**PROJECT:** MANO RIVER UNION ROAD DEVELOPMENT AND TRANSPORT FACILITATION PROGRAMME (MRU/RDTFP) (PHASE II)

**COUNTRY:** MULTINATIONAL (COTE D'IVOIRE & LIBERIA)

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**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) SUMMARY SEPTEMBER 2017**

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| **Director Regional Integration** | Moono MUPOTOLA | RDV0 | 2156 |
1. INTRODUCTION
Most of the Ganta–Harper road (510km) remains unpaved and is generally in an extremely deplorable state. The Government of Liberia (GoL) requested assistance from the African Development Bank (AfDB) for the rehabilitation and paving of this strategic road which forms part of the Trans-African Highway corridors in West Africa. The road when paved, will not only make it adaptable to the adverse climatic conditions but also protect the current investment in addition to other socio-economic benefits associated with road improvement.

The project aims to reduce travel time and vehicle operating cost by improving the road alignment and pavement condition. The road project will also enhance the flow of regional and inter regional traffic and trade, and reduce road user costs, thereby strengthening regional economic integration. The road safety measures that would be put in place will enhance safety standards on the project road. In addition, the project will also facilitate easy access by farmers and traders to social services along the corridor expected to generate more income to augment the Government’s effort in achieving economic development and poverty reduction.

While the overall project is considering the 510-km road from Ganta, Nimba County, to Harper, Maryland, transecting Grand Gedeh and River Gee Counties, the road has been phased into LOTS.

- Lot 1, for which construction work is ongoing and 10km of which has been constructed to the asphalt binder course, consists of the reconstruction of the laterite road from Harper to Karloken in Maryland County. The 16km section from Harper Junction to Cavalla Customs border with Cote D’Ivoire is being constructed as part of Lot 1.
- Lot 2, which is also under construction, consists of the section of road from Karloken to Fish Town (80 km) in River Gee County.
- Lot 3, 118 km from Fish Town to Gbagbo Town – includes the -km corridor studied as part of this ESIA.

The Ministry of Public Works and the African Development Bank are in discussions to construct the first 50-km of Lot 3 from Fish Town to Kelipo Kanweaken. Therefore, Comprtran Engineering & Planning Associates (COMTRAN) was contracted to review and adopt the RAP report for Lot 3, prepared by Stanley Consultants Inc., to reflect information specific to the first 50 km. Given the time-lapse since the study was conducted in 2013, this adjusted report contains updated information and RAP estimates gathered through a scoping assessment. The updated information, specific to the first 50 km, reflects the current impact on assets – its use and restriction, tenants, vulnerable groups and property owners along the corridor; as well as impact from the design review and road alignment recommended by Stanley Consultants.
LOCATION OF THE PROJECT

2. ENVIRONMENTAL ASSESSMENT AND SUSTAINABILITY
The proposed project is expected to have a viable impact on all aspects of sustainable development. The achievement of sustainable development rest solely on the interaction of its three main elements (social, environment and economic). The Environmental & Social Impact Assessment (ESIA) is based on field assessments, document review and discussion with relevant Government officials and project team members such as the Engineer, Geologist, Hydrologist, and Surveyor. The project team provided the proposed project details and desk environmental studies; whilst site environmental data collection was gathered through field survey, monitoring and investigation were done to cover roadside features with respect to environmental conditions. Secondary data gathered were existing basic documents which included topographic maps, scientific and technical reports; other Environment Impact Assessment documents, and Government reports. Information sources and references have been provided at the end of this report.

The social assessment used both secondary and primary sources of data. The primary sources of information were mainly obtained through discussions with the Government officials involved a full presentation of the proposed project, its impacts, and mitigation and enhancement methods. The interaction with Government officials also sought to solicit their views on social aspects to be considered during the design and implementation of the project. The data collection was carried out using structured and semi-structured questionnaires, checklists, observations photography, site visits, and consultation with stakeholders. The survey sampled a statistically representative sample of the people living in the project area, women and youths in the major towns along the corridor. Secondary data was gathered from 2008 census data, the county development agenda documents and other reports on the project area.

Stakeholder consultations were conducted with the study team preparing and presenting the project, its proposed impact and mitigation methods. The stakeholders had the opportunity to raise any anticipated concerns and suggest how these can be mitigated. This included
consultations with government officials and institutions within the project area. The study also held consultations with government officials and institutions within the project area.

3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This ESIA is guided by applicable policy, legal, regulatory and institutional frameworks within the context of Liberian Law. Preparation of this ESIA also draws on the policies and regulations of the African Development Bank and other international institutions.

**National Policy Landscape:** The policies that guided the ESIA assessment included; the Land Right Policy of 2013 provides for equal protection of all relative to land matters; Liberia’s first Poverty Reduction Strategy (PRS-1) - Lift Liberia (2008 -2011) that articulates the Government’s overall vision and major strategies for moving toward rapid, inclusive and sustainable growth and development and the National Environmental Policy (2003) aims at improving the physical environment, quality of life and coordination between economic development, growth, and sustainable management of natural resources. In addition, The Integrated Water Resources Management Plan (IWRMP) (2009) provides an overarching approach to manage water resources in Liberia that is sustainable and beneficial to most people, while the National Forest Policy (2006) provides guidance on how to conserve and sustainably manage all forest areas, so that they will continue to produce a complete range of goods and services for the benefit of all Liberians. The National Biodiversity Strategy and Action Plan (2004) is to sustainably use biodiversity on a long-term basis to meet the needs of both the present and future generations.

**International Policy Landscape:** The ESIA was also guided by the African Development Bank Group’s Policy on the Environment that recommends a strong and diversified economy be recognized as a just means to enhance the capacity for environmental protection and that environmental management tools, like environmental assessments, shall systematically be used to ensure that economic activities are environmentally sustainable, and to systematically monitor their environmental performance. Also underscored is the need for inclusive natural resource management approaches as well as transparency and accountability in implementing mitigation approaches.

**Legal framework:** The Liberian Constitution, 1986 and other laws provide for management of the environment and natural resources. Article 7 of the Constitution (1986) sustainable resource utilization. The Environmental Protection Agency Act (2002) mandates the EPA as the principal authority in Liberia for the management of the environment. Liberia is a signatory to several international conventions and agreements and legal obligations concerned with environmental and social issues. The table below shows some of those covenants and agreements.

<table>
<thead>
<tr>
<th>Convention/Treaty</th>
<th>Ratification date</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Nations International Covenant on Economic, Social and Cultural Rights</td>
<td>1967</td>
<td>The granting of economic, social and cultural rights to individuals, including rights to adequate health, education and living standard.</td>
</tr>
</tbody>
</table>
Institutional Framework: The institutions that have statutory roles in implementation of this ESIA are as follows:

- EPA is responsible for monitoring, coordinating, and supervising the sustainable management of Liberia’s environment. It is mandated to ensure the conduct of environmental impact assessment for all projects and activities that are likely to have significant adverse effects on the environment. Per Environmental Impact Assessment Procedural Guidelines (2006), projects/activities which require mandatory EIA are classified into 26 categories. As the Project is to reconstruction of Zwedru – Harper road, it is categorized as No13, Building and Civil Engineering Industry.

- Ministry of Public Works has the statutory responsibility to approve the design and construction of all civil works, including motor road. Additionally, it is also responsible to carry out urban and town planning, as well as provide architectural and engineering supervision of infrastructure required for waste management.

- The ministry of Lands, Mines and Energy besides its pivotal role in mineral resource development, is also in charge of administering and regulating public and private lands. This includes land tenure, land policy, land reform and land use.

- Ministry of Health and Social Welfare has a Department of Environmental and Occupational Health that handles matters relating to water and sanitation and general environmental issues. It mandates require that sanitary and working environments are conducive for all workplace, to ensure the health and safety of workers and nearby residents. The Ministry also provides capacity building and training of environmental health technicians.

4. PROJECT DESCRIPTION AND JUSTIFICATION

The existing laterite road is a primary two-lane highway as defined by MPW/IIU, which traverses mostly rural communities. The entire Ganta–Harper corridor is unpaved but has been engineered to good riding comfort, with some parts inaccessible mostly during the rainy
season. The gravel surface road of the first 50-km of Lot 3 is graded with some camber to drain runoff from the carriageway. The average width of the carriageway is about 6m with shoulders on both sides having average width of 3m. The towns of Fish Town and Kanweaken have their roads protected by drains to carry runoff from the carriageway.

This project road traverses through fourteen (14) communities along the corridor: Wanken, Gbeapo Pronoken, Sarbo Sweaken, Slobert Village, Gbeapo Kanweaken, Flewroken, Palm Wine Village, Doe Village, Juwah Village, Putuken, Sagba Village, Rock Crusher Village, Combat Gate Village and Kelopo Kanweaken.

**Project Design and Activities:** The proposed 50-km project road consists of upgrading graveled surface from Fish Town to Kelipo Kanweaken to an asphalt paved road. The work will generally consist of clearing the topsoil, earthworks and excavation of longitudinal ditches, construction of culverts and several bridges, pavement construction, erosion control measures, drainage improvement, safety improvements including reflectorized paved markers, sidewalks, curb, gutter through urban areas and other ancillary works.

The project road will be a 2-lane facility (each lane will be 3.65 m wide) and will largely follow existing road with major alignment in several places. Alignment shifting may occur at river crossings to maintain the existing bridge open while new bridges are under construction. Alignment shifting may occur at river crossings (i) to keep the existing bridge open while new bridges are under construction at another point (ii) due to construction and use of temporary bridges while new bridges are under construction at the original spot (iii) due to shifts of curves to meet international standards. The design speed of the road is presented in

<table>
<thead>
<tr>
<th>DESIGN SPEED CRITERIA</th>
<th>Location</th>
<th>Design Speed (km/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Areas</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Approaches to settlements</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>Within Settlements</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Steep grades and sharp horizontal curves</td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

Source: Stanley Consultants, 2013

**Pre-construction Phase:** pre-constructional activities cover the initial investigations and assessment phase. The main components being

- Road Inventory
- Geological and Geotechnical Investigation
- Material Exploration including borrow pits, sand deposits, rock deposits and water for construction. All these will require project specific project briefs to be obtained by the contractor and are not part of this ESIA
- Hydrologic and Drainage Investigation

**The construction Phase** will include establishing the design interventions for the selected roads, due consideration was given to the levels of traffic flows and sub grade strength assessed from the traffic and road condition surveys undertaken on the various project road sections. Under the proposed interventions to be undertaken, the following activities are anticipated:

- General Activities
- Site Clearance;
- Earth works;
- Quarries, borrow pits, stockpiles and spoil areas and dumping of spoils / debris;
• Construction of Culverts and drainage works;
• Road formation (gravel road shaping, sub-base and base preparation, shoulder and sidewalk construction);
• Road surfacing (use of bitumen for prime coat and surface dressing); and
• Ancillary works - Ancillary works associated with road upgrading will include safety features such as warning signs, speed restrictions, traffic calming measures, and drains, stopping lay-bys within settlements, junction improvements and direction sign boards.

Other aspects of the construction phase, which will be addressed include: Contractual aspects – specifically covering environmental clauses in contract specifications and construction Supervision and Monitoring.

The post construction phase will cover issues relating to the operation and maintenance of the project such as maintenance and area wide traffic management and enforcement mechanisms.

Project Justification: The intense wet climatic conditions in Liberia present major challenges in the maintenance of unpaved roads which often come with high life cycle costs. In the absence of a suitable maintenance funding framework, such as a Road Fund, Liberia would increasingly find it difficult to maintain unpaved roads that require consistent routine and periodic regimes with associated technical and cost attention. Paving of the 50km Fish Town to Kelipo Kanweaken road would ensure that the road is better suited to the terrain and climatic conditions and has lower life-cycle costs.

The upgrading of the road corridor is consistent with the GOL’s policy of upgrading all primary roads and provides connectivity with neighboring countries in the sub-region. The Ganta–Harper Highway is an alternative link on the Trans-Coastal: Lagos–Nouakchott Highway as identified by ECOWAS with the potential to facilitate Sub-Regional Trade and Integration in the future.

The project would improve access to transport services for the rural population in River Gee County with the rest of the country; improve farm to market linkages as well as uplift the quality of life of the people of the project area. The road corridor is situated in an area heavily endowed with mineral and agriculture resources such as rubber that could take the populace to a much-needed greater socio-economic development.

5. PROJECT ENVIRONMENT AND SOCIAL BASELINE

Physical Environment: Geological investigations in Liberia have shown that nearly all of the terrain is underlain by Precambrian crystalline rocks which form part of the West Africa Shield. The country can be divided into three (3) geological regions, namely the Liberian Age province, the Eburnean Age Province and the Pan African Age Province. The Liberian Age province is underlain by rocks aged between 2.5 and 3.0 billion years, Eburnean Age Province aged between 2.0 and 2.5 billion years and the Pan African Age Province aged less than 500 million years. The project site is located within the Eburnean Age Province. The rock type near Fish Town is mostly leucocratic gneiss. There are also dark grey diabase dikes that cut across the region, where visible outcrops can be seen in several places.

In relation to soils, at a national level, latosols (porous and friable soils rich in iron, alumina, or silica typically formed in tropical woodlands under very humid climate with relatively high temperature) cover about 75% of Liberia; these are typically de-saturated, reddish-brown in color and quite hard, with low humus content. The soils vary in thickness over bedrock from a
few feet to considerable depth. Specifically, for the project area, the soil type is generally silty reddish-brown with high content of clay which might result from the weathering of sedimentary rock. There are also few areas with lateritic gravel. From the hydrologic point of view, soils with high content of clay often result in high run-off due to it relatively impervious nature. Rainfall run-off can significantly reduce where there are fault lines, fissures and cracks as the run-off finds its way through these opening. Geologically, the catchment is found to be stable with no geological features.

In terms of topography, the catchment areas of River Gee County are generally gently rolling with wide and shallow valleys with the following identified geographical belts: mangrove swamps and beaches along the coast, wooded hills and semi deciduous shrub lands along the immediate interior, low mountains in northeast, dense tropical forests and plateaus in the interior.

The project area is endowed with abundant water resources. The project road crosses major rivers and streams as well as small tributary creeks. The major rivers and streams are perennial whilst most of the tributary creeks are ephemeral. These ephemeral creeks often run completely dry during the dry season, except some few localized depressions in the creek bed. The project area lies in a predominantly undeveloped watershed and traverse largely through forest. The topography can best be described as undulating with few hilly and mountainous sections.

The climate of River Gee County is synonymous with the rest of Liberia, a tropical one with relatively small variations between day and night and between seasons. There are two seasons -the wet season from May to October and the dry season from November to April. The continental and maritime air masses alternate their movements back and forth, from the north to south. This brings some seasonal differences in rainfall intensity. The coastal region has the heaviest rainfall from an annual 3900mm to 4500mm in the west and about 2500mm in the south-eastern part of the country. Rainfall decreases going north and inland except highlands and the northernmost part of the country. The eastward of the country following the Cavalla River receive over 1700mm of rain annually.

The mean monthly relative humidity varies between 70 and 90%. The mean daily bright sunshine hours varies in excess of 4.0 hours. The mean monthly temperatures of the project catchment vary from 24.50°C and 27.50°C. Wind speeds are generally light being of order of 6 knots. Strong winds are usually associated with convective thunderstorm activity during the rainy season and are short. Temperature, humidity and wind affect run-off. High temperatures, low relative humidity and strong winds result in higher evaporation and subsequently reduce runoff. The highest temperature recorded in the project area is 32°C and the minimum is 22°C.

**Biological Environment:** Liberia biodiversity is under threat due to many factors such as ignorance, insufficient public education and awareness, shifting agriculture, unregulated logging, unplanned roads in logging areas, unplanned human settlements, fuel wood gathering, charcoal production, population pressure and establishment of rubber plantations. The Liberian forest serves as habitat for large amounts of endemic flora and fauna and is a unique ecological niche for some of the rarest species in the world. The Jentink’s duiker (the rarest in the world), white-breasted guinea fowl, pygmy hippopotamus, Diana monkey, Liberian mongoose, the giant forest hog, chimpanzees, red colobus (a long-tailed monkey), bongo antelope, leopard and the golden cat are amongst the animal population inhabiting Liberia’s forests. It is also home to hundreds of birds, nine of which are endangered; several dozens of reptiles, including three types of crocodiles and at least eight poisonous snakes; amphibians and at least a thousand different insects.
The vegetation found covering the project area consists of primary and secondary forests and savannah. Most of the forests along the road are open, with only insolated huge trees such as *Antaris toxicaria*, *Pentaclethra macrophylla*, *Piptadenias-trum africanum*, *Sacoglottis. Terminaliasuperba* and *Triplochiton, scleroxclon*, which were giving abundant forest-regrowth. They are 260 species of trees, including the Mahogany, African Walnut, Mahere, Teak, Ebony, Ironwood, Makore, Sikon and Camwood within the project area of influence. Shifting cultivation practices are also destroying the forests in the area. The road runs through a range of luscious secondary forest, with few rubber farms along the road. The coastal vegetation consists of mangrove swamps, savannah woodland and patches of forest scattered in fields of grassland.

**Socio-Economic Environment:** The communities in the project area of influence have social network and support systems. Generally, the social networks include associations along professional lines. For example, tailors, marketers; other associations are based on age, such as youth groups. On the other hand, some associations are based on gender, such as the woman development groups. Such interactions are used to promote and protect personal relationships and welfare. Another social network in the project area of influence is called “Susu”. This social network is particularly a support group of small scale businessmen and women, coming together for saving and loan purpose. The Susu does not only provide financial security to its members, but fosters solidarity and greater cohesion within the communities.

The population of River Gee County, the population is estimated at 71,509, with male and female at 52.1 and 47.9 respectively (LISGIS, 2011). In the County, the road under 50-km of Lot 3 traverses the road traverses the Chedepo, Gbeapo and Nyenawliken Districts. The total population of Chedepo, Gbeapo and Nyenawliken Districts is 26,611, representing 39.8% of the county population, with male to female ratio estimated at 52.2% to 47.8%. The population distribution of Lot 3 project road is presented in the table below.

<table>
<thead>
<tr>
<th>Population Distributions of Affected Districts</th>
<th>River Gee Co.</th>
<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Chedepo</td>
<td>5,435</td>
<td>51.7</td>
<td>5,083</td>
<td>48.3</td>
</tr>
<tr>
<td>Gbeapo</td>
<td>5,743</td>
<td>52.5</td>
<td>5,191</td>
<td>47.5</td>
</tr>
<tr>
<td>Nyenawliken</td>
<td>2,668</td>
<td>51.7</td>
<td>2,491</td>
<td>48.3</td>
</tr>
<tr>
<td>River Gee (Total)</td>
<td>34,863</td>
<td>52.1</td>
<td>31,926</td>
<td>47.9</td>
</tr>
</tbody>
</table>

Source: Stanley Consultants, 2013

This project road passes through fourteen (14) communities along the corridor: Walken Village, Gbeapo Pronoken, Sarbo Sweaken, Slobert Village, Gbeapo Kanweaken, Frewroken, Palm Wine Village, Doe Village, Juwah Village, Putuken, Sagba Village, Rock Crusher Village, Combat Gate Village and Kelopo Kanweaken.

- **Walken Village:** The first and small rural community of the 50-km corridor, just outside of Fish Town, with not more than 5 houses and a population size of approximately 20. The village has a creek, Konah creek, close to the road that serves as a source of drinking water. The only economic activity is farming of plantain, banana, cassava, rice and etc. and the affairs of the community is managed by a town chief, Morris Tweh.

- **Pronoken Town:** Located in Gbeapo District, Pronoken is an urban community with more than forty houses and its population is approximately 400 represented by the town Chief Musa Chea. The town has one (1) Junior High School, Pronoken Junior High,
three (3) Churches (AICA, Lutheran, and AG), four (4) Hand pumps and a football field and a local court house. The main livelihood activities are petty trade, and farming of cocoa, banana, palm and livestock.

- **Sweaken Town**: An urban community, seat to Nyanwleken district commissioner’s office, the town has more than 25 houses and a population size of approximately 150. The Chief Patrick Dweh and his people have benefited from a USAID Funded Sanitation Project, have a cassava processing center, a newly improved town hall and an Elementary School -Dweh Elementary School. They are mainly involved in petty trade and farming of rice and vegetable, with a few owning cocoa farms.

- **Slobert Village**: This is a small village with less than seven (7) structures.

- **Kanweaken also known as Gbeapo Kanweaken**: A populated urban community divided into nine (9) zones with lots of active businesses owned by mostly Liberians, Guineans and Nigerians. Other livelihood activities include the farming produce such as Rubber, Cocoa, Cassava, Plantain and etc.

- **River Gee County is managed Superintendent Phebe Butty, Assistant Supt Weiah N. Seide**: while Kanweaken has an Acting Mayor Richard Q. Quaye. The city can also boost of many different secondary school facilities:
  - Two (2) Senior High School (Gbeapo Central High School, JJ Gelplay Public High School),
  - Three (3) Junior High School (Matthew Swen Junior high school, AICA Mission Junior High School, Bethel World Outreach Junior High School)
  - Three (3) Elementary School (KES Elementary School, Catholic Elementary School, and Baptist Elementary School)
  - One (1) Day Care School (St. Amos Daycare)

- Other social and public facilities include:
  - Two 2 Health Centers (Gbeapo Health Center and Catholic Clinic),
  - 3 Hand pumps along with other socio activities makes Gbeapo a lively place to be.

- **Flewroken**: This is a peri-urban community on the outskirt of Kanwean and has one public primary school, but children and youth benefit from the proximity of the town to Kanweaken schools. They are involved in petty trade and with mixed farming - raising livestock and growing of crops.

- **Palmwine Village**: This is a newly established rural community with about six houses

- **Putuken**: Located in Chedepo District, this an urban community is home to more than fifty houses and its population is approximately 7,337 headed by a town chief, Piah Typson. The community has a few public infrastructures which include: two (2) schools - TMA Junior and High School, Victory Refuge Community School, one (1) Health Center - Putuken Clinic, two (2) Creeks – Malankee and Subee), eight (8) Handpumps in this community and a football field. Livelihood activities involves mixed farming and business.

- **Sargba Village and Rock Crusher**: These two rural communities are home to five (5) houses and an approximated population of twenty-five (25), respectively. Sargba Village has a church (God’s Sower) and a handpump. Villagers are carry out traditional farming as livelihood activities.

- **Combat Gate Village**: This is a rural community that was established by a family in 2017 five (5) structure, three (3) of which are under construction, and its population is approximately fourteen (14). For livelihood source, they are involved in the making of large rice, cassava and corn farms.
- **Kilepo Kanweaken**: This is populated peri-urban community headed by Chief Andy K. Tullay. The town has three (3) schools - Walpa Memorial Junior Institute, AICA Elementary, and AG Elementary; one (1) Health Center - Kilepo Clinic, five (5) Churches - AG, Baptist, AICA, Pentecostal, and ACFI; and seven (7) Hand pumps. Economic activities include petty trade and mixed farming.

The main ethnic group in River Gee County is Grebo – 67.8. Other tribes present were Kpelle, Mandingo, Kru, Lorma, Gio and Mano.

In a recent socio-economic survey, 91.5% of the respondents in River Gee County are Christians and 8.5% Muslims. This outcome is similar to the national figures of 85.5% Christians and 12.2% Moslems, 0.5% practitioners of African Traditional Religion and 1.5% who professed no religious affiliation.

6. **PROJECT ALTERNATIVES**

In the design of roads, alternatives with respect to route alignment, material acquisition, construction technique and technology need be analyzed to avoid and/or reduce potential environmental and social impacts and capital and operating costs.

**Route Alignment Alternatives**: Factors such as engineering design standards and best practice, road safety, farming activities, existing and future mining activities, existing and future services, i.e. power lines, pipelines, and existing and future town developments were considered. Landowner needs were also considered, all within the norms of engineering, practicality and financial viability. All parties including PAP have agreed on the position of the alignment and the road reserve will be proclaimed and landowners and PAP will be paid compensation.

**Material Acquisition**: Construction material - borrow materials (laterite gravel), sand and rock deposits identified are all within an average haulage distance less than 3km offsets from the existing road alignments. Acquisition of these materials will be established with the contractor and the MLME and with the consent of land owners. Impacts of transport of materials to site will not be significant as the distances are short and the road corridor is not very populated.

**Technology Alternatives**: Consultants are aware of the negative impacts associated with road pavement. Mitigation measures and best practices would be adopted to alleviate the associated adverse environmental impacts.

**Economic Evaluation**: The results of the economic analysis are more favorable towards DBST than AC since construction cost for DBST is lower than for AC. However, asphaltic concrete surfacing is being recommended over Double Bituminous Surface Treatment for the following reasons:

- Whole of life cost: This cost extends the construction cost to include maintenance, upgrading, rehabilitation, salvage value and design life issues.
- Maintenance costs for DBST are relatively higher than AC pavement especially with high traffic loading over time. DBST pavement tends to deteriorate faster with heavy traffic loading than AC pavement. This therefore warrants more frequent routine and periodic maintenance activities over the design life of the DBST pavement - maintenance, based on our experience, which is not a carried out on roads across Liberia, Ghana, Uganda and most of Africa.
• Life of the project was referenced to that of DBST roads which is 20 years, beyond which reconstruction will occur. However, AC roads could have useful lives beyond 20 years.
• Furthermore, salvage value of DBST pavement is lower than AC pavement. Beyond the 20 year design life, AC pavements are expected to have salvage value of approximately 20% of cost and will still have useful service life beyond 20 years. Salvage value for DBST pavement is relatively much lower and would require reconstruction after 20 years.
• Reliability: The minimization of design, construction and maintenance risks over the pavement life. Though this is a subjective assessment, it considers those risks of pavement design and construction that are not directly considered by other criteria. Failures of DBST pavement have occurred with heavy traffic loading and have not performed well over many years in many countries. AC surfaced pavement are highly susceptible to fuel spill damage and rutting under heavy wheels. Apart from these maintenance risks, asphalt can provide a highly reliable pavement compared to DBST.

7. PROJECT IMPACTS
The environmental impacts caused due to the development of the project road have been categorized as primary (direct) and secondary (indirect) impacts. Primary impacts are those which are induced directly by the project, whereas the secondary impacts are those which are indirectly induced and typically include the associated investment and changing patterns of social and economic activities due to the proposed action.

Interaction of the project activities with environmental attributes is presented as Activity-Impact matrix in the table below and analyzed into different categories based on the stakeholders’ views, perceptions and the Consultant’s previous experience in undertaking road project ESIs and experiences gained from other road construction projects. The impacts of the project will be both positive and negative. They have been presented as per the various phases of project cycle which includes construction, operation and decommissioning phases.

**IMPACT IDENTIFICATION MATRIX**

<table>
<thead>
<tr>
<th>No</th>
<th>Activities</th>
<th>Physical Environment</th>
<th>Biological Environment</th>
<th>Geology</th>
<th>Topography</th>
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<tr>
<td></td>
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<td>Noise</td>
<td>Flora</td>
</tr>
<tr>
<td>1</td>
<td>Labor Camp Activities</td>
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</tr>
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<td>-ve</td>
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</tr>
<tr>
<td>3</td>
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<td>-ve</td>
<td>-ve</td>
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<tr>
<td>4</td>
<td>Drilling &amp; Blasting</td>
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<tr>
<td>5</td>
<td>Earthwork</td>
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<tr>
<td>6</td>
<td>Pavement Works</td>
<td>-ve</td>
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<tr>
<td>7</td>
<td>Use of Construction Equipment</td>
<td>-ve</td>
<td>-ve</td>
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</tr>
<tr>
<td>8</td>
<td>Plantation and Farms</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>+ve/p</td>
</tr>
<tr>
<td>9</td>
<td>Drainage Works</td>
<td>-</td>
<td>-</td>
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<tr>
<td>10</td>
<td>Culvert and Bridge Construction</td>
<td>-ve/t</td>
<td>-ve/t</td>
<td>-ve/t</td>
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</tr>
<tr>
<td>11</td>
<td>Stripping of Topsoil</td>
<td>-</td>
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<tr>
<td>12</td>
<td>Debris Generation</td>
<td>-</td>
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</tr>
<tr>
<td>13</td>
<td>Oil &amp; Grease</td>
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</table>

12
Operational Phase

<table>
<thead>
<tr>
<th>Vehicular Movement</th>
<th>-ve/p</th>
<th>-</th>
<th>-ve/p</th>
<th>-ve/p</th>
<th>-ve/p</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved Road Surface</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>+ve/p</td>
</tr>
<tr>
<td>Access to Service</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Agricultural Development</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>-</td>
<td>-</td>
<td>+ve/p</td>
<td>+ve/p</td>
</tr>
<tr>
<td>Employment Opportunities</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Improved Communication</td>
<td>+ve/p</td>
<td>+ve/p</td>
<td>-ve/p</td>
<td>-</td>
<td>-</td>
<td>+ve/p</td>
</tr>
<tr>
<td>Improved Security</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Reduced Vehicle Maintenance</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

Note: “-” = No impact; “+ve” = Negative impact; “+ve/p” = Positive impact
“-ve” = Temporary impact; “-ve/p” = Permanent impact

Source: Stanley Consultants, 2013

Positive Impacts

- The construction of the 50-km Fish Town Kelipo Kanweaken road will create employment opportunities both directly or indirectly during construction and operational phases. Socio-economic study infers there are a lot of local human resources. Therefore, most people will be employed as semi-skilled and casual workers. Few skilled workers will be available. It is anticipated that a lot of people will be employed directly and indirectly during the implementation period.
- The communities acknowledged that the project road will contribute to the growth and development of the local economy.
- Ease of Road Transport in River Gee because of improved through better transportation of goods, commodities and services to and from the project area. This is a large positive impact.
- Improved standards of living
- Improved Security: Whereas the project area is relatively peaceful and a safe place to live incidents of theft do occur along the way due to the scarce road users at present. The upgraded road will also increase easier movement by security personnel.
- Education: Improved road conditions would lead to the improvement and construction and of more schools, other advance institutions of learning and increase attendance of girls.
- Road Safety in terms of reduction in accidents when they involve significant improvements in vertical and horizontal alignments, improved carriageway width, junction layout or greater separation of pedestrians, non-motorized traffic and motor vehicles.
- Empowerment of Women to easily access markets and social services on account of reduced travel time.
- Effective storm water management
- Reversal of rural urban migration

Negative Impacts during Construction

- Impact on Topography: During realignment of some parts of the existing 50-km corridor, there would be cutting of slopes and filling which would change topography at some parts of these sections of the road. Earthwork for this would alter the existing topography, although the impact would be negligible. In addition, the geological nature of the terrain is prone to earth flows/mass movement erosion and landslides. Protection measures need to and will be taken through construction, which might alter the topography at a localized level.
• **Impact on Surface Water Drainage** is anticipated on the surface water drainage in the area during the construction phase due to the diversion of waterway. Precautions must to be taken during the construction works of culverts and bridges across these streams, such that the flow of these water bodies is not obstructed.

• **Expected mass movement and soil movements** could lead destructed and non-productive for further agricultural use. The loss of fertile land, even if the area is very small fertile, is always a serious drawback for farmers.

• **The impact on soil** due to the project will be in terms of topsoil erosion. Strengthening and widening of the existing road will not cause significant soil erosion. Soil pollution would take place to a negligible extent due to spillage of construction material, oil, fuel, grease and asphalt around the construction yards. Care will be taken to minimize spillages of construction materials.

• **Impact on surface water quality**: The proposed road corridors are not expected to alter the existing water quality on a permanent basis. Silt load in the streams at the culvert and bridge locations may increase during construction and the spillage of hazardous chemicals during accidents and may pollute the waters; thereby, affecting the ecosystem. The issue of blocking of cross drainage should be taken care throughout the project life.

• **Impacts on Air Environment**: with respect to the existing ambient air quality or with respect to compliance of ambient air quality standards during the post upgrading phase of the life of the road, due to the increase in the traffic volume, the impact on air quality along the project roads is likely to be minor. Impacts on air quality during the construction phase of the project will be considerable as the amount of work involved in the improvement of the road is significant, but any possible impacts will be temporary.

• **Noise impacts**: During the construction phase of the road, the major sources of noise pollution are vehicles transporting the construction material to the construction yard and the noise generating activities at the yard itself. Construction activities are anticipated to produce noise levels in the range of 80 - 95 dB (A). The construction equipment will have high noise levels, which can affect the personnel operating the machines.

• **Impacts on Fauna**: The increased activities of vehicle movement disturb the sensitive movements of fauna. The impacts are expected to be more severe during the times of accidents of vehicles carrying hazardous chemicals. From the site visits and discussion with officials, it is inferred that there are no noticeable habitats or wild or endangered animal habitats along close vicinity of the project road. But upgrading of the road will result in increased human activities along the project area that could increase poaching of animals / any other natural features.

• **Impact on ecological resources**: The road traverses secondary forest terrains rich in bio-diversity as presented in base line environmental profile of the project road. The envisaged borrow pits and land acquisition in the project road will bring about hill cutting and tree cutting. This would have substantial irreversible and long-term impact on the flora and fauna of the project area.

• **Land Acquisition**: The proposed upgrading of the project road will involve land acquisition and demolition of road side structures. A total of eligible 103 PAPs was documented, 241 structures and 7 farms will be affected, while total number of affected persons including number of household members affected is 1,036 persons.

• **Cultural changes**: The road traverses land inhabited dominantly by indigenous communities. Some of the people are Christians, while others are traditionalists and they have established social systems. Expected social vices include degradation of the
cultural values and norms in the area; increase in the levels of crime of the area; and increased desirable and undesirable social interaction in the area.

- **Community health impacts:** Nowhere is impact prevention more important than road safety and human health. The road project may have serious negative consequences for the health of local populations. Although there are no empirical data to support this theory as far as Liberia is concerned, it is believed that migrant populations, particularly truck drivers and construction workers whose mobility is enhanced by new road project are the most likely vectors for these diseases.

- **Public Health impacts:** Dust borne communicable diseases, respiratory infections and minor throat and eye irritations are expected, especially during the dry season because of the emission of vehicular pollutants and dust (carbon monoxide and particulates). The presence of construction workers and related increase in disposable cash makes the transmission of STDs a possibility.

- **Occupational Health and Safety:** Injuries resulting from falling from heights and falling objects, as well as from the misuse of equipment and tools, cuts from stepping on sharp objects such as nails and other metal off-cuts and injuries resulting from clashes between vehicles and the workers as they both operate within the same space are likely to occur during the implementation of the project.

**Negative Impacts during Decommissioning**

The project is expected to be in operation for more than 20 years after construction and therefore decommissioning is in the distant future. However; should this happen, all the positive impacts mentioned in this report would be reversed to be negative. Other negative impacts during decommissioning may include:

- Solid waste generation;
- Noise pollution;
- Dust and exhaust emissions; and
- Occupational hazards.
## PROJECT ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES

<table>
<thead>
<tr>
<th>Environmental Issue</th>
<th>Potential Impact</th>
<th>Mitigation Measure</th>
</tr>
</thead>
</table>
| Soil Erosion and Siltation          | Site preparation and clearing; Removal of vegetation, soil disturbance and poor drainage                                               | • Clearing of the site would be staggered so that areas will be cleared only when construction is about to commence there. Besides maintaining some vegetation on the site, the staggered clearing will limit the area exposed to help prevent massive sheet erosion;  
• Large surface area of credible earth material would not be exposed at one time. |
| Air quality/Noise/Vibrations        | Construction – Earthworks, material transport, quarry blasting, etc.                                                                 | • Construction materials would be covered by tarpaulins when being transported by truck;  
• Regular watering and limiting the speed of vehicles travelling through the settlements will reduce air quality impacts;  
• Borrow pits, quarry concrete plants and asphalt mixing plants will be located more than 500m from any community to reduce noise impacts;  
• Regulate blasting activities near settlements to specific time frames;  
• Ultimately however, the road reconstruction will result in the total elimination of that dust from the road under the present baseline condition of the road. |
| Water ways/Drainage Sites           | Site preparation & clearing activities; Bridge and culvert construction; heaping of materials; chemical spillage                       | • Work on water courses would be commenced in the dry season when the water flow gets very low;  
• Clean fill materials will use (e.g. quarried rocks containing no fine soil) around water courses;  
• Buffer zones of undisturbed vegetation will be provided between road sites and water bodies;  
• Sediment basins will be provide to remove silts, pollutants and debris from road run-offs before discharge to adjoining stream. |
| Water Resources: - Water Quality/ Modification of water flow, Diversion of water course | Water abstraction, Bridge and culvert construction; Site preparation & clearing activities; chemical spillage | • Contractor will provide alternative source of water e.g. borehole for both life camps and for construction works, including supplies for dust suppression in consultation with MLME;  
• Fueling areas would be designate away from streams and wetlands;  
• Handling of hazardous materials will be confined to construction sites. |
| Biodiversity – flora/fauna          | Quarry Extraction; land take for ROW                                                                                                  | • The Consulting Team have consulted the Forestry Development Agency and they will be available to give advice on measures to alleviate the adverse impacts especially on wildlife;  
• Culverts will be designed with the needs of migratory aquatic species in mind. Down-stream siltation will be avoided so as not to ruin possible spawning beds for fish;  
• Schedule for construction would be adhered to as not to frighten wildlife away because of prolonged construction. |
<p>| Ecological Sensitive Sites          | Materials Haulage, land take                                                                                                           | • Land take for ROW will not affect any of the ecological sensitive sites along the route. Sapo National Forest and Grebo National Forest are located more than 50 km away from the road corridor respectively. |
| Cultural/historical Sites           | Land take                                                                                                                            | • MPW, community leaders and County Administrators will work with contractor to relocate or preserve the several burial sites along the route. |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Description</th>
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</table>
| Occupational Health and Safety  | Construction activities      | • Workers are provided with adequate personal protective equipment and enforced to use them;  
• Technical specifications relevant to safety measures are regarded in the installation and use of plant and equipment (e.g. diligent execution of works, general observance of safety rules leading to inherently safe systems);  
• The workers have received sufficient training and experience in connection with safety measures and their observance as well as in the ESMP;  
• There is proper and sufficient supervision of workers. |
| Disruption to Road Use          | Construction - Careless planned detours and road closures | • The contractor would have to complete work in a continuous and consecutive sequence without leaving isolated sections. Hence, road users can expect brief delays in specific locations as work proceeds but markets must remain reachable on any day;  
• The contractor will be expected to ensure that the whole road remains in a usable condition throughout the contract period. |
| Increase in moral laxity        | Migrant workers              | • Engage in community consultation;  
• Ensure local representation in labour force;  
• Intensify HIV enlightenment for construction workers and communities. |
| Conflicts over land ownership   | Land take and resettlement   | • Engage in community consultation. |
8. PUBLIC CONSULTATION AND DISCLOSURE

Formal public meetings were conducted in Kanweaken, River Gee County. The meetings were held between June 30 and July 5, 2013 and were meant to introduce the project to the communities and get better understanding of social and community structures.

An estimated 59 members of public attended the meeting. However; the meeting had low female turnout (29 women) and it is assumed that because the communities are patriarchal in their social setup and males take the lead in all major decisions and communal development matters. However, with the gender sensitization and women involvement in political and social matters, we anticipate more females and gender balance in future consultations.

The local communities consulted cited many problems they anticipate with the proposed road:

- The communities expressed concern on employment; they wanted unskilled workers to be recruited from the local area and local leaders to be consulted as part of the recruitment to reduce the disputes or conflicts that could emerge between the Contractor and the local population during the construction period. This was stressed in all the local meetings. Unnecessary tension could potentially arise if the locals are not considered for employment.

- Encroachment in the road reserve includes crop cover, buildings and temporary structures in several places along the project are within the road servitude or right-of-way. Some parts of the road will be realigned, leading to relocation of some community members. The community recommends they get fairly compensated and there be compensation and consideration of squatters’ rights.

- The communities expressed concern on the possible increase of accidents on the road due to:
  - Over-speeding of vehicles;
  - Lack of road safety signs;
  - Lack of speed breakers;
  - Livestock and children crossings.

- Most community members expressed concern that with the influx of non-indigenous workers and petty traders during construction would be a probable breakdown of social values, which could result in unwanted pregnancies, social problems and spread of diseases.

- People interviewed during public consultations were concerned about:
  - Delays in transportation of goods and services during the construction of the road;
  - The high public vehicle fares and length of time it takes to travel between towns;
  - Poor road conditions which make it difficult to transport food stuff from neighboring towns; and
  - Inaccessibility of some market centers during the rainy seasons.
  - The communities expressed fears of possible increase in dust and noise especially during the construction phase.
  - Due to felling of trees within the proposed right of way, the community felt that this will negatively affect the physical appearance of the area.
  - The communities believed the value of the wetlands and water courses will be degraded.
9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The ESMP is a plan of action for avoidance, mitigation and management of the negative impacts of the project. Environment Enhancement is also an important component of ESMP. The ESMP has been developed with project knowledge and information available to date. Some of the Project’s final details, such as proposed locations of construction camps, actual locations of borrow areas to be used by the Contractor, disposal areas for construction debris among other issues, are currently unknown. As project commencement and scheduling plans are developed and changed, components of the ESMP will require amending. This is therefore a working document, which can be updated whenever new information is received or site conditions change. The objectives of the ESMP are:

- To bring the project into compliance with applicable national environmental and social legal requirements;
- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts;
- To address capacity building requirements within the relevant Ministries if necessary.

Responsibilities: The following entities will be involved on the implementation of this ESMP:

- Ministry of Public Works/Infrastructure Implementation Unit (MPW/IIU): The Ministry of Public Works has established an Infrastructure and Implementation Unit to supervise and monitor all infrastructure projects in the country, including all road projects. Therefore, the responsibility for ensuring that mitigation measures specified in this ESMP and the contract documents are implemented will lie with this unit.
- Ministry of Transport (MOT) and Liberia National Police (LNP): Road safety and accident prevention is the responsibility of the Ministry of Transport and the Liberia National Police.
- Environmental Protection Agency of Liberia (EPA): The responsibility of EPA is to
  - Exercise general supervision and co-ordination over all matters relating to the environment;
  - Be the principal instrument of Government in the implementation of all policies relating to the environment; and
  - Ensure that all mitigation measures proposed are implemented.
- The Supervising Engineer, Resident Engineer (RE) of River Gee County will be appointed by the Ministry of Public Works. They will be required to oversee the construction programs and construction activities performed by the Contractor, in compliance with the present ESMP. The RE will have an Environmental and Social Officer (ESO) in its team to co-ordinate all aspects of the environment during project implementation. This will include (i) following the construction to monitor (ii) review and (iii) verify the implementation of the project’s ESMP.
- Contractor: The Contractor will be appointed by the Ministry of Public Works and will be required to comply with the requirements of the ESIA/ ESMP and the Standard Specifications for Road Works in Liberia, as published by the Ministry of Public Works.
- Local Authorities: The relevant departmental officers in the local authorities of River Gee County should be called upon when necessary during project implementation to provide the necessary permits and advisory services to the project implementers.
<table>
<thead>
<tr>
<th>Environmental / Social Aspect</th>
<th>Recommended mitigation, monitoring and/or management measure</th>
<th>Impacts</th>
<th>Responsibility for implementation</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Acquisition, clearing encroachments and road corridor</td>
<td>* The land acquisition would be in accordance with the RAP and entitlement framework. All road corridor activities are to be completed before starting the construction of the roads.</td>
<td>* Loss of property and livelihoods</td>
<td>MPW/IIU</td>
<td>Pre- construction</td>
</tr>
<tr>
<td>Relocation of utilities and common property resources</td>
<td>* All the utilities and common property resources being impacted due to the project will have to be relocated with prior approval of the concerned agencies before construction starts.</td>
<td>* Damage to utilities, inconvenience to Public.</td>
<td>Contractor</td>
<td>Pre- Construction</td>
</tr>
<tr>
<td>Debris disposal, site identification</td>
<td>* Selection of the disposal sites will be carried out in consultation with the relevant authorities and local community. Ensure that no natural drainage, productive lands or natural habitat is adversely impacted due to disposal. Preferably, debris disposal site should be identified in barren, infertile land.</td>
<td>* Loss of productive lands or natural habitats</td>
<td>Supervising Engineer and the Contractor.</td>
<td>Construction</td>
</tr>
<tr>
<td>Establishment of Quarry and Hot- mix plants</td>
<td>* Specifications of stone crushers, hot mix plants and batching plants to be established for the project should comply with the requirements of the relevant statutory bodies.</td>
<td>* Air, water, noise and soil pollution</td>
<td>Contractor and RE and ESO</td>
<td>Construction</td>
</tr>
<tr>
<td>Selection of construction vehicles, machinery and equipment</td>
<td>* All the vehicles, machinery and equipment to be engaged for the construction work should be attached with the latest, advanced pollution control measures available in the country and those should conform to the relevant National and International standards.</td>
<td>* Air and noise pollution</td>
<td>MPW/IIU, Contractor and RE</td>
<td>Construction</td>
</tr>
<tr>
<td>Materials (Sand, earth and aggregates) sourcing</td>
<td>* Contractor should procure materials from licensed sources. * Every detail (Location, ownership, agreement, redevelopment Plan) of the material sourced should be implemented and periodic inspections so that appropriate measures are implemented at site towards safe operation and minimizing impacts.</td>
<td>* Loss of productive land, noise, water and air pollution</td>
<td>Contractor, RE and ESO</td>
<td>Construction</td>
</tr>
</tbody>
</table>
| Haul roads maintenance | * During the inception of the project, Contractor should identify the network of roads (especially the earth roads) to be used for haulage of construction materials.
* Strategy for the maintenance of identified haul road stretches is to be prepared so that regular maintenance is carried out to those stretches by the Contractor for easy plying of construction vehicles. | * Air and noise pollution | Contractor, ESO and RE | Construction |
|----------------------|--------------------------------------------------------------------------------------------------|----------------------------|-----------------|----------|
| Selection of Borrow areas | * Compliance to all the Statutory requirements towards operation and environmental protection of borrow areas is the sole responsibility of the Contractor.
* RE will inspect locations intended for operation and mitigation measures will be instructed towards satisfactory redevelopment.
* Inspection to the borrow areas carried out. | * Air, water and noise pollution, loss of productive lands | Contractor and MPW/IIU, RE and ESO | Construction |
| Stone quarries and borrow area | * A comprehensive Quarry Management Plan need to be prepared incorporating Environmental and Safety Management Plan with special emphasis to Quarry redevelopment for approval by RE and decommissioning certificate by EPA. | * Air and noise pollution, loss of productive lands | Contractor, RE and ESO | Construction |
| Removal of vegetation cover, Excavations of borrow pits | * Turfing of road embankment slopes, compensatory afforestation and borrow area rehabilitation should be done as preventive measures for soil erosion. | * Increased soil erosion, loss of top soil. | Contractor and RE | Construction and operation |
| Movement of Heavy Vehicles | * Construction vehicles, machinery and equipment shall move, or be stationed in pre-identified designated areas only.
* If operating from temporarily hired land, it will be ensured that the topsoil for agriculture remains preserved & not get compacted. | * Compaction of productive top soil | Contractor and RE | Operation |
| Spillage of fuel, lubricants and hazardous chemicals | * Vehicles and machinery are maintained and refilled in such a fashion that fuel spillage does not contaminate the soil.
* Fuel storage and refilling sites should be kept away from cross drainage structures and important water bodies.
* All spills shall be disposed as desired and the site shall be fully cleaned before handing over.
* Soil quality monitoring should be conducted throughout project life. | * Contamination of soil and negative impact on the growth of the floral vegetation and faunal distribution. | Contractor and RE | Operation |
<table>
<thead>
<tr>
<th>Disposal of construction waste.</th>
<th>* The construction waste should be dumped in selected pits, developed on infertile land and approved. Acquire all applicable waste disposal licenses. Approved waste land to be preferred for.</th>
<th>* Loss of productive lands</th>
<th>Contractor and RE</th>
<th>Construction and operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface runoff from the construction site, dumping of construction debris in or nearby water bodies</td>
<td>* No labor camps, stone crushers, hot mix plants and other heavy machinery should be located near water bodies. No discharge from such establishments should be directed to water bodies. * Dumping of debris in or nearby water bodies to be strictly avoided. Waste products must be collected, stored and taken to approved disposal sites as per prevailing regulations. * Runoff from the construction site should be passed through silt traps. Pitching, stabilization of soil and slope protection measures should be taken up to reduce erosion of soils. * Water quality monitoring should be conducted as per Environmental &amp; Social Monitoring Plan so that appropriate</td>
<td>* Increased turbidity of water. * Deterioration of Water quality of community water sources. * Adverse impact on aquatic ecosystem</td>
<td>Contractor RE, MPW/IIU and local administration</td>
<td>Operation</td>
</tr>
<tr>
<td>Spillage of fuels and lubricants, spillage of hazardous chemicals</td>
<td>* Appropriate drainage arrangements with catch drains and catch pits designed to safely drain out the hazardous chemicals should be provided. * To avoid spillage of fuel and lubricants, the vehicles and equipment shall be properly maintained and repaired. * Maintenance to be carried out on impervious platforms with spill collection provisions. Surface run off from vehicle parking, washing and fueling areas and hot mix plant areas should be passed through oil interception chambers and the oil will be skimmed off from the chamber and will be disposed of by</td>
<td>* Deterioration of water quality of community water sources. Adverse impact</td>
<td>Contractor and RE</td>
<td>Operation</td>
</tr>
<tr>
<td>Cultural Changes</td>
<td>* Strengthen the cultural organizations and encouraging competitions through organization of cultural tournaments; * Ensure that the project contributes to the creation of an atmosphere that is conducive to the functioning of all social centers which are in the project zone of influence.</td>
<td>* To reduce the breakdown of the socio- culture of the natives.</td>
<td>MPW/IIU and local administration</td>
<td>Operation</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>* Sensitization and awareness campaigns should be the responsibility of the National Aids Control Commission together with their county coordinators.</td>
<td>* To reduce prevalence rates</td>
<td>MPW/IIU and National Aids Control</td>
<td>Operation</td>
</tr>
<tr>
<td>Construction of bridges across major water bodies</td>
<td>* The construction of bridges across major water bodies should be done by serving prior notice to the users. Care should be taken to avoid mixing of construction materials with water channel such that it may affect the downstream users or water supply schemes.</td>
<td>* Water shortage in downstream water users</td>
<td>Contractor and RE</td>
<td>Construction</td>
</tr>
<tr>
<td>Construction of embankments</td>
<td>* Earth, stone or any other construction material should be properly disposed of so that the flow of water in cross drainage channels is not blocked.</td>
<td>* Blocking of cross drainage and resultant flooding.</td>
<td>RE and contractor</td>
<td>Construction</td>
</tr>
</tbody>
</table>
| Dust generation due to material handling, operation of crushers and hot mix plants, movement of construction vehicles and construction activities | * All precautions to reduce the level of dust emissions from the hot mix plants shall be taken.  
* The hot-mix plants should be sited at least 500 m from the nearest habitation and from major water bodies. They should be fitted with dust extraction units.  
* Water should be sprayed on the earth mixing sites, asphalt mixing site and service roads.  
* During sub grade construction, sprinkling of water should be carried out at least twice a day on a regular basis during the entire construction period especially in the dry seasons. Special attention should be given in the sections where the alignment passes through sensitive areas such as schools, hospitals and urban areas.  
* As soon as construction is over the surplus earth should be utilized to fill up low-lying areas. In no case, loose earth should be allowed to pile up along the alignment. Vehicles delivering material should be covered. Air quality monitoring should be conducted as per Environmental Monitoring Plan. | * Dust generation due to material handling, operation of crushers and hot mix plants, movement of construction vehicles and construction activities. | RE and contractor | Construction |
| Noise generated from construction vehicles, asphalt plants and equipment | * Construction contract should clearly specify the use of equipment emitting noise of not greater than 90 dB (A) for an eight-hour operation shift.  
* The siting of construction yards should be done leaving at least 100 m distance from any residential areas which will allow noise to attenuate. The main noise producing sources such as the concrete mixers, generators, grader etc. should be provided with noise shields. The noise shields can be any physical barriers, which is effective in adequate attenuation of noise levels. | * Since the noise generating activities are localized and intermittent, no serious impact on human health is anticipated.  
* Residential areas nearby the construction site may experience increase in night time ambient noise levels. | RE and contractor | Construction |
| Removal of trees for widening of existing road and construction of realignments | * Small trees shall be transplanted wherever possible to minimize the impacts of loss of trees. Trees should be removed in phases.  
* Adequate care of the afforested plants should be taken up to achieve optimum survival rate. Landscaping should be done with a lag of 3 to 4 months from the start of the work on any section. The section should be deemed to be complete when the landscaping is over. | * The impact on biodiversity will be negligible since most of the trees are of common occurrence.  
* Loss of trees will lead to Increase in soil erosion, loss of shade and other benefits of trees, and decline in air quality. | RE and contractor | Construction |
| Poor maintenance of machines and vehicles, poor light conditions at the work place, carelessness and poor management of work | * To ensure safe construction environment, lighting devices and safety signal devices shall be installed. Traffic rules and regulations to be strictly followed.  
* Safety of workers undertaking various operations during construction should be ensured by providing them with helmets, masks, safety goggles etc.  
* Regular tool talks, mock drills, training programs to be organized towards educating workers towards adopting safe working methods.  
* The electrical equipment should be checked regularly to avoid risks to workers. At every work place, a readily available first aid | * Accident risk to workers from construction activities | RE, traffic department and contractor | Construction |
| Improvement of roadside amenities | * Restoration and improvement of bus shelters, bus bays and truck stoppage sites to be carried out as per detailed design. Road furniture like footpaths, railings, traffic signs etc. shall be erected as per design. | * Improved comfort level of travelers | RE and contractor | Construction |
| Unhygienic conditions at work place and camp sites, Non- availability of good drinking water. | * Adequate drainage, sanitation and waste disposal to be provided at workplaces.  
* First Aid facility to be made available at each work locations  
Periodical medical checkup facility to be provided to all the workers.  
* At every workplace, good and sufficient water supply shall be maintained to meet the daily chore of the residing population.  
* Measures to be implemented so that waste water is collected in septic tanks/soak pits. No surface stagnation of water will be allowed to avoid disease outbreak. | * Health problems to workers | RE and contractor | Construction |
|---|---|---|---|---|
| Use of water for construction from community water sources | * Arrangement for supply and storage of water will be made by the contractor in such a way that the water availability and supply to nearby communities remain unaffected. If a new well is to be bored, proper sanction and approval by relevant authorities is needed.  
* The wastage of water during the construction should be minimized. In case of tapping water from community sources, consent to be obtained from local administration for the same. | * Scarcity of water to the community | RE and contractor | Construction |
| Absence of proper sanitation and waste disposal in construction camps | * Construction laborers’ camps shall be located away from the habitation and from major water bodies. Adequate sanitary facilities, drainage, washing and toilet facilities with septic tanks and refuse collection and disposal should be provided to the workers. The provision of water supply and toilet facilities should be made as per regulations.  
* Water quality monitoring should be conducted as per Environmental Monitoring Plan. | * Contamination of water bodies and spreading of water-borne diseases.  
* Health risk to workers & public | Contractor and RE | Construction |
| Improvement of road geometry and pavement condition | * Proper implementation of traffic rules by the Traffic Police.  
* Proper maintenance of traffic signs. | * Less chances of accidents | Traffic police | Operation |
| Improvement of road surface and its maintenance | * Proper implementation of vehicular emission control rules by the traffic Department.  
* Roadside tree plantation to be restored and maintained as per the compensatory plantation plan. | * Reduced dust generation from road.  
* Increased Vehicular emissions due to increased traffic. | Contractor, MPW / IIU and LNP | Operation |
| Increase in traffic | * Development of greenbelt comprising selected species of trees with high canopy along the project road for attenuation of noise.  
* Use of horns should be restricted at sensitive locations like schools and hospitals through the use of appropriate signboards along the road. | * Increase in the ambient noise levels, especially during night time along the project road. | Traffic police | Operation |
| Increase in embankment height and improvement of flood water drains | * The cross-drainage system and the flood water drains should be periodically cleared. | * Water logging during wet seasons will not take place | Contractor and MPW/IIU | Operation |
| Movement of vehicles with higher speed. | * Drivers should be warned with proper sign boards for speed restriction within area with high human concentrations.  
* Usage of air horns should be completely avoided within noise sensitive areas both during day and night time. | * Road accidents | Traffic police | Operation |
| Improved safety measures and improved traffic management | * Traffic management plan to be developed, especially in high population areas.  
* Traffic control measures including speed limits to be enforced strictly. Road corridor should be properly marked and further encroachment of road corridor should be strictly prevented.  
* Road side vendors should be restricted to designated areas only. | * The chances of accidents would be reduced | LNP | Operations |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------|------|------------|


Auditing of the ESMP: The ESO shall conduct quarterly audits to ensure that the system for implementation of the ESMP is operating effectively. The audit shall check that a procedure is in place to ensure that:

- The ESMP being used is the up-to-date version;
- Variations to the ESMP and non-compliance and corrective action are documented;
- Appropriate environmental training of personnel is undertaken;
- Emergency procedures are in place and effectively communicated to personnel;
- A register of major incidents (spills, injuries, complaints, legal transgressions, spot fines and penalties etc. is in place and other documentation related to the ESMP;
- Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued through the RE.

Monitoring of the ESMP: Environmental and social monitoring during construction and operation helps to predict unforeseen environmental and social impacts and allows measures to prevent or avert adverse impacts to be developed or introduced in a timely manner.

Maintenance of infrastructure during construction and operation is also important in contributing towards environmental conservation by for example, preventing soil erosion along the road and its upstream and downstream catchments and ensuring proper drainage of run-off, away from the road.

During the construction and operation phases, monitoring will be undertaken to ensure that proposed mitigation measures for negative impacts and enhancement measures for positive impacts are implemented.

### ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN MONITORING

<table>
<thead>
<tr>
<th>Environmental Aspect</th>
<th>Location</th>
<th>Responsibility during design and construction</th>
<th>Responsibility for monitoring during operation</th>
<th>Mode and Period (c)</th>
<th>Frequency of monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land acquisition and Resettlement</td>
<td>* Way leave</td>
<td>MPW/IIU</td>
<td>RAP Report</td>
<td>Site visit and visual inspection (c)</td>
<td>Daily (c)</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>* Construction Camp * Project Sites</td>
<td>Contractor, Supervising Engineer.</td>
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</tr>
<tr>
<td>Air pollution</td>
<td>* Project site</td>
<td>Design Engineer, Contractor, Supervising Engineer, FDA</td>
<td>LNP; MPW/IIU</td>
<td>Visual inspection (c)</td>
<td>Daily (c)</td>
</tr>
<tr>
<td>Noise pollution</td>
<td>* Project site</td>
<td>Supervising Engineer and Contractor</td>
<td>LNP and MPW/IIU</td>
<td>Speed gun (o) Observation/Inspection (c)</td>
<td>Random (o)</td>
</tr>
<tr>
<td>Liquid wastes</td>
<td>* Project site (workshops)</td>
<td>Design Engineer, Supervising Engineer, and Contractor</td>
<td>MPW/IIU</td>
<td>Visual inspection (c) Routine maintenance (o)</td>
<td>Daily (c) Twice a year (o)</td>
</tr>
<tr>
<td>Vegetation loss</td>
<td>* Way leave</td>
<td>Design Engineer, Contractor, Supervising Engineer, Forest Department</td>
<td>MPW/IU</td>
<td>Visual Inspection (c)</td>
<td>At the end of construction</td>
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<tr>
<td>Water</td>
<td>* Material sites and project area</td>
<td>Contractor, Supervising Engineer</td>
<td>MPW &amp; MLME</td>
<td>Water quality analysis (c)</td>
<td>Monthly</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>* Project area</td>
<td>Contractor, Supervising Engineer</td>
<td>MPW/IU</td>
<td>Drainage of project area (c)</td>
<td>Weekly</td>
</tr>
</tbody>
</table>

*Source: Stanley Consultants, 2013*

*Costs of Mitigation and Monitoring:* The costs for mitigation of construction related impacts will be included in the contract documents. During construction and decommissioning phases of the project, the ESO will coordinate the monitoring program and prepare reports for submission to the environmental authorities.

*Environmental and Training and Awareness:* The Contractor will be required to provide for the appropriate environmental training and awareness as described in this ESMP in its costs and programming. An initial environmental awareness training session shall be held prior to any work commencing on site, with the target audience is all project personnel.

*Environmental Risk Management:* The failure of environmental mitigation can result in serious impacts such as erosion, increased road accidents and disruption of the community lifestyles. Construction of a road also involves occupational health and safety risks to road workers, primarily in the areas of storage and handling of dangerous materials, and operation of heavy machinery close to traffic, slopes and watercourses.

*Emergency Procedures:* The Contractor shall submit Statements covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities.

**10. CONCLUSIONS AND RECOMMENDATIONS**

Conclusion: The findings of the environmental and social impact assessment (ESIA) concludes there is an overall positive socio-economic and environmental impact of upgrading, to bitumen standards, the first 50-km of Lot 3 – Fish Town to Kelipo Kanweaken. However, the impact of the project on the bio-physical environment is potentially slightly to moderately negative, both in the construction and operation phase. This is achievable only if appropriate mitigation and support measures are employed. The social impacts of land take and resettlement have been addressed during the RAP studies.

An environmental and social management plan has been prepared and required to update once the contractor has begun mobilization. Provided the road is upgraded with due attention to the mitigation and management measures outlined, the project will have a positive impact on both the bio-physical and socio-economic environment of the project area. It is recommended that this road project be implemented and that the proposed mitigation and monitoring measures are enforced.
Recommendations: Based on the finding of overall positive impact of the project, we wish to recommend the following:

- The road project should be granted a license to commence.
- A monitoring program should be adhered to by the supervising Engineers and MPW/IIU during operation of the road.
- MPW/IIU should liaise with other entities/organizations having utilities on the road to ensure that they only use the edges of the road reserve to avoid future costs of relocation of service and inconvenience.
- MP W/IIU should survey and put beacons on the road reserves to stop encroachment and ease maintenance of roads.

11. REFERENCE AND CONTACTS
Updated Environmental and Social Impact Assessment for the Mano River Union Road Development and Transport Facilitation Program (MRU/RDTFP) Phase II: Paving of Fish Town to Kelipo Kanweaken – First 50-km of Lot 3, 118-km from Fish Town to Gbagbo Town

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