their functions, keeping such impacts within socially defined limits of acceptable change. Specific measures may depend on the ecological characteristics of the affected ecosystem. Such measures must include provision for monitoring
and evaluation to provide feedback on conservation outcomes and to provide guidance for developing and refining appropriate conservation actions.

No project activity that results in the significant reduction in the mean water level or completely drains a lake, a river, or wetland area, or floodplain due to pollution of those ecosystems, to extraction of water for irrigation, or systematic clearing of forest areas for agricultural purposes or any other purpose will be permitted or left unmitigated.

5.3   **Forests (OP 4.36)**

This policy applies to the following types of Bank-financed investment projects; (a) projects that have or may have impacts on the health and quality of forests; (b) projects that affect the rights and welfare of people and their level of dependence upon or interaction with forest; and (c) projects that aim to bring about changes in the management protection or utilization of natural forest or plantations, whether they are publicly, privately or communally owned.

The MTAP will have beneficial effects on the health of forests as investments under the project prohibits non-conforming activities such as logging, mining and hunting in the Forest Reserves (Gola, Loma, Kangari). The environmental and social impacts of the MTAP will come from activities and investments to be made under component 2.

The project may involve significant conversion or degradation of natural forests. The EA incorporates appropriate mitigation measures from activities that are likely to have negative impacts on the forest.

5.4   **Involuntary Resettlement (OP/BP 4.12)**

Significant efforts are to be made in the design and screening stages of proposed project investments, to avoid impacts on people, land, property, including peoples access to natural and other economic resources, as far as possible. Land acquisition, compensation and resettlement of people seem inevitable for certain types of investment under the MTAP. These social issues are of crucial concern to the GOSL and the Bank as its impact on poverty, if left unmitigated, is negative, immediate and widespread. OP 4.12 will be triggered in those cases. Thus a Resettlement Policy Framework (RPF) has been prepared by the GOSL for approval by the Bank in compliance with OP 4.12 (See RPF Document). The RPF sets the guidelines for the
Resettlement and compensation plans (RPFs) that would have to be submitted through NaCEF to the National Environmental Protection Board (NEPB) for approval but would have to be approved by the Bank as a condition for that particular investments.

This policy when triggered, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment of resources to enable the persons displaced or affected by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.

Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living, or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, which ever is higher.

Where there is a conflict between the laws of Sierra Leone and the Bank OP 4. 12, the latter must take precedence if the Bank is to fund this project.

OP 4.12 also requires the RPF to be disclosed both in Sierra Leone and at the Bank Infoshop before appraisal of this project can occur.

5.5 Cultural property (OPN 11.03)

Cultural property includes sites having archaeological (prehistoric), paleontological, historical, religious and unique natural values. The Bank’s general policy regarding cultural property is to assist in their preservation, and to seek to avoid their elimination. Specifically, the Bank (i) normally does not finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage; and (ii) will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. The management of cultural property of a country is the responsibility of the government. The governments’ attention should be drawn specifically to what is known about the cultural property aspects of the proposed project site and appropriate agencies, NGO’s or University departments should be consulted. If there are any questions concerning cultural property in the area a brief reconnaissance survey should be
undertaken in the field by a specialist. Sacred Groves and religious relics may be found in some of the areas under proposed MTAP. OPN 11.03 may be triggered if investment under this project restricts access to such sites or if the communities decide to relocate the sites to some other areas.

5.6 Safety of Dams (OP 4.37, BP 4.37)

Dam safety is a matter of significant importance in many countries in the world today because of the presence of a large number of dams, existing, under construction or planned. The safe operation of dams has significant social, economic, and environmental relevance. Wet mining may involve creation of dams with heights above 15m.

When the World Bank finances new dams, Operational Policy (OP) 4.37: Safety on Dams requires that experienced and competent professionals design and supervise construction, and that the borrower adopts and implements dam safety measures through the project cycle. The policy also applies to existing dams where they influence the performance of a project. In this case, a dam safety assessment should be carried out and necessary additional dam safety measures implemented.

OP 4.37 recommends, where appropriate, that Bank staff discuss with the borrowers any measures necessary to strengthen the institutional, legislative, and regulatory frameworks for dam safety programs in those countries.

5.7 World Bank Screening Process

The screening process used by the World Bank classifies proposed projects into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

- Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
- Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas – including wetlands, forests, grasslands, and other natural habitats—are less adverse than
those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects.

- Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C Project.

- Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

The Mineral Sector Technical Assistant Project (MTAP) has been classified as environmental category A for Large Scale Mining and Small Scale Mechanized mining activities. Artisanal Mining activities may be classified as category B. As requested by the Bank, the Government of Sierra Leone is preparing an Environmental and Social Impact Assessment (ESIA) to address the environmental and social concerns related to subprojects, and a Resettlement Policy Framework (RPF) to address potential issues of displacement and resettlement.

5.8 GAPS BETWEEN SIERRA LEONEAN LEGISLATION AND BANK POLICIES

Overview
Sierra Leone currently has a comprehensive framework for assessing and managing the environmental impacts of development projects. In comparison with the World Bank Safeguard Policies, it would appear that the Sierra Leonean framework lacks the provision of clear requirements or guidance on the following:

- Byelaws and Regulations in the NEPA-2000
- Standards applying to Wildlife Protection and Biodiversity Conservation

Another issue is that while the responsibility for assessing and mitigating environmental impacts lies with the developers, monitoring falls under the Ministry (MLCPE) represented by the NEPB. However the Ministry lacks the logistic capability to carry out the tasks assigned to it by NEPA. Nearly all agencies collecting and managing natural resources and environmental information in Sierra Leone are weak and suffer from lack of human and financial resources. Units established with donor support flourish during the life of the project, but experience slow death following project completion.
Aside from these inadequacies the Sierra Leonean requirements are generally consistent with those of the World Bank.

5.8.1 Consultation and Disclosure Requirements
OP 4.01 requires that for “all Category A and B Projects”, the borrower consults project-affected groups and local non-governmental organizations (NGOs) about the project’s environmental aspects and takes their views into account. The borrower initiates such consultations as early as possible. For Category A Projects, the borrower consults these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared”.
OP 4.01 further requires that “for meaningful consultations between the borrower and project affected groups and local NGOs on all Category A and B projects proposed for IBRD or IDA financing, the borrower provides relevant materials in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted”.

Category B reports for a project proposed for IDA financing are to be made available to project-affected groups and local NGOs, and the public at large in the borrowing country. An EIA report for projects proposed for IDA funding are prerequisites to bank appraisal.

Public consultation and disclosure are addressed by various pieces of Sierra Leone’s legislation and guidelines. Since there are various types of donors whose requirements differ from each other, Sierra Leone’s legislation is more flexible and less stringent than the Bank policies in this respect. However there is no limitation as to the extent and scope of consultation and disclosure, nor as to who should be consulted. There, there is no real contradiction between Sierra Leonean legislation and Bank policies, which can be applied to their public consultation and disclosure without violating Sierra Leonean law.

5.8.2 Social Impacts
The sectoral law takes a human rights approach to the environment, which encompasses both the biophysical and social aspect.

5.8.3 Standards and Guidelines
Standards and guidelines specifically applicable to (a) Wildlife Protection, (b) Biodiversity Conservation have not yet been developed for Territorial and Aquatic Ecosystems.
The Department of the Environment (DOE) however generally requires an EIA from proponents in accordance with the requirements developed in the schedules by the NEPA 2000.

6.0 INSTITUTIONAL ARRANGEMENTS RELATED TO THE ENVIRONMENT.

General organization

A number of government ministries are also involved in environmental management and protection activity by virtue of their responsibilities. The activities of these ministries are regulated by their various Acts and determined generally by their policies.

At present, the following Ministries are in one way or another associated with management issues pertaining to the environment of Sierra Leone:

- Ministry of Lands Housing Country Planning and the Environment (MLHCPE)
- Ministry of Transport and Aviation. (MTA)
- Ministry of Mineral Resources. (MMR)
- Ministry of Agriculture, forestry and food Security. (MAFFS)
- Ministry of Fisheries and Marine Resources. (MFMR)
- Ministry of Tourism and Culture. (MOTC)
- Ministry of Works and Infrastructure. (MOWI)
- Ministry of Energy and Power. (MOEP)
- Ministry of Education, Youths and Sports (MOEYS)

At times, jurisdictional rights of these Ministries overlap. Thus, attempts should be made to harmonize laws to simplify enforcement.

6.1 Ministry of Lands, Housing Country Planning and the Environment (MLHCPE)

At present, the Ministry of Lands, Housing Country Planning, and the Environment is charged with the responsibility of conserving and managing Sierra Leone’s natural environment. It is also responsible for addressing land acquisition and transfers, land ownership and use, national development in a planning capacity and to provide advisory services to the public on land matters and is also responsible for physical planning and management of the forestry resources.
The newly created National Commission for Environment and Forestry (NaCEF) now subsumes the Division of the Environment (DOE) and the Forestry and Food Safety (MAFFS). Modalities are still being worked out.

6.1.2 Ministry of Transport and Aviation (MOTA)

This Ministry is mandated to deal with issues related to transport on land, air and sea as well as local and international communications.

Transport sector contributes to habitat fragmentation and loss as well as the introduction of pollutants into the environment. The GOSL has set up some structures to mitigate the effects of these factors. A transport sector policy is in place.

The Sierra Leone Airports Authority (SLA) was set up as well as the Sierra Leone Maritime Administration (SLMA). The SLMA has among its mandates the following:

- Ensuring the elaboration of any International Maritime Conventions;
- Determination and the prevention of marine source pollutions; and
- Protection of the Marine Environment

6.1.3 Ministry of Mineral Resources (MMR)

The Ministry of Mineral Resources (MMR) is responsible for all aspects of mineral management in Sierra Leone. The major responsibilities could be summarized as follows:

- Mineral Policy formulation;
- Mining negotiations;
- Mining and concessions;
- Mining and minerals exploration;
- Geological surveys;
- Control of explosives for mining;
- Inspection of mining machines and sites
- Relations with international mining and geological organizations and agencies; and
- Collaboration with relevant national and international organizations.

The MMR is headed by a Minister to be assisted by a deputy Minister. The administrative wing of the ministry is headed by the Permanent Secretary.
A Minerals Advisory Board advises the Ministry on its statutory duties particularly those related to the issuing of mineral rights.

MMR has two technical divisions, the Mines Division and the Geological Survey Division. The Mines Division is responsible for processing and issuing all exploration licenses. The responsibility includes monitoring compliance and license and lease requirements and supporting the enforcement of these requirements through revocation of such licenses or prosecution.

The Geological Survey Division as normally responsible for inventorying the mineral resources and preparing various publications to assist with the appropriate development and management of those resources.

The MMR consists of 19 senior staff and 92 mine wardens in the Mines Division. The Geological Surveys Division has 20 professional staff. The Environmental section of the MMR has no staff or equipment making it difficult to enforce some aspects of the provision of new mining act relating to the rehabilitation of mined out areas.

6.1.4 Ministry of Agriculture, Forestry and Food Security (MAFFS).

This Ministry is mandated to develop agriculture and provide food security. The ministry is also charged with the overall responsibility of the management of the natural terrestrial ecosystem resources and food production. There are a number of important Divisions and several units. Research and support services are provided by institutions including National Agricultural Research Co-coordinating Council (NARC), Institute of Agricultural Research (IAR), Njala University and NGOs.

The three Technical Divisions of the MAFFS are Agriculture, Livestock, and Forestry. The two service Divisions are Land and Water Development and Planning Evaluation, Monitoring and Statistics Division.

Activities related to the MAFFS that are of concern to Environmental Management include, Clearing of vegetation including forests, slash and burn, use of fertilizers, logging, and livestock grazing. Guidelines exist for habitat management but are difficult to enforce under the various Acts.
6.1.5 **Ministry of Fisheries and Marine Resources (MFMR)**

This Ministry is responsible for the exploitation and management of our marine resources.

The ministry has as its primary mandate the provision of cheap source of protein for the majority of Sierra Leoneans, thus contributing towards the improvement of National and food security. The MFMR is also responsible for the Monitoring Control and Surveillance of our territorial waters.

There is a Fisheries and Marine Development and Management Act (1994) as well as regulation. A policy is in place. Embedded in the policy and strategy is the conservation and enhancement of environmental quality and sustainable management of rich biodiversity of wetlands, lakes, rivers, beaches, estuaries, bays, lagoons and inland waters.

Fishing activities can lead to habitat fragmentation, over-exploitation of resources, and fuel oil pollutant introductions. Logging for firewood for processing is also of concern.

6.1.6 **Ministry of Tourism and Culture (MOTC)**

The responsibility to promote and develop the country’s tourism industry lies with this Ministry. It is also charged with the duty of protecting the country’s heritage: monuments, cultural and historical sites.

Infrastructure development due to the expansion of tourism and debris associated with their activities are of concern to sound environmental management.

6.1.7 **Ministry Of Works and Infrastructure (MOWI)**

The duty of road construction and maintenance as well as public buildings lies with this Ministry. It enhances the improvement of road networks by securing bilateral and multi-lateral agreements with donors for funding.

Construction and maintenance activities can lead to habitat fragmentation and pollution problems.

6.1.8 **Ministry of Internal Affairs Local Government, Country Planning and Rural Development (MOIALGRD)**

Under the provisions of the Local Government Act (2004), local councils were established as its highest political authority within a specific region having legislative and executive authority and responsibility for promoting both regional development and the welfare of the people in its jurisdiction.
Acting through the Mineral Resources Committees, local councils exercise their responsibility of managing community Development Funds gives to chiefdom councils through the Diamond Area Community Development Fund (DACDF).

Mining licenses activities are also coordinated through the Mineral Resources Committees. The Rehabilitation of mined out areas in the artisanal sector is one of their function. The MMR transfers monies to the Local Councils inorder to carry out some of their mandate.

Local Government structures are very important in the new cadastre system of tracking diamonds from earth to export.

6.1.9 Ministry Of Education, Youths and Sports (MOEYS)
This Ministry is responsible for educational activities and the development of science and technology countrywide. Construction of Educational facilities nationwide has concerns that have to be addressed. The Ministry is concern with the welfare of youths, some of whom are already employed under SWMP.

6.2 NON-GOVERNMENTAL ORGANIZATIONS (NGOS)
There are only a few non-governmental organization (NGOs) in Sierra Leone with interests in environmental and resource management. Some of these are interested in the natural conservation and monitoring of the country’s wildlife and natural habitats.

Among the NGOs involved in environmental management are the Environmental Foundation for Africa (EFA), Royal Society for the Protection of Birds (RSPB), and Sierra Leone Conservation Society (CSSL).

6.3 ORGANIZATIONAL STRUCTURE FOR ENVIRONMENTAL MANAGEMENT AT THE LOCAL LEVEL.

At the local level, the environmental functions are carried out by provincial officers of the DOE of the MLCPE through its Assistant Environmental Officers in the Northern, Southern, and Eastern
provinces, and an officer for the Western Area. It is envisaged that these officers will be part of the area town planning committee set within town councils.

At present, the main tasks of the Assistant Environmental Officers operating at provincial levels basically include monitoring of environmental programmes and projects, evaluation of environmental degradation and compilation of reports. Formerly town councils, including the Freetown City council (FCC) with statutory powers as a Local authority (LA) did not participate in any arrangement affecting environmental management in accordance with the national environmental protection Act, 2000. However, as the Act is implemented these councils have started playing pivotal roles. The City and town councils now have environmental units/committees, which focus mainly on health and sanitation issues.

7.0 MINING SECTOR OVERVIEW

The Sierra Leone economy is based on the exploitation of natural resources, notably agricultural, marine and mineral resources. The agricultural sector accounts for 44% of GDP. Mining is Sierra Leone’s second most important sector and contributes to 20% GDP to the national economy and 90% of registered exports. This sector provides livelihoods for some 200,000 to 300,000 people representing about 14% of the total labour force.

The major minerals currently being exploited are Diamonds, Rutile, Bauxite and Gold. Iron ore was mined at Marampa in the 1950s and it is believed that there are viable deposits within the country.

Other identified minerals include, platinum, chromite, lignite, clays and base metals (Copper, nickel, molybdenum, lead, zinc) chromite, columbite, iron ore and Platinum were mined in the past. It is stated that Sierra Leone has good potential for additional discoveries. The mineral reserves of Sierra Leone are presented in Figure 1.

The mining sector in Sierra Leone is the moment classified into 3 categories:
- Large Scale Mechanized Mining (LSM);
- Small Scale Mechanized Mining (SSM); and
- Artisanal Mining Sector (AMS) (Details are given in 7.1)
Diamonds were discovered in 1930. The diamond fields cover an area of 20,000 Km\(^2\) in about 80 chiefdoms. Diamonds are exploited by the large scale mining sector (Koidu Holdings), Small Scale Mechanized mining sector (SLDC, MTDLL) and Artisanal Mining sector.

About 300,000 people depend on the diamond trade with over 250,000 engaged in the AMS. The AMS diamond trade consists of a complex mix of stakeholders including, local chiefdom administration, Paramount Chiefs, Local Councils, Ministry of Mineral Resources (MMR), Diggers, Agents, License Holders, Supporters, Dealers and Exporters. At present about 2,300 acres are legally mined annually by the AMS. Kimberlite is exploited on a large scale by Koidu Holdings Ltd (KHL).

Rutile was discovered in Sierra Leone in 1954 and mining started in 1964 and has continued except during the war 1995-2001. Rutile is mined by dredging large artificial lakes using very large bucket line dredges. The lake and ponds are subsequently used to store most of the tailings (section 7.3)

Bauxite was discovered in 1960 in the South East of the country and mining started in 1963. Bauxite is mined by the Large Scale Mining sector (LSM) using an open-cast method and processed.

All greenstone belts in Sierra Leone (with the exception of the Marampa Group) has gold. Gold will be mined by the large scale sector and only the AMS is mining at the moment (section 7.3). The prospect of expansion can be inferred from the number of licenses granted so far nationwide in the LSM and SSM sectors and presented in Table 2.

**Table 2 (Licenses) – 2008**

<table>
<thead>
<tr>
<th>License Type</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive Prospecting Licenses (EPL)</td>
<td>51</td>
</tr>
<tr>
<td>Exploration Licenses (EP)</td>
<td>55</td>
</tr>
<tr>
<td>Mining Licenses (ML)</td>
<td>13</td>
</tr>
<tr>
<td>Small – Scale Mining Licenses (SSML)</td>
<td>43</td>
</tr>
</tbody>
</table>

The MMR has in 2007 estimated that there is room for expansion in the Large Scale Mining sector by the establishment of Four (4) new mines (one diamond and three gold) and the development of two already identified deposits – rutile and bauxite.
Table 3 presents Mining Potential.

### Table 3: Mining Potential of Sierra Leone

<table>
<thead>
<tr>
<th>Mines</th>
<th>Annuals Production</th>
<th>Production value (USD millions)</th>
<th>Direct Employment</th>
<th>Indirect Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Rutile mines</td>
<td>3,30,000tons</td>
<td>138.6</td>
<td>2,500</td>
<td>7,500</td>
</tr>
<tr>
<td>2 Bauxite</td>
<td>2,500,000tons</td>
<td>65.0</td>
<td>2,000</td>
<td>6,000</td>
</tr>
<tr>
<td>2 Kimberlite diamonds mines</td>
<td>450,000 cts</td>
<td>76.5</td>
<td>2,000</td>
<td>6,000</td>
</tr>
<tr>
<td>3 gold mines</td>
<td>300,000 oz</td>
<td>90.0</td>
<td>3,000</td>
<td>9,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>370.1</strong></td>
<td><strong>9,500</strong></td>
<td><strong>28,500</strong></td>
</tr>
</tbody>
</table>

The various categories of mining operations employ different methodologies. In the cases of the anticipated expansion of the mining sector, the methodologies employed at the moment are expected to continue with only slight modifications to improve efficiency.

The Environmental Impacts under the MTAP will arise from future increase in mining.
7.1 MINING METHODOLOGY (Case Studies)
The mining sector is a very important segment if not the most important segment of the extractive industry in Sierra Leone when one considers its contribution to the national economy. On the other hand, it has one of the most serious and disastrous environmental consequences if the mining methodology is closely examined. Therefore, any credible environmental impact assessment study of any mine needs to closely study the mining methodology for that particular operation.

Mining usually involves the clearance of large tracts of land, the excavation of the earth materials and their processing to yield a metal, non metal or precious stone at a profit. Considering the environmental effects, the mining industry can be described as consisting of five (5) stages.

Exploration – the survey of an ore to delimit the ore
Development- preparing the mine for production including road construction
Extraction- Ore removal activities from the earth
Beneficiation – Concentration of the ore from low to high grade. This usually occurs near the mine. At this stage chemicals are employed
Processing – mostly carried out at distance and also involves chemicals.

The types of environmental effect observed are also related to the method of extraction; whether open cast surface mining or underground mining. Surface mining is always preferred by the companies on economic grounds except where underground mining is unavoidable.

Mining in general, can be termed primary if the ore that is mined is obtained directly from the rock in which it forms. Examples of primary mining in Sierra Leone include The Koidu Kimberlite Mining by Koidu Holdings Limited (KHL), The bauxite mining at Mokanji by The Sierra Mineral Holding Limited and The Proposed Baomahun Gold Mining in the Valunia chiefdom to be undertaken by Cluff Gold Mining Sierra Leone Limited (CGMSLL).

Mining is termed secondary if the ore that is mined formed in a particular rock and after years of weathering (this may be thousands to millions of years), the materials have been removed from the original material, transported and redeposited somewhere else where it is now mined. Examples of this type include the rutile minining by the Sierra Rutile Limited (SRL), all the artisanal mining going on in the country be it gold or diamond.
The deposits of this secondary mining mostly occur in or along rivers, streams, lakes, seas and are therefore referred to also as alluvial mining.

The reason for this classification hereafter is that primary and secondary mining techniques are different and each has its own environmental problems associated with it.

The Mining Industry in Sierra Leone can be divided into:

1) Large scale mechanized mining (LSM) i.e. Those mining companies which employ heavy duty machines to extract materials and are using sophisticated plants to process their concentrates and get their products.

2) Small scale mechanized mining (SSM) i.e. Those mining companies that use machines and small plants that are not up to the scale of large scale mining companies e.g. The Milestone Trading Sierra Leone Limited (MTSLL)

3) Artisanal mining- Here mining is done by a person or a group of persons using rudimentary tools like pick-axes, shovels, hand and foot shakers etc. This is carried out in Tongo, Kono, Kenema, Baomahun etc.

All the three types of mining are carried out both in water and on land. To cover these three, site visits were made to the various mining companies and artisanal mining areas to study the various mining techniques used in their operations. These different mining techniques may serve as the sources of environmental problems.

The sites visited are going to be treated as specific case studies. Under the MTAP, the mining activities are expected to expand. However the mining methodologies are expected to either remain the same or be improved on slightly. The impact could be inferred from existing conditions.

7.2 The Sierra Mineral Holdings Limited (SMHL)–an example of a large scale mining company

Bauxite deposits were discovered in 1960. Aluminium Industries A.G. Zurich (AIAG) was granted special Exclusive Prospecting Licence over approximately 350km² of land including Gbonge and Mokanje deposits. In 1961, Sierra Leone Ore and Metal Company (SIEROMCO) was
established and granted a mining lease in 1963. The civil conflict and instability lead to the premature closure of SIEROMCO in 1995.

A new company, Sierra Leone Mineral Holdings Ltd (SMHL) was incorporated in 2001 and now carries on mining. The concession area is held under an exploration licence and covers an area of 330km$^2$. An ESIA report was prepared in 2003 by Aqua Terra Consulting.

The Sierra Mineral Holdings Limited (SMHL) is the only company mining bauxite in the country. Like the Sierra Rutile Limited (SRL), it forms part of the Titanium Resources Group. Sierra Mineral Holdings is located 20 miles SE of Sierra Rutile which is about a 30 minutes drive from Sierra Rutile Limited (SRL).

Sierra Minerals has the mining lease EXPL 004/02 and the Lease area covers about 330 km$^2$. The deposits within this lease area are The Gondama, The Jenega Series, The Konta, The Wundes, The Senehun Series, The remnants in the Mokanji South left by The SIEROMCO and The Gbonje deposits.

At present, mining is going on at Gondama, Konta, Senehun and Gbonje. The Jenega like The Gondama are almost depleted and each used to have about 1 million tons of ore. The Gbonje and The Senehun are the high grade ores of about 55% Al in the ore and the rest of the deposits contain low grade ore of about 50% Al in the ore.

About 1.7 million tons of bauxite is mined per year by Sierra Mineral Holdings Limited but only 1.2 million tons is available for shipment. The rest goes as waste in the tailings ponds. Production target is about 4000 tons per day but only 3000-3500 tons of ore is mostly achieved.

The Gbonje which is the main mine has a life span of about 10 years and Gondama about 1 year at the present mining rate.

7.2.1 Mining and Production at the Mokanji Bauxite Mines

Mine Site – Excavation

The deposits are mainly concentrated on the Mokanji Hills. The main activities at the mine involved
(1) Scouting and locating left over bauxite areas by The SIEROMCO Mines i.e. exploration and drilling up to 6 or more meters down into the earth.

(2) Evaluation of the left–overs

(3) Excavation and transportation to the mine plants where the ore is processed for shipment.

Mining is done by the open–cast method (open pit method) after exploration, drilling and assaying i.e. determining the percentage of Al in the ore. The assaying results are then computed in the mine planning software with the cut–off grade (grade at which mining is uneconomical) and the area to be mined is delimited. The ore is then classed as either low, medium or high grade Al-ore.

Mining is carried out close to the surface. The thickness of the overburden is about 1.5m on average meaning the bauxite is close to the surface and the depth of the ore may go up to 7m or more underground. This is economical to the mining company but devastating to the environment in terms of back-fill at the end of mining.

After a deposit has been located, the vegetation and overburden i.e. topsoil are removed using heavy duty machines like the D8 caterpillars and draglines until the ore is approached. This is done without blasting as the topsoil is soft. The bauxite material or the ore is then excavated using the same machines and then loaded by front-end loaders into trucks for transportation to the plant site. This excavation is accompanied by large empty tracts of mined out areas (whether during exploration, drilling or mining). (Photo Fig. 2a)

**Plant site-Production**

The excavated materials are stored closed to the plant into high, medium and low grade Al-ores separately. These materials are left to dry with at most 48% moisture content.

The process is simple dewatering. After dewatering for some days, the materials are then feed on rollers into the plant. (Photo Fig. 26)

The method of feeding into the plant is called blending. Because a certain marketing grade is required, high and low or medium grade ores are blended (mixed) together into the feed plant in a particular ratio. For e.g. a 3:1 ratio of mixing high and low grade ore respectively yields a 53% Al bauxite product. This product is locally called available.
The main processes at the washing plant site are

- Feeding into the plant
- Crushing the feed or raw material
- Washing
- Scrubbing
- Drying
- Packing and storage

After the required blend is fed into the plant, these are crushed and cleaned by washing and scrubbing whilst moving on the rollers. During this process, the crushed materials are sorted by sieves and sizers which separates coarse materials (i.e. grain > 1mm in diameter) from fine materials (i.e. grains < 1mm in diameter). The coarse contains the bauxite together with non-bauxitic materials like vegetation and other rocks. The bauxite is then sorted from these other materials and is sent to special containers. The non-bauxitic materials are then stored separately.

The fines which are clay and muddy materials, combined with the waste water used for cleaning are sent into the tailings ponds. This implies that the ponds contain a lot of silty and muddy materials which in the event of pond failure may affect the locals down stream.

The cleaned bauxite materials are then dried up and stored in temporary storage tanks called silos. After drying these are then loaded into trucks and transported to the Nitti Harbour for shipment.

During production at the plant site, there is constant monitoring of the ore grade by a Portable Infrared Mineral Analyzer (PIMA) every 1 hour. In the event where the end-product does not meet the marketing grade, the feed into the plant is changed until the required grade is obtained at the end.

7.3 The Sierra Rutile Limited – a large scale mining company.
Sierra Rutile Limited (SRL) is licensed to operate in an area of 520km² (130,000 acres) under the special Exclusive Prospecting Licence within the Moyamba and Bonthe Districts. British Titan Products (BTP) of the UK began prospecting for rutile in Sierra Leone in 1954 and was joined by the Pittsburg Plate Glass Company (PPGC) in 1956. BTP and PPGC merged to form Sherbro
Minerals Ltd (SML) in 1964 and began operations in 1967. However went into receivership in 1971 and another company Sierra Rutile Ltd (SRL) was formed.

SRL was a joint venture between Bethlehem Steel Corporation and Nord Resources Corporation. Successful operations started in 1983 by which time SRL was wholly owned by Nord Resources Corporation. In 1993, consolidated Rutile Ltd, an Australian company purchased 50% of the Nord Resources Corporations interest in SRL.

A rebel invasion in 1995 led to the closure of SRL. Operations were restarted in 2002 and are ongoing. An ESIA was undertaken by Knight Piesold in 2001.

The Sierra Rutile Limited, also a member of the Titanium Resources Group has its mining lease MLO11/72 (Area 1) within 8 chiefdoms in both the Moyamba and Bonthe Districts. The rutile deposits occur in the Mokula, Bamba, Belebu, Gangama, Ndendemoia, Gberi, Pujebu and Lanti Chiefdoms. Bamba, Belebu, Pujebu are mined out and Gangama, Gberi and Ndendemoia are yet to be mined. At present, mining is going on in the Lanti North with Lanti South to be mined later. About 7000-8000 metric tons of rutile is produced monthly though projection is 15 metric tons monthly. Daily production is about 988 metric tons and this is about 360620 metric tons per year.

The Sierra Rutile Limited supplies about 30-40% of the world’s total rutile, the second largest in the world and exploration and drilling results point to a lot of resource base.

Sierra Rutile Mining as mentioned earlier carries out secondary mining and the deposits are found in swampy areas and in river channels or courses far away from where once formed. As at present mining rate, mining operation is expected up to 2025 but with the discovery of new resources, the life span of the mine may exceed this

**Production at Lanti North**

**Mine Site**

According to mine planning, if exploration and drilling results point to a rich deposit area, the proposed area to be mined is cleared of vegetation, excavated and flooded by the rains for 2 consecutive rainy seasons. If the rains are not enough, water is pumped from previous mined sites.
into the areas to be mined. Excavation is done here in order to increase elevation of the mine so that the dredge plant can have easy access to the proposed mining site.

Rutile occurs in the surface material right down to the bed rock. Therefore little or no overburden is removed other than vegetation. Mining is mostly carried out in the swampy areas. The Mine site consists of a dredge plant, wet plant and cyclone towers.

The dredge plant is of two types. The D1 or Payne Dredge and the D2 or Solondo Dredge. The D1 comprises of a dredge and a detached wet plant. The D2 comprises of a dredge plant with an inbuilt wet plant. The D1 Dredge consists of 67 buckets in a band and the bucket ladder goes up to 50 ft down below the artificial pond level and 20 ft up above pond level. Photo Fig. 3a

The D2 consists of 76 buckets in a band and pond level is 67 ft. The volume of the bucket in both cases is $24\text{ft}^3$. The D2 therefore digs down deeper and transport more materials to the inbuilt wet plant. Both dredges are over 2000ft long i.e. from wet plant to buckets.

Another difference between the D1 and D2 dredges is that whilst the D2 discharges sand and slime (clay materials) together into the tailing ponds, the D1 discharges both sand and slime separately in the tailing ponds. The environmental implication hereafter is that the tailing ponds into which D2 discharges its waste are easier to rehabilitate than the ponds into which D1 discharges its wastes since barely sand is deposited by the latter.

The dredge plant excavates, collects and sends the materials through pipes to the detached or to the inbuilt wet plant as the case may be. This is the first processing unit done on the mine site. The wet plant then washes, scrubs and process the materials. The materials are then separated by gravity whereby the coarser materials are separated from the lighter ones. The material is then screened thereby removing the sand and clay from the rutile and the other heavy materials ilmenite, hematite and zircon. This is called de-sliming. The de-sliming process occurs in two stages. Through this de-slimming process, the material is upgraded. The bulk material which formally contains only about 1.3-1.8% rutile may now be upgraded to about 5-25% recoverable rutile.

The removed sand and slime (clay materials) together with water are discharged through inclined pipes at $45^0$ at the rear of the dredge plant, in the case of the D1 plant. In the case of the D2 plant,
sand and slime are discharged separately through 2 pipes connected to the dredges into the created ponds whilst the dredge excavates further into the deposit.

This slightly upgraded ore is then sent to 2 cyclone towers. (Photo Fig. 3b) One of the towers is for upgraded rutile with low sulphur content and the other is for rutile with high sulphur content. The sulphur will be removed on the plant site.

The low and high grade sulphur bearing upgraded rutile are then loaded into trucks and transported to the plant site where further upgrading takes place.

**Plant Site - Slurry Plant and dry plant**

The upgraded rutile commonly called feed from the mine site are dumped close to the slurry plant. This is then loaded by front-end loaders into a funnel-shaped container that is lined underneath with a conveyor belt. This transports the feed to a sieve for washing, scrubbing, de-sliming and separation. The main objective here is to increase the grade of rutile commonly called concentrate for the Attrition Plant.

**Attrition Plant**

In the first stage attritioning, washing and de-sliming of the feed is carried out to remove sulphur and silica followed by sieving to remove coarse sand and pebbles from the rutile slurry. The slurry with the aid of spiral movement in the slurry containers and hydrosizers, separates sand and water from rutile. The rutile sinks to the floor of the tanks and the rest is removed as overflow in the process. The rutile is then sent to the floatex section.

**Floatex Section (Floatation)**

The floatex section is another form of hydro-sizing where fines are still removed from coarse. This is done by pumping water at a very high pressure from below thereby allowing lighter materials to float and the heavy minerals sink below and are collected.

The separated fine heavy minerals and coarse light materials are then sent separately to the spiral floatation plant where sulphur is removed by washing and scrubbing with the aid of chemicals like soda ash (sodium bicarbonate), floatation oil, dowfroth and xanthates (potassium amyl xanthates). This removed sulphur together with some rutile fines are later stored in separate ponds outside the
plant. These ponds are cascaded (interconnected) to maintain the sulphur level thereby avoiding spill over. Three such ponds are at rutile.

The rutile, hematite and ilmenite fine materials are then sent to a second stage attritioning where more slime and silica are removed and then again hydrosized (separates coarse from fines). The hydrosized fine rutile is then sent to the dry plant. )Photo Fig. 3c)

**Dry Plant**

The main process here is drying, sizing and dry slimming applying electric currents. In the circuits, static electricity is injected into high tension rolls and these are then charged. The charged rolls will then deflect conductors from non-conductors in the fine materials brought in from the flotex section. Rutile and ilmenite which are non conductors are then separated from the conductors zircon and silica in the processing materials. The non-conductors are then sent to a magnetic field where non-magnetic rutile is separated from magnetic hematite and ilmenite. The dried non-magnetic rutile is then sent into separate cyclones where they are stored, loaded into trucks and transported to the Nitti harbour for shipment.

**The Analytical Laboratory**

The main purpose of the metallurgical laboratory is to monitor the grade of rutile during and after production. It is the quality control unit of the plant. This is done by wet chemical analysis and heavy mineral separation using heavy density liquids or chemicals like bromoform. These chemicals are toxic. The waste chemicals after sample preparation and treatment are collected in underground built tanks outside the laboratory. The samples are then analysed with the X-ray fluorescence spectrometer to obtain elemental composition of the rutile samples.

In the laboratory, the sulphur content of the samples is also analysed using the Leco SC-144 Dr analyzer.

The results of the sulphur and elemental analysis and finally the grade of the ore feed from the mine site are sent to the wet and dry plant operators. The operators may adjust the plant operation conditions as the need may arise so that a high grade rutile ≥ 93% rutile is obtained for shipment. Routine Water Quality analysis are also undertaken by the laboratory.

**7.4 The Cluff Gold Mining Project at Baomahun-A large scale mining company**

Gold at Baomahun was formerly mined by the Baomahun Gold Project Sierra Leone Limited before the war in 1992. Gold mining has been going on at Baomahum since 1930 with a lot of
mined out areas. Gold processing was done using mainly cyanide. Presently, prospecting and exploration are being carried out by the Cluff Gold Mining Project (CGMSLL) in the area. The gold occurs in schists and within banded iron formations. The Cluff Gold is at present at an advanced stage of exploration and the results are indicative of possible potentials which will be mined by both open pit and underground methods of mining: The Gold is going to be mined in situ i.e. primary mining.

Drilling is currently carried out between 500-650m underground and indications of gold are good. The overburden to hard rock varies from 5m to even up to 50m.

Mining of the gold will be possibly by drilling, blasting of the hard rock both in open pit and underground. The loose materials will be mined using gravity washing with water. The types of explosives for blasting are yet unknown but possibly emulsion or power gel type of explosives will be used. The ore-bearing rocks will then be removed using back-hoe excavators and dumped into trucks which will then be transported to the crusher. After the crushing, the crushed materials will be stock piled for treatment in the processing plant. The overburden will be stored in separate places. The interlocked gold (i.e. gold between the grains of the other minerals) within the crushed material is going to be mined by the carbon in leach process (CIL).

The Cluff Gold Project has 2 licenses
(1) The cluff Baomahun license covering an area of 51.8 Km² and (2) The Cluff Victoria license with an area of 85.8 Km².

The exploration licenses are within 137 Km² in the Valunia chiefdom in the Bo District. Presently, 32, 000m of core drilling has been carried out and 24,000m more has to be drilled.

The proposed processing plant activities are described as:-

(1) Crushing
(2) Grinding
(3) Leach and CIL
(4) Cyanide Destruction
(5) Liquid tailings disposal
(6) Acid wash
(7) Elution
(8) Electro–winning and gold room
(9) Reagent and air services

Cyanide addition will be carried out at 4kg/ton of material and this is proposed to be efficient in the recovery process and detoxication.

As at now baseline studies have been done for water bodies within the area under exploration. These are within 5 and more Km from the Baomahun village.

The plant will be designed to treat about 1,000,000 tonnes of ore per year.
Cluff gold is presently operating in Ivory Coast and in Burkina Faso and is currently carrying exploration activities in Sierra Leone.

An ESIA has in 2008 been done by Cemmats Group.

7.5 The Koidu Holdings Limited–A Large Scale Diamond Mining Company

Mine Site
In mid 1960s Sierra Leone Selection Trust (SLST) had located Kimberlite pipes in Koidu (Kono District).

In 1995 Branch Energy Ltd, a subsidiary of Diamond Works Ltd obtained a 25 year renewable mining lease that granted the company the exclusive right to carry out exploration and mining activities in respect of diamond, gold and associated minerals in an area approximately 4km².

In 2002 Branch Energy Ltd and Magma Diamond Resources Ltd entered into a joint venture and formed a new company Koidu Holdings that started operations in 2003. An EIA has been done but unfortunately the company started operations without completing the relocation of people out to the “Safe Zone”. Out of some 200 households only 75 have been successfully relocated.

The Koidu holdings limited is working on two diamondiferous kimberlite pipes in the Kono District. Pipe one is at Koidu, Tankoro Chiefdom and pipe 2 is in Yengema. Another pipe called Pipe 3 is also being worked at Tongo Field which the team also visited in Tongo.

The pipe 1 at Koidu is located west of the Tankoro Police Station with GPs reading N O8° 34,475, W010°57, 427.
The pipe consists of metamorphosed schist and possibly dolerite dikes which intruded granitic basement rocks. The dikes area at pipe 1 is about 150cm\(^2\) and the width of the dikes may vary from 1-5m. (Photo Fig. 4)

Primary diamond mining is practiced in Kono and Tongo. During kimberlite mining, the granitic parent basement rocks are blasted using explosives to gain access to the dikes. The area of excavation within pipe 1 at Koidu is over 600m\(^2\) and the pit is about 90m deep from the surface

Once access is gained to the dikes after blasting, the partly crushed kimberlite materials and kimberlite boulders are collected and loaded into trucks using front-end loaders. These kimberlitic materials are then transported to the plant site and stock piled

**Plant Site**

At the plant site, the blasted kimberlites are loaded into a funnel-like feeder or collector which is lined with a conveyor belt. This belt transports the materials to the first crusher. This crushes the materials to about 35mm diameter grain size. The separates i.e. \(\leq 35\text{mm}\) grains are sent to a second crusher which crushed these to about 1mm grain size.

Crushing is aided by water collected from the nearby created ponds. The 1mm grains which normally contains the diamonds are then mechanically separated using the density and specific gravity of the materials (diamonds having a higher specific gravity). The separate which contains the diamonds and some other non-diamondefeferous materials are sent to the DMS separator and finally to the separator house where the diamonds are sorted out from the non-diamonds.

The waste or aggregates (grains > 1mm in diameter) are collected and dumped about 100m or more from the plant site. These aggregates are used in the construction of houses and pavement of roads.

**7.6 Milestone Trading Sierra Leone Limited – A Small Scale Mining Company**

The Milestone Company has its operation in Tefeya, Sandor chiefdom in the Kono District. It also has a mining lease in the Nimikoro and Nimiyama chiefdoms. The lease area in the Sandor chiefdom covers about 1900 acres, at Nimiyama, about 1400 acres and at Nimikoro about 1000 acres. The Milestone Group at Tefeya is located N 08\(^0\) 47.264’ and W011\(^0\)13.833’. The plant is found about 2 miles off from the camp along the Bafin river and about 120m off the river bank.
Mining is presently going on in the Bafin river and mining is also intended in the Bagbe river which is 1 1/2 – 2 miles away from the Bafin.

The Company is presently classed as a small scale mining company but has acquired more machinery, has grown bigger and can now mine up to 20 acres of land per season. It is therefore suggested that the company be classed as a medium or large scale mining company. At the moment, a suction dredge machine is on its way and this is proposed to be mining about 200 tons of material per hour through suctioning on the floor of the Bafin and Bagbe rivers.

**Mining**
Mining in the Bafin is secondary and the company is presently mining the alluvial deposits along the banks of the Bafin river about 100m or more from the river mouth using heavy duty machines; excavators, caterpillars, dump trucks etc. The caterpillars clear up the vegetation and top soil up to the gravel along the banks and stock piled these close to the river site in the forest. The river bank gravel materials are then excavated using the excavators and the gravels are stored close to the plant.

**Plant Site**
At the plant site, the gravel materials are crushed, washed and scrubbed in a funnel-like container using water pumped from the river. The current machine processes about 50-80 tons of materials per hour. Through mechanical separation the light fine materials are separated from the coarse heavy ones by floatation. The processes involved here are digging, sieving and sizing. After sieving and sizing, the light materials are collected through pipes and channeled back into the river. The coarse materials and vegetation are stock piled on the plant site. The concentrate which contains the diamonds are separated and collected in different containers depending on the size of the grain. The contents of the containers are then sent into an x-ray separation house where the diamonds are separated from the non-diamondiferous materials through the injection of x-rays. The diamonds are then collected for safe keeping. (Photo Fig. 5)

The slime obtained after washing and scrubbing the gravels are collected and stored in ponds as these are gold–bearing. This slime is then panned for gold by the locals on request by the company without using chemicals. The waste water and rest slime are sent back into the river through artificial channels and ponds.
7.7 Artisanal Mining in Tongo – Kenema District and Kono District (Transpose)

Both Kono and Kenema Districts have a long history of artisanal mining activities (over 40 years). Both Koidu – New Sembehun area and Tongo Field have been used by MMR and NGOs as being among the pilot areas for reclamation work after artisanal mining activities. According to surveys during the war, 94% of all shelter in Kono District was destroyed.

Both Koidu – New Sembehun and Tongo Fields share certain things in common.
- Massive destruction during the war;
- Poor social services infrastructure including Schools, and Health facilities;
- Limited sources of safe drinking water with dependence mostly on wells;
- Poor sanitation facilities; and
- High migrant population.

Artisanal mining is nearly the same all over the country except the depth and size of the area under mining which varies from place to place. The artisanal miners at Tongo and Kono mainly mine old reworked areas left by the once popular Sierra Leone Selection Trust (SLST) mining company and later the National Diamond Mining Company (NDMC). Virgin lands according to the miners are far off from the water needed for mining and are also expensive to mine (Photo Fig. 6)

There are two main methods of Artisanal mining carried out in Tongo Field and Kono. These methods are only employed by licensed miners to dig within a specified place. They use rudimentary tools and no mechanized method is employed. Mining is taking place both on land and in streams or rivers.

Land mining involves clearing up the vegetation cover and the removal of overburden, which is done using cutlasses, pick axes, hoes, shovels etc. Land mining is subdivided into (1) Flat and low Terrace mining and (2) High Terrace mining

The mining is mainly carried out along river banks, low lying plains and swamps. The depth of the overburden may vary from 2-7m or more

(1) Land Mining

i The Flat low terrace mining

The flat low terrace mining is mostly carried out in swamps. This method involves digging the earth by using shovels and pick axes to cut down vegetation. The miners dig the earth down to the gravel. During this digging period, they may come across water in the pits, which will then be
dewatered by small petrol driven pumps. The work is usually done by small groups of men. They are not on pay roll wages except that they may receive Le 1000-2000 per day for feeding. They may receive 2/3 of the sale proceeds of diamonds recovered and the license holder has no control over them. They will dig the pits down to the bedrock in most cases. The gravel obtained will be washed after the whole digging exercise in nearby streams. This type of method is mostly applied in the mining of alluvial deposits found at shallow depths.

ii The high terrace Mining
High terrace mining is done by the same method as in low terrace mining. Here ground water is usually absent in the pits therefore, the use of pumps is unnecessary. The ground that is removed from the pits is then transported in bags to a nearby stream for washing. In the case of high terrace mining, materials are also excavated from old mining terraces used by NDMC to access gravels.

Stream and river mining
In stream and river mining, 3 methods are employed in mining the stream bed and river bed deposits,

(i) Skin Diving
(ii) Air-lift Diving
(iii) Aqua-lung Equipment Diving called the Potoon Diving.

i. Skin Diving
This is the most popular type of stream mining and is carried out in relatively shallow water with the aid of a stick tripod erected on the river bed. The diver has no oxygen tank and last for at least 3 minutes under the water. The miner or diver normally dives into the water with a rope tied on a bucket to collect the gravel deposit, and another person usually a relative to the diver in a canoe or boat called the “Draw Back” takes the gravel and turns it into the boat. It is a tedious task and time consuming. A large number of persons are engaged in this type of mining during the dry season as the water level is low and on the assumption that the river beds contain enriched gravel.

ii Air Lift Diving
This type of mining is normally carried out by a group of persons or small companies along the Sewa and Bafin rivers (Kono, Kenema). The Air lift which is the equipment only operates efficiently in deep waters up to 80m. The machine operates under the influence of high water
pressure which draws the deposit on land. This type of mining is efficient and more economical than the skin and the aqua-lung diving.

iii. Aqua-Lung Driving/ Potoon Driving

Aqua lung, like skin diving is carried out in relatively shallow waters with the aid of a stick tripod erected on the river bed. Diving is carried out with the aid of oxygen and therefore diving lasts longer. The procedure is the same as in skin diving.

7.8 Artisanal Gold Mining at Baomahun

Gold mining in Baomahun and surrounding area is of concern to both MMR and MAFFS because of the Kangari Hills forest reserve which has now been designated a biodiversity site. Other areas under potential threat include:

- Western Area for Dimension Stones and Plantinum;
- Gola Forest (prospecting for Kimberlite);
- Tama Forest Reserve in Kono for diamonds; and
- Ferengbaia Forest Reserve for Gold

The Kangari Hills reserve was gazetted a forest reserve in 1955 and upgraded to non-hunting forest reserve in 1973. The reserve is located in the Kunike and Gbonkelenken chiefdoms in the Tonkolili District and the Valunia Chiefdoms in the Bo District.

Baomahun is in the Bo District Potential threats to the forest is through logging, farming and artisanal gold mining (both legal and illegal). The villages where gold mining is ongoing include Baomahun, Pujehun, Njagulima, Labama, Gongokpa, Moryorgboh, Mendekelema, Victoria Kowama and Ngowajahun.

Gold is currently been mined at Baomahun using cutlasses, pick axes, shovels and sluice boxes by the locals. The mining is carried out in reworked swampy areas close to the Baomahun village. These are left out areas by the Baomahun Gold Project before the war in 1992. The swampy areas are suitable to mine as there is no water in the forests to mine the gravels.

After the vegetation is cleared, the first layer of soil is removed and the second layer which normally is gold bearing is excavated and stock piled. Gold washing is carried out using sluice boxes that are about 6-7m long and 0.5m wide. The base of the boxes are lined with old rubber carpets or mats and tied with binding wires. (Photo Fig. 7)
The excavated stock piled gravels are loaded into the boxes and washed with water driven out from electric pumps obtained from the swamps. During washing, the gravels are scrubbed against each other with the hand whereby vegetation and clay materials are washed over the boxes and dumped on site leaving the gold behind attached to the mat. The gold is then collected for safe keeping. The dumped sand, pebbles and stones are later used to backfill the dug-out pits which is not properly carried out. There are reports of mercury being used by the artisanal sector in the recovery process. Mercury is non biodegradable and toxic.

8.0 ENVIRONMENTAL AND SOCIAL IMPACTS

The ongoing mining and proposed expansion of activities will result in a variety of environmental and social impacts. Under the MTAP the mining activities will employ similar technologies as ongoing activities.

8.1 ENVIRONMENTAL IMPACTS

Large scale and small scale mechanized

The environmental impact will result from the mining activities themselves during preparation, ore recovery, mineral processing and closure (design and construction phase, operation phase and closure phase). The MTAP anticipates an increase in mining activities using similar ongoing technologies. However sophisticated machinery may be introduced for the three (3) categories (Large Scale (LS) Small – scale mechanized (SSM) and Artisanal Mining Sector (AMS). The operations of the first two categories (Large Scale and Small Scale mechanized) have been considered together based on actual field observation.

Impacts have been considered based on present and ongoing activities and proposed activities for the expansion of the mineral sector under the MTAP. The following companies are already mining and have been used as examples.

These companies have plans to expand using the same mining methods.

For Large Scale mining;

- Sierra Mineral Holdings LtD. SMHL (Bauxite)
- Sierra Rutile Mines LtD. SRL (Rutile and Zarcon)
- Koidu Holdings – KHL (Diamonds)
Proposed Large Scale:
Cluff Gold Mining LtD. CGML (Gold)

For Small – Scale Mechanized:
- Milestone Trading LtD. (Aluvial Diamonds and some gold from tailings).

Based on the type of equipment (heavy equipment processing plants, scale and extent of operations it is doubtful whether some of the small-scale mechanized mining companies can now not be classified as large scale miners.

There are certain operations impacts that are or may be common to all. Those with peculiarities shall be mentioned in the report. Artisanal mining will be treated in a separate section.

There are two types of mining activities recognizable so far: Dry Mining (extraction) and Wet extraction.

Dry Mining is done by Sierra Mineral Holding (Bauxite), Koidu Holdings (Diamonds) Cluff Gold Mining LtD (Gold) proposed, Milestone Trading (Diamond). Similar operations are to be expected in future.

In addition Koidu Holdings employs blasting for deep kimberlite diamond minings. Cluff Gold proposes to employ both surface (150 – 200m), blasting and deep mining for Gold at a latter date.

Wet extraction is employed by Sierra Rutile Mines by continuous bucket line. Milestone Trading carries out Mining at the moment but proposes to use suction Dredges later. The plans for expansion of the sector intended under this project will employ similar methods. The Mining will usually include clearing of vegetation, removal of overburden, excavation for ore recovery (also by suction), Mineral Processing.

Water management during operations is done by pumping from existing rivers or streams (SRL, SMHL, KHL and MTL). CGML will also use surface streams and rivers.

Water is required for plant operation (Wet and Dry). Rain water harvesting is also practised at the moment by SRL.

The following facilities are usually found at the sites.
- Camp
- Plants
- Tailings pond (SRL, SML) absent at MTL
- Waste Dump
- Airstrip (KHL, CGHL)
- Ancillary Facilities (Roads, Hospital, Schools)
- Holding Sites for export by sea (SMH, SRL)
- Export of product could also be by air (KHL)

The mining activities for expansion of the mineral sector will impact the physical, biological and social environments in similar manner as ongoing operations.

8.2 MINING IMPACTS

8.2.1 Dry Recovery Impacts
This section relates more to dry ore recovery impacts whilst wet extraction impacts have been treated in section 8.2.2.

Climate
The projects will entail the utilization of tailings ponds as in Sierra Mineral Holdings (SMHL) and Sierra Rutile (SRL). Milestone Trading (MTL) has no tailings ponds. In addition to the tailings ponds aerated ponds created during mine reclamation will result in standing water bodies during operations and post closure. The increased area of surface water bodies will result in increased evaporation in the immediate area of the ponds themselves. This may impact the microclimate of the project area by lowering temperatures in the site area. The project area cleared and exposed for the installation of facilities and for mining can be substantial. Increased exposure of the area formerly vegetated may result in a noticeable rise in temperatures.

Air Quality
Apart from the Artisanal Mining Sector (AMS) it is assumed no burning of cleared vegetation will take place on site.

The timber and undergrowth cleared from the area to be mined will be stored for use on site. Undergrowth and vegetation not suitable for construction will be disposed of in spoil piles.
Air quality will also be impacted by emissions from passenger vehicles and from heavy earth moving equipment used for land clearing operations and mining. The major emissions from construction equipment include:

- Nitrates;
- Carbon Monoxide;
- Sulphates;
- Particulates less than 10 µ
- Carbon dioxide; and
- Aldehydes

Some air quality recommendations by the World Bank for heavy equipment is presented below:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Dioxide (No$_2$)</td>
<td>24hr average 150µg/m$^3$</td>
</tr>
<tr>
<td>Particulate matter</td>
<td>24hr average 70 µg/m$^3$</td>
</tr>
<tr>
<td>Sulphur Dioxide (So$_2$)</td>
<td>24hr average 125 µg/m$^3$</td>
</tr>
</tbody>
</table>

Although no recommended Air Quality standards exist, none of the mining companies visited had a capacity to measure and quality.

**Geology**

Mining operations will result in the removal of the soil and rock present at the site. During mining, soils will not be segregated by material type. Mining will consequently result in an alteration of the surficial soils present at the site. The mining will therefore result in changes in the topographic height, slope relief intensity, degree of shaping and exposure of the area. The modification of surficial soils will influence the water balance in the area since the new surficial soil may be either more permeable or less permeable than the current at ground surface. Slope failures also pose threats.

In Kimberlite mining huge craters or pits are usually the result of mining. In Koidu-New Sembehun where KHL are mining, huge craters (100m X 100m X 100m) are to be found in pipe 1.

A smaller crater was found at Tongo Fields. Similar geological features of smaller proportions may result from CGML operations in Baomahun in the Valunia Chiefdom.
**Water Resources**

The wastewater produced by the mining operation will consist of water from the mine itself and wastewater from the mineral processing circuits.

Another source of waste water is from the laboratories as in SRL, domestic wastewater and rainwater runoff from the developed areas such as workshops and other onsite facilities. Discharge of wastewater into surface water may impair surface water quality by causing changes to its physical, chemical and biological properties. In accordance with this ESIA the water management facilities will be designed to ensure no uncontrolled discharges to surface waters.

There are about three (3) recognizable types of tailings ponds:

- From Washing or Wet plants in which no chemicals are used but tailings consisting mostly of aggregates, sand and slime (SRL, SMHL, MTL, KHL);
- Those from processing plants in which chemicals could be used (SRL, CGML);
- From laboratories in which chemicals may be used (SRL, CGML).

Tailing ponds containing chemicals must be specially constructed and clearly demarcated (SRL has established special ponds and proposed to use specially lined pits for chemical effluents from laboratories). CGML is committed to similar proposals in compliance with the ESIA done by Cemmats (2008).

Our present environmental laws do not provide guidelines for effluent discharged to receiving waters from tailings impoundments, mine drainage, sedimentation basins, sewage systems and storm water.

The World Bank guidelines are therefore proposed as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6 – 9</td>
</tr>
<tr>
<td>BOD</td>
<td>50mg/ℓ</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>20mg/ℓ</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>50mg/ℓ</td>
</tr>
<tr>
<td>Temperature – at the edge of a designated mixing zone</td>
<td>Max 5°C above ambient of receiving waters max 3°C if receiving waters 28°C</td>
</tr>
</tbody>
</table>
**Ground Water**

Mining activity may entail excavation below the existing groundwater level when the latter is found within a relatively shallow depth. This will interfere with the existing groundwater flow regime and will result in the temporary reversal of groundwater flow directions (Bauxite, gold and Kimberlite mines). Groundwaters inflow into the excavated pits during mining operations may require pumping in order to avoid flooding.

After mine closure residual depressions may continue to receive groundwater flow as well as water from rainfall craters left by kimberlite operations and underground gold mines (proposed) will fall into this category.

Clearing of the area for mining will change the vegetation cover and will alter ground water recharge and runoffs conditions. Waste material from both the mining and mineral processing phases will usually be placed in spoil piles. In the mining area precipitation can induce leaching of chemicals from these spoil piles. Mining and mineral processing waste containing large amounts of water soluble substances or heavy metals can jeopardize the groundwater, unless the soil under the dump is sufficiently impermeable. Groundwater quality may also be impacted by infiltration of wastewater from the tailings management area and by leaching of minerals into solution from the mine itself. Additional sources of contamination may be by seepage from waste management facilities on site.

**Surface Water**

Site clearing will produce increased discharges to surface water flow since interruption and evapotranspiration will be reduced. The volume of additional inflow may result in increased surface water levels in the rivers and streams immediately adjacent to the mine site.

This will lead to increased turbidity, low productivity and drawn down of water down stream. This is the case of the mining operations for diamonds in the Baffia river (MTL).

Precipitation can induce leaching of chemicals from spoil piles. Surface runoff from mining and mineral processing waste containing large amounts of water – soluble substances or heavy metals can result in degradation of surface water quality. In the event of large amounts of rainfall, waste dumps may erode and landslides may result and cause sediment to spread over large areas.
Breaches in tailings pond may also occur during such conditions. Surface water quality can also be impacted by sediment and nutrients in wastewater discharged to surface water from workshops and other service areas. Change in natural water quality may affect the organisms found in aquatic systems. The behaviour, reproduction and physiology of organism may be affected. If bacteria, algae, and water plants are fed upon by fish, these pollutants may be passed onto the food chain and consumed by men.

Surface runoff from onsite areas, such as site access roads, can introduce sediments and nutrients loads into surface water bodies into which it is discharged. Surface runoff of water contaminated by waste management facilities onsite can also impact surface water quality. As GOSL environmental laws lack specific guidelines for residual heavy metals discharged into surface water bodies the World Bank guideline is therefore recommended.

The following are recommended target guidelines below which there is expected to be no risk for significant adverse impact on aquatic biota or human use.

In cases where natural background concentrations exceed these levels, the discharge may contain concentrations up to natural background levels. Concentrations of up to 110% of natural background can be accepted if no significant adverse impact can be demonstrated.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Limits</th>
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<tbody>
<tr>
<td>Arsenic</td>
<td>1.0mg/ ℓ</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.1mg/ ℓ</td>
</tr>
<tr>
<td>Chromium, Hexavalent</td>
<td>0.05mg/ ℓ</td>
</tr>
<tr>
<td>Chromium, Total</td>
<td>1.0mg/ ℓ</td>
</tr>
<tr>
<td>Copper</td>
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</tr>
<tr>
<td>Iron/Total</td>
<td>2.0mg/ ℓ</td>
</tr>
<tr>
<td>Lead</td>
<td>0.6mg/ ℓ</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.002mg/ ℓ</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.5mg/ ℓ</td>
</tr>
<tr>
<td>Zinc</td>
<td>1.0mg/ ℓ</td>
</tr>
</tbody>
</table>
Terrestrial Resources

Land Use

Large scale and small scale mechanized mining results in a change in vegetation cover over significant areas. The activities may increase soil erosion, soil compaction and nutrient leaching from the surficial soils. Loss of vegetations cover will alter living conditions for flora and fauna.

Records in Sierra Rutile area and Sierra Mineral Holdings lease areas indicate that as much as 150 species of plants may have existed before devegetation. There may have been many species of animals including 5 species of Rodents, 12 primate species, 31 species of other mammals, 20 species of reptiles and amphibians, as many as 23 species of bats and up to 53 species of freshwater fish species.

Vegetation (Flora)

Cutting of large tracts and clearing for mining in anticipation of expansion, will make plant regeneration difficult. Flora regeneration difficulties will depend on the mining methodology. In the case of open pit mining for Bauxite, Gold and Diamonds (SMHL, CGML, MTL), backfilling by over burden spoil piles and extra materials from outside is a possibility for flora regeneration. In the case of kimberlite mining the huge craters left behind are most unlikely to be successfully reclaimed and revegetated. An alternative use is proposed in this ESIA.

Where reclamation is possible nutrients contained in the biomass, either disappear or are washed out by rain water. The conditions required for regeneration will also disappear with the clearing and cutting required for the mine operation. Native plant species may be replaced by aggressive opportunities grass and shrub species (also observed in the field). The biodiversity will also be lost.

Wildlife (Fauna)

Stocks of animals depend on the existence of habitats of a certain size. Clearing for the mine, process facilities, and personnel facilities will fragment the area. In addition, some animal species depend on the existence of other plants and animal species within the habitat for nutrients/food, cover, etc. Clearing and encroachment will alter several of the physical conditions including light, humidity and temperature. The installation and facilities and other construction works will form
temporary barriers to the movement of animals, including access to water bodies. People associated with the mining activities may harvest commercially valuable animals and plant species. Persistent acid mine drainage and discharge to surface water may also contaminate the water available to wildlife in the area. Acid mine drainage is formed when pyrite, an iron sulphide, is exposed and reacts with air and water to form sulphuric acid and dissolved iron. Some or all of this iron can precipitate to form red, orange or yellow sediments in the bottom of rivers and streams into which the acid mine drainage discharges. The acid runoff further dissolves heavy metals such as copper, lead, mercury into ground or surface water. All pyritic material will be placed above the water table to isolate the material from contact with water, and to preclude leaching of acid weathering products. In areas where pyritic material is used those areas will be capped with clay or other materials to reduce permeability.

During operation of the mine, wildlife will be displaced to other areas. Wildlife will migrate to escape physical disturbance and noise produced by mining activities. While disturbances may be stressful to some wildlife, other species may easily adapt to and thrive successfully in affected zones owing to the phenomenon of habituation. Access roads will interfere with normal tracts of animals and increase collisions will vehicles. In contrast, however some animals are attracted to roads for various reasons, including protection from predators, good food supplies and better travel conditions. Many species of migrating birds including water fowls and waders will be attracted to open bodies of water (mining ponds, tailings ponds and reclaimed ponds). These birds may be harvested by people in the project area.

**Threatened and Endangered species**

A few endangered and threatened species are:

- **Hippopotamus amphibus amphibus** - hippopotamus (South, East)
- **Cephalophus jentini** - Zebra duiker (South, East)
- **Synceros Caffer** - Forest buffallor (South, East, North)
- **Loxodonta Africana** - African Elephant (Kono-East)
- **Colobus polykomos** - Colobus monkey (South, East, North)
- **Pan troglodytes verus** - Western Chimpanzees (South, East, North, Western Area
- **Papio papio** - Western Baboon (North, East)
- **Felis Sylvestris** - African Wild cat
**Panthera pardus** - Leopard (North, East, South)

**Noise, Odour and Dust**

Dust emission would occur during the construction and operation phases by vehicles using the site roads, from material stockpiles onsite and from blasting operations. The total dust emissions from the stock piles result from the following:

- Loading and reloading of material unto and from the stock piles
- Equipment traffic in the storage area
- Wind erosion of the materials in the stockpiles.

Noise levels above the alert threshold of 86 decibels and hazard threshold of 95 decibels will be produced from heavy duty machine operation. During maintenance operations, vehicles in maintenance workshops usually generate noise levels in the vicinity of 72-110 decibels. Power generation plants usually generate noise in the range of 90 – 105 decibels. Exposure to noise levels above the tolerable threshold of 72 decibels can cause/result in fatigue, tiredness, low morale and decreased production levels and productivity. Tired workers are also prone to accidents and this can contribute to an increase in accidents in the working environment. Continuous noise produced by mining operations may disrupt acoustic communication between fauna and may lead to changes in behaviour as it relates to mating, food gathering, warning signals and brood care in areas near emission sources.

Rock blasting operations would use explosives normally used in quarrying. These explosive would be either Ammonia Nitrate/fuel oil (ANFO) or Trinitrotoluene (TNT). These explosives emit carbons Monoxide (ANFO< TNT), Nitrates (ANFO), Methane (TNT), Sulphates (ANFO) and Ammonia (TNT).

The Kimberlite mines (KHL) has established 3 sites (pipes) and during blasting the vibration and noise is a menace to inhabitants. The resident within 500m not yet resettled are required to vacate their houses temporarily during blasting which could last for several hours. Gold mines using blasting may be faced with similar challenges.
Traffic
The mining activities have introduced a series of unpaved roads to enhance traffic in the area. In the expansion of the activities additional traffic will be introduced into these areas. Enhanced road conditions may result in increased speed over the road which may result in increased incidences of vehicular accidents along the roadway.

Cultural and Archaeological Resources
There is evidence that both cultural and archaeological resources have been significantly affected by the construction and operations phases of the mining activities. In the Rutile area, because whole communities have been relocated, sacred groves (secret society bushes) and artefacts (stone engravings and foot prints of warriors) have had to be interfered with. This is likely to be the case for the Large Scale and Small-Scale mechanized mining sector. This situation will continue as the mining sector expands.

8.2.2 Wet Extraction Impacts
Because of the special problems posed by wet extraction of rutile, some wet extraction impacts have been considered separately in this section. Mining methodology has been described in the previous section 7.

Sierra Rutile Ltd (SRL) operates a series of ponds and dams that are mined using very large bucket line dredges. There are at the moment 2 dredges (D1 and D2) and a third D3 is planned. The cumulative extent of land disturbance is significant, affecting nearly 13,000 hectares, much of which has been permanently lost for agricultural purposes. The water is derived from the streams and rain.

Wet mining impacts are detailed below:

Climate
Dredging for the removal of over burden and for the recovery of ore will result in practically no aerial emissions from the ore or overburden. Emissions will be limited to that of the hydraulicking equipment. The emissions are not expected to exceed those of earthmoving equipment to be used for dry recovery. Wet recovery entails the creation of large artificial lakes within the project area. Evaporation from those lakes will affect the microclimate of the project area resulting in lowering temperatures.
Geology
During wet extraction, the removal of the overburden will modify the topography of the dry land being exploited. Fine grained soils are removed leaving behind soils and other rubble containing large amounts of unclassified soil that is extensively lacking in fine and superfine contents. Consequently, soil formation, as an essential prerequisite for recolonization by plant associations, would be seriously impeded. The dredging operations will not impact the bedrock geology of the area.

Water Resource
Wet extraction will have a much greater impact on water resources.

Groundwater
Wet extraction will permanently alter groundwater flow conditions in the area both during mining and after the completion of mining. Groundwater levels will be lowered in the artificial lakes during the mining operation, consequently groundwater flow will be towards the artificial lakes (see Knight Pesold and Co, 2001)

Groundwater quality may be impacted by leaching of minerals into solution both from the mine and from the mined out areas. The presence of dissolved minerals in the groundwater can change the pH of groundwater in the area. In addition, groundwater quality may be impacted by spillage of oil and fuel from dredging equipment directly to surface water which is discharging to groundwater.

Surface Water
Dredging results in reduced surface water flows since water will have to be withdrawn continuously to support the dredging operations. Small streams within the area to be mined will be eliminated by the mining operations. Where suction dredges are used on river beds the water quality is adversely impacted.

The discharge of wet-extraction sludge will create sediment plumes that will travel long distances before the clay and silica fractions finally settle out of suspension (In SRL operations, the fractions are actively removed into tailings ponds). The deposition of transported sediment therefore will reduce water quality for significant distances for the site.
Further groundwater in the area may discharge to surface water. Consequently any dissolved chemicals present in groundwater will be introduced to surface water by groundwater discharge. The dams are protected by embankments and there is a threat of dam failure.

**Fishes**
Wet extraction introduces large quantities of sediment to streams (through spillways) which will impact the fisheries resources.

Stagnant lakes (lentic environment) eliminate fish species adapted to fast flowing conditions and replaces them with those adapted to stagnant bodies of water. Catfishes such as *Mormyrus* sp, *Clarias* sp, *Synodontis* sp, *Chrysichthys* sp are lost. Other fish fishes including *Hydrocynus forskali*, *Hepseteus* adoe and *Alestes* are also lost.

These groups are replaced by Cichlidae (Tilapia types) including *Tilapia monodi*, *Tilapia caudomarginatus*, *Hemichromis bimaculatus* and *H. fasciatus* (Direct observations indicate that out of some 36 species originally in the area around SRL mines there are now less than 5 species).

**Terrestrial Resources**
Wet extraction results in the removal of all surficial soil and replacement by a cover of highly saturated fine grained soils. The area actually mined will be altered and wet extraction will completely alter the land use in the area. The sand tailings are devoid of humus and no forest will cover the area for a considerable period of time. At SRL attempts to revegetate the sandy areas with economic trees has not been successful. (Darwin Initiative is still in the experimental stage).

Loss of vegetative cover exposes the area to the full force of the prevailing winds. Groundwater recharge rate and surface runoff conditions will be altered.

**Flora (Vegetation)**
Loss of vegetative cover leads to loss of flora species and biodiversity in a manner similar to those of dry mining.

As indicated regeneration of plant life will be difficult and a different type of plant life will emerge after reclamation.
**Fauna and Wildlife**
Reduction in habitat size and fragmentation are similar to those indicated for dry mining. Contamination and degradation of water quality are the consequences of wet mining.

**Threatened and Endangered Species**
As pointed out earlier, loss of large forested areas leads to loss of species including threatened and endangered ones.

**Noise Odour and Dust**
No dust is emitted in wet extraction. The noise emitted during mining operation is more or less continuous. Continuous noise stress may affect communities in the proximity. Continuous noise may disrupt acoustic communication between fauna and may lead to changes in behaviour as it relates to mating, food gathering, warning signals and brood care in areas near the emission sources.

**Traffic**
Minimal traffic will be introduced by wet extraction. Most of the vehicles will be service vehicles. There is danger to other traffic including cattle from anchorage cables to dredges as in SRL.

**Cultural and archaeological Resources**
As indicated earlier wet extraction require relocation of communities including cultural and archaeological resources. In most cases archaeological resources in the area may not be known (covered by vegetation) prior to being encountered by the dredging operations. The dredging operations will consequently negatively impact these resources.

**Health and Safety**
Dams and ponds could fail if not properly constructed and monitored. In the Rutile area there was one reported failure during the war when the company was not operating. (Regular inspection are undertaken by SRL).

Stagnant water bodies could lead to a proliferation of diseases including; Malaria, lymphatic filariasis and schistosomiasis (if the surface water is not acidic).


8.3 SOCIO ECONOMIC CONDITIONS

The general demographic profile of the country has been captured in section 2. As a condition for issuance of licences to both the Large Scale and Small-Scale mechanized mining agencies an Environmental and Social Impact (ESIA) studies must be undertaken.

Most of records and EIA reports examined so far present detailed accounts of the socio-economic status of the areas of operation. Direct observation and consultation with stakeholder groups [Mining Companies, Mines Engineers, Mines Wardens, Mines Monitoring Officers, Dealers Diggers, Project Affected Persons (PAP), NGOs Local Communities, Chiefs, Local Government Officials] reveal that certain aspects of socio-economic impacts of ongoing mine operations and proposed expansion are common.

Most of the mineral resources occur in rural areas. Some diamond and gold deposits could be found around big towns and cities (Kenema, Bo, Koidu-New Sembehun). Inspite of immigration into the mining areas, the dominant ethnic groups in the former pristine state continue to dominate the regions.

Rural, indigenous communities are characterized by poverty, poor or few social amenities (few schools, few health centres, few water and sanitation facilities) poor roads and a traditional way of life.

Most of the people were formerly engaged in farming practices (Rice, vegetables, tree crops), Hunting, Fishing and cattle herding. Logging, fuel wood and charcoal trade were also actively carried out.

Consultations revealed that nearly all stakeholder groups were aware of the economic benefits of the mining operations.

Two categories were identifiable:

- Individuals who expect direct benefit and;
- Those people (particularly rural villagers and women) who view employment as less of a project benefit.
The expectation of the people generally are for assistance with agriculture, education, health services, water, electricity and housing.

**Land Use**

Impacts related to land use include impact to livelihoods and residences. The loss of agricultural land due to occupation by the project will result in the loss of agricultural income and livelihoods, increased pressure on other farm lands or land related conflicts. Where permanent residences and communities fall within the project footprint, residents will be physically displaced. Displaced people will be resettled according to a Resettlement Action Plan (PAP).

Both mining companies and local communities hold quite conflicting views on resettlement and compensation issues. The subject of Resettlement is dealt with in a separate document (Resettlement Policy Framework – RPF). In Sierra Rutile Limited (SRL) operational area, 12 villages have been relocated. In most agreements as spelt out in the ESIAs and RPF a house for house compensation policy is pursued. However in some cases the mining operations started without completion of resettlement (KHL).

An annual Surface Rent amounting USD 10 per acre are paid in accordance to a Government directive. As detailed below, this was considered inadequate and unfair in distribution by local residents;

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>% of Total Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landowners</td>
<td>45</td>
</tr>
<tr>
<td>Paramount Chiefs</td>
<td>15</td>
</tr>
<tr>
<td>Local Councils</td>
<td>20</td>
</tr>
<tr>
<td>Chiefdom Development</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The inter-relationship between men and women; boys and girls in households are generally determined by traditions and stereotyped roles for the sexes. There are indications that inequity exists which impede the equal contribution of men and women. The tradition includes land tenure systems that do not favour land ownership by women.
Many development projects face the risk of elite capture at different stages. NGOs, youth groups, women’s groups and chiefs have been accused of consuming large portions of resource allocated for development purposes.

**Employment and Labour**

The operation of the mines create employment opportunities for residents in the area (for SRL 20% of workforce) Employment of both skilled and unskilled labour may bring financial benefits to the communities if residents are considered for the jobs. The projects create demand for skilled labour. The demand for skills may result in improved education standards and services in the communities while there is a limited knowledge base for skilled jobs using heavy-duty equipment local residents (youths) interviewed expressed willingness to be trained in these areas.

The projects may therefore result in people in the communities acquiring new skills if a training program forms part of the construction activities. The direct and indirect economic contribution of the mining project sustains a multiplier process within the country, resulting in an increase in incomes and employment that exceeds the original contribution to the project.

This economic rippling effect continues as portions of wages and profits are spent by businesses and workers within the local economy, supporting other jobs. From interviews conducted, records of agreements and ESIA s it is the policy of most mining companies to provide training to employees. Social amenities are expected to be upgraded through assistance including agriculture, education, health services, water and sanitation, electricity and housing.

Improved infrastructure usually add value to the visual aesthetic beauty and increase tourism. There may be social resentment by people in the area if a significant number of employees especially in unskilled labour is from outside the area. There will also be repatriation of money away from the area itself and the associated lack of development in the area.

Opportunities of paid employment may change the traditional division of labour between men and women in the indigenous communities in close proximity of the mine (there were not many women employees in many companies. There were few women contractors).
Given the prevailing conditions in the country, social unrest, racial tensions and other conflicts may arise among people of different ethnic, social and economic background moving into the area. Conflicts may also develop between artisan miners and other categories of mining companies as the artisanal miners begin to find out that areas previously used to extract ore (diamond and gold) now belonged to companies.

**Community Safety**

It was clear from stakeholder consultations that there is a strong desire for improved roads within the project areas. Access to agricultural markets, health and educational services would be enhanced by road improvements and would significantly assist in addressing fundamental socio-economic constraints. Concerns were also expressed about the deterioration of roads as a result of increased traffic and raised community safety concerns regarding potential accidents. For lakes and ponds created by wet extraction there is risk of drowning for humans and wildlife.

**Health and Well-Being**

The influx of migrant mine employees or tourists can serve to disrupt social cohesion existing within communities. Residents may alter their lifestyles after exposure to culture and lifestyles introduced by project employees from areas remote to the communities in the project area. Nutritional patterns may change which may result in malnutrition among women and children especially if the costs of food become prohibitive due to higher salaried mine employees.

As more residents seek employment at the mines they may move away from traditional farming, fishing, hunting and herding practices and develop a dependence on job opportunities to provide for their families and their existence may be determined by their spending power.

Social interaction with other groups is likely to bring about an increase in alcohol, drug abuse, prostitution and crime.

The circulation of money from wages and salaries would sustain all the workers leisure activities. This may increase the demand for alcohol, drugs and sexual services especially for migrant workers. In the midterm this may bring about an increase in sexually transmitted diseases including HIV/AIDS.
8.4 Analysis of Alternatives

The No-action alternative would have no significant impact on climate or geology at the sites. The only activities that would go on include farming, fishing, logging, hunting and herding. Some alteration in ground cover may occur over small areas due to localized operation. This alternative would not impact significantly land use, vegetation, wildlife or threatened or endangered species in the area. No-action is unlikely to attract investors to the area. The absence of roads, electricity and other social amenities would serve as a deterrent to prospective investors. Since the demand for skilled labour would remain stagnant, no-action may lead educated groups to migrate in search of better job opportunities.

The other alternative is Artisanal mineral exploitation. Artisanal mining operation may not entail the withdrawal of large quantities of water and in the case of gold and diamonds is usually carried out in swamps and small bodies of water. The cumulative effect is however huge and although landscape reclamation is easy, the cost could be prohibitive.

9.0 ENVIRONMENTAL AND SOCIAL MITIGATION AND MANAGEMENT

The Environmental Management procedures in Sierra Leone are based on some statutory instruments to cover a wide range of activities. These legislative frameworks include the following:

- National Environmental Policy (1994);
- Environmental Impact Assessment Procedures (1999); and
- National Environmental Protection Act (2000)

There are sector specific instruments including the Mines and Mineral Act (1996).

From the examination of a range of EIA reports for various mining companies presented to the project team, it was clear that they were prepared to satisfy certain donors and the GOSL regulations.

The EA reports are fairly general for all sectors (Agriculture, Mining, Wildlife, water and Sanitation, Solid Waste etc), some standards and guidelines are also missing.

Because certain activities (Mining, Agriculture, Transportation, Wildlife, Forestry etc) are important to the country, in terms of their contribution to the economy and more importantly
because of the potential environmental impacts arising from activities in some of these sectors, there is a need for a legislative review. Such reviews when complete must now present in detail EIA requirements specific for each sector.

9.1 Environmental Mitigation and Management

The present Environmental and Social Management Plan (ESMP) presented in this ESIA proposes a framework for the mining sector. Compliance monitoring is also looked at in a separate section.

The ESMP proposed in this ESIA is based on direct field observations of ongoing mining activities. It is to be assumed that investments under the MTAP for future expansion of the mineral and mining sector would be inline with the present ongoing and proposed mining technologies. After consultation with the ongoing mining companies it became obvious that there will be very little adjustments to the present technologies in place. From interviews, each company is committed to management of the environment in its mining areas as evidenced by the Environmental Assessment (EA) reports in compliance with the Environmental Protection Act. (2000)

An applicable, relevant and appropriate Environmental and Social Management Plan (ESMP) has been developed to mitigate and minimize the environmental consequences identified so far. These have been summarized in Table 7. A separate monitoring plan has been developed to assess the effectiveness of the management plan. The environmental mitigation measures in this ESMP include:

- Production technology, disposal methods and engineering designs.
- Pollution controls, recycling and conservation of resources, monitoring, special social services or community awareness education.
- Compensatory measures for the restoration of altered resources.

Monitoring would be undertaken to evaluate the success or failure of the environmental management plan measures and to reorient the ESMP if required.

The environmental consequences that can be mitigated are as follows:

- Open-pit excavation Impacts
Several other environmental consequences that cannot be mitigated are as follows:
- Climate Effects
- Effects on Geology
- Gaseous emissions by equipment
- Vegetation Impacts
- Wildlife Impacts
- Craters excavated from Kimberlite mining Impacts
- Riverbank erosion Impacts.

The management plan has been developed to ensure that the impacts that cannot be mitigated are minimized to minimum possible. In addition, several of the consequences on impacts that cannot be mitigated do not exceed tolerable limits. The wildlife and vegetation impacts are not exactly mitigated by the provisions of the management plan.

However, there is a relative abundance of similar vegetation and wildlife in the area. It is expected that wildlife will return to the area after reclamation and revegetation. The plant type in the reclaimed area may, however be different from that currently occurring in the area.

### 9.1.1 Terrestrial Resources

Planting new vegetation around production facilities and along access roads will mitigate the impact on terrestrial resources. The siting of plant installations should consider several alternative locations to minimize impact on terrestrial resources. Particular attention will be paid to vulnerable or conservation-worthy plant and animal species that will be affected.

### 9.1.2 Open Pit Management

For future expansion in the mining sector, mine walls will be designed and sloped to preclude slope failures and slides. No excavated soil will be stored at the crest of slopes. Swamps will be excavated in mined out area on the floor of the mine and all groundwater flow and precipitation
will be channelled into those. Surface runoff will be prevented from entering open pit and from adding to the volume of groundwater inflow and direct precipitation (SMH, MTL). Following ore extraction all worked – out areas will be drained and graded to eliminate all open bodies of water that could serve as breeding grounds for pathogenic vectors like malaria – transmitting mosquitoes. Equipment will not generally be serviced in the mine pit, to ensure that no oil and fuel spills in the pit.

9.1.3 Overburden Management

Overburden soil removed from above the ore horizon will be stockpiled for land reclamation. To minimize excessive land consumption and the associated clearing of forested areas, all stockpiles will be sited within the mine itself.

Initially overburden material will be stockpiled above ore bearing areas. However, as mining progresses, the overburden would be stored within the open spaces in mined out areas. (This is currently practiced in Bauxite mines by SMHL and in diamond mines by MTL).

Stockpiled soil will be periodically watered to minimize dust emission. In addition all stockpiles will be surrounded by a soil containment berm to preclude the easy flow of surface runoff and sediment from stockpiles. The containment berms will be constructed of soil pervious enough to enable the passage of surface runoff water while trapping sediments contained in that runoff. The height and slopes of each stockpile will be such that foundation and slope failures do not occur.

9.1.4 Water Management

The tailings pond will be designed to operate with a minimum freeboard of 1.5m and will be surrounded by berms. The berms will prevent discharge by overtopping from the pond and will also preclude precipitation runoff from entering the pond. Storm water runoff and water from the mine pit will both be channelled to a sedimentation pond. That pond will be designed to provide a detention time of 48 hours. Discharge from the sedimentation pond will be via a spillway and will be channelled through a sediment control structure constructed of matrix of stone, sand and grass to remove sediment prior to discharge to surface water bodies in the site area. (Sierra Rutile is an example of such).
The mine will be developed to ensure minimum disturbance to streams and creeks in the area. In instances where this cannot be avoided, sediment control structures and practices will be used to prevent the inflow of sediment to surface water. The control practices will include sediment traps or screens to control run-off and sedimentation. Surface runoff from the workshop and other vehicle service areas will be channelled to an oil/water separator, if necessary. All water from the oil/water separators will be skimmed prior to discharge. Site clearing operations will progress in a gradual and phased manner to ensure there are no large increases in surface runoff.

9.1.5 Tailings Management
The tailing pond will be sited in areas of low soil permeability to ensure minimum discharge to groundwater. In addition, the bottom of the tailings pond will be above the high groundwater level and it will be designed with the minimum surface area required to satisfy capacity constraints. The Tailing Pond will also be surrounded by berms to prevent uncontrolled discharges to surface water and to preclude surface runoff from entering the tailings area. The part of the tailings pond above ground level will be designed to prevent slope failure and the associated release of tailings to the environment. The tailings pond area would be patrolled to prevent faunal from straying into the pond. Piezo metres have been installed by SRL. Dam failure evaluation has taken place at SRL.

9.1.6 Hazardous Material Management
Hazardous materials in the mine site are expected to consist essentially of waste oils and grease from work shop operations and from vehicles. Other sources such as chemicals (Gold & Rutile) may be derived from dry plant operations. Radioactive materials need special care. All hazardous materials will be located in secure storage facilities on-site to prevent accidental release and protect against rainfall that may result in contaminated run-off and leaching. All storage areas for hazardous material will be concreted to provide an impervious surface and to prevent uncontrolled discharges to groundwater. Material Safety Data Sheets (MSDS) will be kept on site and all measures to contain spills of hazardous materials shall be in accordance with the procedures therein. No rainfall would be allowed to percolate through areas where hazardous materials are stored and no uncontrolled run-off will be permitted from these areas. Stormwater from the area around the storage facilities will be channelled to the sedimentation pond. Incompatible substances that can react upon mixing to generate heat, fire, gas, explosion, or violent polymerization will not be located within proximity of each other. Hazardous material will be disposed of in accordance with guidelines established by the NaCEF.
9.1.7 Waste Management
Solid waste from the operation of the residents will be composted or disposed of in secure areas designed in accordance with guidelines provided by the NEPB. All food waste and organic matter will be composted and the composted material will be used as fertilizer for revegetation of the reclaimed areas. Septic waste will be managed by a series of septic tanks on site. Discharge from the septic tanks will be channelled through a granular filter bed prior to discharge. Septic tanks contents will be emptied when possible or as dictated by capacity constraints, by a licensed operator and will be disposed in accordance with NaCEF guidelines. Ashes from burning of vegetation will be added to the overburden soil and will be used for land reclamation. The coarse fraction of the tailing waste will be used in the construction of sediment control structures onsite. The fine fraction of tailings will be used to maintain both site access roads and roads within the mine itself.

9.1.8 Land Reclamation
All open-pit and stockpile areas will be regraded to as close to original contours as possible. Erosion controls would also be applied around regarded areas to ensure minimum soil loss prior to vegetation taking hold in the areas. The compactive effort will be controlled during regrading to ensure that the soil compaction does not prevent stormwater infiltration. This will ensure the soil would able to fulfil its divers functions as a water reservoir, a biotope for plants and animals, and a basis of agricultural production. Regraded areas will be covered by humus to enhance conditions for revegetation. All streams that were temporarily diverted during the mining operations will be restored to their channels and cross-sections and berms will be provided adjacent to the reclaimed channels to preclude the easy flow of sediment into the restored waterways.

Any ponds, lakes or dams created for mining purposes will be closed, backfilled and recontoured. This should also include lakes already established in the Rutile area. Fish ponds will only be established after initially draining, lining with clay and refilling and stocking with fish.

Craters left behind from kimberlite diamond mining operations as is practised at the moment by the Koidu Holdings cannot be reclaimed through backfilling since the tailings consisting of granite aggregates are used in construction industry. The pits could be lined and rain harvested and the dam used for domestic water supply.
9.1.9 **Air Quality, Dust & Noise**

Water will be sprinkled on roads, other conveying routes and stockpiles to control dust emissions. A dust bonding against such as molasses may also be used if its use reduces the frequency with which the road should be sprinkled with water. The noise emissions would be limited by appropriate soundproofing of individual pieces of equipment. Equipment will be fitted with special exhaust systems (mufflers). Additionally, the miners will be required to wear personal noise-protection gear, e.g., ear protectors.

9.2 **Employee Health and Safety**

All shallow pools and ponds in the area will be identified and eliminated to reduce impacts on health and safety. Pesticides that are non-toxic to humans, fish and livestock will be used for habitat and vector control. A body will be established to provide health advisory and support health services and to monitor disease vector and disease incidences. During the operation of the facility, emphasis will be placed on providing a safe and healthy environment for the workers. A health and safety plan will be implemented. Occupational Safety & Health plans will be implemented in the following areas:

- Industrial Accident prevention and management
- Occupational Hygiene.
- Illness & Infectious disease prevention and management.
- Sewage and Waste Disposal.

Cluff Gold, Milestone Trading and Sierra Rutile mines have Health and Safety Departments. Safety procedures at SRL are very laudable.

9.2.1 **Industrial Accident Prevention and Management**

Industrial accident prevention and management will be effected via the company safety program. Many companies have Safety and Health departments. This will commence during the construction phase and last through the operating phase until the cessation of operations. The program will include the following:

- Hazard identification and control.
- Monitoring and reporting of industrial accidents.
- Training or education of employees in industrial first aid.
- Industrial Accident Protocol.
• Fire Safety & preparation
• Hazard Identification and Control

Table 4 lists the potential hazards in different phases of the operations of the facilities and the preventative and remedial activities necessary for their elimination and control. In addressing these hazards, the first priority will be their elimination via modification in the design of equipment or process. If this is not possible or feasible and the hazard cannot be eliminated, then the employees will be provided with the necessary safety protective gear to prevent any injuries during the work process. Hazard identification and reporting will constitute an ongoing activity in which the employees’ participation will be considered an integral part of his work functions. The environmental policy (1994) clearly stipulates the responsibilities of employees and supervisor/management in this regard. The supervisor/manager of any mining company has obligation to:

• Inspect all machines and equipment for the existence of potential hazards and ensure that they are in working order.
• Inform the worker of any hazards present.
• Instruct the employee in the correct safe work procedure to prevent any injuries and ensure that those instructions are followed.
• Provide the necessary safety protective gear when required.
### Table 4: Potential Hazards During Operational Phases

<table>
<thead>
<tr>
<th>Phase</th>
<th>Potential hazard</th>
<th>Protection &amp; preventive Safety measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing of Site &amp; Construction of Living Quarters:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Felling trees</td>
<td>Insect Bites</td>
<td>Use of insect repellents</td>
</tr>
<tr>
<td>- Removal of topsoil &amp; overlying vegetation</td>
<td>Snake Bites</td>
<td>Provision of snake bit kits</td>
</tr>
<tr>
<td>- Assembly of building</td>
<td>Minor Trauma to Extremities</td>
<td>Use of safety shoes &amp; gloves</td>
</tr>
<tr>
<td>- Assembly of generating plant</td>
<td>Lacerations from use of sharp tools</td>
<td></td>
</tr>
<tr>
<td>Excavation of ore &amp; transportation to plant</td>
<td>Fugitive dust blown into eyes</td>
<td>Use of clear goggles</td>
</tr>
<tr>
<td></td>
<td>Inhalation of fugitive dusts</td>
<td>Use of dust/mist respirators</td>
</tr>
<tr>
<td></td>
<td>High noise levels from working of heavy duty vehicles – trucks, tractors etc.</td>
<td>Use of ear plugs</td>
</tr>
<tr>
<td>Operation of Power generating plant</td>
<td>High noise levels</td>
<td></td>
</tr>
<tr>
<td>Maintenance shop operations</td>
<td>Contact dermatitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skin irritation from exposure to grease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High noise levels</td>
<td></td>
</tr>
<tr>
<td>Backfilling of mined out areas</td>
<td>Fugitive/wind blown dust into eyes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inhalation of fugitive dust</td>
<td></td>
</tr>
</tbody>
</table>

The employee on the other hand has the obligation to:

- Cease work once a hazard is perceived.
- Report the hazard to the supervisor who will in company with the safety representative inspect the condition or circumstances and determine its validity.
- Obey the instruction to perform alternative work or cease work completely as directed by the supervisor.
- Return to the workstation or proceed once the hazard has been adequately dealt with or eliminated.

**9.2.2 Hazard Monitoring and Reporting**

Monitoring of hazards and work conditions will be the prime responsibility of the safety representative. He will be responsible for:

- Performing Safety Inspections on and off the operations site on a regular and programmed basis (at least once per month) for the detection of unsafe conditions or any potential hazards and for reporting of these hazards to management.
- Recording of all accidents minor and loss time accidents in a ledger (Table 5 shows the format to be used for recording industrial accidents).
- Remitting of reports of industrial accidents or fatalities to the Ministry of Mineral Resources when required.

**Table 5: Accident Report Format**

<table>
<thead>
<tr>
<th>Personal injury</th>
<th>Equipment damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of person involved</td>
<td>Dept/Area</td>
</tr>
<tr>
<td>Name of injury</td>
<td></td>
</tr>
<tr>
<td>Place of injury</td>
<td></td>
</tr>
<tr>
<td>Description of accident</td>
<td></td>
</tr>
<tr>
<td>Type of accident:</td>
<td>Loss Time</td>
</tr>
<tr>
<td>Foreman Signature</td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
</tr>
</tbody>
</table>

In addition to the abovementioned, all employees will be educated about their responsibility to participate in the creation of a healthy and safe environment by:

- Reporting unsafe and hazards conditions when detected
- Performing work in a safe manner by following the correct work procedure.

The present safety standards at SRL are commendable.

### 9.2.3 Training & Education of Employees

In confirmation with the objectives of safety program the following training programs will be implemented:

- Basic first aid programs (all employees).
- Advanced first aid programs (five employees)
- Accident investigation & reporting seminars (supervisory personnel & safety reps.)

The basic first aid program will be extended to all employees and would be geared to ensure that in the event of an accident or injury, someone with first aid knowledge will always be present to render initial assistance until further medical attention can be made available. Qualified personnel
will run seminars to impart the necessary theoretical as well as practical skills required. These courses will be scheduled depending on the employee strength and attrition.

The advanced first aid program will constitute an upgrading course from the basic first aid program in which selected employees including supervisors and the Safety representative will be exposed to advanced first aid knowledge and techniques which will enable them to participate in the recognition and the initial management of serious injuries and illnesses e.g. Fractures, Spinal Injuries, Malaria, Typhoid fever etc.

9.2.4 Industrial Accident Protocol
Serious injuries will be referred to a medical practitioner and medical institution. In the event of an industrial accident the following protocol will be followed:

- A basic first aider will be summoned if not already present at scene of accident.
- The basic first aider will render first aid care.
- The basic first aider will summon an advanced first aider who will administer further care if necessary and evaluate the necessity for removal to the first aid centre.
- The advanced first aider will summon the vehicle specifically identified for this purpose and supervise the removal of the injured to the first aid station.
- The employee’s immediate supervisor will be informed. He will:
  - Make contact with the identified medical Practitioner and Institution and inform them of the time of arrival of injured employee.
  - Complete the accident form and forward same along with the injured to the medical institution for completion by medical practitioner
  - Inform the Safety representative who will record the accident in the Industrial accident register.

A vehicle will be available at all times to respond to accidents. That vehicle will serve as an ambulance and will have the following equipment:

1. oxygen cylinder and gas masks resuscitation equipment.
2. a bed and accommodation for a first aid attendant to sit alongside the injured.
3. a flashing light attached to warn other road users.
4. communication equipment
9.2.5 Occupational Hygiene

The main environmental occupational hazards to which employees will be exposed during the operations phase of the mining entity are:

- Dust
- Noise
- Heat
- Fumes

**Dust Exposure**

The mining process may consist of excavation, transportation, washing and extraction of ore from the host material. Blasting and/or grinding of hard rock may also occur. As a consequence the production process may result in the dispersion of particulate matter into the air. Particulate matter dispersed into the air will be fugitive wind blown dust from the excavation and blasting and transportation ore on trucks. Development of respiratory disease due to inhalation of respirable dust has been shown to be in direct proportion to the total load of dust inhaled over a time period. This in turn is a function of:

a) The dust particle size  
b) The concentration of particles in the atmosphere.  
c) The duration of exposure

The concentration of dust particles in the air is not expected to be consistently above acceptable international standard since it is basically wind blown dust. The development of respiratory disease due to inhalation of dust is very low and will probably need exposure time far in excess of twenty five years to develop.

Notwithstanding the abovementioned, the following measures will be implemented in order to decrease or eliminate respirable dust inhalation and prevent any adverse effects on workers:

1. Provision of dust respirator with filters to employees exposed during the land reclamation, excavation and transportation phases of the operation.
2. Siting of living quarters a convenient distance from the operations site and on the leeward side of same.
3. Minimal denudation of vegetation around campsite.
4. Chest X-Rays of all employees once/yearly in order to detect any incipient pulmonary disease such as persistent coughing and/or shortness of breath.

These measures will assist to eliminate or reduce further the very low risk of the development of lung impregnated disease by employees exposed to dust. Workers in the excavation and transportation phases of the operations are also exposed to wind blown/fugitive dust being blown into the eyes and causing eye irritation and conjunctivitis. These employees will be provided with clear goggles and eye wash lotion will at all times be available for washing the affected eyes. Such measures were already in place at SRL.

**Noise**

The following measures will be implemented to address worker health and safety related to noise associated with the operation:

1. Control of noise levels at source via installation of silencers on exhaust system of poor generating plant.
2. Provision of hearing protection to employees exposed to high noise levels: ear muffs for employees in the maintenance shops and generating plant areas.
3. Earplugs for employees who operate heavy duty machines.
4. Siting of power generating plant and mining operations in location away from the living quarters of employees.
5. Warning signs in areas of high noise levels instructing employees to wear earmuffs or earplugs as required.
6. Hearing conservation program for employees exposed to noise. This will consist of
   a. Audiological examination before employment to establish baseline hearing capacity on initiation of employment.
   b. Yearly audiological testing of employees exposed to high noise levels.
   c. Acquisition of a portable sound level meter
   d. Measurement of sound levels in instances where it is suspected that deviations from the previous levels are occurring.

Blasting for ore produces particularly annoying sounds (noise).

**Heat**

Measures to decrease the effect of increased exposure to heat will include:
- Measurement of ambient temperature levels in vicinity of generating plant
- Provision of heat shields – coating of surface of generating plant by high reflective material such as polished aluminium

### 9.2.6 Fuel Oil Management

Fuel oil storage areas will be located well away from areas of fire hazard such as where welding operations will be performed. All fuel will be trucked to site by secure fuel trucks and transferred into fuel storage tanks that are founded on impervious surfaces. The fuel tanks will be housed within bermed enclosures. The enclosures will be sized to retain the contents of 110% of the tank in the event of tank failure. The volume of fuel stored onsite at any time during the construction and operation of the facility is not expected to exceed 1500 gallons. Discharge from fuel storage areas will be channelled to an oil-water separator prior to being discharged to surface water, if necessary.

Indiscriminate dumping of waste oil will not be permitted under any circumstances. Waste oil will be stored in suitable containers at designated points located around the Project site. All locations will be selected based on factors such as proximity to water, migration routes, fire risks and access. All waste oil storage area will be provided with secondary containment to deal effectively with any leakage or spillage. All liquid spent oils, fuels and lubricants will be collected by individual operators and returned in drums to oil companies.

### Spill Contingency Plan

A spill contingency plan will be developed to respond to any spills of oil. Some elements of the spill contingency plan are contained in the Emergency Response Plan detailed below. The contingency plan will be developed after the mine is permitted and operational since the NaCEF must concur with the layout to ensure the threats to environmental resources in the area are minimized based on their guidelines. Contingency plans will also address the likelihood of tailings spills. The Spill Contingency Plan will have the following distinct components:

- Hazard identification
- Vulnerability Analysis
- Risk Assessment and
- Response Action
The hazard identification will determine the following:

- Type of material stored and transported through and to the area.
- The points where material is stored in large quantities and the mode of movement of that material from one point to the next.
- The location of response equipment and personnel trained to use the equipment.

The vulnerability analysis will identify all resources and sensitive receptors that can be impacted during any spills of stored materials. This analysis will not consider any communities since none will be expected within close proximity of the site. This information will be used to identify specific locations, waterways, plants, etc. that are likely to be susceptible to any spills. The risk assessment will then compare the hazard and vulnerability of each media likely to be impacted by any spills. The best method for controlled the spill will be developed after the risk assessment has been completed.

Response actions would be developed to address the risks identified by the risk assessment. The response action will consist of the following:

- Notification of NEPB, NaCEF and MMR
- Defining the size, position and content of the spill, its direction and speed of movement and its likelihood of affecting sensitive receptors.
- Ensuring that all personnel responding to the spill can do so safely
- Stopping the flow of the spilled material and preventing any oil spilled from igniting
- Containing the spilled material to a limited area
- Removal of all the spilled material
- Disposal of the spilled material in a manner acceptable to the NEPB and NaCEF.

9.2.7 Traffic Management

Mining agencies shall make good any damages to public road used to access the mine site provided the damage is attributable to its use of the roadway. No restrictions will be placed on traffic flowing through the area that uses the access road constructed to the mine site. Restrictions will be imposed on traffic flows into active mining areas. Project vehicles only will be permitted into mining areas. Signs will be posted along the access road indicating to road users that companies will not accept liability for accidents on the access road and also indicating that road
users are responsible for providing their own insurance cover for accidents on the access road. [This operates now in most areas (KHL, MTC, CGML, SRL)].

9.2.8 Catchment Area Management
A catchment management plan will help to ensure the operation lifetime of the project through the control of siltation and through the reduction of erosion. A catchment management plan will be developed in cooperation with the responsible national statutory authority for management of the catchment area. (NaCEF). This plan will take cognizance of the regional development plan, including plans of the NaCEF and Forestry Division and the MMR and will include plans for areas downstream of the site. The objective of the catchment management plan will be to maintain as closely as possible the original pre-project hydrological runoff characteristics of the project area. The catchment management plan will address the protection and conservation of the local natural resources and contain measures for safeguarding water for future development. The plan will also ensure that water quality and security of water supply is provided to transient people who use the waters of the streams in the area.

All forest cover outside of the area cleared for the mine site operation will be maintained to control run-off, to limit erosion, to minimize sediment and nutrient supplies, to maximize infiltration and to maintain pre-project rates of evapotranspiration. The adoption of sound catchment management practices for the area will reduce the inflow of debris and other material from both point and diffuse sources into the streams in the area thereby ensuring the maintenance of water quality downstream of the project.

The developer will request that the responsible national statutory authority develop a land use plan for the area to promote sound catchment area practices and will integrate that land use plan with catchment management plan. Since the Developer will have limited legal authority, the developer will assist in controlling and carefully managing land development in the area through advising the NaCEF on potential sustainable development options in the area and on particularly damaging activities, on actions to avoid encroachment into especially sensitive areas of the upper catchment, on unsuitable activities currently practiced in the catchment area, including reporting particular incidents of poor practice once the project is operational and on the optimization of access into and within the project catchment area. The threats to sensitive Biodiversity areas such as Kangari Hills shall be evaluated.
The developer will provide the NEPB and NaCEF with all information on logging operations within the Project Area. The responsible national statutory authority will undertake to ensure that a formal Environmental Impact Assessment is conducted where any new forestry exploitation project or mining operation is proposed upstream of the project. No concessions are to be sited in the area to be mined. If the company determines that uncontrolled logging is occurring in the area covered by the EIA report, both the NEPB and NaCEF will be informed.

The developer will report to the NaCEF and NEPB instances of clearing for small scale agriculture along access routes and within forested areas that could prove detrimental to the environment if left uncontrolled. The developer will develop in consultation with the responsible national statutory authority, methods to curb or mitigate these problems.

9.2.9 Erosion and Sediment Control Plan

Mining will be undertaken with long-term erosion and sediment control as a primary consideration. Mining operations conducted during the rainy season will be clearly demonstrated, to the satisfaction of the NaCEF, that at no stage of the operations will there be any substantial risk of increased sediment discharge from the site. When mining occurs in the rainy season, the smallest practicable area of erodible land will be exposed during mining operations and the time of exposure shall be minimized. Natural features, including vegetation, terrain, watercourses and similar resources shall be preserved wherever possible. Limits of mining shall be clearly defined and marked to prevent damage by mining equipment.

Permanent vegetation and structures for erosion and sediment control shall be installed as soon as possible. Adequate provision shall be made for long-term maintenance of permanent erosion and sediment control structures and vegetation. No topsoil shall be removed from the area outside the mining limits unless approved by the Land and Surveys department. Topsoil overburden shall be stockpiled and redistributed to provide a suitable base for seeding and planting. Runoff from the stockpiled area shall be controlled to prevent erosion and resultant sedimentation of receiving waters. Runoff shall not be discharged from the site in quantities or at velocities substantially above those which occurred before grading.

Waste rock and soil from the mining and mineral processing operations will be disposed in spoil piles or tailings ponds located in the mined out areas. No spoil pile will be sited within 100m of
any waterways. All spoil piles would be surrounded by a soil containment berm to preclude the easy flow of surface runoff and sediment from stockpiles. The containment berms would be constructed of soil pervious enough to enable the passage of surface runoff water while trapping sediment contained in that runoff. The height and slope of each spoil pile would be such that foundation and slope failure do not occur.

Stormwater runoff and water from the mining operations would both be channelled to temporary sedimentation ponds. Those ponds would be designed to provide a detention time of 48 hours. Discharge from the sedimentation pond would be via a spillway and would be channelled through a sediment control structure constructed of a matrix of stone, sand and grass to remove sediment prior to discharge to surface water bodies in the site area. Here ponds could be constructed as in Bauxite and Rutile Mines.

Mining would proceed in such a manner as to minimize disturbance to streams in the area. In instances where this cannot be avoided, sediment control structures and practices would be used to prevent the inflow of sediment to surface water. These control practices would include sediment traps or screens to control run-off and sedimentation. Surface runoff from maintenance workshops and other vehicle service areas would be channelled to an oil/water separator. All water from the oil/water separators would be skimmed prior to discharge. Sumps would be excavated on the floor of the mine and all groundwater flow and precipitation would be channelled into those. Measures would be implemented to prevent surface runoff from entering the open pit and from adding to the volume of groundwater inflow and direct precipitation.

Erosion control operations would be performed under favourable weather conditions. When excessive moisture or other unsatisfactory conditions prevail, the work would be stopped. Erosion control materials shall not be applied in adverse weather conditions which could affect their performance. Erosion control will be accomplished by using one of the following:

- Erosion control blankets
- Geotextile fabric
- Seeding
Before placing the erosion control blankets the subgrade will be graded smooth with no depressions or void areas and would be free from obstructions, such as tree roots, projecting stones or other foreign matter. No vehicles will be permitted directly on the blankets. Before geotextile fabric is placed the subgrade shall be compacted and graded level with no depressions, voids, soft or uncompacted areas and shall be free from obstructions, such as tree roots, projecting stones or other foreign matter. Seeding shall then be applied to the areas.

9.3 Socioeconomic Impact Mitigation and Management
Managing socio-economic impacts involves minimizing negative effects and enhancing positive benefits.

Land Use
Loss of land and property as well as displacement and relocation will be mitigated through resettlement planning. The Ministry of Agriculture, Forestry and Food Security (MAFFS) through the Lands and Survey Department, will be requested to identify lands for individuals or households that can be provided for farming. Relocation shall be phased to ensure that crops currently being cultivated are not lost and that new lands are cultivated prior to the lands being converted to mining purposes. The companies will consult with the department of Lands Surveys and the newly created Lands Commission to demarcate communities and traditional lands to ensure there is minimum impacts on these areas.

The World Bank guidelines would be used to address the issues as follows:

- Both economic (eg. Farm fields) and physical (eg. Homes) displacements will be addressed when resettlement planning is needed;
- If the source of any individual’s livelihood is affected by more than 10 percent (eg. More than 10% of their farm fields), the replacement of that livelihoods and not simple cash compensation will be required;
- Affected people will be left no worse off and preferably better off by the project;
- Loss will be compensated at full replacement cost plus 50% and informal occupation rights will be taken into consideration;
- Resettlement will be carried out in a consultative manner, particularly when it comes to the selection of resettlement sites, with the affected people, the host
communities and local authorities. The objective is to reach broad community consensus.

- The RAP is tied to the ESIA process and provisions will be made for long-term monitoring of affected people and their livelihood.

Participation of vulnerable and marginalized groups in consultation and negotiations shall be encouraged.

**Employment and Labour**

Measures to manage the potential effects of employment and labour will be put in place through a combination of public consultations, policies and planning. These measures will include:

- A hiring policy giving preference for employment of local people with the best qualifications for a given position. In the case of equal qualifications among many candidates, preference will be given to GOSL citizens and local residents in the project areas;
- A procurement policy that gives preference to locally produced goods and services;
- Accommodation of non-local workers in a dedicated construction camp with independent water and waste treatment facilities;
- Control of spontaneous settlements in the project vicinity;
- Providing transport facilities for construction and other workers;
- A code of conduct for mine and project workers that establishes rules for interaction between the project, its workers and local community;
- Developing a workforce HIV/AIDS management and awareness program; and
- Voluntary and free-of-charge HIV testing and counselling for project workers.

Each mining agency shall have a Community Affairs Department or Community Relations Department. The companies will after consultations with the surrounding communities establish a mechanism to respond to concerns that arises in the surrounding community, and that are related to operation of mine site.

The potential negative impacts of labour will be reduced through compliance with national and international labour standards, and through on going consultations and monitoring.
Each company will be committed to a policy of providing training to employees. Temporarily hired local workers will obtain on-the-job training in aspects such as safety and other technical topics. This training will enhance the capacity of temporary workers to secure better jobs in the future.

**Community Safety**

Community safety can be enhanced through the implementation of safety measures such as upgrades of roads, speed limits, drivers education, public education and scheduled maintenance of vehicles.

**Health and Well-Being**

Sound and sustainable project development is build around human health and the social well-being of locally affected communities.

Mining project activities should include the construction and upgrades of certain facilities including roads, power, water, sanitation, education and health posts.

The risks of increasing incidences of diseases including Sexually Transmitted Diseases such as HIV/AIDS will be addressed through rigorous prevention, awareness and monitoring programs. Several measures and policies will be employed to reduce potential negative impacts on community well-being including:

- Implementation of a workers code of conduct;
- Accommodation of non-local workers in a dedicated construction camp;
- Establishment of a fair compensation mechanism; and
- Transport and publicly – disclosed employability and hiring policies.

**9.3.1 Cultural and Archaeological Resources**

Consideration would be given to both natural and cultural landscapes in the planning and implementation of the project. In addition relics associated with the former operation of the mine and other elements which may be of special importance for the history of the area will be set aside from the operations and will be preserved. Any chance finds will be reported to the appropriate authorities (Ministry of Tourism and Culture)
9.4 Mitigation Cost of Reclamation

The mitigation costs for environmental management will depend on many factors including the following:

- The type of ore mined;
- The type of technology employed;
- The scale and extent of operations; and
- The life of the mine operations (years spent mining)

Apart from estimates obtained for the AMS for reclamation of hectare of mined out area (USD 3000-6000), for Large Scale (LSM) and Small-scale mechanized (SSM) mining operations this information is not available.

Estimates for South-east Asia and the Caribbean for LSM and SSM operation for companies with their own machinery amount to USD 500 – USD 600 per ha (Mcmahon et.al, 2000).

The Table 6 presented below is a summary of annual estimates for the mitigation measures in Days per year. It is compiled from records of similar operations elsewhere.

Table 6: Summary of Mitigation Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Equipment</th>
<th>Days/ year</th>
<th>Unit Cost $US</th>
<th>Equipment Costs</th>
<th>Man-days/ year</th>
<th>Unit cost ($US)</th>
<th>Manpower Cost</th>
<th>Total Mitigation Cost $US</th>
<th>per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrestrial Resources</td>
<td>Nil</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>96</td>
<td>20.00</td>
<td>1920.00</td>
<td>1920.00</td>
<td></td>
</tr>
<tr>
<td>Openpit Management</td>
<td>Pump</td>
<td>60</td>
<td>200.00</td>
<td>12000.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12000.00</td>
<td></td>
</tr>
<tr>
<td>Overburden &amp; Dust Management</td>
<td>Water Sprayer</td>
<td>52</td>
<td>100.00</td>
<td>5200.00</td>
<td>52</td>
<td>20.00</td>
<td>1040.00</td>
<td>6240.00</td>
<td></td>
</tr>
<tr>
<td>Water Management</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48</td>
<td>20.00</td>
<td>960.00</td>
<td>960.00</td>
<td></td>
</tr>
<tr>
<td>Tailing Management</td>
<td>Pump</td>
<td>300</td>
<td>1500.00</td>
<td>6000.00</td>
<td>300</td>
<td>10.00</td>
<td>3000.00</td>
<td>23000.00</td>
<td></td>
</tr>
<tr>
<td>Waste Management</td>
<td>Contract truck</td>
<td>4</td>
<td>1500.00</td>
<td>6000.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6000.00</td>
<td></td>
</tr>
<tr>
<td>Hazwaste Management</td>
<td>Contract truck</td>
<td>12</td>
<td>1500.00</td>
<td>15000.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>33000.00</td>
<td></td>
</tr>
<tr>
<td>Socioeconomic Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>250</td>
<td>30.00</td>
<td>7500.00</td>
<td>7500.00</td>
<td></td>
</tr>
<tr>
<td>Land Reclamation</td>
<td>Trucks</td>
<td>30</td>
<td>2500.00</td>
<td>75000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>225000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excavator</td>
<td>30</td>
<td>5000.00</td>
<td>150000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

YEARLY MANAGEMENT & MITIGATION COSTS 315,620
The Environmental and Social Management Plan (ESMP) elaborated in Section 9 has been summarized in Table 7.

### Table 7: Environmental and Social Management Plan (ESMP) for MTAP

<table>
<thead>
<tr>
<th>Activities</th>
<th>Potential Impacts</th>
<th>Mitigation</th>
<th>Implementation Agency</th>
<th>Monitoring Agency</th>
<th>Annual cost per Mining Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction &amp; Operations</td>
<td></td>
<td>• Erosion control and water management as described below.</td>
<td>Consultant Architect (CA)</td>
<td>MMR, Mining Company, NEPB, NaCEF, NGOs</td>
<td>• Mitigation Cost (Contractor)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reclamation planning to restore sustainable biological communities or agriculture as feasible.</td>
<td>Contractor Project</td>
<td>Mining Company, NGOs</td>
<td>• Monitoring Cost (USD 20,000) to Agency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Salvage of topsoils that may be useful for reclamation.</td>
<td>Mining Company</td>
<td>Mining Company, NGOs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Avoidance of large-scale soil compaction.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Control of erosion with vegetative ground cover and other temporary measures.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Adherence to an erosion and sediment control plan.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spill containment and clean-up practices.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Soil restoration as needed through mulching and fertilization.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reclamation and monitoring of reclaimed land to ensure acceptable productivity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure</td>
<td>Changes in the landscape and underlying geomorphology.</td>
<td>• Changes in soil quality/productivity.</td>
<td>Consultant Architect (CA)</td>
<td>MMR, Mining Company, NEPB, NaCEF, NGOs</td>
<td>• Mitigation Cost (Contractor)</td>
</tr>
<tr>
<td>Water Resources</td>
<td>Surface and groundwater volume changes due to changes in flow regimes, catchments, groundwater drawdown.</td>
<td>• Minimize project footprint and diversion of streams; develop tailings facility in stages.</td>
<td>Contractor Project</td>
<td>Mining Company, NGOs</td>
<td>• Monitoring Cost (USD 20,000) to Agency.</td>
</tr>
<tr>
<td></td>
<td>Surface and groundwater quality changes due to metal leaching and transport, release from containment ponds, seepage from tailings, effluent releases, treated sewage releases or accidental spills</td>
<td>• Implementation of runoff and sediment control procedures during site clearing and preparation to minimize the migration of sediments to waterbodies.</td>
<td>Mining Company</td>
<td>Mining Company, NGOs</td>
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<td></td>
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<td>• Use of runoff from waste rock and ore storage facilities in the processing plant.</td>
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<td>• Treatment of storm water runoff from the plant and other facilities prior to release.</td>
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<td>Activities</td>
<td>Potential Impacts</td>
<td>Mitigation</td>
<td>Implementation Agency</td>
<td>Monitoring Agency</td>
<td>Annual cost per Mining Agency</td>
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| **Closure** |                  | • Lined tailings facility and return water dam.  
  • Secondary containment around surface tanks and storage areas containing potential contaminants.  
  • Treatment of effluent, if needed.  
  • Comprehensive environmental action plan to include hazardous materials handling requirements and spill response capability.  
  • Emergency measures for prevention or cleanup of containment pond releases.  
  • Restoration, as much as possible, of native plant communities at closure to control erosion.  
  • Removal of potential contaminants and contaminated infrastructure at closure.  
  • Reduction on water supplies used by people.  
  • The groundwater process supply/pit dewatering system will be designed to minimize drawdown impacts on local wells/springs.  
  • Basic groundwater supply systems will be provided to villages where spring water sources are affected. | • Consultant Architect (CA)  
 • Contractor Project  
 • Mining Company | MMR Mining Company, NEPB, NaCEF, NGOs, Communities | Mitigation Cost (Contractor)  
 Monitoring Cost (USD 20,000) to Agency. |
| **Construction and Operations** | **Air, Noise, Traffic, Natural Risks**  
  • Increase in dust, sulphur dioxide and nitrous oxide levels due to mine fleet exhaust, emissions from facilities and fugitive dust.  
  • Increase in greenhouse gas emissions.  
  • Increase in noise and vibration at the site and along access routes.  
  • Increase in traffic congestion and traffic accident rate. | • Dust control measures including wet suppression, wind breaks, treatment of surface roads and prompt revegetation of selected exposed areas.  
  • Maintenance of air quality levels within applicable guidelines at receptor locations.  
  • Use of vehicles equipped with appropriate noise limiting devices.  
  • Use of continuous miner in place of ripper, truck, shovel and crusher combination.  
  • Maintenance of noise and vibration levels within applicable guidelines at receptor locations.  
  • Roads will be upgraded and widened to accommodate traffic – separate pathways constructed along some roads for pedestrian and bicycle traffic.  
  • A bypass road will be constructed around Fungurume.  
  • Speed limits, driver education, public education, vehicle scheduling and vehicle maintenance. | • Use of vehicles equipped with appropriate noise limiting devices.  
 • Use of continuous miner in place of ripper, truck, shovel and crusher combination.  
 • Maintenance of noise and vibration levels within applicable guidelines at receptor locations.  
 • Roads will be upgraded and widened to accommodate traffic – separate pathways constructed along some roads for pedestrian and bicycle traffic.  
 • A bypass road will be constructed around Fungurume.  
 • Speed limits, driver education, public education, vehicle scheduling and vehicle maintenance. | CA, Mining Agency  
 MMR Mining Agency  
 NaCEF, NEPB, NGOs, Local Communities | Agency Operations Cost  
 Operations cost (No extra cost) |
<table>
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<tr>
<th>Activities</th>
<th>Potential Impacts</th>
<th>Mitigation</th>
<th>Implementation Agency</th>
<th>Monitoring Agency</th>
<th>Annual cost per Mining Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operations</strong></td>
<td>• Increased risk of project or public facilities being adversely affected from</td>
<td>• Assessment of natural risks.</td>
<td>• Consultant Architect (CA)</td>
<td>MMR, Mining Company, NEPB, NaCEF, NGOs Communities.</td>
<td>•Mitigation Cost (Contractor)</td>
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<td></td>
<td>extreme natural events, including seismic activity and high rainfall, and</td>
<td>• Project design based on international standards to manage and protect</td>
<td>• Contractor Project</td>
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<td>Monitoring Cost (USD 20,000)</td>
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<td></td>
<td>resulting effects on the public and environment. Examples include exceedance of</td>
<td>facilities and workers against extreme events.</td>
<td>• Mining Company</td>
<td></td>
<td>to Agency.</td>
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<td></td>
<td>water containment capacity or slope failures.</td>
<td>• Build in conservative design features in tailings facility including</td>
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<td>adequate capacity; emergency planning to mitigate effects if a failure</td>
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<td>occurs.</td>
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<td></td>
<td>• Implement risk management program including aspects such as spill</td>
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<td>clean-up and protection of the general public.</td>
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<td></td>
<td></td>
<td>• Dewatering and consolidation of tailings to reduce long-term hazards.</td>
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<td></td>
<td>• Use of vegetation screening, dust management, colour management,</td>
<td>CA, Mining Agency</td>
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<td>Operations Cost Monitoring</td>
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<td></td>
<td></td>
<td>and limiting light pollution.</td>
<td></td>
<td></td>
<td>(USD 10,000)</td>
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<td></td>
<td></td>
<td>• Reclamation for establishment of native vegetation cover.</td>
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<tr>
<td><strong>Operations and Reclamation</strong></td>
<td><strong>Visual Aesthetics</strong></td>
<td>• Use of vegetation screening, dust management, colour management,</td>
<td>CA, Mining Agency</td>
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<td></td>
<td>• Decline in visual aesthetics due to construction of the mines, plant and</td>
<td>and limiting light pollution.</td>
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<td></td>
<td>associated infrastructure on visual aesthetics.</td>
<td>• Reclamation for establishment of native vegetation cover.</td>
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<td>• Use of vegetation screening, dust management, colour management,</td>
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<td>and limiting light pollution.</td>
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<td></td>
<td></td>
<td>• Reclamation for establishment of native vegetation cover.</td>
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<tr>
<td><strong>Construction, Operations and Closure</strong></td>
<td><strong>Biological Environment</strong></td>
<td>• Modification/minimization of footprint.</td>
<td>CA, Mining Agency, Contractors, NGOs</td>
<td>MMR, Mining Agency, NaCEF, NEPB, Communities, NGOs</td>
<td>Monitoring Cost only (USD 30,000)</td>
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<td></td>
<td>Biodiversity, Flora, Fauna, Fish</td>
<td>• Establishment of off-site natural areas to compensate for disturbed</td>
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<td></td>
<td>• Direct loss of biodiversity including rare habitats and local endemic species.</td>
<td>flora communities.</td>
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<td></td>
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<td>• Relocation of critical habitat.</td>
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<td></td>
<td>• Direct translocation of rare plants and critical habitat to off-site</td>
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<td>areas.</td>
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<td></td>
<td></td>
<td>• Restoration of vegetation.</td>
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<td>• Reclamation of terrestrial and aquatic habitats, as much as possible.</td>
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<td>• Dust control measures as described above.</td>
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<td>• Agroforestry program for local residents to reduce dependence on</td>
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<td></td>
<td></td>
<td>natural habitats.</td>
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<td>• Employees and subcontractors not permitted to hunt, fish or trap on</td>
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<td>project sites. Locations.</td>
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<td></td>
<td>• Indirect loss of habitat quality due to dust, air quality, and human</td>
<td>• Compact project design to reduce edge.</td>
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<td></td>
<td>population change.</td>
<td>• Use of existing disturbed areas for temporary accommodation areas to</td>
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<td>avoid new fragmentation.</td>
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<td>• Reclamation to connect fragmented habitats.</td>
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<td>• Reduction in connectivity of habitat affecting movements of wildlife species.</td>
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<td>Activities</td>
<td>Potential Impacts</td>
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<td>Implementation Agency</td>
<td>Monitoring Agency</td>
<td>Annual cost per Mining Agency</td>
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<tr>
<td>Operations</td>
<td>• Introduction of exotic species (terrestrial and aquatic)</td>
<td>• Monitoring and control of exotic species.</td>
<td>MMR</td>
<td>Mining Company, Mining Company, NGOs, Communities</td>
<td>Mitigation Cost (Contractor) Monitoring Cost (USD 20,000) to Agency.</td>
</tr>
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<td></td>
<td>• Changes in water flows or quality from the development during operations may affect adjacent plant communities.</td>
<td>• Minimize water-related effects to vegetation through maintenance of flows in the dry season, if needed, and treatment of effluent. Restore equivalent amount of vegetation.</td>
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<td></td>
<td>• Destruction of natural habitats in downstream areas (terrestrial and aquatic) in the case of a dam failure.</td>
<td>• Build in conservative design features in tailings dam (proper safety factors). • Emergency planning to mitigate effects if a failure occurs. • Major hazards mitigation as above.</td>
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<td></td>
<td>• Water quality and volume changes in streams and wetlands, affecting fish and aquatic fauna.</td>
<td>• Mitigate effects through site design and water management plan (see water, above). • Mitigation as needed to address water quality issues, including lining of tailings storage facility and recycling of all waste rock, ore stockpile and plant site runoff (see water above).</td>
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<td>• Fish habitat degradation as a result of riparian deforestation and establishment of ponds.</td>
<td>• Water quality protection through runoff and sediment control. • Prompt revegetation of areas disturbed along watercourses.</td>
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<td></td>
<td>• Degradation of protected areas.</td>
<td>• Location of project away from protected areas.</td>
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<tr>
<td>Construction Operations</td>
<td>Social Environment Public Health and Safety</td>
<td>• HIV/AIDS and transmissible disease programming, including public education. • Prompt revegetation of areas disturbed along watercourses.</td>
<td>GOSL, Mining Agency, NGO, Local Government, Local Communities</td>
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<td></td>
<td>• Increase in transmission of HIV/AIDS and other transmission diseases.</td>
<td>• Co-operative forest management program.</td>
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<td>• Increased public safety risks due to the presence of large imported workforces.</td>
<td>• Compensation and resettlement planning as appropriate.</td>
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<td></td>
<td>Livelihoods</td>
<td>• Comprehensive resettlement if appropriate, and compensation program, following detailed consultation with local communities: assistance to develop agriculture in host areas. • Provision of a combination of compensation, replacement land, title, payment of all moving costs, and temporary income during the re-establishment phase.</td>
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<td>• Loss or reduced access to natural resources.</td>
<td>• Provision of a combination of compensation, replacement land, title, payment of all moving costs, and temporary income during the re-establishment phase.</td>
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<td>• Higher density of people using the same agricultural and grazing resources.</td>
<td>• Provision of a combination of compensation, replacement land, title, payment of all moving costs, and temporary income during the re-establishment phase.</td>
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<td>• Resettlement and loss of agricultural land, fruit trees and perennial crops.</td>
<td>• Provision of a combination of compensation, replacement land, title, payment of all moving costs, and temporary income during the re-establishment phase.</td>
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<td>• Disruption to subsistence livelihood as people leave their land and try to re-establish themselves on new land.</td>
<td>• Provision of a combination of compensation, replacement land, title, payment of all moving costs, and temporary income during the re-establishment phase.</td>
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<td>Activities</td>
<td>Potential Impacts</td>
<td>Mitigation</td>
<td>Implementation Agency</td>
<td>Monitoring Agency</td>
<td>Annual cost per Mining Agency</td>
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<tr>
<td><strong>Construction Operation</strong></td>
<td><strong>Community Infrastructure</strong>&lt;br&gt;• Loss of immovable assets and community infrastructure.&lt;br&gt;• Increased pressure on existing social and physical infrastructure.&lt;br&gt;• Loss/alteration of historic resources and places of cultural importance.&lt;br&gt;• Disruption of social networks and support systems.&lt;br&gt;• Migration (temporary workers and infrastructure needs).</td>
<td>• Replacement of community infrastructure, especially around areas of direct impact and in host communities.&lt;br&gt;• Cooperative community development and infrastructure planning.&lt;br&gt;• Avoidance, excavation and preservation of historic resources, as needed.&lt;br&gt;• Resettlement planning, if appropriate, to keep extended families and sub-communities together.&lt;br&gt;• Planning for temporary workforce.</td>
<td>Consultant Architect (CA) Contractor Project Mining Company GOSL</td>
<td>MMR Mining Company, NEPB, NaCEF, NGOs Communities.</td>
<td>•Mitigation Cost (Contractor) Monitoring Cost (USD 50,000) to Agency.</td>
</tr>
<tr>
<td><strong>Closure</strong></td>
<td><strong>Economic/Income Effects</strong>&lt;br&gt;• Increase in inflation.&lt;br&gt;• Increase in income effects (increased inequality, competition for jobs, increased demands on disposable income).&lt;br&gt;• Loss of incomes at closure.</td>
<td>• Enhance community support systems/development.&lt;br&gt;• Economic and social programming; proactive local employment and procurement; opportunities for training and employment with the project and assistance with business development.&lt;br&gt;• Cooperative efforts with stakeholders during operations to plan for closure; reclamation planning designed to meet the needs of local stakeholders.</td>
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<td><strong>Cultural and Social Change</strong>&lt;br&gt;• Loss of traditional rights to the land, which are intimately related to history on the land.&lt;br&gt;• Social conflict in host communities.&lt;br&gt;• Cultural change (dissimilarity in age, gender, or ethnic composition).</td>
<td>• Compensation for land and resource use; return to title holder at closure.&lt;br&gt;• Dispute resolution mechanisms; community policing.&lt;br&gt;• Comprehensive workforce management program; cultural awareness program for expatriate staff, community initiatives.</td>
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<td><strong>Cultural Resources</strong>&lt;br&gt;• Loss of cultural heritage sites.</td>
<td>• Sites of importance may be impacted by the project.&lt;br&gt;• Indirect impacts may be mitigated through educating nonlocals of the local cultural practices.</td>
<td>GOSL, Mining Agency, NGO Local Government Local Communities</td>
<td>GOSL, NGOs Local Government NaCEF, NEPB</td>
<td>Operations Cost Monitoring (USD 30,000)</td>
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</tbody>
</table>
10.0 INSTITUTIONAL RESPONSIBILITIES FOR THE MANAGEMENT PLAN

The responsibilities for the implementation of the management plan must lie primarily with major stakeholders including the local communities.

An examination and review of the legislative framework reveals that the institutions responsible for environmental management are known. (See Section 6). Their roles and responsibilities have also been defined. Some EIAs also contain detailed descriptions of the roles and responsibilities of these institutions. In many instances however the capacities of the institutions to carry out their responsibilities is not given due attention. The responsibilities of the mining companies or Agencies in environmental management are also merely mentioned.

This ESIA identifies the major stakeholder groups and defines their roles.

These include:
- Mining Companies and Agencies
- National Commission for the Environment and Forestry (NaCEF)
- National Environmental Protection Board (NEPB)
- Ministry of Lands, Housing Country Planning and the Environment (MLHCPE)
- Ministry of Agriculture, Forestry and Food Security (MAFFS)
- Ministry of Mineral Resources (MMR)
- Higher Institutions of learning
- Local District Councils
- Chiefdom Committees
- Local Committees
- Local and International NGOs
- Private Sector
- Civil Society Groups
- Consultants
- Donor communities including World Bank.

Mining Companies

Under this ESIA every mining agency will ensure that in accordance with the respective EIAs Environmental Department is established consisting of professionals qualified in the following disciplines:
- Mining Engineering
- Civil Engineering
- Environmental Sciences

The environmental Team will be able to ensure that the facilities conform to the design requirements and standards. Other Tasks will consist of the following:
- Monitoring of Solid and Septic waste disposal
- Installation and Sampling of Groundwater monitoring wells
- Sampling of surface water
- Management of Weather station Data
- Inspection of Fuel Management Facilities
- Coordination of the company’s health and safety program.

Many companies whose operations may extend for periods of more than 10 years will have a fully equipped laboratory facility not only for products testing but also for water quality monitoring (surface water, ground water, tailings ponds) and for samples to be analyzed for the following:
- Arsenic - Nitrogen
- Cadmium - Lead
- Chromium - Mercury
- Copper - Nockel
- Iron (Total) - Zinc
- Heavy metals - pH
- Total Dissolved - BOD₅
- Oil and grease - Temperature

Groundwater will be monitored for the following:
- Arsenic
- Chromium
- Copper
- Iron
- Lead
- Mercury
- Nitrates
- Volatile Organics
- Total petroleum

At the moment only SRL has the capacity for such analysis. Private sector with such capacities will be contracted to help if the company lacks capacity. Records of environmental monitoring will be provided on demand.

Each mining agency/company will have a Community Affairs Department to attend to the socio-economic concerns of the community.

The community expectations and aspirations shall be assessed. Compensations and relocation matters will be discussed in accordance with the provisions of the Resettlement Policy Framework (RPF) formulated for the purpose.

Provision of Social Services and the administration of Community Development Funds and Foundations shall form part of the deliberations.

Training skills for employment and the sustainability after mine closure shall be promoted.

**NaCEF, MLHCPE, MAFFS**

The functions of the Department of the Environment (DOE) of the MLHCPE and the Forestry Division of the MAFFS had been taken over by the National Commission of the Environment and Forestry (NaCEF)

NaCEF’s mandate include:

(i) facilitate coordination and cooperation amongst government Ministries Departments and Agencies at the national and local levels in all areas relating to environmental protection;

(ii) receiving national and sectorial environmental policies and EIAs; and

(iii) promoting goals and strategies monitoring, setting of standards, education and training, coordination of national policies and the provision of environmental data and information.
Technically the existing Environmental and Forestry administrative structures of the MLHCPE and the MAFFS have been taken over by NaCEF.

NaCEF is under funded, under resourced and grossly understaffed. The Department of the Environment (DOE) for example has no vehicles, no laboratories and no equipment. NaCEF cannot carry out environmental audits or enforce compliance efficiently. This agencies needs to be strengthened. In 2007, the GOSL allocated only USD 326,000 to NaCEF.

In 2007 two line ministries (MAFFS and MLHCPE) had been re-established and therefore technically the NEPB restored. It is a matter of urgency that the statutory position of NaCEF clarified and strengthened. (See Section 6)

**Ministry of Mineral Resources (MMR)**

The MMR has as its mission to “Develop policies and programmes for the systematic and economic exploitation of mineral resources as well as formulate appropriate regulations for the mining industry and related activities to ensure that the nation derives maximum benefit from the mineral resources”.

Among the major responsibilities of the MMR are the following:

- Mineral Policy formulations;
- Mining negotiations;
- Mining concessions;
- Mining and mineral exploration;
- Geological surveys;
- Inspection of mining machines and sites;
- Relations with International mining and geological organisations and agencies; and
- Collaboration with relevant national and international organisations.

There MMR like other line agencies is underfunded and understaffed. Mining engineers and Geologists prefer to work with the private sector where the salaries are better.

The needs to be better coordination between other line ministries (MAFFS, MLHCPE) and the MMR.
**Higher Institution of Learning**
The Higher Institutions of Learning such as University of Sierra Leone (USL) and University of Njala must introduce appropriate courses inorder to strength the resource base for environmental management.

In the Mineral Resources sector, more Geologists and Mining Engineers must be trained inorder to strengthen the MMR and the companies (USL shall be introducing Mining Engineering degree in 2009).

**Local Government Structure**
Local councils have Environmental Committees which are involved in many environmental works. These committees often lack the technical capacity to carryout their mandate. Training and employment of qualified staff are necessary to enhance the participation of these committees in environmental management.

Many chiefdoms have Mining Committees that are concern with environmental management as one of their activities (Lower Bambara Mining Committee). The chiefdom committees are however mostly concern with the Artisanal mining sector.

**NGOs**
The NGOs (Local and International) will be encouraged to acquire the capability of carrying out independent environmental audits.

Active NGOs (Local and International) that have been involved in Environmental Monitoring and Advocacy include, Environmental Foundation for Africa (EFA), Environmental Security and Sustainability (FESS), Orient, Peace Diamond Alliance, Royal Society for the Protection of Birds, (RSBP), Conservation Society of Sierra Leone (CSSL) and Network Movement for Justice and Development (NMJD).

Usually these NGOs operate using funds from voluntary donations from individuals and private foundations. Mining companies through the GOSL should be made to undertake part of the financial responsibility for environmental Monitoring carried out by the NGOs and GOSL.
They must also be allowed to participate in Socio-economic work to sensitize and raise the awareness of communities concerning their rights in compensation matters, social services and Environmental concerns.

NGOs will also be actively involved in reclamation work especially in the artisanal mining sector.

**Contractors**
Contractors at the level of construction, operation and closure will be urged to implement Environmental Mitigative Measures as is prescribed under this ESIA.

**Consultants**
Consultants will be required to carry out Environmental Assessments, and develop site specific EIAs and site specific EMP’s. Consultants will also supervise the environmental Mitigation measures to be carried out by contractors.

**World Bank and Donors**
The World Bank and other donor agencies shall in collaboration with NEPB and NaCEF review draft ESIA’s and EIAs and monitor the overall implementation of this ESIA, including the review of mineral environmental reports provided by the MMR.

**11. MONITORING PLAN**
Based on the multifaceted nature of the MTAP, monitoring will be done by as many stakeholder groups as possible based on the institutional responsibilities described in the section 10.

The proposed team will consist primarily of but shall not be limited to the following:
- Environmental and Safety Department of the mining Agency/company;
- Community Development Department or Human Resources Division of the company;
- NaCEF (DOE of MLHCPE);
- Ministry of Mineral Resources MMR;
- Environmental Committee of the District or City Council;
- Civil Society and Community Based Organizations (CBO);
- Project Affected Persons (PAP)
- Oversight committee of Parliament;
- Local and International NGOs; and
- Advocacy groups

It is expected that monitoring will be conducted during all phases of each project venture – pre-construction, start-up, operations, closures and post-closure. The program is expected to play a pivotal role in ensuring that the trends for specific parameters are tracked and it will provide information on compliance with legislative norms, set guidelines or desirable operational limits; and form the basis for corrective actions and modification of activities if necessary. GOSL will ensure that part of the cost is borne by the Mining agencies.

The intensity of sampling will depend on the time and location of the development activities and results derived from monitoring data. Monitoring outcomes for each of the resources follows.

11.1 Resources Monitoring

Terrestrial Resources
Spontaneous growth after reclamation is a measure of successful establishment of plant cover. Wildlife-sighting in various areas of the basic site will be noted. Species composition and abundance and distribution maps will be built as an indicator of recolonization by wildlife.

Overburden Monitoring
Overburden areas will be monitored to determine the integrity of the containment berm around its base. The piles will also be monitored to ensure their height and slopes do not exceed the tolerable limits. Dust emissions from piles will be visually monitored and corrective action implemented when required.

Water Monitoring
Water quality standards will be established by NaCEF as part of its mandate in line with World Bank standards, some of which have been presented in this ESIA.

Surface, groundwater and waste water samples shall be recovered and analyzed at least once a month. The records will be presented on demand and compared with the results from independent sources.
**Tailings Monitoring**
The tailing ponds will be monitored at least once monthly or as dictated by NaCEF to visually determine their structural integrity. The ponds will also be inspected to determine seepage through the dam and to ensure that adequate freeboard exist for their continued use.

**Hazardous Material Monitoring**
Inventories of hazardous materials will be monitored to ensure all material is used for the purposes intended. Waste containment areas will be monitored to ensure that the impervious surface upon which they are sited is not breached.

The area will be monitored to determine that incompatible chemicals are not stored together and that stormwater discharges from the area are channelled to the sedimentation pond.

The presence of radioactive materials must be reported to the Protection from Radiation Board of the Ministry of Energy and Power (MOEP). A special Environmental Management Framework (ESMF) and Resettlement Policy Framework (RPF) is required for the exploration and exploitation of Radioactive ores.

**Solid Waste Monitoring**
The solid waste disposal mechanism will be monitored to determine the effectiveness of the operations. Waste from the mining operation will be monitored to ensure that the coarse (sand) and fine fractions (sulphide and slime) are used for mine reclamation and road construction within the mining concession only.

**Reclamation Monitoring**
The land reclamation area will be monitored to ensure that it is done in conformity with design specifications. The health of the plants will also be monitored.

**Air Quality and Dust Monitoring**
Equipment will be visually monitored to ensure emissions do not exceed tolerable levels. Roads will be monitored to ensure that excessive dust is not emitted from surface.
Socio – Economics

Certain social indicators needed to be monitored include the following:

- Assess whether resettlement objectives have been met; specifically, whether livelihoods and living standards have been restored or enhanced;
- Assess resettlement efficiency, effectiveness, impact and sustainability, drawing lessons as a guide to future resettlement policy making and planning;
- Ascertain whether the resettlement entitlement were appropriate to meeting the objects, and whether objectives were suited to the affected persons conditions;
- Income of beneficiary people;
- Presence of schools and clinics;
- Nutritional status of children and food security situation;
- Sanitation related diseases;
- Water use and availability of safe drinking water;
- Efficiency of Town/community management;
- Number of local people trained in Environmental Management;
- Number of industrial disputes and causes; and
- Disputes between local communities and the companies.

11.2 Emergency Response Plan (ERP)

Most of the EIAs examined so far did not contain any specific sections on Emergency Response Plan (ERP). In any legislative review an ERP will be made mandatory. The ERP will be site-specific and amendable to suit the circumstances. However certain elements must be noted. Each company will be required to prepare an ERP for the mine and ancillary facilities.

The ERP will identify supplies and resources to be utilized during an emergency event. Preventive measures will be enacted in the event of the following:

- Failure of tailings facilities
- Slope failure of mine
- Fuel/oil spill to waterways in project area
- Explosions at the mine site
- Natural catastrophes such as landslides or Earthquakes.
The Emergency Response Plan (ERP) defines responsibilities and provides procedures designed to identify unusual and unlikely conditions which may endanger the facilities in time to take remedial action and to notify the appropriate public officials of possible, impending, or actual imperilment of the environment. The ERP will contain notification procedures to safeguard the lives of citizens and to safeguard the environment in areas around the mine site in the event of an emergency.

If an emergency is imminent or is developing slowly, steps will be initiated to immediately advice persons in the vicinity of the emergency to evacuate due to the potential emergency and to notify the appropriate authorities. All possible efforts to reduce discharge to water resources and to the air in the vicinity of the mine site will be effected.

If an earthquake or landslide occurs or one is reported in the vicinity, a visual inspection of the facilities will be conducted immediately and if the ponds/dams for example are failing the site mine operator will immediately implement the emergency imminent procedures after the evaluation of the extend of the damage. If slope failure may take place it will be dealt with appropriately.

In an emergency situation, equipment, supplies and labour will be needed on short notice. These equipment and supplies may include Earthmoving equipment, sand, aggregates and gravel, sand bags pumps, pipes and labourers. The ERP must be adapted to suit different environment.

**Closure Plan**

Closure and Reclamation Plans are embodied in the mining policy and Act. However in any legislative review, it will be necessary to spell out procedures in the regulations.

The opinion expressed in this ESIA is that reclamation should not be necessarily linked to the closure of the mine. In the case of unforeseen circumstances (war or bankruptcy) the companies could fold up leaving behind unreclaimed land. The Bauxite Mines in the then SIEROMCO and Sierra Rutile Mines are good examples. In the case SRL large sways of land are now under water.

In accordance with this ESIA, mined out areas will be progressively closed as mining progresses and not necessarily at the end of closure. A period ranging from 6 to 12 months is considered reasonable.
Reclamation should be considered to be a continuous process up to final closure. Closure will consist of regrading mine out areas to facilitate aerated water flow and planting other reclaimed areas. In addition all processing facilities will be disbanded and transported away from site. The processing facilities area will then be seeded and revegetated.

The primary goal of the closure plan measures is to minimize ecological degradation. The other goal is to restore the mine site to a condition that is similar to the surrounding landforms and topography and that will provide long-term reclamation success and minimize the need for long-term operation and maintenance at the site after closure.

Further the objective of a closure plan is the enactment of measures to protect water quality, to minimize restoration and protection of groundwater and to enhance the potential for long-term reclamation success. The closure plan will address the following components:

- Permanent protection of air and water;
- Restoration of habitat compatible with native cultural, wildlife, and other non-mining uses;
- Establishment of self-sustaining biological potential capable of supporting native vegetative cover appropriate for the area; and
- Restoration of an overall aesthetic environment providing cultural values visual quality and other traditional use opportunities.

Prior to preparation of the mine closure plan an inventory of the items to be addressed by closure will be developed.

These are expected to include:

- Mine pits
- Mine ponds
- Process facilities
- Water management facilities
- Tailings management facilities
- Exploration, access and haul roads
- Topsoil stockpiles
All pits will be regraded to obtain free draining conditions. All areas will be evaluated to assess acid mine drainage (AMD) generation potential and likely future impacts to water quality. Reclamation materials will be classified and their present and future potential impacts to water quality evaluated and prioritized for use in reclamation as backfill. The reclamation plans will also optimize usage of the available materials to maximize the effectiveness of the reclamation plan. The closure plans will make extensive use of impervious soils and will ensure that all slopes in reclaimed areas are flatter than 6:1 slopes to reduce and potentially eliminate surface water infiltration in AMD generation areas.

All areas used for tailings and sediment ponds will be regraded as near as possible to original contours, and as necessary to obtain free drainage conditions. Material used for backfill will be determined by evaluation of spoilpiles and water quality monitoring results. In areas where the surficial soil is determined to have high AMD potential soil will be excavated and used as backfill to remove it as a source of poor quality seepage into groundwater aquifers.

In the cases of wet mining as is practiced by SRL it is recommended that at least 75% of the ponds, lakes and dams be reclaimed by backfill in accordance with the wishes of the communities using procedures described in this ESIA (Photo Fig 7).

Those ponds which could be used for fish farming purposes will first be drained and lined appropriately with clay and then refilled, before stocking with fish. This would minimize the effects of heavy metal including radioactive material.

Open pits or craters left by Kimberlite operation are a special case. The tailings consisting of granite aggregates will be used in construction industry for infrastructure and roads as is practised by Koidu Holdings (KHL). This open pits or craters (Photo Fig 4) could be put into alternative use by properly draining lining and actively pumping water or harvesting rain. This could become a source of domestic water supply.

In other operations for Bauxite (SMHL) or alluvial diamond mining (MTL) Photo Fig 4) reclamation could proceed as detailed in the ESIA.
Long-term revegetation success will be enhanced by providing a minimum thickness of 30cm of topsoil and/or subsoil to promote greater moisture retention and encourage rooting. Emphasis will be given to restoration of native vegetation, wildlife habitat, and aesthetic values. Revegetation of plant facilities areas and other features will include the extensive use of trees and shrubs to reduce visual impacts. Overall soil thickness over reclaimed areas would be increased as necessary to support revegetation with trees and shrubs.

All haulage and access roads will be regraded and closed except for agreed upon access roads. To match adjacent slopes, roads and berm material will be pulled from the fill portion to aid in regarding. All exploration roads at the mine site will be regarded in a similar manner to haul and access roads. This will include all areas outside the active mining area.

All buildings and other structures and equipment used in mining and processing will be removed. All concrete footings and pads will be removed and used as backfill. All topsoil areas will be regarded and revegetated.

The primary reclamation materials to be used are cover soil, subsoils, and non-acid generating and acid neutralizing materials such as gravels and selected waste overburden. Impervious ground covers will be installed using clays excavated from the mine pits.

In AMD areas the impervious ground cover will consist of 30cm of topsoil underlain by 60cm of clay. The 30cm of topsoil will serve to increase water storage capacity and provide a good substrate for rooting and to maximize the likelihood of long-term vegetative success.

The closure plan will re-establish grassland and/or forest settings on the areas previously disturbed by mining. The permanent seed mixtures will include native species appropriate for the area. Vegetation will consist of tree and shrub types, and a grass seed mix that is native to the area. Introduced vegetation species will be considered to add for their benefits to add organic matter to soils (Acacia and Cashew).

Reclaimed facilities will be inspected and annual reports provided to evaluate the success of prior reclamation.
Reclamation monitoring would be coordinated with NaCEF and MMR. Reclamation success will be evaluated both in terms of vegetation and erosion. The existing monitoring programs for surface and groundwater will continue in accordance with monitoring plans proposed under this ESIA.

Monitoring would be modified to address reclamation as it proceeds and as it is deemed necessary.

12.0 ARTISANAL MINING SECTOR (AMS) IMPACTS

The Artisanal Mining Sector (AMS) currently concerns itself mostly with diamonds and gold with the latter mostly mining illegally. With the expansion of all the mineral sector under the MTAP the AMS for diamonds is expected to yield up to USD 150-200 million in export value. Gold may yield another USD 15 million.

Before the war there were well over 5,000 artisanal mining licenses in existence and the MMR estimated there were 500,000 artisanal miners in the country.

Under the mining code, only native Sierra Leoneans are eligible for artisanal licenses and the maximum area that can be mined is 5 acres. Assuming that on the average 1 licenses holder acquires 2.5 acres, for 5,000 mine license holders as much as 12,500 acres could be mined out at any one time. However the AMS usually presents 3 scenarios in their activity as noted by Fischer and Keili (2005) which are:

- Mining in virgin (previously unmined) areas without prior rights being issued;
- Mining in virgin areas where prior rights have been issued in the form of exploration permits or mining lease;
- Mining in previously mined out areas where major geological disturbances have already occurred.

At present about 2,000 miners licenses legally registered. It is fair to say that perhaps at any one time as much as 10,000 acres could be under mining activities. The cumulative effect could be extensive. In 1994 for example it was estimated that after the invasion of Kambia District by as many as 5,000 displaced miners from Kono District as much as 10,000 acres of inland valley rice swamps had been degraded and made unsuitable within a few weeks. Cemmats estimates that some 2,300 acres could be mined annually.
Most artisanal mining areas have short productive lives, usually less than 10 years. While artisanal mining may increase rural incomes in the short term, increased reliance on mining relative to agriculture combined with significant environmental damage during the mining phase may have lasting impact on the potential for more balanced rural development in mined – over areas.

12.1 IMPACTS
12.1.1 Biophysical Impacts
Climate
Artisanal mining is widely practiced and in as many as about 80 Districts. Apart from the establishment of temporary coffer dams in any one locality even in the case of expansion under the MTAP the effect on the local micro-climate will be negligible. Nationally the cumulative effect on the weather pattern is similar to those of slash and burn agriculture as large areas of vegetation are removed.

Air Quality
Vegetation cleared may be stored for use on site or disposed of in spoil piles. Burning cleared vegetation will emit gases (carbon monoxide, Methane, volatile organics etc) and particulate matter. The effect is fairly localized and temporary.

Terrestrial Resources
Land Use
There is change in vegetation cover and removal of surficial soil. Uncontrolled pit digging will lead to erosion and leaching and with no routine backfilling there is loss of top soil.

A new vegetation of worthless opportunistic grass species may emerge even after reclamation. Fuel wood and charcoal burning in over crowded “boom towns” increases pressure on the flora. Clearing of vegetation will alter the species composition and biodiversity of the area. Animals (mammals, reptile, amphibians, birds) will relocate to similar habitats out of the mining areas. Soil fauna will be affected. Hunting game will pose a threat to some rare and vulnerable species. Siltation, increased turbidity and pollution will impact negatively on fish fauna of streams, rivers and lakes.
Hydrological Resources
Most artisanal mining operations usually take place in swamps, streams and rivers. Surface water quality is altered by erosion, and siltation, discharge from machines, including seepage pollution of residual oil to water bodies. Water demand in processing is also high (Photo Fig. 6).

In the cases of gold, any use of chemicals (cyanide and mercury) carries with it high health risks and possible fatalities.

The quality of water down stream for drinking and domestic use is impaired. Agricultural activities may also be adversely affected. The erosion of river banks through mining activities may alter the course of stream and may also lead to a drawn down of water.

Pits and burrows would lead to the formation of stagnant water pools. There will be increase in diseases such as malaria and bilharzias. There will be disruption of natural drainage and siltation of drainage courses.

Groundwater flow directions are altered and quality impacted negatively. As majority of inhabitants depend on wells there is the risk of spread of diseases such as cholera and typhoid. Analysis of well water quality in both Kono and Tongo Field revealed cross-contamination of wells.

12.2 Socio-Economic Conditions
Accidents leading to severe injuries and fatalities may occur as a result of unsafe mining conditions. There is a significant risk to the diggers from unstable slopes, and excavations leading to landslides, subsidence of overlying formations, and possible entrapment. Old mining areas that are being reworked can be dangerous because of uneven land surfaces and hidden depressions.

Due to increase in migrant populations there is increase in pressure on the few social amenities and services. This is even more so in “boom towns”. In most cases sanitation facilities are inadequate and at times non – existent. Potable water is in short supply and drinking water quality is impaired even in wells. This will lead to a spread of diseases such as cholera, and typhoid. Both solid and liquid waste disposal mechanisms are usually poor thus posing further health challenges.
There is inspite of many interventions from the GOSL and international community the Tributor system (“a system of debt bondage”) in which the artisnal miners are not paid a salary.

The complex system of the artisanal trade involving many stakeholders (Diggers, Agents, Supporters, Dealers, Exporters, local councils, chiefs, MMR GGDO, NRA) makes it easy for elite capture especially where ignorance and poverty are prevalent.

Child labour in the AMS remains an ongoing problem and may continue under the MTAP unless mitigated.

Overcrowding in mining areas will lead to increase in crime, drug and substance abuse, increase in prostitution and sexually transmitted diseases including HIV/AIDS. There will also be an erosion of family and cultural values and a disruption in established social norms.

### 12.3 Mitigation Measures

#### 12.3.1 Land Reclamation

In order to restore the land to productive use mined out areas must be reclaimed progressively. Unlike the large scale mining sector in which technology plays the vital role, here it is awareness raising campaigns, training and stakeholder involvement that is of utmost important.

Land reclamation usually involves backfilling using spoil pile materials, contouring the land and establishing improved drainage of abandoned mining areas

The cost of reclamation is put as between USD 3,000 and USD 6000 per acre. Cemmats quotes MMR sources as USD 9000 per acre. The rehabilitation fees paid by an artisanal license holder amounts to about USD 70 per acre. Miners do not at the moment feel obligated to undertake any reclamation work.

Many NGOs including Foundation for Environmental Security and Sustainability (FESS) Peace Diamond Alliance (PDA), Integrated Diamond Management Program (IDMP) and National Coalition for Extractives (NACE) have all provided training and funding to local communities to undertake reclamation and rehabilitation work. GOSL has provided funding to communities to undertake rehabilitation work on pilot basis (Lotoboina in Tongo Field, Kaisombo in Kono) Photo
Fig. 8). Whilst the programmes may have been successful, from a financial point of view this system may not be viable, let alone sustainable or needs review.

Local initiatives have also succeeded. Women’s groups such as Sinava and Muloma in Tongo Field have also successfully reclaimed mined out areas.

Cemmats Group has suggested “Reverse mining” strategy in which the mined out gravel overburden are reprocessed before backfilling. Proceeds from any diamond found are then used to finance the cost of rehabilitation. This system has yet to be adopted.

12.3.2 Unsafe Mining Condition
Accidents leading to injuries and fatalities could be avoided if training, and awareness on safe mining procedures could be carried out. Excavation procedures could be developed to minimize land slides and improve embankment stability. Care must be taken with regard to water management practices. Tunnelling during mining should be avoided.

12.3.3 Socio-Economics
The implementation of the activities devolved to the local councils in the provision of social services for their communities needs to be reviewed. There needs to be more community involvement in the use of funds such as Diamond Area Community Development Fund (DACDF).

The new guidelines to be issued by the MMR should focus on the entire sector and not just diamonds. The provision of more social services to depressed areas by GOSL, Local Councils and mining Agencies will minimize the effects of many social ills.

However training and awareness raising that restores more confidence and empowerment to the various stakeholders including miners should be the cornerstone of any legislative review.

The training provided by NGOs, Donors and GOSL functioning will help break the cycle of poverty and ignorance. These efforts should be coordinated properly in order to avoid duplication.

It has been noted that in line with the Core Mining policy that training has been undertaken that is geared towards the empowerment of the artisanal mining communities by linking them to
international markets and tracking diamonds from earth to export. This would help raise awareness on the disadvantages of the tributor system and remove some of the bottlenecks in the newly introduced cadastre system. These activities should be strengthened.

Training activities or modules for stakeholders (Miners, Chiefs, government officials, local councils, community women and NGO leaders) will be strengthened in:

- Environmental consequences of mining activities (short term and long term)
- Basic valuation of diamonds and other precious minerals;
- Management of funds;
- Land use patterns to reduce dependence on mining;
- Community relations;
- Mining legislation; and
- Reclamation of mined – out land.

13.0 RECOMMENDATIONS AND CONCLUSIONS

The GOSL, through its line agencies (MMR, EPA, MLGCPRD, MAFFS) has made tremendous strides especially in the elaboration of policies and legislative frameworks.


The MMR appears to operate openly and transparently in the granting of permits and licences. There is a supervisory board and the accusations of abuse of official positions levied by some NGOs and communities could not be substantiated.

Following on the recommendations of many studies including particularly the Strategic Environmental and Social Assessment (2007) – SESA, the MMR has embarked on a series of legislative reforms and activities to make the Mineral Sector more efficient. The Mineral Sector Technical Assistant Project (MTAP) is one such laudable attempt. Given the timeframe, this ESIA cannot be very exhaustive and focuses on the major issues.

The main issues considered are given below.
13.1 Institutional Strengthening

The key agencies for environmental management have been identified, their roles and responsibilities have been clearly spelt out in various pieces of legislative framework. The key institutions are given below.

**Ministry of Mineral Resources (MMR)**

MMR, has the task of managing the mineral sector. However as pointed out in this ESIA, MMR is understaffed, under funded and under resourced. Under the MTAP the agency will be restructured inline with its mandate.

More trained and qualified personnel will be recruited as required. Training will also be provided. This will be undertaken as part of the activities under the MTAP within the first two years of the project. A more efficient MMR will generate enough revenue for a more competitive remuneration for the workers.

**Environmental Protection Agency (EPA)**

The EPA is a newly created entity that succeeds the National Commission for the Environment and Forestry (NaCEF). The EPA will be responsible for environmental management. EPA like NaCEF should have adequately trained staff and enough financial resources to be able to fulfil its mandate particularly of setting-up of environmental standards and monitoring.

Being part of the coordinating team for donor funding activities, the PSC of the MTAP would attract donor funds for capacitating the EPA.

**Local Councils, Chiefdom Administration, and NGOs**

Having devolved some functions including environmental management to Local councils the Environmental committees will be trained and strengthened. Other stakeholders groups need to be trained and strengthened in line with this ESIA. MMR staff will be co-opted from time to time to help with training for which councils must be responsible.

Chiefdom administrative staff will also be trained using appropriate modules developed by the EPA. Environmental NGOs will be encouraged to acquire capacity for monitoring. Funds for the purpose could be provided under component E of the MTAP
13.2 Environmental Management Tools

Although the Environmental Impact Assessment (EIA) procedure in Sierra Leone is consistent with international standards, the implementation is often inadequate and unsatisfactory. A large number of EIA reports examined so far contain a large number of irrelevant information fail to focus on the key aspects of the affected environment in sufficient detail. Very often no attempt is made to reconcile potential mining activities and potential future land use. Legislative review under the MTAP should make it mandatory for the recommendations of the EIA reports to be taken into consideration before permits are granted for the operations of the mine.

The lack of performance – based standards for assessing compliance with EIA and reclamation plan requirement; and the lack of a schedule of intermediate sanctions, tailored to the severity and frequency of violations are among the visible lapses.

As pointed out earlier, NaCEF the predecessor to EPA was incapacitated to carry out its mandate. Reclamation of mined land can reduce the long-term impacts of mining with acceptable financial costs. Reclamation plans and incentives for their proper implementation can reduce the “footprint” of mining operations, limit threats of water pollution and erosion to human health and safety, return land to productive uses, and promote conservation of biological diversity.

The newly revised legislation under the MTAP will introduce a Reclamation Guarantee Program and mandating retroactively that all mining contractors in the production stage must post a guarantee of timely and proper reclamation of mining areas. The law will require mining companies to plan for mine closure and reclamation before the last years of operation and to provide funds for MMR to implement the plan if the company fails to do so.

The guarantee should be posted before the issuance of the exploitation permit. There may be need for the reclassifications of the Mining Sector categories into large scale, Medium scale, small scale and artisanal sectors. These legislative changes will take place within Two (2) years of the MTAP.
13.3 Coordination Issues

There is need for interagency coordination. The MMR and EPA need to collaborate and coordinate their activities more closely in environmental management matters. Frequent interagency meetings are necessary. This will be achieved by funding the activities under component D of the MTAP during the life of project.

The potential exists for frequent inter-sectorial conflicts between mining, forestry and agriculture. There is need for frequent consultations and harmonization of various pieces of legislation.

The newly created EPA will introduce new standards for water quality appropriate to the mining sector. The present water quality standards prescribed by Sierra Leone Water Company (SALWACO) of the Ministry of Energy and Power (MOEP) are not appropriate to the mining sector. The Project Steering Committee (PSC) of MTAP will solicit donor funding for the purpose.

Environmental oversight and monitoring will be done by as many stakeholders as possible as suggested under this ESIA and coordinated by the MMR and EPA. These activities will be coordinated by the Project Support Team (PST) under the MTAP.

Training will also be provided for the Environmental committees of Local Councils, local communities and NGOs inorder to strengthen them for effective participation in environment management.

The public will also be made aware of the environmental and health dimensions of mining.
14.0 DOCUMENTS CONSULTED


Cemmats (2007) Mining Sector Reform in Sierra Leone: A Strategic Environmental and Social Assessment.


GOSL (1994) Mines and Minerals Act

GOSL (2000) National Environmental Protection Act

GOSL (2004a) The Core Mineral Policy MMR, SL

GOSL (2004b) National Land Policy

GOSL (2004c) The Republic of Sierra Leone Biodiversity Strategy and Action Plan

GOSL (2004d) Diamond Industry Annual Review. Freetown


GOSL (2006) National Lands Act

ANNEX I

List of Persons Consulted in Freetown

1. Kamara, Bartholomew  Director of Forests MAFFS
2. Jusu, Syril    Director of the Environment (MOLHCPE)
3. Kamara, John    Environment Officer (MOLHCPE)
4. Mbaimba, Edwin  Environment Officer (MOLHCPE)
5. Lappia, Samuel  Environment Officer (MOLHCPE)
6. Wurie, A.R.    Director of Mines (MMR)
7. Kamara, S.I.    Senior Assistant Secretary (MMR)
8. Komba, Emmanuel  Deputy Secretary (MMR)
9. Kamara, A.S.    Procurement Officer (MMR)
10. Fornah, Mary  Ag. Staff Superintendent (MMR)
11. Braima, Abu A.  Director (NMJD)
12. Keili, Andrew  Cemmat Group
13. Squire, Chris  Commissioner NaCEF
14. Fode, Dan    Head of Department, Geology, FBC
### List of Some Persons Contacted

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<tr>
<th>Sierra Mineral Holdings</th>
<th>Mokanji, Gondama</th>
<th>Sierra Rutile Limited</th>
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<td>Farmer – Gondama</td>
<td>Supervisor Community Develop. Off.</td>
<td>Section Chief</td>
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<td>Juma Seyah, Trader</td>
<td>Inatoma Gindeh, Housewife</td>
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| Lahia Kabba            |                   | Government Mines Engineer, Bo dist. |                   |                   |                 |                   |

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<tr>
<th>Name</th>
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<tr>
<td>Edmond Kawa</td>
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<td>Idrissa Sesay</td>
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<td>Bawomahun</td>
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<td>Cluff Gold SL Ltd.</td>
<td>Cliford Patnelli</td>
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<td>Godfrey Amakwa</td>
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<td>Kono</td>
<td>Mr. N. Dakoro</td>
<td>Security Officer (Koidu Holdings)</td>
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<td>Saffa Saquee</td>
<td>Chief Resettlement</td>
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<td>Daniel Gbondo</td>
<td>NGO (Foundation for Environmental Security and Sustainability)</td>
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<td>J. Andrew Grant</td>
<td>Consultant (FESS)</td>
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<td>Mile Stone SL Limited</td>
<td>Rian Vinzyl</td>
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<td>Tefeya (Kono District)</td>
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PERCEPTION OF COMMUNITY MEMBERS

Visits were made to a number of mining areas within the limited time frame available to the consultants. The perception of the communities was sought about the operations of the companies for large-scale and small-scale mechanised mining. The consultants found out that the perception of the people were almost the same.

As noted in section 1 of the ESIA report, the meetings were both formal and informal. Not all the names of participants were captured and included in the list presented above.

Mokanji and Gondama (Sierra Mineral Holdings) – 23/05/2008

The Sierra Mineral Holdings headquarter is at Mokanji and the mining operations are in Gondama (a small village) some 7 miles from Mokanji. Most of the inhabitants are farmers and they complained about the loss of farmlands and inadequate compensations. They thought that they had not been adequately consulted on many matters (The ESIA done for SMHL in 2003 indicated that adequate consultations had taken place). The farmers (Rice and Vegetables) in inland valley swamps appear to have been most affected by the drawn down of water in streams and rivers below the mine area. This the team believed, is due to the diversion of water for the establishment of tailings ponds. Concerns were also raised about the inadequacy of the basic social amenities (Schools, good water supply, hospitals etc). The slow pace of rehabilitation following the resumption of mining activities was also raised as an important issue. The activities of some NGOs such as Plan International in rehabilitation of schools and hospitals as well as provision of hand dug wells were lauded. The community members however did acknowledge that the company was providing jobs and had constructed and upgraded trunk as well as feeder roads. The community affairs Departments of the community countered by stating that the company is plagued with financial problems at the moment and had plans for community development and pointed to the establishment of community Development Fund.

On reclamation most people were of the opinion that it was progressing rather two slowly and unsatisfactorily. The economic trees (cashew nuts and coconuts on impoverished reclaimed land) did not seem to be doing well.
Moriba Town and Mogbwemo (SRL) – 24/05/08

These are relatively large towns located about 1.5km each (North and South respectively) of the main administration site.

Even though two separate formal consultative meetings were held yet the community perception were identical and have been summarized below. The meetings were held in the presence of the Community Affairs Development Officer (Mr. Dauda Kamara) and the exchanges were frank.

The older members of the communities were of the opinion that the consultative process now has improved considerably. At the inception of the company operations in the 1960s they were of the opinion that the communities were not adequately briefed on many matters including relocation and resettlement as well as environmental impacts. In those days they opined the loss of shelter lead to only compensation and not the provision of appropriate shelter. The compensation was considered inadequate. The complained that the present administration did not address the compensation issues emanating from the past. The Community Affairs Officer (CAO) explained that the ownership of the company has changed hands several times and a new dispensation was now on the ground.

Certain facilities that were accorded to the communities before the war had been cut off. Among these were the provision of food items to community leaders on a monthly basis and the provision of buses to convey their children to school and back. Wells provided before the rebel incursion have fallen into disrepair and most of them have not been rehabilitated. Sanitation facilities and clinics were considered inadequate.

The communities were of the opinion that they ought to have been provided with electricity. The CAO replied that a needs assessment had been completed for all major villages and contracts for infrastructures (wells, schools, community centres) already been awarded. Community leaders were of the opinion that they should have been involved in the award of contracts. Jobs had been provided to some members of the community and they expected more.

The communities expressed dissatisfaction over the relocation of communities no matter what the level of compensation is. Majority of the people interviewed were of the opinion that lakes and ponds established for mining purposes should be closed, and reclaimed and land restored. Use of
ponds for fisheries purposes was not very attractive to the community. (Youths were found bathing and fishing).

Among the problems facing some community members was the flooding of the lands during the rainy season from the spill over effects of the dams. Crops are damaged and grazing land for cattle affected.

The rehabilitation work undertaken after reclamation by the company is not effective as the crops planted (coconuts, oil palm, cashew nut) are not doing well because of the poor quality of the soil. Darwin Initiative of reclamation has also not been very successful. The community feels that they have often not been sufficiently consulted and have not been involved in planning and implementation of Community Development Project. The consultants were of the opinion that the line of communication between the companies and the host communities have not been very effective.

**Tongo Fields – Artisanal Mining – 25/05/2008**

At Tongo Fields artisanal mining for diamonds is carried out on a wider scale. Almost every member of the community is in one way or the other related to mining activities (as dependent, or actively involved as digger, dealer, sponsors, agent etc).

Visits were made to some active mining sites, local councils, NGOs groups where discussions were held. Concern was expressed at the depressed state of what was clearly an over crowded “Boom Town”. People expressed the opinion that sufficient funds were not committed by the Government and their representatives toward the provision of social amenities. They were suspicious of the chiefs and community leaders in the use of the Diamond Area Community Development Fund (DACDF).

The community members were of the opinion that reclamation and rehabilitation of mined out land should be done by the Government since some fees for the purpose had been paid by the miners. NGOs and CBOs groups such as Peace Diamond Alliance were lauded for their good work at reclamation. The Team however found out that some areas (Lottobolina) that have already been rehabilitated were being remined illegally. Community sensitization and awareness raising needs to be intensified.
**Baomahun (Valunia) – Bo District – 26/05/08**

Baomahun is a “Boom Town” where artisanal Gold mining takes place. Some members of the community admitted that they may not be mining legally. The Cluff Gold Sierra Leone Company is still prospecting and exploring much to the frustration of community members whose expectations are high. The community expects the company to provide employment and basic facilities such as good roads, sanitation, schools and health centres.

Despite the long history of gold mining in this area the community members were of the opinion that subsequent mining companies had not done much in the provision of basic social services. They hoped that this time things would be different. They were conscious of the environmental degradation but hoped that Government and not the community should do land reclamation.

**Koidu Holdings (Kimberlite)**

**Koidu New Sembehun – 27/05/08**

Here two sorts of communities were encountered:

- Those involved in artisanal diamond mining mostly youths; and
- Persons affected by the kimberlite mining activities of the Koidu Holdings Limited (KHL).

Artisanal mining communities faced similar problems as the Tongofield communities. The youth groups have been actively involved in reclamation work funded by GOSL and NGOs. Youths expressed concern over the slow pace of release of funds.

Persons affected by KHL operations complained about start of operations before the completion of the resettlement process. Only 75 houses out of 200 have been built for displaced persons. Some of the previous houses contained more rooms than the Five (5) room houses provided by the company. Compensations for productive land are still outstanding.

Blasting and Noise vibrations are considered one of the inconveniences they have to put up with. There is some water pollution but wells have been provided. The CAO and the Environmental Officers (EO) of KHL were absent and could not be interviewed.
Milestone Trading Ltd (Tefeya – Kono District) – 27/05/08
The villages are quite removed from the mining site itself. Only a few homes were visited by the team at the nearest village. The company had built access roads, Bridges, provided wells and a school. Farmlands were lost and very few employment for local residents existed. The few people interviewed recognized the damage to baffin river by siltation and lamented that only chiefs may have been involved in the negotiation and projects.
Dragline caterpillar loading bauxite ore into a truck (Photo Fig. 2a)

Bauxite ore close to the surface with little vegetation and overburden (Photo Fig. 2b)
High, low and medium grade bauxite ores ready to be loaded in the plant feeder at Sierra Mineral Holding Limited (Photo Fig. 2c)

The D1 dredge discharging sand and slime waste together into the tailings pond during mining (Photo Fig. 3a)
The cyclone towers at rutile mine site depositing sulfur-bearing and non-sulfur bearing rutile from the dredge plant (Photo Fig. 3b)

Plant site in the sierra rutile mines where screened rutile is produced by the spiral and floatation methods (Photo Fig. 3c) Dry Plant
The excavated pit at pipe 1 in the Koidu Holdings Kimberlite mining showing diagonal Kimberlite in the centre (Photo Fig. 4)

Washing alluvial gravel from the Bafin river at the Milestone Trading-Kono (Photo Fig. 5)
Artisanal miners washing gravels in nearby lake (Photo Fig. 6)

Sluice box used by artisanal gold miners at Baomahun (Photo Fig. 7)
Reclaimed artisanal mined out area west of Tongofield. (Photo Fig. 8a)

Reclaimed artisanal mined out area (Lottboina)Tongofield. (Photo Fig. 8b)