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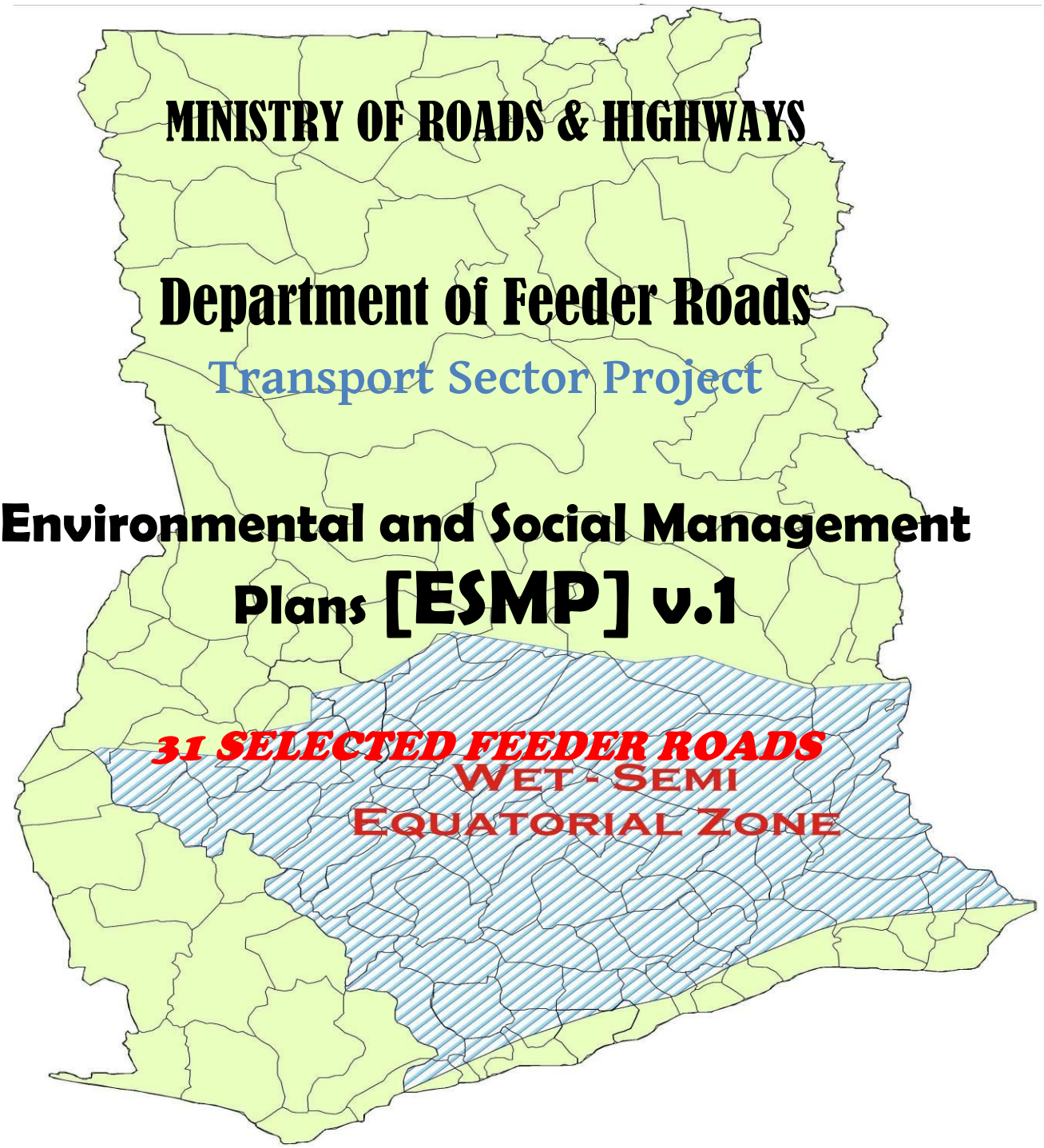
REPUBLIC OF GHANA

MINISTRY OF ROADS & HIGHWAYS

Department of Feeder Roads

Transport Sector Project

Environmental and Social Management Plans [ESMP] v.1



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List of Acronyms

CEHRT	Centre for Environment and Health Research and Training
DA	District Assembly
DE	District Engineer
DFR	Department of feeder Roads
IDA	International Development Association
EA	Environmental Assessment
EC	Energy Commission
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
FID	Factories Inspectorate Department
GHA	Ghana Highway Authority
GHGs	Green House Gases
GNFS	Ghana National Fire Service
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
ILO	International Labour Organisation
LI	Legislative Instrument
MEST	Ministry of Environment, Science and Technology
MoE	Ministry of Energy
MRH	Ministry of Roads and Highways
MTTU	Motor Traffic and Transport Unit
NETF	National Employment Task force
NYEP	National Youth Employment Program
OP/BP	Operational Policy/Banks Policy
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SE	Site Engineer
SIM	Stakeholder Identification Matrix
SNEP	Strategic National Energy Plan
STIs	Sexually Transmitted Infections
ToR	Terms of Reference
TSP	Transport Sector Project
RoW	Right of Way
RPF	Resettlement Program Framework
URTIs	Upper Respiratory Tract Infections
VOC	Vehicle Operating Cost
WHO	World Health Organization

EXECUTIVE SUMMARY

Introduction

The Department of Feeder Roads of the Ministry of Roads and Highways (MRH) have selected eighty-four (84) feeder roads for minor rehabilitation/spot improvement and other maintenance works throughout the country. The maintenance works fall under the Transport Sector Project (TSP) to be financed by the International Development Association (IDA).

The implementation of projects under the TSP is guided by the Environmental and Social Management Framework (ESMF) and the Resettlement Policy Framework (RPF) of the MRH. This is to ensure compliance with the relevant environmental and social safeguard requirements for sound project execution. Therefore in line with the ESMF and the RPF, 84 ESMPs have been prepared for the maintenance works on the 84 selected feeder roads. The roads have been grouped under the four major eco-climatic zones of Ghana – the South-Western Equatorial; Dry Equatorial; Wet Semi Equatorial; and the Tropical Continental Zones. In order to facilitate administrative and implementation arrangement of the ESMPs, the eco-climatic zones have been aligned with the relevant regional boundaries. Thus, the ten administrative regions of Ghana have been grouped into four, based on their broad eco-climatic characteristics as follows:

- Western Region - South Western Equatorial Zone
- Ashanti, Eastern and Volta (middle) Regions - Wet Semi-Equatorial Zone
- Central, Greater Accra and Volta (southern) Regions - Dry Equatorial Zone
- Brong Ahafo, Northern, Upper East & West and Volta (northern) Regions - Tropical Continental Zone

This report focuses on the maintenance works in the Wet-Semi Equatorial Zone, and presents the ESMPs for the thirty one selected feeder roads in twenty one districts within the 4 regions which make up the zone.

The scale of the maintenance/rehabilitation works is rather limited, with localised impacts within the existing right of way (RoW). No land outside the RoW or property, building or any structure will be affected by the road works, therefore no compensation or resettlement will be required. Also no sensitive sites or resources such as forest reserve, sacred grove, cemetery, shrine or other places of historical and cultural interests are within or near the RoW of any of the 31 roads earmarked for maintenance. Furthermore, the maintenance works will not affect any utility lines such as water, electricity or telecommunication lines. Thus, the World Bank safeguard Policies such as the Involuntary Resettlement, Management of Cultural Property, Conservation of Natural Habitats and Forestry are not triggered.

Policy, Legislative and Administrative Frameworks

The relevant policy and legislative frameworks applicable to the sector and feeder road ESMP preparation and therefore considered included:

- Environmental and Social Management Framework of the Transport Sector Project (TSD);
- Ghana's Environmental Policy;
- Environmental Protection Agency Act, 1994;
- Environmental Assessment Regulations and Procedures;

- Environmental Assessment (Amendment) Regulations, 2002;
- Occupational Safety and Health Policy of Ghana (Draft);
- National Workplace HIV/AIDS Policy;
- The World Bank Requirements.

General Project and Zonal Information

All the road alignments already exist, but in deplorable conditions. Ashanti Region has a total of 65.55km (29.1%) of feeder road designated for maintenance works in the Wet-Semi Equatorial Climatic Zone. Central and Eastern Regions follow in succession with 58.3km and 52.5km representing 25.8% and 23.3% respectively. Volta region (middle) with a total road length 48.8km constitutes 21.7% of designated roads in this zone. The lengths and recommended works for the various roads in the Wet-Semi Equatorial Climatic Zone are given in the table below.

Table 1 Selected Road for Maintenance in Wet-Semi Equatorial Zone

No.	Road Name	Districts	Length (km)	Recommended Works
Ashanti Region				
1.	Fumso-Odemu-Anwhiam	Adansi North	10.00	Spot Improvement
2	Twepease Junction- Twepease	Adansi South	5.05	Minor Rehabilitation
3	Bakame-Sunkwa-Mamponteng-Ankaase	Asante Akim South	4.70	Minor Rehabilitation
4	Dansabonso-Appiahkrom-Yawsafo	Asante Akim South	4.50	Minor Rehabilitation
5	Gyereso-Aboabo-Bibiani	Atwima-Mponua	12.00	Spot Improvement
6	Adomfe-Tanokrom	Asante Akim South	10.00	Spot Improvement
7	Kona-Brofoyedru-Adegensuagya	Sekyere South	4.20	Spot Improvement
8	Kumawu-Drabonso-Aframso	Sekyere-Afram Plains	10.40	Minor Rehabilitation
9	Sekyere-Akrokyere	Sekyere-Afram Plains	4.70	Spot Improvement
Sub-Total			**65.55**	
Volta Region (Middle)				
10	Adzoatsi-Dekpor	Ketu North	1.10	Spot Improvement
11	Agorve Junction-Devego	Ketu North	13.8	Rehabilitation
12	Aveyime-CattleRanch-Mafi Aklawaya	North Tongu	12.4	Minor Rehabilitation
13	Odumase Junction-Odumase	Biakoye	5.0	Spot Improvement
14	Wute-Sasekpe-Amegakope-Kutime	North Tongu	16.5	Minor Rehabilitation
Sub-Total			**48.8**	
Central Region				
15	Wamaso-Acquakrom	Twifo-Heman-Lower Denkyira	0 .60	Minor Rehabilitation
16	Jukwa-Krobo	Twifo-Heman-Lower Denkyira	7.00	Spot Improvement
17	Kwame Alert Junction-Kwame Alert-Amuzu	Twifo-Heman-Lower Denkyira	26.00	Spot Improvement
18	Ntonton-Kona	Upper Denkyira East Municipal	5.00	Spot Improvement
19	Nsuta-Bepokokoo	Assin South District	6.70	Spot Improvement
20	Senchem-Asensuhu-Agave	Assin North Municipal	4.00	Minor Rehabilitation
21	Kwanyarko-Namawora	Agona East	4.00	Spot Improvement
22	Abowinim-Nkodwo	Ajumako-Enyan-Essiam	4.00	Spot Improvement
23	Mfuom-Aponkwaa-Onomakwaa	Twifo-Heman-Lower Denkyira	6.00	Spot Improvement
Sub-Total			**58.3**	
Eastern Region				
24	Sutapong - Sutapong Fall	Upper Manya	2.80	Spot Improvement
25	Akorabo Junction – Kromaneng	Suhum-Kraboa-Coaltar	2.40	Spot Improvement
26	Frankadua – Alabo River	Asuogyaman	5.20	Minor Rehabilitation

27	Agavenya Junction-Brukum Agavenya	Yilo Krobo	3.70	Spot Improvement
28	Akoradarko – Bomoden	Fanteakwa	9.50	Spot Improvement
29	Abekoase – Subriso	Atiwa	8.00	Spot Improvement
30	Anum Apapam – Kofipare	Suhum-Kraboa-Coaltar	3.80	Spot Improvement
31	Abenase – Akokoase	Akyemansa	17.1	Spot Improvement
Sub-Total			**52.5**	
Total			**225.15**	

The combined land area of the four regions making up the zone is 74,108 km^2 which is about 31% of Ghana's total land surface. The Ashanti and Eastern Regions are located within the high forest zone of the country. The Central Region is coastal savannah along the coast, while semi-deciduous forest predominates the inland areas. It bears similarity to the Volta Region (middle) which has savannah grassland as well as mangrove swamps and semi-deciduous forest areas.

The zone is characterized by a double maxima rainfall in June and October. The first rainy season is from May to June, with the heaviest rainfall in June while the second season is from September to October, with little variations between the districts. Temperatures range between 26^oC in August and 30^oC in March. The relative humidity which is high throughout the year varies between 70% -80%. Economic activities within the Wet-Semi Equatorial zone comprise agriculture, commerce and also various services.

Potential Impacts, Mitigation and Monitoring Measures

The main benefits of the projects will include enhanced mobility and access to market centres, efficient transportation, as well as reduced vehicle operating cost, reduced transportation cost and time and also CO_2 emissions. With the spot improvement works, farmers will be able to transport farm produce easily, reducing post harvest losses.

The potential adverse impacts for which relevant mitigation and monitoring measures have been provided include: water resource, drainage and erosion impacts, dust generation and air quality, temporary site office impacts, noise and vibration impacts, occupational health and safety and HIV/AIDS and STIs risks and waste generation as well as impacts of road diversion.

Mitigation measures include: culverts and drains designed with adequate capacity to direct and contain flows and run-off, to prevent overflow and road embankment erosion; excavated and heaped materials retained in confinements and located 10 meters (minimum distance) away from water bodies and drainage channels; covering of all flyable materials; agreement between contractor and owner of land identified for erection of site office; use of noise protection devices and limiting time of exposure; water dousing, speed control limits and ramps; training and strict schedule of maintenance/servicing of machinery; use of personal protective equipment (PPE), provision of first aid kits as well as erection of warning signs; sensitization and awareness on transmission and prevention of HIV/AIDS and STIs; composting and segregation of waste and maintaining high hygienic standards. In addition to mounting warning signs and directing traffic near culvert construction sites, barricades will also be mounted to protect workers.

Monitoring will check the effectiveness of mitigation and erosion prevention measures, material losses into and contamination of water bodies; records of machinery maintenance schedules; noise and vibration exposure levels and duration; water dousing and speed control; fulfilment of the terms of agreement on use of site for project office; records of injury and clinic attendance cases, use and state of PPEs; HIV/ AIDS awareness programs effectiveness; state of toilets and segregation of waste; and mounted road signs and traffic direction.

Environmental and Social Management Plan Implementation

The general outline of ESMPs implementation by the various actors will involve the following stages:

- ESMP preparation and approval;
- Contract specifications on E&S safeguards obligations;
- Rehabilitation/project contract award;
- E&S safeguards implementation plan and schedule;
- Rehabilitation/project commencement;
- Capacity building on E&S safeguards (and other awareness programme);
- E&S safeguards and mitigation implementation;
- Monitoring of safeguard/mitigation measures;
- Reporting; and
- Compliance and other periodic verification monitoring.

The main environmental and social safeguard measures in the ESMPs are:

- Water resources, erosion control and flood prevention management;
- Noise and vibration exposure management;
- Dust control management;
- Public and occupational health and safety management;
- HIV/AIDS and health awareness management;
- Waste management; and
- Road diversion and accident prevention;
- Temporary office site reinstatement.

The key actors in the implementation of the ESMPs include:

- The contractor- to be awarded the rehabilitation contract and be required to implement the environmental and social safeguard measures;
- DFR - to ensure that E&S safeguards and other mitigation measures are duly implemented;
- EPA - to ensure compliance with the ESMP and other relevant approval conditions;
- MRH - to oversee the effective implementation of the road project and related E&S safeguards
- MEST - to address complaints of any aggrieved parties on E&S safeguards, especially with respect to 'unfavourable' decisions of the EPA.

The other components of the ESMP include capacity building, proposed implementation budget and E&S safeguards obligations of contractors. Capacity building mainly on E&S safeguards planning, implementation and supervision, monitoring and reporting, and also public and occupational E&S and health (including HIV/AIDS) awareness and waste management have been prepared to enhance the capacity of DFR District Engineers, Contractors and their Site Engineers/Foremen as well as selected members of nearby communities.

A proposed budget of nine hundred and sixty one thousand, four hundred and thirty two dollars ($961,432) to facilitate implementation of the various measures, monitoring plan and capacity building of the ESMP has been made as an integral part of financing for the rehabilitation/maintenance projects. The specific E&S safeguards obligations for the contractor to be incorporated into the contract specifications are also provided, as well as other contractual provisions made in the General Items of the Bills of Quantities.

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1.0 INTRODUCTION

1.1 Background

Under the Transport Sector Project (TSP) by Ministry of Roads and Highways (the then Ministry of Transportation), an Environmental and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF) were prepared for the road transport sector in 2008. The ESMF and the RPF provided the means to addressing the safeguards requirements of projects to be financed under the TSP, when they were due for implementation.

Currently, eighty-four (84) feeder roads have been selected for rehabilitation/maintenance works throughout the country under the TSP. The provisions of the ESMF require the preparation of an Environmental and Social Management Plan (ESMP) for each of the selected roads, given that the roads are in use and benefit from rehabilitation works from time to time. The country has been divided into four zones base on eco-climatic variations namely: the Tropical Continental, South-Western Equatorial, Wet-Semi Equatorial and the Dry Equatorial zones for purposes of grouping the planned rehabilitation / maintenance works. Wet-Semi Equatorial Zone which comprises the Ashanti, Middle Volta, Central and Eastern Regions is expected to benefit from the maintenance works of 31 feeder roads. This report covers the ESMPs for the selected 31 feeder roads in the Wet-Semi Equatorial Zone.

The total length of feeder roads in this eco-climatic zone is 16421.55km. Out of this10224.58km is engineered; 2030.38 km is partially engineered; while 2448.1km is unengineered. Feeder roads regularly undergo maintenance works given that they are often not tarred and hence susceptible to rapid deterioration. The main object of the proposed maintenance works is to improve the road condition to reduce travel time and enhance interconnection between the adjoining communities.

The nature and scale of the rehabilitation/maintenance works are rather limited and within the existing right of way (RoW). The likely environmental and social impacts will also be localised and mainly temporary, with known and easy to apply mitigation and management measures. No land outside the RoW or property, building or any structure will be affected by the road works, therefore no compensation or resettlement will be required. Also no sensitive sites or resources such as forest reserve, sacred grove, cemetery, shrine or other places of historical and cultural interests are within or near the RoW of any of the 31 roads earmarked for maintenance. Furthermore, the magnitude of maintenance works will not affect any utility lines such as water, electricity or telecommunication lines. Thus, the World Bank's Policy on Involuntary Resettlement, Management of Cultural Property, Conservation of Natural Habitats and Forestry are not triggered.

1.2 Objectives of the ESMPs

Environmental and Social Management Plans (ESMPs) are required for each road in line with the ESMF of the TSP. Environmental and Social Management Plans are usually prepared for existing undertakings/projects in accordance with Ghana's Environmental Assessment (EA) Regulations (LI 1652, Section 24). The purpose of the ESMP is to:

- Reduce the potential adverse environmental and social impacts of the required maintenance/civil works;
- Facilitate monitoring and enhancement measures as contribution to environmental and social performance during implementation;
- Provide institutional strengthening measures for effective oversight and supervision; as well as
- Ensure compliance with the safeguards requirements of the projects, in line with the ESMF

1.3 Methodology for the ESMPs

The ESMP preparation involved field visits to the project si**t**es, document review and consultation with key representative stakeholders at the national, regional and district levels. The main national and the World Bank reference documents reviewed included:

- Environmental and Social Management Framework for TSP (2008);
- Resettlement Policy Framework for the TSP;
- Environmental Protection Agency Act, 1994 (Act 490);
- Environmental Assessment Regulations, 1999 (LI 1652);
- Environmental Assessment (Amendment) Regulations, 2002 (LI 1703)
- National Environmental Action Plan;
- Ghana EIA Procedures; and
- World Bank's Environmental and Social Safeguards Policies (OP/BP 4.01 and OP/BP 4.12).

The national and regional level institutions involved in the ESMP processes were the EPA and the DFR. The district engineers of the relevant DAs were also consulted. Three sets of data capture forms (Appendix I) were designed and used to conduct individual road project assessments. The forms captured data on the following:

- Project description (i.e. for the specific feeder roads);
- Project corridor and adjoining area (baseline) information; and
- Potential impacts (environmental and social) of the project (road works & borrow pits).

The scope/structure of the ESMPs for the Wet-Semi Equatorial Zone covers the following:

- Policy, legislative/regulatory and administrative frameworks;
- Regional (baseline) information on feeder roads;
- Beneficial and adverse impacts for specific project roads;
- Mitigation measures for the project roads;
- Monitoring plan; and
- Environmental and social management implementation plan and budget.

The methodology also took into account provision made in the general items of the bill of quantity (BoQ) which are incorporated into contracts by the DFR.

1.4 Organization of Report

This report contains thirty-six (36) main chapters, preceded by a non-technical executive summary. The main sections are:

- Chapters 1, 2 and 3: General introduction to the ESMPs, overview of applicable legal, policy and administrative frameworks, and general project zonal information;
- Chapter 4 – 12: Assessment of each of the nine project roads in the Ashanti Region;
- Chapter 13 – 17: Assessment for each of the five project roads in the middle Volta Region;
- Chapter 18 – 26: Assessment for each of the nine project roads in the Central Region;
- Chapter 27 – 34: Assessment for each of the eight project roads in the Eastern Region;
- Chapter 35: Implementation of ESMPs and associated budget; and
- Chapter 36: Consultation with stakeholders.

2.0 POLICY, LEGISLATIVE AND ADMINISTRATIVE FRAMEWORKS

The principal policies, laws and procedures on ESMP and related requirements which guided preparation of the ESMPs are presented below.

1) The national environmental requirements:
    a. Ghana's Environmental Policy;
    b. Environmental Protection Agency Act, 1994;
    c. Environmental Assessment Regulations and Procedures; and
    d. Environmental Assessment (Amendment) Regulations, 2002.

2) The national land, labour, safety and health requirements:
    a. Lands Statutory Wayleaves Act, 1963;
    b. Factories, Offices and Shops Act, 1970;
    c. Occupational Safety and Health Policy of Ghana (Draft);
    d. National Workplace HIV/AIDS Policy;
    e. Labour Act, 2003; and
    f. Youth Employment Implementation Guidelines.

3) Environmental and Social Management Framework - Ghana Transport Sector Program (TSP).

4) The World Bank Requirements
    a. Environmental Assessment (OP 4.01);
    b. Conservation of Natural Habitats (OP 4.04**)**;
    c. Forestry (OP/BP 4.36); and
    d. Management of Cultural Property (OPN 11.03);

2.1 National Environmental Requirements

Ghana's Environmental Policy

The environmental policy of Ghana formulated in the National Environmental Action Plan (NEAP) of 1993 hinges strongly on 'prevention' as the most effective tool for environmental protection. The policy aims at a sound management of resources and environment, and the reconciliation between economic planning and environmental resources utilization for sustainable national development. Within this context and in relation to the road transport sector, the policy also seeks among others, to institute an environmental quality control and sustainable development programs by requiring prior EA (including environmental and social management) of all developments, and to take appropriate measures to protect critical eco-systems, including the flora and fauna they contain against harmful effects, nuisance or destructive practices. The adoption of the NEAP led to the enactment of the EPA Act 1994 (Act 490); and subsequently the passing of the Ghana EIA Procedures into the EA Regulations, 1999 (LI 1652).

Environmental Protection Agency Act, 1994

The Environmental Protection Agency (EPA) Act, 1994 (Act 490) grants the Agency enforcement and standards setting powers, and the power to ensure compliance with the Ghana EA requirements/procedures. The Agency (including its Regional and District Offices) is also vested with the power to determine what constitutes an 'adverse effect on the environment' or an activity posing 'a serious threat to the environment or public health', to require EAs, ESMPs, AERs, etc of an 'undertaking', including road transport sector projects, to regulate and serve an enforcement notice for any offending or non-complying undertaking.

The Agency is required to conduct monitoring to verify compliance with permit conditions for project and mitigation commitments. Furthermore, a requirement by EPA for an EA precludes any authorising MDA from licensing, permitting, approving or consenting such undertaking, unless notified otherwise.

Environmental Assessment Regulations and Procedures

The Environmental Assessment (EA) Regulations combine both an environmental assessment and environmental management systems. The EA considers environmental and social aspects in an integrated way. The regulations prohibit commencing an "undertaking" (including road transport sector projects) without prior registration and environmental permit. Undertakings are grouped into schedules to enable registration and securing environmental permit from the EPA through the EA system.

The Regulations also define the relevant stages and actions, including: certification, fee payment, ESMP, AER, suspension/revocation of permit, complaints/appeals, etc.

Environmental Assessment (Amendment) Regulations, 2002

The Environmental Assessment (Amendment) Regulations, 2002 (LI 1703) were made to amend sections of the EA fees regime of LI 1652 (the 'principal enactment') on processing charges, payment for environmental permit and certificates (for ESMPs) issued by the Agency.

2.2 National Land, Labour, Safety and Health Requirements

Lands Statutory Wayleaves Act, 1963

The Lands Statutory Wayleaves Act 1963 (Act 186) was enacted to facilitate the entry on any land for the purposes of construction, installation and maintenance of public utility works and creation of right of ways and other similar right for such works. Works for which right of ways may be created are "feeder roads or works for purposes of, or in connection with any public utility works". The Act and its accompanying Regulations, the Lands Statutory Wayleave Regulations 1964 (LI 334) provides the modalities and procedures for the acquisition of the Statutory right of ways. Thus, the mechanism for entry for survey works and construction has been spelt out in details. Provision has also been made for restoration of affected lands where that is possible.

Factories, Offices and Shops Act, 1970

The Factories, Offices and Shops Act of 1970 (Act 328) mandates the Factories Inspectorate Department to register factories and ensure that internationally accepted standards of providing safety, health and welfare of persons are adhered to. It defines a factory to include any premises (whether in or not in a building) in which one or more persons are employed in manual labour, among others. The Act spells out the responsibilities of the employer in ensuring a safe and healthy work environment so as to guarantee the health and safety of employees. In this respect, the Act makes provision for the protection of the workforce that will be involved in the road construction activities.

Occupational Safety and Health Policy of Ghana (Draft)

The policy statement of the OSH Policy (draft 2004) is: 'to prevent accidents and injuries arising out of or linked with or occurring in the course of work, by minimizing, as far as reasonably practicable, the cause of the hazards in the working environment and, therefore, the risk to which employees and the public may be exposed'. The policy is derived from provisions of the International Labour Organization (ILO) Conventions 155 and 161. The policy document has specific sections on objectives, scope, strategies, activities and promotion and awareness creation.

National Workplace HIV/AIDS Policy

The broad objectives of the policy among others, are to provide protection from discrimination in the workplace to people living with HIV and AIDS; prevent HIV and AIDS spread amongst workers; and provide care, support and counselling for those infected and affected.

Labour Act, 2003

The purpose of the Labour Act, 2003 (Act 651) is to amend and consolidate existing laws relating to labour, employers, trade unions and industrial relations. The Act provides for the rights and duties of employers and workers; legal or illegal strike; guarantees trade unions and freedom of associations, and establishes the Labour Commission to mediate and act in respect of all labour issues. Under Part XV (Occupational Health, Safety and Environment), the Act explicitly indicates that it is the duty of an employer to ensure that every worker works under satisfactory, safe and healthy conditions.

Youth Employment Implementation Guidelines

The authority for decision-making on the implementation of the National Youth Employment Program (NYEP) resides in the Ministry of Employment and Social Welfare, through a National Employment Task Force (NETF) set up to implement the program. District Employment Task Forces set up are made accountable to the NETF in all their undertakings throughout the implementation of the program.

The overall objective of the program is to empower the youth to be able to contribute more productively towards the socio-economic and sustainable development of the nation. The specific objectives of the Program include checking the drift of the youth from the rural to urban communities in search of jobs by creating those opportunities in the rural areas, etc.

2.3 Environmental and Social Management Framework

The Environmental and Social Management Framework (ESMF), sponsored by the World Bank was prepared for the Ghana Transport Sector Program (TSP). The ESMF provides a corporate environmental and social safeguard policy framework, institutional arrangements, and capacity available to identify and mitigate potential safeguard issues and impacts of each sub-project. The ESMF was designed to address potential adverse environmental and social impacts at the planning stage of the feeder roads' maintenance works.

The ESMF defines the management procedures to avoid causing harm or exacerbating social tensions, and to ensure consistent management of environmental and social issues during feeder roads maintenance works.

2.4 The World Bank Requirements

The Bank's Safeguard Policies

The Bank's safeguard policies are designed to help ensure that programs proposed for financing are environmentally and socially sustainable, and thus improve decision-making. The Bank's Operational Policies (OP) are meant to ensure that operations of the Bank do not lead to adverse impacts or cause any harm. The relevant ones include:

- Environmental Assessment (OP 4.01);
- Management of Cultural Property (OPN 11.03);
- Conservation of Natural Habitats (OP 4.04**)**;
- Forestry (OP/BP 4.36)

Environmental Assessment (OP 4.01)

The OP 4.01 requires among others that screening for potential impacts is carried out early, in order to determine the level of EA to assess and mitigate potential adverse impacts. The Bank's project screening criteria group projects into three categories:

- Category A – Detailed Environmental Assessment;
- Category B - Initial Environmental Examination and

- Category C – Environmentally friendly.

The EA ensures that appropriate levels of environmental and social assessment are carried out as part of project design, including public consultation process, especially for Category A and B projects. The OP 4.01 is triggered if a program is likely to present some risks and potential adverse environmental impacts in its area of influence. The OP 4.01 is applicable to all components of the Bank's financed projects, even for co-financed components.

Considering the rather limited scale and nature of the proposed maintenance works on the feeder roads, and the potential low magnitude and localized environmental and social impacts of the project, the proposed feeder roads maintenance works are classified category 'B'.

3.0 GENERAL PROJECT AND ZONAL INFORMATION

3.1 Project Description

The proposed works form part of DFR's ongoing rehabilitation/maintenance activities which aim at improving access and mobility to and from the beneficiary communities and the districts. All the selected roads already exist, but are in deplorable conditions. Settlements, schools, farms are the main rural infrastructure located along some of the project routes. The maintenance works to be carried out are mainly spot improvement and minor rehabilitation as provided in table 3.1 below. These works will, however, not affect any structure or facility within the corridor.

The Table 3.1 provides the list/name and length of roads, the district/municipality and region they fall in as well as the type of maintenance works to be carried out.

Table 3. 1 Proposed Roads for Maintenance in the Wet-Semi Equatorial Zone

No.	Road Name	Districts	Length (km)	Recommended Works
Ashanti Region				
1.	Fumso-Odemu-Anwhiam	Adansi North	10.00	Spot Improvement
2	Twepease Junction- Twepease	Adansi South	5.05	Minor Rehabilitation
3	Bakame-Sunkwa-Mamponteng-Ankaase	Asante Akim South	4.70	Minor Rehabilitation
4	Dansabonso-Appiahkrom-Yawsafo	Asante Akim South	4.50	Minor Rehabilitation
5	Gyereso-Aboabo-Bibiani	Atwima-Mponua	12.00	Spot Improvement
6	Adomfe-Tanokrom	Asante Akim South	10.00	Spot Improvement
7	Kona-Brofoyedru-Adegensuagya	Sekyere South	4.20	Spot Improvement
8	Kumawu-Drabonso-Aframso	Sekyere-Afram Plains	10.40	Minor Rehabilitation
9	Sekyere-Akrokyere	Sekyere-Afram Plains	4.70	Spot Improvement
Sub-Total			**65.55**	
Middle Volta Region				
10	Adzoatsi-Dekpor	Ketu North	1.10	Spot Improvement
11	Agorve Junction-Devego	Ketu North	13.8	Rehabilitation
12	Aveyime-Cattle Ranch-Mafi Aklawaya	North Tongu	12.4	Minor Rehabilitation
13	Odumase Junction-Odumase	Biakoye	5.0	Spot Improvement
14	Wute-Sasekpe-Amegakope-Kutime	North Tongu	16.5	Minor Rehabilitation
Sub-Total			**48.8**	
Central Region				
15	Wamaso-Acquakrom	Twifo-Heman-Lower Denkyira	0 .60	Minor Rehabilitation
16	Jukwa-Krobo	Twifo-Heman-Lower Denkyira	7.00	Spot Improvement
17	Kwame Alert Junction-Kwame Alert-Amuzu	Twifo-Heman-Lower Denkyira	26.00	Spot Improvement
18	Ntonton-Kona	Upper Denkyira East Municipal	5.00	Spot Improvement
19	Nsuta-Bepokokoo	Assin South District	6.70	Spot Improvement
20	Senchem-Asensuhu-Agave	Assin North Municipal	4.00	Minor Rehabilitation
21	Kwanyarko-Namawora	Agona East	4.00	Spot Improvement
22	Abowinim-Nkodwo	Ajumako-Enyan-Essiam	4.00	Spot Improvement
23	Mfuom-Aponkwaa-Onomakwaa	Twifo-Heman-Lower Denkyira	6.00	Spot Improvement

Sub-Total			**58.3**	
Eastern Region				
24	Sutapong - Sutapong Fall	Upper Manya	2.80	Spot Improvement
25	Akorabo Junction – Kromaneng	Suhum-Kraboa-Coaltar	2.40	Spot Improvement
26	Frankadua – Alabo River	Asuogyaman	5.20	Minor Rehabilitation
27	Agavenya Junction-Brukum Agavenya	Yilo Krobo	3.70	Spot Improvement
28	Akoradarko – Bomoden	Fanteakwa	9.50	Spot Improvement
29	Abekoase – Subriso	Atiwa	8.00	Spot Improvement
30	Anum Apapam – Kofipare	Suhum-Kraboa-Coaltar	3.80	Spot Improvement
31	Abenase - Akokoase	Akyemansa	17.1	Spot Improvement
Sub-Total			**52.5**	
Total			**225.15**	

Spot Improvement

Spot improvement works basically involves maintenance of specific spots on the road that are in bad shape and thus impedes easy transportation. This may include construction of culverts, sectional gravelling, sectional levelling, etc.

Minor Rehabilitation

The activities undertaken are similar to that of spot improvement works but the extent of works differs in that they are more involving. Such works include clearing, formation activities, blading, gravelling, culvert construction and drain cleaning.

3.2 Zonal Baseline Information

The combined land area of the four regions making up the zone is 74,108 km^2 which is about 31% of Ghana's total land surface. The Ashanti and Eastern Regions are located entirely within the high forest zone of the country. The Central Region has coastal savannah with grassland and few trees along the coast, while semi-deciduous forest predominates the inland areas. It bears similarity to the Volta Region (middle) which has savannah grassland as well as mangrove swamps and semi-deciduous forest areas.

The zone is characterized by a double maxima rainfall in June and October. The first rainy season is from May to June, with the heaviest rainfall occurring in June while the second season is from September to October, with little variations between the districts. Temperatures range between 26^{o}C in August and 30^{o}C in March. The relative humidity which is high throughout the year varies between 70% -80%. Economic activities within the Wet-Semi Equatorial zone comprise agriculture, commerce and also various services.

The Ashanti region is endowed with a unique geography, lakes, scarps, forest reserves, waterfalls, national parks, birds and wildlife sanctuaries (Owabi Arboretum and Bomgobiri wildlife sanctuaries). The region is drained by Rivers Offin, Prah, Afram and Owabi. There are other smaller rivers and streams which serve as sources of drinking water for residents of some localities in the region. The major occupation in all the districts is agriculture, except in the Kumasi metropolis, where commerce predominates.

The Volta Region has 92.5% of its economically active population employed in various industries, with 7.5% unemployed. The rate of unemployment is highest in Kpando (11.1%), followed by Jasikan (10.4%) and Ho (10.5%). The rest of the districts have unemployment rate ranging from 3.4% for Nkwanta, to 9.7% for Hohoe. The rate of unemployment is higher among females than males in seven

of the 15 districts. Students constitute 31.1 % of the non-economically active population in the region. Workers in the agricultural and related occupations are in the majority in all the districts. Agriculture remains the largest industry in the region except Keta and Krachi, districts where fishing is the mainstay.

The Central Region can be broadly divided into two: the coast, which consists of undulating plains with isolated hills and occasional cliffs characterised by sandy beaches and marsh in certain areas; and the hinterland, where the land rises between 250 metres and 300 metres above sea level. The predominant industry in all districts except Cape Coast is agriculture (52.3%), followed by manufacturing (10.5%). Agriculture (including fishing) is the main occupation and employs more than two thirds of the workforce in many districts. Cocoa production is concentrated in Assin, Twifo-Hemang-Lower Denkyira and Upper Denkyira while oil palm production is mainly in Assin and Twifo-Hemang-Lower Denkyira. Other major agricultural enterprises are pineapple and grain production. Fishing is concentrated mainly in the six coastal districts. More males (8.6%) than females (4.6%) are engaged in professional/technical occupations while more females (18.2%) than males (6.0%) are involved in sales work. It is important to note that in all the districts, except Cape Coast, less than 10 % active population are engaged in service activities.

The Eastern Region is the third most populous region, after the Ashanti and Greater Accra. The region is one of the most economically active regions in the country. Both agriculture and industry feature prominently in the region's economic activities. Figure 3.1 shows the four eco-climatic zones of Ghana.

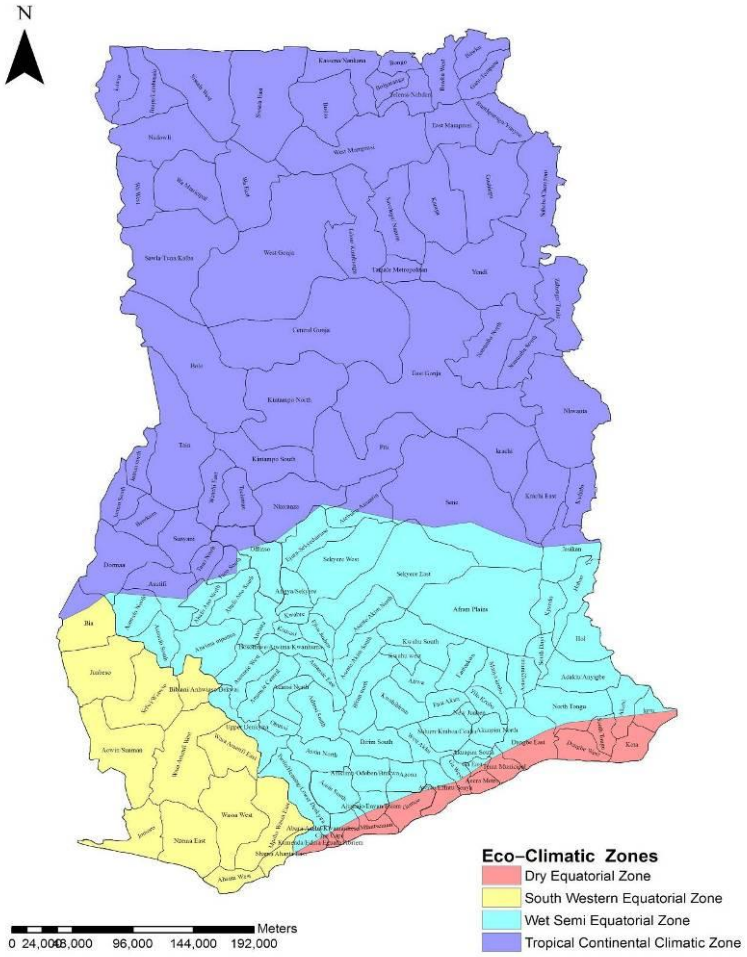

Figure 3. 1 A map of Ghana Showing the Four Eco-Climatic Zones

ROADS IN THE ASHANTI REGION

4.0 FUMSO-ANWIASO-ADEM SPOT IMPROVEMENT PROJECT

4.1 Project Environment Information

The project road is located in the Adansi North District, 24.7km from Fomena the district capital. The road is 10km long and 4m wide with the following communities along the stretch: Fumso, Odem and Anwiaso. There are schools at Fumso and Odem, a market at Fumso and a health centre at Fumso.

The main vegetation type is forest. The area is generally noted for cocoa farming and palm plantations. The area is drained by 14 drainage channels and the road crossed by some water crossing channels at low laying sections and creeks. The topography is generally rolling and hilly.

4.2 Project Description

The current state of the road is poor, though it benefited from some spot improvement works in the form of culvert construction in 2009. It is earth surface with low lying sections and water crossings. Sections are rendered almost unmotorable in the rainy season. The width of the road is reduced to 4.0m on the average (instead of 6.0m).

The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets and health centres, as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 4.1 below.

Table 4. 1 Locations of Specific Works along the Fumso-Anwiaso-Adem Road

	Specific Works	**Location/Distance**
1	Clearing	Fumso to Anwiaso, Ch.0+000 to Ch.9+400
2	Formation	Ch0+000 to Ch9+400
3	Construction of culverts	0+000,1+700,2+600,2+900,3+000,4+300,5+400,5+800,5+900,6+400,6+700,7+300,8+900,8+950
4	Filling and gravelling	Filling of all culvert approaches and gravelling the approaches

Clearing involves weeding or vegetation removal along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction, formation works which include blading. Two (2) types of new culverts will be constructed, 14 in number along the road. The sizes and numbers are as follows:

a) 8No. 900x700;
b) 6 No. 1200x900.

Filling will be done mainly in the approaches of culverts and also 2km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 4 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 2 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (1,580 bags)
b) Laterite (20,413m^3)
c) Chippings (128m^3)
d) Sand (64m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of thirty (30) will be employed for the project. The project implementation will take about 8 months.

4.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Fumso, Odem and Anwiaso communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food to the about 32 workers during their 8 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (10km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

4.3.1 Potential Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The spots improvement specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 10km road may result in the pollution of the creeks especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes.
The project road which lies in an area with rolling and hilly topography will have minimal impacts on the creeks especially if work is carried out in the dry season. In the rainy season however, flows may be increased resulting in flooding, ponding, soil erosion, channel modification of the creeks. Other sources of water pollution may include chemicals (eg. from cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Fumso.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the creeks especially during the rainy seasons. There will be 14 culverts and drainage channels along the road corridor to direct run offs. Fuels and other sources of raw materials such as cements and iron rods will be stored at designated places at site office at Fumso away from steep slopes and the creeks to prevent pollution from run offs. The bulldozer, vibratory/static roller, tipper trucks, motor loader and grader to be used for the

rehabilitation works will be serviced regularly (two months interval) for better engine performance to prevent fuel leakages into the water bodies.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind,
  rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and

4.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 10.0km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and the health center to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

4.3.3 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the

location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

4.3.4 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work; and
- Toolbox meetings held on regular basis to address new developments on health and safety issues.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and

- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

4.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

4.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

4.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 14 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

4.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

5.0 TWEAPEASE JUNCTION-TWAPEASE MINOR REHABILITATION PROJECT

5.1 Project Environment Information

The project road is located in the Adansi South District, about 24.8km from Edubiase, the district capital. The road is 5km long with the following communities along the stretch: Tweapease, Subriso, Brekete, Praso and Nsuta. There are schools and a health centre at Subriso.

The vegetation type is forest. The area is generally noted for agriculture: food crops and cocoa farms. The area is drained by three (3) small water crossings which cross the road at low laying areas. The topography is generally hilly and undulating.

5.2 Project Description

The current state of the road is poor, no culverts and not accessible. It was only cleared with dozer in 2007. The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets and health centres as well as interconnection between communities.
The specific works intended to be carried out are mainly clearing, shaping, formation, filling and gravelling, culvert construction. The specific works (according to mileage (location) and/or distance) are provided in table 5.1 below.

Table 5. 1 Locations of Specific Works along the Tweapease Junction-Twapease Road

	Specific Works	**Location/Distance**
1	Clearing	Twapease Jn –Twapease, 0+000 to 4+000
2	Formation	0+000 –4+000
3	Filling and gravelling	Filling all culvert approaches and gravell the approach fillings
4	Construction of culverts	0+500,0+700,1+250,1+800,1+900,1+900,2+000,3+000,3+400,3+850

Clearing involves weeding or vegetation removal along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction.
Formation works includes blading and drains. 2 types of new culverts will be constructed, 9 in number along the road. The sizes and numbers are as follows:

a) 7No. 900x700;
b) 2 No. 1200x900;

Filling will be done mainly with gravel. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 3 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 2 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (822 bags);
b) Chippings ($4679m^3$); and
c) Sand ($8m^3$).

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary

Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The rehabilitation is expected to employ a workforce of thirty (30) and the project implementation will take about 8 months.

5.3 Potential Impacts, Mitigation and Monitoring Measures

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Tweapease, Subriso, Brekete, Praso and Nsuta communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the communities indirectly by the services they will render such as selling of food to the about 30 workers during their 8 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (5km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site impacts

5.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The rehabilitation specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 5km road may result in the pollution of the creeks especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes.

The project road which lies in an area with hilly and undulating topography will have minimal impacts on the creeks especially if work is carried out in the dry season leaving enough working distance to these water bodies. In rainy season however, flows may be increased resulting in flooding, ponding, soil erosion, channel modification of the creeks. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Twapease.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the creeks especially during the rainy seasons. There will be 9 culverts and drainage channels along the road corridor to direct run offs.

Fuels and other sources of raw materials such as cements and iron rods will be stored at designated places at site office at Twapease away from steep slopes and the creeks to prevent pollution from run offs. The bulldozer, vibratory/static roller, tipper trucks, motor loader and grader to be used for the rehabilitation works will be serviced regularly (two months interval) for better engine performance and prevent fuel leakages into the water bodies.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer.

5.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 5km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment could occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and the health center to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

5.3.3 Dust and Air Quality Impacts, Mitigation and Monitoring

The rehabilitation works on the 5km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Tweapease, Subriso, Brekete, Praso and Nsuta communities and the workers if work is carried out during the dry season which is usually the case. Air pollution effects are going to be mainly due to the particulates from vehicular emissions of the bulldozer, vibratory/static roller, tipper trucks, motor loader and grader. Other sources are silica in dust during gravelling and from the earth agitated by constructional equipment and vehicles plying on the 5km uncompleted and untarred roads and other raw materials such as the 822 bags of cements to be used. The resultant effects are acute/chronic respiratory disorders, lung and heart diseases etc. Acute manifestations of its effects include inflammatory conditions like bronchitis, bronchiolitis and pneumonia which may be rapidly fatal.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

5.3.4 Occupational and Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work; and
- Toolbox meetings held on regular basis to address new developments on health and safety issues.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;

- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

5.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval.There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

5.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable

construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Daily inspection of emptying of toilets after each days work.

5.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of nine (9) culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

5.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

6.0 BANKAME–MAMPONTENG-ANKAASE MINOR REHABILITATION PROJECT

6.1 Project Environment Information

The project road is located in the Asante Akim South District, about 28km from Juaso, the district capital. The road is 4.7km long and 5m wide with the Asuogya, Dansabonso and Yawsarfo communities along the stretch. There are schools at Yaw Sarfo and Dansabonso, and a market at Dansabonso.

The vegetation type is forest. The area is generally noted for the cultivation of cocoa, cola, cassava and plantain. The area is drained by one stream, but the name of the stream is not known. The topography is generally undulating.

6.2 Project Description

The current state of the road is very poor with lots of gullies and potholes. It is earth surface with rolling and hilly sections and one water crossing. Sections are rendered almost unmotorable in the rainy season.

Figure 6. 1 Sections of the Bankame-Sunkwa-Mamponteng-Ankaase Road

The objective of the proposed minor rehabilitation works includes improving access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 6.1 below.

Table 6. 1 Locations of Specific Works along the Bankame–Mamponteng-Ankaase Road

	Specific Works	**Location/Distance**
1	Clearing	Ch.0+000 –Ch.4+800,
2	Formation	Ch.0+000 –Ch.4+800
3	Construction of culverts	0+300,.0+500,1+050,1+150,1+400,2+150,3+500,3+820,4+100
4	Filling and gravelling	0+025-0+350,0+450-0+550,1+00-1+100,1+350,1+450,2+850-2+950,4+050 – 4+150 and gravelling from 3+800-4+800

Clearing involves weeding or vegetation removal along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and drains. Three (3) types of new culverts will be constructed, 10 in number along the road. The sizes and numbers are as follows:

a) 3 No. 900x700
b) 6No. 1200x900
c) No. 2/1200x900
d) 1No. 1800x1250

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 4 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 2 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The types of raw materials and the estimated quantities will include:

a) Portland cement (1,728bags)
b) Laterite ($13,337m^3$)
c) Chippings ($223.3m^3$)
d) Water ($85m^3$)
e) Sand ($116.65m^3$)
f) Reinforcement rods (5.46tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The rehabilitation works is expected to employ a workforce of twenty-seven (27) and its implementation will take about 8 months.

6.3 Potential Impacts, Mitigation and Monitoring Measures

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Dansabonso, Asuogya and Yawsarfo communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (4.7km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Dust generation and air quality impacts
- Potential road diversion impacts
- Occupational health and safety impacts
- HIV/AIDS Impacts
- Waste generation and sanitation impacts
- Temporary site impacts

6.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The rehabilitation specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 4.7km road may result in the pollution of the creeks especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes.

The project road which lies in an area with hilly and undulating topography will have minimal impacts on the creeks especially if work is carried out in the dry season leaving enough distance to these water bodies. In rainy season however, flows may be increased resulting in flooding, ponding, soil erosion, channel modification of the creeks. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the creeks especially during the rainy seasons. There will be 10 culverts and drainage channels along the road corridor to direct run offs. Fuels and other sources of raw materials such as cements and iron rods will be stored at designated places at the site office away from steep slopes and the creeks to prevent pollution from run offs. The bulldozer, vibratory/static roller, tipper trucks, motor loader and grader to be used for the rehabilitation works will be serviced regularly (two months interval) for better engine performance to prevent fuel leakages into the water bodies.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer.

6.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4.7km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and clinics to reduce their impacts. Construction works close to schools would be carried out after close of school. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;

- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

6.3.3 Dust generation and Air Quality Impacts, Mitigation and Monitoring

Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

6.3.4 Occupational Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;

- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

6.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval.There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

6.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest

district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Daily inspection of emptying of toilets decommissioning after each days work.

6.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of ten culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

6.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

7.0 DANSABOSO–APPRIAHKROM YAWSARFO JUCTION MINOR REHABILITATION PROJECT

7.1 Project Environment Information

The project road is located in the Asante Akim South District, about 35km from Juaso, the district capital. The road is 4.5km long and 4m wide with the following communities along the stretch: Dansabonso, Asuogya, Yawsarfo, Ofoase and Yaw Bronya. There are schools at Dansabonso and Yawsarfo, market at Ofoase and health centre at Ofoase.

The vegetation type is forest. The area is generally noted for the cultivation of cocoa, cola, cassava and plantain. The area is drained by four streams. The topography is generally hilly and undulating.

7.2 Project Description

The current state of the road is very poor with lots of gullies and potholes poor. It is earth surface with undulating and hilly sections and three water crossings. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed minor rehabilitation works includes improving access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 7.1 below.

Table 7. 1 Locations of Specific Works along the Dansaboso–Appriahkrom Yawsarfo Road

	Specific Works	**Location/Distance**
1	Clearing	0+000 -8+000
2	Formation	0+000 -8+000
3	Construction of culverts	0+700,1+300,2+600,5+100,5+900,6+200,6+500,7+800
4	Filling and gravelling	0+6500-0+750,1+250-1+350,1+550-1+650,6+150-6+400,1+750-1+850,5+050-5+150,5+850-5+950,7+750-7+850 and gravelling from 0+0000-8+000

Clearing involves weeding or vegetation removal the along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and drains. Two types of new culverts will be constructed, 13 in number along the road. The sizes and numbers are as follows:

a) 4No. 900x700;
b) 9No. 1200x900;

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 4 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 2 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (2009bags)
b) Laterite (5,120m^3)
c) Chippings (130m^3)
d) Water (71.69m^3)
e) Sand (65m^3)
f) Reinforcement rods (5.12tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will also be construction of Site office at Yawsarfo to include places of convenience, store rooms, etc. The rehabilitation work is expected to employ a workforce of twenty-seven (27) and its implementation will take about 8 months.

7.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Dansabonso, Asuogya, Yawsarfo, Ofoase and Yaw Bronya communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food and other services to the about 27 workers during their 8 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (4.5km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

7.3.1 Potential Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The rehabilitation specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 4.5km road may result in the blocking of the drainage channels especially during the rainy seasons resulting flooding and affecting the drainage pattern of the area. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Yawsarfo.

Vegetation clearing, blading and gravelling will be restricted to the right of way and done in a manner so as not to block drainage channels especially during the rainy seasons. There will be 13 culverts and drainage channels along the road corridor to direct run offs.
Fuels and other sources of raw materials such as cements and iron rods will be stored at designated places at site office at Yawsarfo away from steep slopes and the drainage channels to prevent pollution

from run offs. The bulldozer, vibratory/static roller, tipper trucks, motor loader and grader to be used for the rehabilitation works will be serviced regularly (two months interval) for better engine performance to prevent fuel leakages into the water bodies.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer.

7.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4.5km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and the health center to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

7.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on

impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

7.3.4 Occupational and Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

7.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for

indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

7.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and

- Daily inspection of emptying of toilets decommissioning after each days work.

7.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 13 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

7.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;

- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

8.0 GYERESO-ABOABO-BIBIANI SPOT IMPROVEMENT PROJECT

8.1 Project Environment Information

The project road is located in the Atwima -Mponua District, about 47.5km from Nyinahin, the district capital. The road is 12km long and 5.8m wide with the following communities along the stretch: Aboabo, Owusukrom, Kalongo, and Yaw Barimakrom. There are schools at Aboabo,Gyereso and Bibiani , markets at Gyereso and Bibiani and health centres at Gyereso and Bibiani

The vegetation type is forest. The area is generally noted for the cultivation of cocoa, cassava and plantain. The area is drained by four streams. The topography is generally hilly and undulating.

8.2 Project Description

The current state of the road is very poor with lots of gullies and potholes. It received spot improvement works from 0.0km to 6.0km in 2008. It is earth surface with undulating and hilly sections and four water crossings. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets and health centres as well as interconnection between communities.
The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 8.1 below.

Table 8. 1 Locations of Specific Works along the Gyereso-Aboabo-Bibiani Road

	Specific Works	**Location/Distance**
1	Clearing	0+000 -12+600
2	Formation	0+000 -12+600
3	Construction of culverts	7+200,9+100
4	Filling and gravelling	Filling of all culvert approaches then gravelling from:0+000-0+300,1+000-2+000,2+300-2+700.3+400-6+600,6+800-12+600

Clearing involves weeding or vegetation removal the along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and drains.2 types of new culverts will be constructed, 2in number along the road. The sizes and numbers are as follows:

a) 1No. 2/2x2 B.C;
b) 1No. 1/4X4B.C.

Filling will be done mainly in the approaches of culverts and also 10.7km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 3 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 2 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (1,209bags)
b) Laterite (12,214m^3)
c) Chippings (1.60m^3)
d) Water (59.52m^3)
e) Sand (84m^3)
f) Reinforcement rods (22.16tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will also be construction of Site Office at Aboabo to include places of convenience, store rooms, etc. The rehabilitation works is expected to employ a workforce of twenty-seven (27) and its implementation will take about 8 months.

8.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Aboabo, Owusukrom, Kalongo, and Yaw Barimakrom communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (12km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

8.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The spot improvement specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 12km road may result in the pollution of the four creeks especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes. The project road which lies in an area with hilly and undulating topography will have minimal impacts on the creeks especially if work is carried out in the dry season leaving enough distance to these water bodies. In rainy season however, flows may be increased resulting in flooding, ponding, soil erosion, channel modification of the creeks. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Aboabo.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the creeks especially during the rainy seasons. There will be 2 culverts and drainage channels along the road corridor to direct run offs.

Fuels and other sources of raw materials such as cements and iron rods will be stored at designated places at site office at Aboabo away from steep slopes and the creeks to prevent pollution from run offs.

The bulldozer, vibratory/static roller, tipper trucks, motor loader and grader to be used for the spot improvement works will be serviced regularly (two months interval) for better engine performance to prevent fuel leakages into the water bodies.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer.

8.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 12.0km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and the health centers to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

8.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

The spot improvement works on the 12km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Aboabo, Owusukrom, Kalongo, and Yaw Barimakrom communities and the workers if work is carried out during the dry season which is usually the case. Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

8.3.4 Public and Occupational Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

8.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

8.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;

- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Daily inspection of emptying of toilets decommissioning after each days work.

8.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of two culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Effective traffic flow and vehicular and worker safety will be monitored daily. Appropriate positioning of road signs, reflectors, speed ramps, control limits and the role of traffic attendants will be monitored. Accidents and near misses will be recorded and reported to the contractor and the DE on daily basis for immediate remedial action. In the event of any accidents the first aid team will attend to the victims and convey them to the nearest health center.

8.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;

- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

9.0 ADOMFE - TANOKROM SPOT IMPROVEMENT PROJECT

9.1 Project Environment Information

The project road is located in the Asante Akim South District, about 20.0km from Juaso, the district capital. The road is 10.0km long and 4.0m wide with the following communities along the stretch: Adomfe and Tanokrom. There are schools at Adomfe and Tanokrom, market at Adomfe, health centre at Adomfe and coffee factory at Tanokrom.

The vegetation type is forest. The area is generally noted for the cultivation of cocoa, cola, cassava and plantain. The area is drained by a stream. The topography is generally hilly and undulating.

9.2 Project Description

The current state of the road is very poor with lots of gullies and potholes. It received reshaping from 0.0km to 2.0km in 2009. It is earth surface with undulating and hilly sections and four water crossings. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets, coffee factory and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided inTable 9.1 below.

Table 9. 1 Locations of Specific Works along the Adomfe - Tanokrom Road

	Specific Works	**Location/Distance**
1	Clearing	0+000 -10+000
2	Formation	0+000-10+000
3	Construction of culverts	0+900,1+200,3+500,3+800,4+500,6+200,6+500,6+800,7+200
4	Filling and gravelling	0+000 -10+000-gravelling, filling of all culvert approaches

Clearing involves weeding or vegetation removal the along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and drains.3 types of new culverts will be constructed, 15 in number along the road. The sizes and numbers are as follows:

a) 2No. 900x700;
b) 12No. 1200x900.

Filling will be done mainly in the approaches of culverts and also 10.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 4 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 2 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (1556bags)
b) Laterite (28,826m^3)
c) Chippings (151m^3)
d) Water (56m^3)
e) Sand (76m^3)
f) Reinforcement rods (7.4tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will also be construction of Site office at Tanokrom to include places of convenience, store rooms, etc. The spots improvement works is expected to employ a workforce of thirty five (35) and implementation will take about 8 months.

9.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Adomfe and Tanokrom communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food and other services to the about 35 workers during their 8 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (10km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

9.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The spot improvement specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 10km road may result in the pollution of the streams especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes.

The project road which lies in an area with hilly and undulating topography will have impacts on the streams especially if work is carried out in the rainy season without leaving enough distance to these water bodies. In rainy season, flows may be increased resulting in flooding, ponding, soil erosion, channel modification of the streams. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Tanokrom.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the streams especially during the rainy seasons. There will be 15 culverts and drainage channels along the road corridor to direct run offs.

Fuels and other sources of raw materials such as cements and iron rods will be stored at designated places at site office at Tanokrom away from steep slopes and the streams to prevent pollution from run offs. The bulldozer, vibratory/static roller, tipper trucks, motor loader and grader to be used for the spot improvement works will be serviced regularly (two months interval) for better engine performance and to prevent fuel leakages into the water bodies.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer

9.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 10km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and the health center to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

9.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

9.3.4 Public and Occupational Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

9.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 5 members from the workforce while the nearby communities nominate 5 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

9.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;

- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Daily inspection of emptying of toilets decommissioning after each days work.

9.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 15 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

9.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

10.0 KONA-BROFOYEDU ADENGENSUAGYA SPOT IMPROVEMENT PROJECT

10.1 Project Environment Information

The project road is located in the Sekyere South District, about 8.0km from Agona, the district capital. The road is 4.2km long and 4.5m wide with the following communities along the stretch: Kona, Brofoyedru and Adengensuagya. There are schools at Kona, market at Kona and Police Station at Kona

The vegetation type is forest. The area is generally noted for the cultivation of cocoa, cassava and plantain. The area is drained by five streams. The topography is generally hilly and undulating.

10.2 Project Description

The current state of the road is very narrow, rough with lots of gullies and potholes. A culvert was constructed on it in 2007. It is earth surface with undulating and hilly sections and five water crossings. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 10.1 below.

Table 10. 1 Locations of Specific Works along the Kona-Brofoyedu Adengensuagya Road

	Specific Works	**Location/Distance**
1	Clearing	0+000-0+400,3+3150-4+200
2	Formation	0+000-4+200
3	Construction of culverts	0+000
4	Filling and gravelling	Filling all culvert approaches and gravelling from 0+00-4+800

Clearing involves weeding or vegetation removal the along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and drains. 1 type of new culvert will be constructed, 8 number existing culverts are on the road without filling and 600m of 600mm concrete U-drains. The sizes and numbers are as follows:

a) 1No. 900x700;
b) 5No.900mmø pipe-existing;
c) 3No. 1200mmøpipe-existing.

Filling will be done mainly in the approaches of culverts and also 4.7km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 3 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (1,379bags)
b) Laterite (4,725m^3)
c) Chippings (219.8m^3)
d) Water (49.22.m^3)
e) Sand (109.9m^3)
f) Reinforcement rods (1tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The spots improvement work is expected to employ a workforce of twenty-six (26) and implemented within 8 months.

10.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Kona, Brofoyedru and Adengensuagya communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food and other services to the about 26 workers during their 8 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (4.2km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

10.3.1 Potential Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The spot improvement specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 4.2km road may result in the pollution of the creeks especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes.

The project road which lies in an area with hilly and undulating topography will have impacts on the creekss especially if work is carried out in the rainy season without leaving enough distance to these water bodies. In rainy season, flows may be increased resulting in flooding, ponding, soil erosion, channel modification of the creeks. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Brofoyedru.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the creeks especially during the rainy seasons. There will be 1 additional new culverts adding the existing 8 along the road corridor to direct run offs.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer.

10.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4.2km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools to reduce their impacts. Construction works close to schools would be carried out after close of school. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

10.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

The spot improvement works on the 4.2km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Kona, Brofoyedru, Adengensuagya communities . Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

10.3.4 Public and Occupational Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and

- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

10.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The road spot improvement works could be breeding grounds for the HIV/AIDS epidemic. People (mainly men) working on the road will have to be mobile; they have to spend much time away from their homes and satisfy their sexual needs on the road. Migration - short term or long term, increases opportunities to have sexual relationship with multiple partners, thus becoming a critical factor in the spread of HIV/AIDS. With communities such as Kona, Brofoyedru, Adengensuagya along the road corridor, HIV/AIDS could be an issue.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

10.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Daily inspection of emptying of toilets decommissioning after each days work.

10.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 8 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

10.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

11.0 KUMAWU-DRABONSO SPOT IMPROVEMENT PROJECT

11.1 Project Environment Information

The project road is located in the Sekyere-Afram Plains District, about 18km from Kumawu, the district capital. The road is 10.40km long and 5m wide with the following communities along the stretch: Drabonso, James Town, Dagomba and Winamda. There are schools at Dagomba and Drabonso, markets at Drabonso and a health centre at Drabonso.

The vegetation type is forest. The area is generally noted for the cultivation of cocoa, teek plaintation, cassava, plantain and a game reserve along the road corridor. The area is drained by one stream, called river ongwam. The topography is generally undulating.

11.2 Project Description

The current state of the road is very poor with lots of gullies and potholes. It is earth surface with rolling and hilly sections and one water crossing. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of kerbs, culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 11.1 below.

Table 11. 1 Locations of Specific Works along the Kumawu-Drabonso Road

	Specific Works	**Location/Distance**
1	Clearing	Ch.14+000 –Ch.24+400,
2	Formation	Ch.14+000 –Ch24+400
3	Construction of culverts	Ch.18+850,Ch.19+000,Ch.20+000,Ch.21+350,Ch.21+600,Ch.22+800,Ch.23+2000,Ch.23+520,Ch.23+700 Ch23+800,Ch.24+300,Ch24+350
4	Filling and gravelling	Filling of all culvert approaches and gravelling from Ch.14+000-Ch.17+800,ch.20+100-ch.21+000

Clearing involves weeding or vegetation removal along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and drains.2 types of new culverts will be constructed, 12 in number along the road. The sizes and numbers are as follows:

a) 11 No. 900x700
b) 1No. 1200x900
c) No. 2/1200x900
d) No. 1800x1250
e) No.2/1800x1250)

Filling will be done mainly in the approaches of culverts and also 4.7km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 4 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 2 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (1,057bags)
b) Laterite (13,337m^3)
c) Chippings (137m^3)
d) Water (52m^3)
e) Sand (68m^3)
f) Reinforcement rods (5.46tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The spot improvement is expected to employ a workforce of twenty-seven (27) and implementation will take about 8 months.

11.3 Potential Impacts, Mitigation and Monitoring Measures.

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Drabonso, James Town, Dagomba and Winamda communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (10.4km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

11.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The rehabilitation specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 10.4km road may result in the pollution of the creek especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes.

The project road which lies in an area with hilly and undulating topography will have impacts on the creek especially if work is carried out in the rainy season without leaving enough distance to these water bodies. In rainy season, flows may be increased resulting in flooding, ponding, soil erosion, channel modification of the creek. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Dagomba.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the creek especially during the rainy seasons. There will be 2 a new culverts along the road corridor to direct run offs.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;

All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer.

11.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 10.4km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and the health center to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to the health center will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

11.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

The rehabilitation works on the 10.4km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Drabonso, James Town, Dagomba and Winamda communities. Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

11.3.4 Public and Occupational Health and safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and

- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

11.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

11.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will

be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Daily inspection of emptying of toilets decommissioning after each days work.

11.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 12 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

11.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or

may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

12.0 SEKYERE-AKROKYERE SPOT IMPROVEMENT PROJECT

12.1 Project Environment Information

The project road is located in the Sekyere Afram Plains District, about 21km from Kumawu, the district capital. The road is 4.7km long and 5m wide with the following communities along the stretch: Sekyere, Akrokyere and Bodwease. There are schools at Sekyere, Bodwease and Akrokyere, markets at Sekyere and Akrokyere and a health centre at Sekyere

The vegetation type is light bush. The area is generally noted for the cultivation of cocoa, cola, cassava and plantain. The area is drained by one stream, river ongwam. The topography is generally undulating.

12.2 Project Description

The current state of the road is very poor with lots of gullies and potholes poor. It is earth surface with rolling and hilly sections and one water crossing. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed minor rehabilitation works includes improving access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts, concrete U-drains and kerbs and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 12.1 below.

Table 12. 1 Locations of Specific Works along the Sekyere-Akrokyere Road

	Specific Works	**Location/Distance**
1	Clearing	Ch.0+250 –Ch.4+700,
2	Formation	Ch.0+000 –Ch.4+700
3	Construction of culverts	Ch.0+400,Ch.0+550,Ch.0+700,Ch.2+000,Ch.2+100,Ch.2+200,Ch.2+300 Ch.3+000,Ch.3+200,Ch.3+850 Ch.4+000,Ch.4+400,Ch.4+600
4	Filling and gravelling	Filling of all culvert approaches and gravelling from Ch0+900- Ch.1+500 and Ch.1+700-Ch.4+700

Clearing involves weeding or vegetation removal along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and drains. 2 types of new culverts will be constructed, 15 in number along the road. The sizes and numbers are as follows:

a) 11No. 900x700
b) 4No. 1200x900
c) No. 2/1200x900
d) No. 1800x1250
e) No.2/1800x1250)

Filling will be done mainly in the approaches of culverts and also 3.6km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 3 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 2 No. Concrete mixer ($0.5m^3$)
i) 2 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (2,354bags)
b) Laterite (9,151m^3)
c) Chippings (304m^3)
d) Water (116m^3)
e) Sand (152m^3)
f) Reinforcement rods (1.68tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The rehabilitation work is expected to employ a workforce of thirty (30) and implementation will take about 8 months.

12.3 Potential Impacts, Mitigation and Monitoring Measures

The road has not benefited from any rehabilitation works recently. The current proposed spot improvement works of the 4.7km stretch form part of road works to enhance access to Sekyere, Akrokyere and Bodwease.

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Sekyere, Akrokyere and Bodwease communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food and other services to the about 30 workers during their 8 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (4.7km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Dust generation and air quality impacts
- Potential road diversion impacts
- Occupational health and safety impacts
- HIV/AIDS Impacts
- Waste generation and sanitation impacts
- Temporary site office impacts

12.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The spot improvement specific works such as vegetation clearing, formation, construction of culverts and filling and gravelling of the 4.7km road may result in the pollution of the creek especially during the rainy seasons resulting in deteriorating the water quality and modifications in the flow regimes.

The project road which lies in an area with hilly and undulating topography will have impacts on the creek especially if work is carried out in the rainy season without leaving enough distance to these water bodies. In rainy season, flows may be increased resulting in flooding, ponding, soil erosion,

channel modification of the creek. Other sources of water pollution may include chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage from the site office at Sekyere.

Vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 15m to the banks of the creek especially during the rainy seasons. There will be 15 culverts along the road corridor to direct run offs.
The SE will be responsible to ensure observance and compliance of the following:

- A separation distance of 50m for heaping construction materials from streams and channels;
- Sites for fuelling of machinery and servicing of equipment located at a minimum distance of 100m from the stream and drainage channels;
- Embankment erection around fuelling and other liquid or spillable storage sites;
- Provision of toilets and urinal at locations not less than 50m away from the stream; and
- Adequate worker awareness on sanitation and measures to avoid water resource contamination.

12.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4.7km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and the health centers to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to the health centers will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

The use of appropriate PPEs for noise protection will be closely monitored by the Site Engineer. Maintenance plan for all equipments and machinery will be monitored to ensure that regular maintenance is followed to reduce noise from operations. Exposure limits of workers of high noise and vibration area will also be monitored. Noise levels will be monitored at the work areas.

12.3.3 Dust and Air Quality Impacts, Mitigation and Monitoring

The spot improvement works on the 4.7km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Sekyere, Akrokyere and Bodwease communities. Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient

dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Visual inspection of schools and farms within the project's area of influence will be undertaken to ascertain effectiveness of water dousing. A log book will be kept for monitoring the regularity of vehicle and machinery servicing under the supervision of the Site Engineer. Records of all monitoring activities will be contained in a quarterly report to the District Engineer.

12.3.4 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

12.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

12.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.
Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;

- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Daily inspection of emptying of toilets after each days work.

12.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 15 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

12.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

ROADS IN (MIDDLE) VOLTA REGION

13.0 ADZOATSI-DEKPOR SPOT IMPROVEMENT PROJECT

13.1 Project Environment Information

The project road is located in the Ketu North District, about 10km from Dzodze, the district capital. The road is 1.10km long and 3m wide with the following communities along the stretch: Adzadzi, Dekpor Home. There are school farms bordering the road around Dekpor Home, Ehi, Lave and Weta

The dominant vegetation type is savannah bush. The area is generally noted for agriculture: cultivation of cassava and cash crops such as maize, tomato, yams etc. The area has Angoe stream that crosses the road. The topography is undulating.

13.2 Project Description

The current state of the road is poor and has lost its formation and gravels. There has been no major rehabilitation works on the road recently. It is earth surface with low lying sections in water plains. Sections are rendered almost unmotorable in the rainy seasons.

The objective of the proposed rehabilitation work is to improve the road condition to reduce travel time and accidents and to improve access to farming areas, schools, markets and health centres as well as interconnection between communities. The road also provides access to the Afife Rice Farms.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and sectional re-gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 13.1 below.

Table 13. 1 Locations of Specific Works along the Adzoatsi-Dekpor Road

	Specific Works	**Location/Distance**
1	Clearing	Km 0+000 – 2+900
2	Formation	Km 0+000 – 2+900
3	Construction of culverts	1+100, 2+900
4	Filling and gravelling	Km 0+000 – 2+900

Clearing involves weeding of savannah vegetation along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culverts construction. Formation works includes blading and drains. 700mmx900mm types of new culverts will be constructed, 2 in number along the road.

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader (1m^3)
d) 2 No. Tipper trucks (6m^3)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 1 No. Concrete mixer (0.5m^3)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (130 bags)
b) Gravel (2,191m^3)
c) Fine aggregates (2009.7m^3)
d) Coarse aggregates (10790.9m^3)
e) Reinforcement rods (0.68 tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The spot improvement work is expected to employ a workforce of twelve (12) and implementation will take about 8 months.

13.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Adzadzi and Dekpor Home communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food to the about 12 workers during their eight (8) months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (1.10km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

13.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The spots improvement specific works such as savannah clearing, formation, construction of culverts and filling and sectional re-gravelling of the 1.10km road may result in the pollution of the Angoe Stream resulting in deteriorating the water quality and modifications in the flow regimes.

Since the project road lies in water plains and the topography is undulating, flow may be increased resulting in flooding, ponding, soil erosion, channel modification and siltation of the stream. Other sources of water pollution may include sedimentation, changes in biological activity in the stream and on their banks, chemicals (e.g from cement) spillage, and contaminated run off from petroleum product seepage, exhaust emissions and corrosion of reinforcement rods among others.

Savannah clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 30m to the banks of the Angoe Stream. There will be two culverts and drainage channels along the road corridor to direct run offs.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;

- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind,
  rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on the Angoe Stream:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

13.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 1.1km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools to reduce their impacts. Construction works close to schools would be carried out after close of school. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

13.3.3 Dust generation and Air Quality Impacts, Mitigation and Monitoring

Dusty conditions will be created due to haulage of construction materials from source to project site and could be a source of concern for the Adzadzi and Dekpor Home communities. Tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the

location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and

The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

13.3.4 Public and Occupational Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done daily to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

13.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

13.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;

- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

13.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 2 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

13.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 8 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

14.0 AGORVE JUNCTION-DEVEGO REHABILITATION PROJECT

14.1 Project Environment Information

The project road is located in the Ketu North District, about 50km from Dzodze, the district capital. The road is 13.80km long and 4m wide with the following communities along the stretch: Agorve, Tsienu, Mantole, Xife, and Devego. There are houses (200m), farms (350m), schools (600m) and clinics (450m) from the road at Agorve.

The vegetation type is savannah bush. The area is generally noted for the cultivation of cassava and cash crops such as maize, tomato, yams etc. The area has 2 streams, Angoe and Lagoo that cross the road. The topography is undulating.

14.2 Project Description

The current state of the road is poor and has lost its formation, with lots of soft spots with water crossings. There was a rehabilitation works on the road in 2005. It is earth surface with low lying sections in water plains. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed rehabilitation work is to improve the road condition to reduce travel time and accidents and improving access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and sectional re-gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 14.1 below.

Table 14. 1 Locations of Specific Works along the Agorve Junction-Devego Road

	Specific Works	**Location/Distance**
1	Clearing	km 0+000 – 13+800
2	Formation	km 0+000 – 13+800
3	Construction of culverts	Kkm 0+970, 2+100, 3+800, 4+100, 4+825, 5+700, 5+750, 7+00, 7+010, 8+300, 8+400, 9+700, 10+250, 11+100, 11+150, 12+950, 13+100
4	Filling and gravelling	km 0+000 – 13+800

Clearing involves weeding of savannah vegetation along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culverts construction. Formation works includes blading and drains, 700x900 types of new culverts will be constructed 17 in number along the road.

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader (1m^3)
d) 1 No. Tipper trucks (6m^3)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 1 No. Concrete mixer (0.5m^3)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (1,105bags)
b) Gravel (70,860 m^3)
c) Fine aggregates (6,796.5m^3)
d) Coarse aggregates (32,6011.2m^3)
e) Reinforcement rods (5.78 tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The rehabilitation work is expected to employ a workforce of sixteen (16) and implementation will take about 12 months.

14.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Agorve, Tsienu, Mantole, Xife and Devego communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food to the about 16 workers during their 12 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (13.80km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

14.3.1 Water Resources/Erosion/Flooding Impacts, Mitigation and Monitoring

The rehabilitation specific works such as savannah clearing, formation, construction of culverts and filling and sectional re-gravelling of the 13.80km road may result in the pollution of the Angoe and Lagoo streams resulting in deteriorating the water quality and modifications in the flow regimes.

Since the project road lies in water plains and the topography is undulating, flow may be increased resulting in flooding, ponding, soil erosion, channel modification and siltation of the Angoe and Lagoo streams. Other sources of water pollution may include sedimentation, changes in biological activity in the stream and on their banks, chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage, exhaust emissions and corrosion of reinforcement rods among others.

Savannah vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 30m to the banks of the Angoe and Lagoo streams. There will be 17 culverts and drainage channels along the road corridor to direct run offs.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer.

14.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 13.8km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from houses, schools and the health center to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

14.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

The rehabilitation works on the 13.80km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Agorve, Tsienu, Mantole, Xife, Devego communities. Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

14.3.4 Occupational/Public health and Safety Impacts, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

14.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 12 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with

the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 3 members from the workforce while the nearby communities nominate 3 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Quarterly monitoring of the effectiveness of awareness programmes will be in the form of questions and answers/free discussions, and the campaigns by the peer group educators, led by the SE and health team.

14.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

14.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 17 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Effective traffic flow and vehicular and worker safety will be monitored daily. Appropriate positioning of road signs, reflectors, speed ramps, control limits and the role of traffic attendants will be monitored. Accidents and near misses will be recorded and reported to the contractor and the DE on daily basis for immediate remedial action. In the event of any accidents the first aid team will attend to the victims and convey them to the nearest health center.

14.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 12 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of

the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

15.0 AVEYIME CATTLE RANCH – MAFI AKLAWAYA MINOR REHABILITATION PROJECT

15.1 Project Environment Information

The project road is located in the North Tongu District, about 57km from Adidome, the district capital. The road is 12.4km long with the following communities along the stretch: Aklawaya, Brah, Xekpa, Amenorkofe. There are houses (30m) and farms (15m) from the road at Aveyime.

The vegetation type is savannah bush. The area is generally noted for agriculture: cultivation of cassava and cash crops such as maize, tomato, yams etc. The area has three streams Aklakpa, Alabo and Tordje that flow wide forming a flood plain. The topography is generally flat.

15.2 Project Description

The current state of the road is poor and has lost its formation and with lots of soft spots. There was rehabilitation works on the road ten (10) years ago. It is earth surface with low lying sections in water plains. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed rehabilitation work is to improve the road condition to reduce travel time and accidents, and to improve access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and sectional gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 15.1 below.

Table 15. 1 Locations of Specific Works along the Aveyime Cattle Ranch – Mafi Aklawaya Road

	Specific Works	**Location/Distance**
1	Clearing	Km 0+000 – 13+000
2	Formation	Km 0+000 – 13+000
3	Construction of culverts	Km 0+000, 0+200, 0+400, 0+600, 1+200(jnc culvert), 1+220, 1+500, 1+530, 2+700, 3+300, 3+500, 3+700, 4+700, 4+750, 4+800, 4+800, 4+900, 5+500, 6+100, 6+400(jnc culvert)
4	Filling and gravelling	Km 0+000 – 13+000

Clearing involves weeding of savannah vegetation along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culverts construction. Formation works includes blading and drains. 700x900 and 900x1200 types of new culverts will be constructed, 20 in number along the road. The sizes and numbers are as follows:

a) 18 No. 700x900;
b) 2 No. 900x1200;

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 2 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (910 bags)
b) Gravel (37,772 m^3)
c) Fine aggregates (53,982m^3)
d) Coarse aggregates (47,101.0m^3)
e) Reinforcement rods (4.76 tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The minor rehabilitation is expected to employ a workforce of eighteen (18) and implementation will take about 12 months.

15.3 Potential Impacts, Mitigation and Monitoring Measures

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Aklawaya, Brah, Xekpa, and Amenorkofe Aveyime communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created for the nearby communities indirectly by the services they will render such as selling of food to the about 18 workers during their 12 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (12.4km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

15.3.1 Water Resources /Erosion/Flooding Impacts, Mitigation and Monitoring

The minor rehabilitation specific works such as savannah clearing, formation, construction of culverts and filling and sectional re-gravelling of the 12.4km road may result in the pollution of the Aklakpa, Alabo and Tordje streams in the area resulting in deteriorating the water quality and modifications in the flow regimes especially during the rainy season.

Since the project road lies in flood plains and the topography is flat, flow may be increased heavily resulting in flooding, ponding, soil erosion, channel modification and siltation of the creeks especially during the rainy seasons. Other sources of water pollution may include sedimentation, changes in biological activity in the stream and on their banks, chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage, exhaust emissions and corrosion of reinforcement rods among others.

Savannah vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 30m to the banks of the streams. There will be 20 culverts and drainage channels along the road corridor to direct run offs.
The SE will be responsible to ensure observance and compliance of the following:

- A separation distance of 50m for heaping construction materials from streams and channels;
- Sites for fuelling of machinery and servicing of equipment located at a minimum distance of 100m from the stream and drainage channels;
- Embankment erection around fuelling and other liquid or spillable storage sites;
- Provision of toilets and urinal at locations not less than 50m away from the stream; and
- Adequate worker awareness on sanitation and measures to avoid water resource contamination.

15.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 12.4km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

The use of appropriate PPEs for noise protection will be closely monitored by the Site Engineer. Maintenance plan for all equipments and machinery will be monitored to ensure that regular maintenance is followed to reduce noise from operations. Exposure limits of workers of high noise and vibration area will also be monitored. Noise levels will be monitored at the work areas.

15.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

The rehabilitation works on the 12.4km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Aklawaya, Brah, Xekpa, Amenorkofe Aveyime communities. Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the

location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Visual inspection of schools and farms within the project's area of influence will be undertaken to ascertain effectiveness of water dousing. A log book will be kept for monitoring the regularity of vehicle and machinery servicing under the supervision of the Site Engineer. Records of all monitoring activities will be contained in a quarterly report to the District Engineer.

15.3.4 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

15.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 12 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 3 members from the workforce while the nearby communities nominate 3 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Quarterly monitoring of the effectiveness of awareness programmes will be in the form of questions and answers/free discussions, and the campaigns by the peer group educators, led by the SE and health team.

15.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

15.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 20 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Effective traffic flow and vehicular and worker safety will be monitored daily. Appropriate positioning of road signs, reflectors, speed ramps, control limits and the role of traffic attendants will be monitored. Accidents and near misses will be recorded and reported to the contractor and the DE on daily basis for immediate remedial action. In the event of any accidents the first aid team will attend to the victims and convey them to the nearest health center.

15.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 12 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

16.0 ODUMASE JUNCTION–ODUMASE SPOT IMPROVEMENT PROJECT

16.1 Project Environment Information

The project road is located in the Biakoye District, about 15km from Nkonya Ahenkro, the district capital. The road is 3.0km long and 4.5m wide with Odumase as the only communities along the stretch. There are schools, farms and houses about 50m from the road at Odumase.

The vegetation type is savannah bush. The area is generally noted for agriculture: cultivation of cassava and cash crops such as maize, tomato, yams and fishing. The topography is undulating.

16.2 Project Description

The current state of the road is poor and has lost its formation and gravels. There has been no major rehabilitation works on the road. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed rehabilitation work is to improve the road condition to reduce travel time and accidents and to improve access to farming areas, schools, markets and health centres as well as interconnection between communities such as Nkonya Ahinkro, Odumase, Abotoase, and Kwamekrom. The road also provides access to Kwamekrom and Abotoase, major farming centres.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and sectional gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 16.1 below.

Table 16. 1 Locations of Specific Works along the Odumase Junction–Odumase Road

	Specific Works	**Location/Distance**
1	Clearing	Km 0+000 – 3+100
2	Formation	Km 0+000 – 3+100
3	Construction of culverts	Km 1+700, 2+600
4	Filling and gravelling	Km 0+000 – 3+100

Clearing involves weeding of savannah vegetation along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culverts construction. Formation works includes blading and drains 700x900 and 900x1200 types of new culverts will be constructed, 2 in number along the road. The sizes and numbers are as follows:

a) 1 No. 900x700;
b) 1 No. 1200x900.

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader (1m^3)
d) 2 No. Tipper trucks (6m^3)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 1 No. Concrete mixer (0.5m^3)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (130bags)
b) Gravel (2,191m^3)
c) Fine aggregates (2,473.8m^3)
d) Coarse aggregates (28,324.7m^3)
e) Reinforcement rods (0.68 tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The spot improvement work is expected to employ a workforce of thirteen (13) and implementation will take about 12 months.

16.3 Potential Impacts, Mitigation and Monitoring Measures

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Odumase community will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** Jobs will be created the nearby communities indirectly by the services they will render such as selling of food to the about 13 workers during their 12 months stay on the road.

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (3km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

16.3.1 Water Resources /Erosion/Flooding Impacts, Mitigation and Monitoring

Since there are no water bodies or creeks along/near the road corridor, impact on surface water resources will not be an issue. Impact on ground water sources could however be chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage, exhaust emissions and corrosion of reinforcement rods among others.

Impacts on ground water sources will be prevented by ensuring that fuels and other sources of raw materials such as cements and iron rods are stored at designated places at site office at Odumase away from bare ground. The bulldozer, vibratory/static roller, tipper trucks, motor loader and grader to be used for the rehabilitation works will be serviced regularly (two months interval) for better engine performance to prevent fuel leakages into the water bodies.

The Site Engineer (SE) of the Contractor will monitor the storage areas at the site office at Odumase for fuel, cement, iron rods etc to ensure the appropriateness or otherwise of these sites in the prevention of run off into the streams and seepage into ground water sources. All monitoring will be on weekly basis and the findings reported in the monitoring report to the Regional EPA. The SE will also monitor the maintenance log of vehicles to ensure they follow the two monthly servicing schedules and report to the DE.

16.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 3km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools to reduce their impacts. Construction works close to schools would be carried out after close of school. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

The use of appropriate PPEs for noise protection will be closely monitored by the Site Engineer. Maintenance plan for all equipment and machinery will be monitored to ensure that regular maintenance is followed to reduce noise from operations. Exposure limits of workers of high noise and vibration area will also be monitored. Noise levels will be monitored at the work areas.

16.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

The rehabilitation works on the 3km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for the Odumase community and the workers. Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Visual inspection of schools and farms within the project's area of influence will be undertaken to ascertain effectiveness of water dousing. A log book will be kept for monitoring the regularity of vehicle and machinery servicing under the supervision of the Site Engineer. Records of all monitoring activities will be contained in a quarterly report to the District Engineer.

16.3.4 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

16.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 12 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 2 members from the workforce while the nearby communities nominate 2 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Quarterly monitoring of the effectiveness of awareness programmes will be in the form of questions and answers/free discussions, and the campaigns by the peer group educators, led by the SE and health team.

16.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by

workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

16.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 2 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Effective traffic flow and vehicular and worker safety will be monitored daily. Appropriate positioning of road signs, reflectors, speed ramps, control limits and the role of traffic attendants will be monitored.

Accidents and near misses will be recorded and reported to the contractor and the DE on daily basis for immediate remedial action. In the event of any accidents the first aid team will attend to the victims and convey them to the nearest health center.

16.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 12 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

17.0 WUTE – SASEKPE - KUTIME MINOR REHABILITATION PROJECT

17.1 Project Environment Information

The project road is located in the North Tongu District, about 35km from Adidome, the district capital. The road is 16.5km long and 5m wide with the following communities along the stretch: Wute, Sesekpe, Deveme, Amegakope, Kutime. There are houses (20m) and farms (100m), schools (60m) and clinics (200m) from the road.

The vegetation type is savannah bush. The area is generally noted for agriculture: cultivation of cassava and cash crops such as maize, tomato, yams etc. The area has four streams that cross the road. The topography is generally flat.

17.2 Project Description

The current state of the road is poor and has lost its formation and with lots of soft spots with water crossings. There was a rehabilitation works on the road three (3) years ago. It is earth surface with low lying sections in water plains. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed rehabilitation work is to improve the road condition to reduce travel time and accidents and improving access to farming areas, schools, markets and health centres as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and sectional gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 17.1 below.

Table 17. 1 Locations with Specific Works along the Wute – Sasekpe - Kutime Road

	Specific Works	**Location/Distance**
1	Clearing	Km 0+000 – 5+300, Km 7+200 – 15+500
2	Formation	Km 0+000 – 16+500
3	Construction of culverts	Km 2+550, 3+100, 4+500, 7+580, 8+500(B/S), 9+200, 12+400, 12+900, 13+000, 15+900, 8+700, 14+100, 14+800
4	Filling and gravelling	Km 0+000 – 16+500

Clearing involves weeding or savannah vegetation removal the along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culverts construction. Formation works includes blading and drains 700x900 and 900x1200 types of new culverts will be constructed, 14 in number along the road. The sizes and numbers are as follows:

a) 11 No. 700x900;
b) 3 No. 900x1200.

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 4 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 2 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Portland cement (1,105bags)
b) Gravel (43,484 m^3)
c) Fine aggregates (39,000m^3)
d) Coarse aggregates (355,500m^3)
e) Reinforcement rods (5.78 tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The rehabilitation is expected to employ a workforce of eighteen (18) and implementation will take about 12 months.

17.3 Potential Impacts, Mitigation and Monitoring Measures

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Wute, Sesekpe, Deveme, Amegakope and Kutime communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (16.5km) activities. These will include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

17.3.1 Water Resourses /Erosion/Flooding Impacts, Mitigation and Monitoring

The minor rehabilitation specific works such as savannah clearing, formation, construction of culverts and filling and sectional re-gravelling of the 12.4km road may result in the pollution of the Wute, Sesekpe, Deveme, Amegakope, Kutime streams in the area resulting in deteriorating the water quality and modifications in the flow regimes especially during the rainy season.

Since the topography of the area is flat, flow may be increased heavily resulting in flooding, ponding, soil erosion, channel modification and siltation of the four streams especially during the rainy seasons. Other sources of water pollution may include sedimentation, changes in biological activity in the stream and on their banks, chemicals (cement/concrete) spillage, and contaminated run off from petroleum product seepage, exhaust emissions and corrosion of reinforcement rods among others.

Savannah vegetation clearing, blading and gravelling will be restricted to the right of way. Heaps of sand and gravel from excavation will not be kept less than 30m to the banks of the streams. There will be 14 culverts and drainage channels along the road corridor to direct run offs.

The SE will be responsible to ensure observance and compliance of the following:

- A separation distance of 50m for heaping construction materials from streams and channels;
- Sites for fuelling of machinery and servicing of equipment located at a minimum distance of 100m from the stream and drainage channels;
- Embankment erection around fuelling and other liquid or spillable storage sites;
- Provision of toilets and urinal at locations not less than 50m away from the stream; and
- Adequate worker awareness on sanitation and measures to avoid water resource contamination.

17.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 16.5km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and clinics to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

The use of appropriate PPEs for noise protection will be closely monitored by the Site Engineer. Maintenance plan for all equipments and machinery will be monitored to ensure that regular maintenance is followed to reduce noise from operations. Exposure limits of workers of high noise and vibration area will also be monitored. Noise levels will be monitored at the work areas.

17.3.3 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

The rehabilitation works on the 16.5km stretch of the feeder roads construction will cause air pollution which could adversely affect the people engaged directly or indirectly in road sector activities. This could be one of the major issues for Wute, Sesekpe, Deveme, Amegakope, Kutime communities and the workers. Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the

location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Visual inspection of schools and farms within the project's area of influence will be undertaken to ascertain effectiveness of water dousing. A log book will be kept for monitoring the regularity of vehicle and machinery servicing under the supervision of the Site Engineer. Records of all monitoring activities will be contained in a quarterly report to the District Engineer.

17.3.4 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

17.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 12 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 3 members from the workforce while the nearby communities nominate 3 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Quarterly monitoring of the effectiveness of awareness programmes will be in the form of questions and answers/free discussions, and the campaigns by the peer group educators, led by the SE and health team.

17.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

17.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 14 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Effective traffic flow and vehicular and worker safety will be monitored daily. Appropriate positioning of road signs, reflectors, speed ramps, control limits and the role of traffic attendants will be monitored. Accidents and near misses will be recorded and reported to the contractor and the DE on daily basis for immediate remedial action. In the event of any accidents the first aid team will attend to the victims and convey them to the nearest health center.

17.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration 12 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

ROADS IN THE CENTRAL REGION

18.0 WAMASO-ACQUAKROM MINOR REHABILITATION PROJECT

18.1 Project Environment Information

The project road is located in the Twifo-Heman-Lower Denkyira District, about 48km from Twifo-Praso, the district capital. The road is 600m long and 3.4m wide, linking Wamaso to Acquakrom. There are three farms located at chainages: 0+100, 0+350, and 0+500 along the road corridor and covering a total area of 2,400m² and about 2.8m from the roadside.

The vegetation type is a lush forest. The area is generally noted for timber logging, small-scale mining, and agriculture (crop cultivation and livestock rearing). The area is drained by 3 drainage channels that cross the road. The topography is generally flat.

18.2 Project Description

The current state of the road is poor, and unengineered. It is earth surface with low lying sections and water crossing points. Sections are rendered almost unmotorable in the rainy seasons.

The objective of the proposed minor rehabilitation is to facilitate the transportation of goods and persons, as well as the interconnection between communities such as Wamaso and Acquakrom at chaianges: 0+00 and 0+600.

The specific works intended to be carried out are mainly clearing of vegetation, construction of culverts and sub-base. The specific works (according to mileage (location) and/or distance) are provided in Table 18.1 below.

Table 18. 1 Locations of Specific Works along the Wamaso-Acquakrom Road

	Specific Works	**Location or Distance**
1	Clearing of vegetation	0+00 – 0+600
2	Construction of culverts	0+000, 0+200, 0+300
3	Sub-base	0+00 - 0+600

Sub-base will involve sectional gravelling of the entire road stretch. Two types of new culverts will be constructed, along the road. The sizes and numbers are as follows:

c) 2 No. 900x700; 'U' Culvert
d) 1 No. 1200x900; 'U' Culvert

The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader ($1m^3$)
d) 2 No. Tipper trucks ($6m^3$)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 1 No. Concrete mixer ($0.5m^3$)
i) 1 No. Poker vibrator

The type of raw materials and the estimated quantities will include:

a) Sand (14.07m³)
b) Chippings (22.50m³)
c) Gravel chippings (4208m³)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of thirty (30) will be employed for the project. The project implementation will take about 8 months.

18.3 Potential Impacts, Mitigation and Monitoring Measures

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Wamaso, Acquakrom, and Twifo Tema communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** It is expected that the rehabilitation works will generate employment and inject funds into the rural economy, through direct employment and increased income from commerce for those in the catchment communities.

There will be a few localized potential adverse impacts due to the rather limited and small-scale nature of the project activities. These include:

- Water resources impacts
- Noise and vibration impacts
- Dust generation and air quality impacts
- Potential road diversion impacts
- Occupational health and safety impacts
- HIV/AIDS Impacts
- Waste generation and sanitation impacts
- Temporary site office impacts

18.3.1 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Visual inspection of schools and farms within the project's area of influence will be undertaken to ascertain effectiveness of water dousing. A log book will be kept for monitoring the regularity of vehicle and machinery servicing under the supervision of the Site Engineer. Records of all monitoring activities will be contained in a quarterly report to the District Engineer.

18.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 600m road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition persons who may be working on farms (at 0+100, 0+350, and 0+500) close to the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from schools and clinics to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). The static machines will be sited at least 100m away from farm workers to reduce their impacts. Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The contractor or designated supervisor will be accountable for any instance of non-compliance.

The use of appropriate PPEs for noise protection will be closely monitored by the Site Engineer. Maintenance plan for all equipments and machinery will be monitored to ensure that regular maintenance is followed to reduce noise from operations. Exposure limits of workers of high noise and vibration area will also be monitored. Noise levels will be monitored in the work areas and sensitive areas like schools and clinics.

18.3.3 Water Resources /Erosion/Flooding Impacts, Mitigation and Monitoring

The minor rehabilitation works may result in deterioration in water quality of the three drainage channels that cross the road especially in the rainy seasons. Since the project will last for about eight months, delay in construction works after the vegetation has been cleared will lead to siltation of water bodies from particle laden run-offs. Other potential sources of impacts are heaping of materials, earthworks, blocking and narrowing the river flow at the crossing point (located at chainages: 0+000, 0+100, and 0+200) to make way for construction of culvert. Other sources of water pollution include sedimentation, changes in biological activity in the drainage channels, due to chemicals spillage, contaminated run off from the leakage of petroleum product, among others.

Culverts have been designed for construction along drainage channels to prevent erosion and subsequent siltation of water bodies. It will be ensured that vehicle washing, servicing, fuelling and refuelling are carried out at designated places away from the drainage channels and under trays to avoid oil spills. Drains will be designed to direct stormwater and other run-offs away from the water courses. The site clearing activities will be restricted to the right of way to prevent dust and loose soil straying into the drainage channels, thereby blocking the channels.

Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out. All material storage areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these surfaces would be continuously done by the Site Engineer. The monitoring activities will also aim at capturing relevant sources of impacts on the three drainage channels:

- Sediment-laden run-off from cleared areas of road;
- Contaminants in run-off from fuel and oil residue, etc);
- Oil and grease waste from equipment servicing and vehicle washing; and

18.3.4 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

18.3.5 Potential Spread of HIV/AIDS, Prevention and Monitoring

The setting up of Site Offices for the 8 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Quarterly monitoring of the effectiveness of awareness programmes will be in the form of questions and answers/free discussions, and the campaigns by the peer group educators, led by the SE and health team.

18.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

18.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 3 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Effective traffic flow and vehicular and worker safety will be monitored daily. Appropriate positioning of road signs, reflectors, speed ramps, control limits and the role of traffic attendants will be monitored. Accidents and near misses will be recorded and reported to the contractor and the DE on daily basis for immediate remedial action. In the event of any accidents the first aid team will attend to the victims and convey them to the nearest health center.

18.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 12 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

19.0 JUKWA-KROBO MINOR REHABILITATION PROJECT

19.1 Project Environment Information

The project road is located in the Twifo-Heman-Lower-Denkyira District, about 51km from Twifo-Praso, the district capital. The road is 7.0km long and 6.0m wide, serving the following communities: Jukwa, Anwiam and Krobo at chainages: 0+00, 5+700 and 7+00. There are seven (7) farms located along the stretch at chainages: 0+800, 1+300, 1+900, 2+400, 3+000, 6+000, 6+300, and covering a total area of 5,600m^2.

The vegetation type is a lush forest. The area is generally noted for timber extraction, small-scale mining, and agriculture (crop cultivation and livestock rearing). The area is drained by 15 drainage channels at chainages: 1+100, 1+300, 1+600, 2+300, 3+700, 4+600,4+650, 5+250 and 6+650. The topography is generally hilly.

19.2 Project Description

The current state of the road is fair. It is engineered. It is earth surface with low lying sections and water crossing points. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed minor rehabilitation is to improve the road condition and access to farming areas, as well as the interconnection between communities.

The specific works intended to be carried out are mainly clearing and sub-base. The specific works (according to mileage (location) and/or distance) are provided in Table 19.1 below.

Table 19. 1 Locations of Specific Works along the Jukwa-Krobo Road

	Specific Works	**Location or Distance**
1	Clearing	0+000, 7+000
2	Sub-base	0+000, 7+000
3	Culvert construction	1+300, 4+650, 5+250

Clearing involves weeding along the road corridor to widen the width of the road, while sub-base involves sectional gravelling of the entire road stretch. Three new culverts are to be constructed on the road at chainages: 1+300, 4+650 and 5+250.

The list of types and numbers of equipment/machinery to be used include:

a) 1 No. Bulldozer D7 or equivalent
b) 1 No. Motor grader 140G or equivalent
c) 1 No. Pay loader (1m^3)
d) 2 No. Tipper trucks (6m^3)
e) 1 No. Water tanker (9000litres)
f) 1 No. Vibratory or static roller (10 tonnes)
g) 1 No. Pick-up
h) 1 No. Concrete mixer (0.5m^3)
i) 1 No. Poker vibrator

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the

construction phase. It is estimated that a workforce of about thirty-five (35) will be employed for the project. The project implementation will take about 12 months.

19.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers at Jukwa, Anwiam and Kyirayewa will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.** It is expected that the rehabilitation works will generate employment and inject funds into the rural economy, through direct employment and increased income from commerce for those in the catchment communities

There will be a few localized potential adverse impacts due to the rather limited and small-scale nature of the project activities. These include:

- Water resources impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- HIV/AIDS spread
- Waste generation
- Temporary site office impacts

19.3.1 Dust Generation and Air Quality Impacts, Mitigation and Monitoring

Dusty conditions will be created due to haulage of construction materials from source to project site; tipping, loading and spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 50km/h when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Visual inspection of schools and farms within the project's area of influence will be undertaken to ascertain effectiveness of water dousing. A log book will be kept for monitoring the regularity of vehicle and machinery servicing under the supervision of the Site Engineer. Records of all monitoring activities will be contained in a quarterly report to the District Engineer.

19.3.2 Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 7km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition persons who may be working on farms (at 0+800, 1+300, 1+900, 2+400, 3+000, 6+000 and 6+300) close to the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. The static machines will be sited at least 100m away from farm workers to reduce their impacts. Static machines will be sited at least 100m away from schools and clinics to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quiet periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The contractor or designated supervisor will be accountable for any instance of non-compliance.

The use of appropriate PPEs for noise protection will be closely monitored by the Site Engineer. Maintenance plan for all equipments and machinery will be monitored to ensure that regular maintenance is followed to reduce noise from operations. Exposure limits of workers of high noise and vibration area will also be monitored. Noise levels will be monitored in the work areas and sensitive areas like schools and clinics. The use of appropriate PPEs for noise protection and maintenance schedule for all equipment and machinery will be monitored. Working hours of workers of high noise areas will also be monitored.

19.3.3 Water Resources /Erosion/Flooding Impacts, Mitigation and Monitoring

Minor Rehabilitation works may result in deterioration in water quality of the six streams that crosses the road at the following chainages: 1+100, 1+600, 2+300, 3+700, 4+600 and 6+650. Since the project will last for about twelve months, delay in construction works after the vegetation has been cleared will lead to soil particles being put in suspension in the streams, especially after a downpour. Other potential sources of impacts are heaping of materials, earthworks, and restricting of the flow of streams for culvert construction. In some cases the speed of flow may be increased resulting in flooding, ponding, soil erosion, channel modification and siltation of the river. Other sources of water pollution include sedimentation, changes in biological activity in the streams and on their banks, due to chemicals spillage, contaminated run off from the leakage of petroleum product, among others.

It will be ensured that vehicle washing, servicing, fuelling and refuelling are carried out at designated places away from the river. Drains will be designed to direct stormwater and other run-offs away from the stream. The bulldozer and grader for land clearing and site preparation will be restricted to the right of way, and directed away from the streams as much as possible to prevent dust and loose soil straying into the streams.

Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out. All material storage areas would be monitored weekly to ensure that they are not exposed to the wind, rain or areas of run-offs. Inspection of these surfaces would be continuously done by the Site Engineer. The monitoring activities will also aim at capturing relevant sources of impacts on the six streams:

- Sediment-laden run-off from cleared areas of road;
- Contaminants in run-off from equipment servicing and vehicle washing (fuel and oil residue, etc); and
- Construction of drainage channels and culverts.

19.3.4 Occupational/Public Health and Safety Impacts, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 50km/h at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

19.3.5 HIV/AIDS Impacts, Mitigation and Monitoring

The setting up of Site Offices for the 12 months duration of the project will create a temporary convergence point. People may converge for instance, for purposes of selling/buying food and other items. The opportunity to converge and interact with and among workers presents conditions for indulgence in sexual relationships. HIV/AIDS and other infection risks are likely to increase if workers engage multiple sexual partners.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select 4 members from the workforce while the nearby communities nominate 4 members to form a peer group team. This team will undertake HIV/AIDS awareness campaigns at two months interval. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted.

Quarterly monitoring of the effectiveness of awareness programmes will be in the form of questions and answers/free discussions, and the campaigns by the peer group educators, led by the SE and health team.

19.3.6 Waste Generation and Sanitation Impacts, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

19.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 3 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed

control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Effective traffic flow and vehicular and worker safety will be monitored daily. Appropriate positioning of road signs, reflectors, speed ramps, control limits and the role of traffic attendants will be monitored. Accidents and near misses will be recorded and reported to the contractor and the DE on daily basis for immediate remedial action. In the event of any accidents the first aid team will attend to the victims and convey them to the nearest health center.

19.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration of 12 months for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

20.0 KWAME ALERT JUNCTION-KWAME ALERT-AMUZU SPOT IMPROVEMENT PROJECT

20.1 Project Environment Information

The Kwame Alert Road is located in the Twifo-Heman-Lower-Denkyira District, about 26.0km from Twifo-Praso, the district capital. The road is 4.0km long and 6.0m wide, with the following communities along the stretch: Betimor, Kwame Alert and Amuzu at chainages: 0+00, 3+200 and 4+00. There are 6 farms located at chainages: 0+700, 1+700, 1+000, 1+300, 2+000, 2+100, and 2+900, covering a total area of 3,800m^2.

The vegetation type is a lush forest. The area is generally noted for timber extraction, small-scale mining, and agriculture (crop cultivation and livestock rearing). The area is drained by 12 drainage channels that cross the road. The topography is generally undulating.

20.2 Project Description

The current state of the road is fair, though engineered. It is earth surface with low lying sections and water crossing points. Sections are rendered almost unmotorable in the rainy season.

The objective of the proposed spot improvement works is to improve some sections on the road, access to farming areas, schools, markets and health centers, as well as the interconnection between neighbouring communities such as Hemang, Bukrusu and Betimore.

The specific works intended to be carried out are mainly clearing, raising of low lying areas, and construction of culverts. The specific works (according to mileage (location) and/or distance) are provided in Table 20.1 below.

Table 20.1 Locations of Specific Works along the Kwame Alert Junction-Kwame Alert-Amuzu Road

	Specific Works	**Location or Distance**
1	Clearing	0+000-3+700
2	Raising of low lying areas	0+150-0+250, 1+650-1+750
3	Construction of culverts	0+200, 1+700
4	Laying of sub-base	0+000-3+700

Clearing involves weeding along the corridor to widen the width of the road. It will also allow enough space for other works such as culverts construction. Some low-lying sections along the road will be raised to prevent the road from being washed during the raining season. Filling will also be done mainly in the approaches of culverts. Sub-base, involving sectional gravelling of the entire road stretch would be carried out.

One type of new culvert would be constructed along the road. The size and numbers are as follows:

a) 2 No. 900x700;

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3); and
g) 1No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000litres);

The type of raw materials and the estimated quantities will include:

a) Sand (7.22 m³)
b) Chippings (11.53 m³)
c) Gravel chippings (12304 m³)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of about thirty (30) will be employed for the project. The project implementation will take about 12 months.

20.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers at Betimor, Kwame Alert and Amuzu will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

There will be a few localized potential adverse impacts due to the rather limited and small-scale nature of the project activities. These include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impact

20.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

20.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

This section of the road is prone to erosion during the rainy season when the stream flow increases. Severe erosion leads to this section of the road becoming unmotorable. Culverts construction activities and earthworks such as excavation could generate some amount of silt into the stream.

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating waterbodies.
Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

20.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition persons who may be working on farms (0+700, 1+700, 1+000, 1+300, 2+000, 2+100, and 2+900) close to the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

20.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select four (4) from the workforce while the nearby communities nominate four (4) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

20.3.5 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and

speeding, as well as poorly shaped haul routes.Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
  Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

20.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by

workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

20.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 2 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and

- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

20.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 12 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

21.0 NTONTON-KONA SPOT IMPROVEMENT PROJECT

21.1 Project Environment Information

The Ntonton-Kona Road is located in the Upper Denkyira East Municipality, about 22.0km from Dunkwa-on-Offin, the municipal capital. The road is 5.0km long and 3.7m wide, with the following communities along the stretch: Ntonton, Yaw Nkromakrom, and Kona. There are Cocoa and Oil Palm plantations located along the entire stretch of road.

The vegetation type is a lush forest. The area is generally noted for timber extraction, cocoa/ oil palm production and general agriculture (crop cultivation and livestock rearing). The area is drained by 5 drainage channels. The topography is generally undulating.

21.2 Project Description

The current state of the road is poor. It was worked on about ten years ago. It is earth surface with low lying sections and water crossing points. Sections are rendered almost unmotorable in the rainy season which will require the construction of an extra culvert.

The objective of the proposed spot improvement works is to link Kyekyewere, Djamase and Abudu, as well as interconnects neigbouring communities such as Kyekyewere and Praprababida.

The specific works intended to be carried out are mainly clearing, rising of low lying areas, construction of culverts and blading. The specific works (according to mileage (location) and/or distance) are provided in the Table 21.1 below.

Table 21. 1 Locations/Distances of Specific Works along the Project Road

	Specific Works	**Location or Distance**
1	Clearing	0+000-5+000
2	Raising of low lying areas	3+280-3+400, 3+450-3+550,
3	Construction of culverts	3+350, 3+500, 4+200, 4+700
4	Blading	0+000-5+000

Clearing involves weeding along the corridor to widen the width of the road. It will also allow enough space for other works such as culverts construction. Some low-lying sections along the road will be raised to prevent the road from being washed during the raining season. Filling will also be done mainly at the culvert approaches.

Three types of new culverts will be constructed, along the road. The sizes and numbers are as follows:

a) 2 No. 900x700;
b) 1 No. 1250x1800;
c) 1 No 2/1800x1800

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader ($1m^3$);
f) 1No. Concrete mixer ($0.5m^3$); and
g) 1No. Tipper trucks ($6m^3$);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000litres);

The type of raw materials and the estimated quantities will include:

a) Sand (132.81 m³)
b) Chippings (212.35 m³)
c) Gravel chippings (16958 m³)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of about forty (40) will be employed for the project. The project implementation will take about 8 months.

21.3 Potential Impacts, Mitigation and Monitoring Measures

The current state of the road has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Ntonton, Yaw Nkromakrom, and Kona will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

There will be a few localized potential adverse impacts due to the rather limited and small-scale nature of the project activities. These include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impact

21.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

21.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

This section of the road is prone to erosion during the rainy season when the stream flow increases. Severe erosion leads to this section of the road becoming unmotorable. Culverts construction activities and earthworks such as excavation could generate some amount of silt into the stream.

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating waterbodies.
Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on the any waterbody;
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

21.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 5km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

21.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select five (5) from the workforce while the nearby communities nominate five (5) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

21.3.5 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and

speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

21.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by

workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

21.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 3 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and

- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

21.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 8 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

22.0 NSUTA-BEPOKOKOO SPOT IMPROVEMENT PROJECT

22.1 Project Environment Information

The Nsuta-Bepokokoo Road is located in the Assin South District, about 22.2km from Nsuaem-Kyekyewere, the district capital. The road is 6.7km long and 2.5m wide, with the following communities along the stretch: Nsuta and Bepokokoo. Mehane and Ankaase are also villages within the area that uses the road but are not along the road corridor. There are farms located along the entire stretch of the road covering a total area of 13,500m^2.

The vegetation type is forest with patches of grassland and shrubs. The area is generally noted for timber extraction, farming and charcoal burning. The area is drained by 7 drainage channels and the road crossed by some 3 rivers namely: Aniakra, Amoraa and Simon at chainages 1+200, 2+600 and 4+300 respectively. The topography is generally undulating.

22.2 Project Description

The current state of the road is poor. It was worked on about eight years ago, and would require replacement of culverts. It is earth surface with low lying sections and water crossing points. During the rainy season, sections are rendered unmotorable thereby resulting in inadequate transportation services for the haulage of food items and other goods. This has increased the incidence of post harvest losses.

The objective of the proposed spot improvement works is to ensure all-year-round accessibility at optimum cost, improving access to markets and health centers, farming areas, etc, as well as interconnection between communities such as Nsuta, Anyinabrim and Bepokokoo.

The specific works intended to be carried out are mainly clearing, formation and lying of sub-base. The specific works (according to mileage (location) and/or distance) are provided in the Table 22.1 below.

Table 22. 1 Locations of Specific Works along the Nsuta-Bepokokoo Road

	Specific Works	**Location or Distance**
1	Clearing	0+000 – 6+700
2	Formation	0+000 – 6+700
3	Laying of sub-base	0+000 – 6+700
4	Culvert Construction	0+600,1+00,1+400, 1+600, 2+200, 2+300, 3+300

Clearing involves weeding along the corridor to widen the width of the road. It will also allow enough space for other works such as culvert construction. Formation works include blading and compaction of road surface, while laying of sub-base to be undertaken on this road will involve sectional gravelling of culvert points and others. Three types of new culverts will be constructed, 7 in number along the road.

The sizes and numbers are as follows:

a) 3 No. 900x700;
b) 3 No. 1200x900;
c) 1No 2/1800x1800

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3); and

g) 1No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000litres);

The type of raw materials and the estimated quantities will include:

a) Sand (4157 m³)
b) Chippings (211.52 m³)
c) Gravel chippings (19585 m³)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of seventy (70) will be employed for the project. The project implementation will take about 12 months.

22.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impact

22.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

22.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

The road is crossed by some 3 rivers namely: Aniakra, Amoraa and Simon. The tunnelling provided to drain the rivers across the road is inadequate and as such the river floods sections of the road to about 20m during heavy rains. This usually results in the road being damaged due to erosion, most times beyond usage.

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the rivers.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

22.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 6.7km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive

noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

22.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select five (5) from the workforce while the nearby communities nominate five (5) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

22.3.5 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routesNoise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

22.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

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22.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 7 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened

to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

22.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 8 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

23.0 SENCHEM-ASENSUHU-AGAVE MINOR REHABILITATION PROJECT

23.1 Project Environment Information

The Senchem-Asenuhu-Agave Road is located in the Assin North Municipality, about 38.0km from Assin Fosu, the municipal capital. The entire length of the road is 4.0km, whilst the width is 3.0m from Senchem to Asensuhu and 5.0m from Asensuhu to Agave. It has the following communities along the stretch: Senchem, Asensuhu and Agave. There are other farming villages Yakahya Kope, Maame Toro Kope, Repairer Kope, Mesa Kope, Kwabila Kope, Padi Kope within the road corridor. There are farms located along the entire stretch of the road and covering a total area of 13,500$m^{2.}$ There is a school at chainage 1+00.

The vegetation type is forest with patches of grassland and shrubs. The area is generally noted for timber extraction, farming and charcoal burning. The area is drained by 13 drainage channels. The topography can be described as alternating between flat and undulating.

23.2 Project Description

The current state of the road is deplorable. It is un-engineered and earth surface without any formation works. There are no drainage structures and during the rainy season, sections are rendered unmotorable. Transportation services are severely affected especially, the haulage of food items and other goods, leading to increased incidence of post-harvest losses.

The objective of the proposed minor rehabilitation works is to ensure all-year-round accessibility at optimum cost, improving access to markets and health centers, farming areas, etc, as well as interconnection between communities such as Senchem, Asensuhu, Agrave Camp, and Mafi.

The specific works intended to be carried out are mainly clearing, cutting of drains, construction of culverts and formation of road. The specific works (according to mileage (location) and/or distance) are provided in the Table 23.1 below.

Table 23. 1 Locations of Specific Works along Senchem-Asenuhu-Agave Road

	Specific Works	**Location or Distance**
1	Clearing	0+00 – 4+00
2	Road Formation	0+00 – 4+00
3	Construction of culverts	0+500, 0+600, 1+00, 1+300, 1+650, 1+900, 2+00, 2+100, 2+200, 2+400, 3+100, 1+800, 3+00

Clearing involves weeding along the corridor to widen the width of the road. It will also allow enough space for other works such as culvert construction. Cutting of drains along the road will be done to accommodate stormwater in order to prevent the road from being washed away by storm water/run-off. Formation works include blading of drain materials and compaction onto road surface, while lying of sub-base on this road will involve gravelling of entire length. Two new culverts will be constructed, 13 in number along the road. The sizes and numbers are as follows:

a) 11 No. 900x700;
b) 2 No. 1200x900;

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;

e) 1No. Loader (1m3);
f) 1No. Concrete mixer (0.5m3); and
g) 1No. Tipper trucks (6m3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000litres);

The type of raw materials and the estimated quantities will include:

a) Sand (48.52 m^3)
b) Filling material (4725m^3)
c) Chippings (77.15m^3)
d) Sub-base material (12000m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of thirty six (36) will be employed for the project. The project implementation will take about 12 months.

23.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

23.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

23.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the rivers.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

23.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition a school (chainage 1+00) will also be a receptor of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the

machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Works close to the school would be done after school hours. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays.. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

23.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select five (5) from the workforce while the nearby communities nominate five (5) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

23.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public.

The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

23.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels, and from marshy and low lying areas to prevent potential pollution of ground and surface water. The sanitary facilities will be decommissioned at the completion of the maintenance project. In a case where any community expresses interest in the facility (through its chief), the DE will be duly informed and required to hand over the facility to the community. It is only under such a circumstance that the contractor will be absolved from the obligation to decommission the facility.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

23.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 13culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and

- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

23.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 12 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

24.0 KWANYARKO-NAMAWORA SPOT IMPROVEMENT PROJECT

24.1 Project Environment Information

The Kwanyarko-Namawora Road is located in the Agona East District, about 54.4km from Agona Nsaba, the district capital. The road is 4.0km long and 2.8m wide, linking Kwanyako to Namawora.

The vegetation type is lush forest. The area is generally noted for agriculture (crop cultivation). The area is drained by 12 drainage channels. The topography is generally undulating.

24.2 Project Description

The state of the road is poor. Some improvement works were carried out on it about 5 years ago. The road has low lying sections and water crossing points, which will require the construction of culverts.

The objective of the proposed spot improvement works is to facilitate the transportation of agricultural produce to market centres, and also provide easy access to health centres.

The specific works intended to be carried out are mainly clearing, blading, and construction of culverts. The specific works (according to mileage (location) and/or distance) are provided in the Table 24.1 below.

Table 24. 1 Locations of Specific Works along the Nsuta-Bepokokoo Road

	Specific Works	**Location or Distance**
1	Clearing	0+000-4+000,
2	Blading	0+000-4+000
3	Construction of culverts	0+000, 0+250, 0+400, 1+00, 2+500, 2+900, 3+600, 0+600, 0+800, 1+300, 1+500.

Vegetation along the road corridor will be cleared to widen the width of the road, and also allow enough space for other works such as the construction of drains and culverts. Certain sections will receive blading, while some low-lying sections along the road will be raised. 4types of new culverts will be constructed, eleven (11) in number along the road. The sizes and numbers are as follows:

a) 5 No. 900x700
b) 2No 2/900x1200
c) 2 No. 1200x900
d) 2No 1250x1800

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer
b) 1No. Water tanker;
c) 1No. Motor Grader
d) 1No. Roller; and
e) 1No. Wheel Loader
f) 1No. Concrete mixer.
g) 1No. Tipper trucks

The type of raw materials and the estimated quantities will include:

a) Sand (69.70 m^3)
b) Chippings (106.67 m^3)
c) Gravel chippings (3057 m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary

Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of 50 people will be employed for the project. The project implementation will take about 12 months.

24.3 Potential Impacts and Mitigation Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

24.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

24.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating waterbodies.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

24.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

24.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select five (5) from the workforce while the nearby communities nominate five (5) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

24.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);

- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly;and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

24.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

24.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 11 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

24.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 12 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

25.0 ABOWINIM-NKODWO SPOT IMPROVEMENT PROJECT

25.1 Project Environment Information

The Abowinim-Nkodwo Road is located in the Ajumako-Enyan-Essiam District, about 6.4km from Ajumako, the district capital. The road is 4.0km long and 2.5m wide, with the following communities along the stretch: Enyan Amoanda, Eyiakrom, and Nkodwo.

The vegetation type is lust forest. The area is generally noted for agriculture (crop cultivation). The area is drained by 9 drainage channels and the road crossed by some two (2) streams, namely Otowaraba and Bruku. The topography is generally undulating.

25.2 Project Description

The road is narrow and in a deplorable state. It benefitted from some improvement works about 12 years ago. There are water crossing points which will require the construction of culverts.

The objective of the proposed spot improvement works is to facilitate the transportation of agricultural produce to market centres, provide easy access route to health centres and to interconnect communities.

The specific works intended to be carried out are mainly clearing, raising, blading, and construction of culverts. The specific works (according to mileage (location) and/or distance) are provided in the Table 25.1 below.

Table 25. 1 Locations Specific Works along the Abowinim-Nkodwo Road

	Specific Works	**Location or Distance**
1	Clearing	0+000-4+000,
2	Blading	0+000-4+000
3	Construction of culverts	0+200, 0+500, 0+600, 1+200, 2+00, 2+100, 2+600, 2+900, 3+500

Vegetation will be cleared along the road corridor to widen the width of the road, and also allow enough space for other works such as the construction of culverts. Certain sections will receive blading. One (1) type of new culverts will be constructed, nine (9) in number along the road. The sizes and numbers are as follows:

a) 9 no. 900x700

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer
b) 1No. Water tanker;
c) 1No. Motor Grader
d) 1No. Roller; and
e) 1No. Wheel Loader
f) 1No. Concrete mixer.

The type of raw materials and the estimated quantities will include:

a) Sand (26.63 m^3)
b) Chippings (42.60 m^3)
c) Gravel (2501 m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase.It is estimated that a workforce of 35 will be employed for the project. The project implementation will take about 6 months.

25.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers at Enyan Amoanda, Eyiakrom, and Nkodwo will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

25.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

25.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

The road crossed by some two (2) streams, namely Otowaraba and Bruku.The tunnelling provided to drain the streams across the road is inadequate and as such the streams floods sections of the road. This usually results in the road being damaged due to erosion, most times beyond usage. Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the streams.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

25.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 4km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

25.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select four(4) from the workforce while the nearby communities nominate four(4) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

25.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

25.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

25.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 9 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

25.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 8 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction

26.0 MFUOM-APONKWAA-ONOMAKWAA SPOT IMPROVEMENT PROJECT

26.1 Project Environment Information

The Mfuom-Aponkwaa-Onomakwaa Road is located in the Twifo-Hemang-Lower-Denkyira District, about 35.5km from Twifo Praso, the district capital. The road is 6.0km long and 5m wide, with the following communities along the stretch Mfuom, Apokwa and Onomakwaa.

The vegetation type is lush forest. The area is generally noted for agriculture (crop cultivation). The area is drained by fourteen (14) drainage channels. The topography is generally undulating.

26.2 Project Description

The road is narrow and in a deplorable state. It benefitted from some improvement works about 6years ago. The objective of the proposed spot improvement works is to facilitate the transportation of agricultural produce to market centres, provide easy access route to health centres and to interconnect communities.

The specific works intended to be carried out are mainly, clearing of the road, formation of road, provision of culverts and the filling and gravelling of critical sections. The specific works (according to mileage (location) and/or distance) are provided in Table 26.1.

Table 26. 1 Locations of Specific Works along the Mfuom-Aponkwaa-Onomakwaa Road

Specific Works	**Location or Distance**
Clearing	0+00 – 6+00
Formation Of Road	0+00 – 6+00
Culvert Construction	0+450, 1+100, 1+300, 1+600, 1+800, 2+400, 2+900, 3+600, 3+950, 4+100, 4+400, 5+00, 5+600, 5+900
Filling/Gravelling of Sections	0+350-0+500, 1+050-1+175, 1+250-1+350 etc

Vegetation will be cleared along the road corridor to widen the width of the road, and also allow enough space for other works such as the construction of culverts. The entire road would be formed bringing on to the material from the drain and compacted.
Five (5) types of new culverts will be constructed, 14 in number along the road. The sizes and numbers are as follows:

a) 6 No. 900x700;
b) 2No 2/1250x1800
c) 3 No. 2/1200x900;
d) 1No 1/1800x1800
e) 2No 3/1200x900

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer	b) 1No. Water tanker;
c) 1No. Motor Grader	d) 1No. Roller; and
e) 1No. Wheel Loader	f) 1No. Concrete mixer.

The type of raw materials and the estimated quantities will include:

a) Sand (244.56 m^3)
b) Chippings (395.87 m^3)
c) Gravel (6077 m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source

is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of 40 will employed for the project. The project implementation will take about 12 months.

26.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers at Enyan Amoanda, Eyiakrom, and Nkodwo will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The right of way (RoW) already exist. The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road (10km) activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

26.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and

- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

26.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating waterbodies.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

26.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 6km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

26.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select five (5) from the workforce while the nearby communities nominate five (5) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

26.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

26.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

26.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 14 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

26.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 8 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

ROADS IN THE EASTERN REGION

27.0 ABEKOASE-SUBRISO SPOT IMPROVEMENT PROJECT

27.1 Project Environment Information

The Abekoase-Subriso Road is in the Atiwa District of the Eastern Region, about 20km from Kwabeng the district capital. The road stretches over a distance of 8km and it passes through the Abekoase, Subriso and Sekyere communities. There are mainly farms at Abekoase and subriso communities along the road corridor, located about 20m from the road. Farming is a main economic activity in the area and the few markets (at Sekyere which is adjacent the main Accra Kumasi Highway) serving the communities are highly patronized during market days.

The vegetation of the project area is forest. The landscape is undulating. The River Mame is the main water body which together with 7 other minor streams and creeks drains the area.

27.2 Project Description

The road condition is poor. Reshaping works was carried out in 2006. The situation gets worse during the rainy season when, due to the inadequate drainage, numerous potholes develop. The road width of 6m has been reduced to 3m at various sections due to encroachment by weeds and washing away at the edges.

The objective of the rehabilitation works is to reduce the travelling time along the stretch thereby improving access to the adjoining communities and other social facilities such as schools and hospitals (in Abekoase and subriso).

The specific works to be carried out are mainly clearing, shaping, filling, sectional gravelling and culvert construction. The specific works (according to mileage (location) and/or distance) are provided in Table 27.1.

Table 27. 1 Locations of Specific Works along the Abekoase-Subriso Road

	Specific Works	**Location or Distance**
1	Clearing	8.0km
2	Formation	8.0km
3	Construction of culverts	8/700*900 U- culverts at 0+200,0+350,0+400,2+900,4+850,4+900,5+100,5+300
4	Filling and gravelling	Filling -7,339 m^3 Gravelling -3.5km

Clearing involves weeding along the corridor to restore the width of the road. It will also allow enough space for other works.

The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3); and
g) 2No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (480bags)
b) Coarse aggregates (80m^3); and

c) Fine aggregates (48m^3); d) Reinforcement timber (2.4tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of between 20 and 30 will be employed for the project. The project implementation will take about 6 months.

27.3 Potential Impact, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Abekoase and subriso communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

27.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;

- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

27.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

The River Mame is the main water body which together with 7 other minor streams and creeks drains the area. The tunnelling provided to drain the river across the road is inadequate and as such the river floods sections of the road to about 20m during heavy rains. This usually results in the road being damaged due to erosion, most times beyond usage.

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the river.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

27.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 8km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 20m from the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

27.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

27.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and

speeding, as well as poorly shaped haul routesNoise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

27.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by

workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

27.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 8 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

27.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 6 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction

28.0 ABENASE-AKOKOASE SPOT IMPROVEMENT PROJECT

28.1 Project Environment Information

The Abenase-Akokoase Road is located in the Akyemansa District, about 15km from Ofoase, the district capital. The road is 17.1km long with Abenase and Akokoase communities along the stretch. There are a number of schools and a health center at Abenase and some markets at Akokoase. Various farms are located along the corridor, about 35m from the road.

The vegetation type is forest. The area is generally noted for agriculture. The area is drained by 5 drainage channels. The topography is generally undulating.

28.2 Project Description

The current state of the road is poor, though it benefited from some reshaping works in 2007. It is earth surface with low lying sections and water crossings. Sections are rendered almost unmotorable in the rainy season. The width of the road is reduced from 6.0m to about 3.0m due to washing away at the edges.

The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets and health centers and enhancing inter-connectivity between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 28.1.

Table 28. 1 Locations or Distances of Specific Works along the Abenase-Akokoase Road

	Specific Works	**Location or Distance**
1	Clearing	17.1km
2	Formation	17.1km
3	Construction of culverts	5/700*900 u culvert
4	Filling and gravelling	Filling-2,063m^3 Gravelling-4.6km

Clearing involves weeding along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and construction of drains.

Filling will be done mainly in the approaches of culverts and also laying of 1.0km of gravel sub-base. The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3); and
g) 2No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000 litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (300 bags)
b) Gravel (460m^3)

c) Chippings (259m^3) d) Sand (162m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of between 20 and 30 persons will be employed for the project. The project implementation will take about 6 months.

28.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Abenase and Akokoase communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

28.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;

- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

28.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the river.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

28.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 17.1km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 35m at some points of the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be

restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays.. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and

Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

28.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

28.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes.Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

28.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be

composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

28.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 1 culvert during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

28.7.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of6 months) for which the site office will be in use. Though the proposed road

works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

29.0 AGAVENYA JUNCTION-BRUKUM AGAVENYA SPOT IMPROVEMENT PROJECT

29.1 Project Environment Information

The Agavenya Junction-Brukum Agavenya Road is located in the Yilo Krobo District of the Eastern Region, about 25km from Somanya, the district capital. The road is 3.7km long with the Agavenya, Sutawa and Mgomi communities along the stretch. Other adjoining communities such as Nsutapong and Agogo also use the road. There are 15 schools within Agavenya and Sutawa and various farms along the road. These facilities and farms are usually about 40m away from the road.

The vegetation type is Forest. The area is generally noted for agriculture. The topography is undulating. The area is devoid of any water bodies.

29.2 Project Description

The current state of the road is poor, though it benefited from some reshaping works in 2008. It is earth surface with low lying sections and water crossing points. Sections of the road are rendered almost unmotorable in the rainy season. The width of the road is reduced to 4.0m on the average (instead of 6.0m).

The objective of the proposed spot improvement works includes improving access to farming areas, schools, markets and health centers as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 29.1.

Table 29. 1 Locations of Specific Works along the Agavenya Junction-Brukum Agavenya Road

	Specific Works	**Location or Distance**
1	Clearing	3.7km
2	Formation	3.7km
3	Construction of culvert	1/1800x1250
4	Filling and gravelling	Filling-1780 m^3 Gravelling-1.0km

Clearing involves weeding along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and construction of a culvert (1 no. 1800x1250). Filling will be done mainly in the approaches of the culvert and also 1.0km of gravel sub-base will be laid. The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3); and
g) 2No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000 litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (120 bags)
b) Chippings (301.5m^3); and

c) Sand (188m^3) d) Gravel (390 m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of 20–30 persons will be employed for the project. The project implementation will take about 6 months.

29.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Agavenya, Sutawa and Mgomi communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

29.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;

- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

29.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

29.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 3.7km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 40m at some points of the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set

work schedule to avoid delays.. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

29.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

29.3.5 Occupational/Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes.Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls

will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

29.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable

construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

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29.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction 1 culvert during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

29.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 6 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and

economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction

30.0 AKORABO JUNCTION – KROMANENG SPOT IMPROVEMENT PROJECT

30.1 Project Environment Information

The Akorabo Junction-Kromaneng Road is in the Suhum Kraboa Coaltar District of the Eastern Region, about 10.3km from the district capital, Suhum. The road stretches over a distance of 2.4km and it passes through the Akorabo and Kromaneng communities. Other communities that use the road are Kroekyia and Water Works. There are farms along the road corridor, located about 20m from the road. Farming is a main economic activity in the area and the few markets serving the communities are highly patronized during market days.

The vegetation of the project area is forest set on an undulating landscape. Seven (7) minor streams and creeks drain the area.

30.2 Project Description

The road condition is poor. Reshaping works was carried out in 2005. The situation gets worse during the rainy season when, numerous potholes develop due to the inability of rainwater to drain off. The road width is also narrowed due to washing away at the edges and also encroachment by weedy vegetation.

The objective of the rehabilitation works is to reduce the travelling time along the stretch thereby improving access to the adjoining communities and other social facilities such as schools and hospitals.

The specific works intended to be carried out are mainly clearing, shaping, filling, sectional gravelling and culverts (8 in number) construction. The specific works (according to mileage (location) and/or distance) are provided in Table 30.1

Table 30. 1 Locations of Specific Works along the Akorabo Junction – Kromaneng Road

	Specific Works	**Location or Distance**
1	Clearing	2.4km
2	Shaping	2.4km
3	Construction of culverts	8/700*900mm u-culvert 0+250,0+380,0+600,1+200,1+400,1+475,1+800,2+050
4	Filling and gravelling	Filling-1.450km Gravelling-1.080km

Clearing involves weeding along the corridor to widen the width of the road. It will also allow enough space for other works. The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3); and
g) 2No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000 litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (480 bags)
b) Coarse aggregates (86m^3);
c) Fine aggregates (48m^3)
d) Reinforcement rods (2.5 tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source

is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of between 20 and 30 will be employed for the project. The project implementation will take about 6 months.

30.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Akorabo and Kromaneng communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

30.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and

- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

30.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Seven (7) minor streams and creeks drain the area. The tunnelling provided to drain the streams during heavy rains is inadequate. This could usually results in the road being damaged due to erosion, most times beyond usage. Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the waterbodies

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

30.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 2.4km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 20m at some points of the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings,

and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

30.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

30.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes. Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers

on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

30.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services.

Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

30.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 8 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

30.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 6 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and

economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

31.0 AKORADARKO-BOMODEN SPOT IMPROVEMENT PROJECT

31.1 Project Environment Information

The Akoradarko-Bomoden Road is located in the Fanteakwa District, about 15km from Begoro, the district capital. The road is 9.5km long with the Duapolice and Tadeso communities along the stretch. There are schools and markets at Akoradarko and Tadeso and cemetaries at Duapolice; all located about 20m from the road.

The vegetation type is Semi-deciduous Forest. The area is generally noted for agriculture. The area is drained by 2 drainage channels. The topography is undulating.

31.2 Project Description

The current state of the road is poor, though it benefited from some reshaping works in 2007. It is earth surface with low lying sections and water crossing points. Sections with water crossings are rendered almost unmotorable in the rainy season. The width of the road is reduced to 4.0m on the average (instead of 6.0m).

The objective of the proposed spot improvement works includes improving access to farming areas, schools and markets within the communities. The specific works intended to be carried out are mainly clearing, formation, construction of culverts, filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 31.1.

Table 31. 1 Locations of Specific Works along the Akoradarko-Bomoden Road

	Specific Works	**Location or Distance**
1	Clearing	9.5km
2	Formation	9.5km
3	Construction of culverts	2/700*900mm u culverts at 2+500and4+720
4	Filling and gravelling	Filling-6800m3 Gravelling-5.9km

Clearing involves weeding along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and construction of drains.

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base will be laid. The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3);
g) 2No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000 litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (120 bags)
b) Chippings (765m^3); and
c) Sand (485m^3)
d) Gravels (3540m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source

is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of 20-30 persons will be employed for the project. The project implementation will take about 6 months.

31.3 Potential Impacts, Mitigation and Monitoring Impact Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in the Akoradarko, Duapolice and Tadeso communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

31.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;

- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

31.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating waterbodies.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

31.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 9.5km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 20m at some points of the road and also a school and a market at Akoradarko and Tadeso repectively will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Works close to schools would be done after school hours. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to

3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

31.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

31.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers

on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues;
- Monitoring to ensure the first aid team undertakes education exercise regularly; and
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

31.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services.

Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

31.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 2 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

31.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 6 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and

economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

32.0 ANUM APAPAM – KOFIPARE SPOT IMPROVEMENT PROJECT

32.1 Project Environment Information

The Anum Apapam-Kofipare Road is located in the Suhum Kraboa Coaltar District of the Eastern Region, about 22.2km from Suhum, the district capital. The road is 3.8km long with Anum Apapam and Kofipare communities located along the stretch. There are farms along the corridor usually situated about 20m from the road.

The vegetation type is forest. The area is generally noted for agriculture. The area is drained by 6 drainage channels. The topography is hilly and undulating.

32.2 Project Description

The current state of the road is poor, though it benefited from some spot improvement works in 2008. It is earth surface with low lying sections and water crossing points. Sections are rendered almost unmotorable in the rainy season. The width of the road is reduced to 4.0m on the average (instead of 6.0m).

The objective of the proposed spot improvement works includes improving access to farming areas as well as interconnection between communities.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts, filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 32.1.

Table 32. 1 Specific Works and their Locations along the Anum Apapam – Kofipare Road

	Specific Works	**Location or Distance**
1	Clearing	3.8km
2	Formation	3.8km
3	Construction of culverts	6/700*900 u culverts at ch 1+800, 1+900,2+250,2+300,2+400,2+700
4	Filling and gravelling	Filling-5,650 m3 Gravelling-1.0km

Clearing involves weeding along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and construction of drains. Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base will be laid. The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader ($1m^3$);
f) 1No. Concrete mixer ($0.5m^3$); and
g) 2No. Tipper trucks ($6m^3$);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000 litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (360 bags)
b) Coarse aggregates ($301.5m^3$); and
c) Fine aggregates ($188m^3$)
d) Reinforcement rods (1.8tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of twenty-four (24) persons will be employed for the project. The project implementation will take about 6 months.

32.3 Potential Impacts, Mitigation and Monitroing Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers in Anum Apapam and Kofipare communities will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

32.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;

- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

32.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating waterbodies.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

32.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 3.8km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 40m at some points of the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be

restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays.. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

32.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

32.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes.Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be done to ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

32.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be

composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

32.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 6 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

32.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite

of the short duration (of 6 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction

33.0 FRANKADUA-ALABO RIVER SPOT IMPROVEMENT PROJECT

33.1 Project Environment Information

The Frankadua-Alabo Road is located in the Asuogyaman District, about 11.5km from Atimpoku, the district capital. The road is 5.2km long from Frankadua to the Alabo River. There are a number of farms along the road corridor usually sited 20m from the road.

The vegetation type is forest. The area is generally noted for agriculture. The area is drained by 6 drainage channels. The topography is undulating.

33.2 Project Description

The current state of the road is poor, though it benefited from some reshaping works in 2008. It is earth surface with low lying sections and water crossings. Sections are rendered almost unmotorable in the rainy season. The width of the road is reduced to 4.0m on the average (instead of 6.0m).

The objective of the proposed rehabilitation works includes improving access to farming areas and to facilitate conveyance of farm produce during harvest seasons.

The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 33.1.

Table 33. 1 Locations or Distances of Specific Works along the Frankadua-Alabo River Road

	Specific Works	**Location or Distance**
1	Clearing	5.2km
2	Formation	5.2km
3	Construction of culverts	6/700*900 u culvert 1+100,1+600,2+400,2+650,2+900and4+600
4	Filling and gravelling	Filling-1950m^3 Gravelling-1.0km

Filling will be done mainly in the approaches of culverts and also 1.0km of gravel sub-base will be laid. The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3);
g) 2No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000 litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (360 bags)
b) Coarse aggregates (66m^3); and
c) Fine aggregates (42m^3)
d) Reinforcement rods (1.8 tonnes)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. The project is estimated to employ a workforce of 20-30. The project implementation will take about 6 months.

33.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers at Frankkadua will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

33.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;
- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

33.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the waterbodies.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on any waterbody:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

33.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 5.2km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 20m at some points of the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays.. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

33.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

33.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes.Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);

- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

33.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

33.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 6 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

33.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite of the short duration (of 6 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

34.0 SUTAPONG – SUTAPONG FALL SPOT IMPROVEMENT PROJECT

34.1 Project Environment Information

The Sutapong-Sutapong Fall Road is located in the Upper Manya District of the Eastern Region, about 16km from Asesewa, the district capital. The road is 2.8km long with Sutapong, Teguenya and Popornya being beneficiary communities. A good number of farms border the road and are usually located about 20m from the road.

The vegetation type is Semi-deciduous Forest. The area is generally noted for agriculture. The area is drained by 5 drainage channels. The topography is undulating.

34.2 Project Description

The current state of the road is poor, though it benefited from some reshaping works in 2004. It is earth surface with low lying sections and water crossing points. Sections are rendered almost unmotorable in the rainy season. The width of the road is reduced to 4.0m on the average (instead of 6.0m).

The objective of the proposed spot improvement works is to improve access to farming areas.
The specific works intended to be carried out are mainly clearing, formation, construction of culverts and filling and gravelling. The specific works (according to mileage (location) and/or distance) are provided in Table 34.1.

Table 34. 1 Specific Works and their Locations along the Sutapong – Sutapong Road

	Specific Works	**Location or Distance**
1	Clearing	2.8km
2	Formation	2.8km
3	Construction of culverts	5/700*900mm u culverts at 0+500,0+650,1+080,1+950 and 2+200
4	Filling and gravelling	Filling-1600m^3 Gravelling-1.0km

Clearing involves weeding along the corridor to widen the width of the road to 6.0m. It will also allow enough space for other works such as culvert construction. Formation works includes blading and construction of drains.

Filling will be done mainly in the approaches of culverts and also 1km of gravel sub-base will be laid. The list of types and numbers of equipment/machinery to be used include:

a) 1No. Bulldozer D7 or equivalent,
b) 1No. Vibratory or Static roller (10 tonnes);
c) 1No. Motor Grader 140G or equivalent,
d) 1No. Pick-up;
e) 1No. Loader (1m^3);
f) 1No. Concrete mixer (0.5m^3); and
g) 2No. Tipper trucks (6m^3);
h) 1No. Poker vibrator
i) 1No. Water tanker (9000 litres);

The type of raw materials and the estimated quantities will include:

a) Portland cement (300bags);
b) Fine aggregates (36m^3);
c) Coarse aggregates (64m^3)

Construction materials (e.g. sand, laterite and gravel) will be obtained from approved sources, certified by the EPA as fully compliant with the Environmental Assessment Regulations. Where no such source is available, it is the obligation of the contractor to identify potential sources and obtain the necessary Environment Permit (through a Preliminary Environmental Assessment - PEA) to develop and restore borrow pits. Chippings will be sourced from EPA approved quarry sites.

There will be a Site Office (SO) erected at a strategic location, of not more than 1 acre in size, along the road corridor which will serve as a place for meeting and keeping equipment and machinery during the construction phase. It is estimated that a workforce of twenty-four (24) persons will be employed for the project. The project implementation will take about 6 months.

34.3 Potential Impacts, Mitigation and Monitoring Measures

The road currently has poor surface and structure conditions which impede transport of farm produce and general movement, especially during the rainy season to health and market centres, etc. With road improvement from the maintenance works, farmers will be able to move their farm produce easily, reducing post harvest losses. Other benefits include improved access to market centres, reduced vehicle operating cost (VOC), reduced travel time and reduced transportation cost. It will also ease movement, for instance, school attendance, to seek medical care, especially for pregnant women and also enhance trade. Unskilled labourers would be employed from the local communities and this could serve as an employment opportunity for unemployed local community members**.**

The potential adverse impacts will be few and localized due to the relatively small-scale nature of the project road activities. These will include:

- Water resource impacts
- Noise and vibration impacts
- Air quality impacts
- Potential road diversion impacts
- Occupational health and safety risks
- Potential HIV/AIDS spread
- Waste generation
- Temporary site office impacts

34.3.1 Potential Dust and Air Quality Impacts, Mitigation and Monitoring

Generation of dust will occur during haulage of construction materials on site, trips to the stockpile depot and haulage from the borrow pit to the feeder road construction site, spreading of gravel, sand and chippings are all activities that could add to the ambient dusty conditions. Workers are the most exposed to the effects of dust (PM_{10}) which include upper respiratory tract infection, irritation of the eyes, etc.

Dousing of the active sections of the road with water at scheduled intervals (twice daily in the dry season) will be used to control dust. Speed of 40km/hr when approaching the school area will be observed by construction vehicles. Drivers of vehicles that transport materials will be trained on impacts of dust. Speed ramps will be constructed at least 200m from either side of the road from the location of the school. PPEs such as nose masks and safety goggles shall be provided for all workers at project site.

Monitoring will cover the following parameters and their frequency of monitoring:

- Twice daily inspection of water dousing will be conducted on the road in the morning and afternoon, especially during the dry season;
- Twice daily inspection of PPE use by workers exposed to dust;

- Twice weekly checks on adherence to speed limit (40km/hr) within the catchment communities by the Site Engineer;
- Weekly inspection of records on servicing of project vehicles and equipments; and
- The use of tarpaulin to cover haulage trucks will also be checked daily. Local communities will be sensitized on the need to report non-compliant contractor to the DE.

34.3.2 Potential Water Quality Impacts, Mitigation and Monitoring

Excavation activities for U-drain and culvert construction will lead to increased turbidity and siltation. Oil leaks, rubber and metal components resulting from machinery and vehicular wear and tear and servicing as well as human and other wastes could end up contaminating the waterbodies.

Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from the streams and will have spill containment structures such as drains, oil trap, sump and bins in the site office to prevent seepage of oil. Locations for heaping construction materials (e.g. sand and other aggregates) will not be less than 50m from water bodies and drainage channels. The provision of toilets and urinals will be at locations not less than 100m away from the stream and creeks.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of equipment and vehicles such as the bulldozer, grader, etc for potential failures of any hydraulic component or leaks, and operational integrity would be carried out;
- All heaped material areas would be monitored weekly to ensure that they are not exposed to the wind rain or areas of run-offs. Inspection of these would be continuously done by the Site Engineer; and
- There will be weekly monitoring on the following relevant sources of impacts on water:
  - Sediment-laden run-off from cleared areas of road;
  - Contaminants in run-off from plantation and farms (fuel and oil residue, etc);
  - Oil and grease waste from equipment servicing and vehicle washing; and
  - Construction of drainage channels and culverts.

34.3.3 Potential Noise and Vibration Impacts, Mitigation and Monitoring

The main sources of noise will be from the use of:

- Bulldozers and grader in clearing the 2.8km road;
- Concrete mixers to mix concrete for culvert construction; and
- Vibratory roller for sectional filling and gravelling.

These machines generate noise levels of between 78dB – 95dB at 15m and 96dB – 111dB at 1.5m. Though the nature of the works will be such that noise generation will be intermittent, the noise levels by the machinery far exceed 85dB, above which hearing impairment can occur. The effects of excessive noise and vibration on humans include stress, hearing impairment, communication problems, etc. Workers, especially those working with or close to these equipments will be badly exposed. In addition people working in farms located about 20m at some points of the road will also be receptors of noise due to their relative distances from the road.

Noise protection devices such as ear muffs and plugs will be provided to all workers on site. Additionally workers exposed to loud noise and vibration will not be allowed to work with the machines for more than 3 hours in a day. Maintenance of machinery and equipment schedule will be observed and made available for inspection to ensure minimal noise generation. Static machines will be sited at least 100m away from homes, schools and clinics and to reduce their impacts. Construction works close to schools would be carried out after close of school while works close to clinics will be

restricted to the hours of 10:00 am to 3:00pm to avoid the relatively quit periods (mornings evenings, and nights). Impacts from machines such as bulldozers would be transient and their use will be to a set work schedule to avoid delays.. The operators would be made conscious of working in sensitive locations. The Contractor or designated supervisor will be accountable for any instance of non-compliance.

Monitoring will cover the following parameters and their frequency of monitoring:

- The use of appropriate PPEs for noise protection will be closely monitored twice a day;
- Weekly checks with school and clinic authorities to ascertain possible noise impacts affecting the school and clinc by the District Engineer; and
- Maintenance records for all equipment and machinery will be inspected weekly to ensure that regular maintenance is followed to reduce noise from operations.

34.3.4 Potential Spread of HIV/AIDS, Prevention and Monitoring

The threat of potential spread of HIV/AIDS and other STIs arises since the introduction of the projects could also lead to an increase in sexual promiscuity. The provision of jobs to local people would enhance their financial status, which may create the condition to engage multiply sexual partners and hence increase the risk of HIV/ AIDS infection.

Continued education on the issues of transmission and prevention has been recommended by the Ghana AIDS Commission (GAC) and some HIV prevention and control organizations as an efficient means of getting the message across to the populace. Management of the contracting firm in collaboration with the District Health Directorate will ensure that workers are briefed on the nature, transmission mode and the implication of HIV at two months interval. Since there is apathy toward the reality of the disease even among groups of people who are privy to the seriousness of the pandemic, regular sensitization of the workers will emphasize the deadly effects of the disease. The contractor will select three (3) from the workforce while the nearby communities nominate three (3) members to form a peer group team. There will be free condom supplies to workers and community members. Private discussions, counselling and testing will be promoted. This team will undertake HIV/AIDS awareness campaigns at two months interval.

Monitoring will cover the following parameters and their frequency of monitoring:

- There will be quarterly HIV/AIDS awareness workshops, to be held by qualified health personnel, to assess the level of awareness and understanding of workers and townsfolk. Assessment will be done at each workshop in the form of questions and answers, where the participants will be required to respond to questions designed to elicit particular views;
- Records on the training of Peer Educators would be checked every two months; and
- There would be monthly checks on records of condoms distributed.

34.3.5 Occupational\Public Health and Safety Risks, Mitigation and Monitoring

Accidents constitute an important risk in road maintenance works resulting in injuries. Operations of the concrete mixer, bulldozer, grader and the use of rollers have the potential to cause injury to workers. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes.Noise and vibration of machinery as well as dusty conditions created by moving vehicles and machinery could affect the health of workers and the public. The public could be affected through poor reinstatement of borrow pits which could serve as grounds for breeding of mosquitoes.

Four (4) workers shall be trained (by a health team from the District Health Centre) on first aid and other safety procedures. The trained first aid team will be in charge of educating their fellow workers on safety and first aid procedures. PPEs such as nose masks, ear plugs, gloves, goggles and overalls will be provided for all works. Enforcement of health measures and safety regulations in the operation of vehicles and machinery and use of PPEs will be performed by the SE, in addition to the following activities:

- Incidence of injuries and ailments of workers and the public will be kept on record (and prevalent injuries or ailments identified and reported for remedial action by management);
- Posting of speed limits of 40km/hr at approaches to works sites;
- Routine checks to ensure workers are in their complete PPEs before the commencement and during work, non-compliant staff will be appropriately reprimanded and subsequently a fine of GH¢5 and then outright dismissal;
- DFR's reinstatement/ restoration plan, giving details of final shape, method of achieving it, drainage and sediment control, re-soiling and re-vegetation measures would be implemented to cater for developed borrow pits;
- Toolbox meetings held on regular basis to address new developments on health and safety issues; and
- Monitoring to ensure the first aid team undertakes education exercise regularly.

Monitoring activities will be carried out in order to maintain the health and safety of the public and all workers. These include:

- Sanitary facilities such as mobile toilets and wash rooms will be checked whether they have been provided before the start of the project;
- Weekly checks would be doneto ascertain that the mobile toilets are provided at designated distances;
- Weekly review of records of incidents (injuries, cuts, falls, knockdowns), their investigation and implementation of recommended actions;
- The Site Engineer will monitor the use of appropriate PPEs by workers twice daily;
- Records of appropriate training for each worker will be inspected monthly to ensure that all workers have the appropriate training needed for their work;
- Reinstatement plan burrow pits will be reviewed at the beginning of the project by the DE to check for compliance;
- Tool box meeting records will also be reviewed weekly to further identify training needs of workers and address them appropriately;
- Adherence to stipulated speed limit (40km/hr) will be checked twice weekly by the Site Engineer; and
- The education exercises of first aid team will be recorded and inspected monthly by the contractor to ensure they undertake the education exercise regularly.

34.3.6 Waste Generation, Mitigation and Monitoring

The main sources of waste will include cleared vegetation and construction debris (e.g. removed old culverts), packaging materials (e.g. cement bags), plastics and organic wastes from activities at the sites, and also sanitary waste. Improper handling of waste generated can become a source of nuisance, disease and infections, e.g. breeding grounds for flies and mosquitoes. Indiscriminate defecation by workers could lead to health problems, e.g. cholera and other diarrhoea diseases among workers and in nearby communities. Waste may also be carried by run-off into the stream contaminating it.

Waste bins will be provided at all working sites and at the SOs. Waste will be segregated at source into two – organic and then waste plastics and glass. Organic wastes and cleared vegetation will be

composted near the work site to enrich the soil, while plastics and glass will be taken to the nearest district's dump sites or sold. Zoomlion will be contracted to provide the waste disposal services. Workers will be trained on the need and benefits of waste segregation for full cooperation. Suitable construction debris will be used as part of the filling materials. Sanitary facilities (including toilets) will be provided. Mobile toilets and urinals will be located at a minimum distance of 100m away from any stream or drainage channels.

Monitoring will cover the following parameters and their frequency of monitoring:

- Daily monitoring of waste segregation and littering;
- Weekly monitoring of emptying of bins at waste dump sites;
- Weekly monitoring of waste composting;
- Daily inspection of work site to detect indiscriminate defecation; and
- Toilets decommissioning on project completion.

34.3.7 Potential Road Diversion Impacts, Mitigation and Monitoring

Construction of 5 culverts during the maintenance works can obstruct road traffic. The options considered for maintaining road access to vehicular traffic during culvert construction included:

- A temporal diversion of access completely from the existing road by by-passing the culvert section; and
- Closing one lane of the road for culvert construction, while the other lane (restricted access) is opened to traffic.

While the latter alternative (with restricted access), avoids potential 'trespassing' farmlands, etc and therefore eliminates the need to pay compensation; it nevertheless exposes workers and the general public to imminent accident risks. Since only one lane will be accessible at any one time, vehicles traveling in opposite directions may be involved in accidents at or near the culvert crossing (construction site). Speeding vehicles are likely to fall into 'culvert trenches' or ditches or involved in head-on collision at the culvert site. Construction workers will be operating close to moving vehicles, at the risk of falling vehicles or objects on them or even knockdowns.

The current road width has reduced to between 3 and 4m, although the RoW is 6m. Thus adequate space is available to allow for construction works without affecting any adjoining land. Before closing one lane for culvert construction, a temporary structure will be installed on the other lane to be opened to traffic. The closed lane will be blocked at a location 100m away from the culvert, with appropriate warning signals and reflectors, with speed limit of 20km/h, but 10km/h at the narrow crossing, speed control ramps and traffic attendants directing vehicular movement. The actual working areas will be secured with barricades. The construction period will be effectively scheduled and strictly followed.

Monitoring will cover the following parameters and their frequency of monitoring:

- Effective traffic flow as well as vehicular and worker safety will be monitored daily;
- Daily inspection of appropriate positioning of road signs, reflectors, speed ramps, control limits, and the role of traffic attendants; and
- Daily inspection of records on accidents and near misses by contractor and the DE for immediate remedial action. In the event of any accident the first aid team would attend to the victims and convey them to the nearest health centre.

34.3.8 Temporary Site Office Impacts, Mitigation and Monitoring

The site office required for the project will have to be strategically located along the road corridor. The selected site may however affect farm crops, physical assets or other properties of land owners, in spite

of the short duration (of 6 months) for which the site office will be in use. Though the proposed road works will be of benefit to the land owner, it is important that he/she does not suffer any social and economic loss from the temporary use of the land for project office. In the arrangement with the contractor for use of the land, the land owner may not have the negotiation skills to secure a fair deal or may end up being cheated. The contractor may also fail to deliver any agreed terms and disappear after the project to the detriment of the land owner.

As a common practice, a site for use as field office is usually identified during site visit by bidders, before submission of bids. The contractor (winning bidder) will however, be required to observe the following conditions in selecting the site:

- Identify a potential site, which must not be a farmland with crops or any physical asset;
- Identify the landowner through the Assembly member and/or Chief of the community;
- Seek the consent of the landowner to erect the proposed site office on the land for the specified duration of the road project;
- Agree with the landowner to hand over the agreed structure to be erected to the landowner; and
- Agree on other measures to render the site safe and usable to the satisfaction of the landowner.

The agreement will be documented and signed by the contractor and the owner with the District Engineer and Assembly member or Chief of the community as witnesses.

In addition to periodic visits (twice a month) to the site office, the District Engineer will be in communication with the land owner to ascertain whether the conditions agreed on between owner and contractor are being met. The contractor will be required to include the state of fulfilment of the agreement terms in the quarterly report to be submitted to the District Engineer. It will be required of the contractor (by the DE) to reinstate the site and hand over the structure to the owner after completion of construction.

35.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN IMPLEMENTATION

The plan for implementation of enhancement and mitigation measures and monitoring activities in the ESMP is presented in this chapter. The plan highlights the relevant institutional roles/responsibilities for monitoring and reporting on the environmental and social safeguards performance and results, as well as a proposed capacity building provision to facilitate the ESMPs implementation. Cost estimates for implementation of the various measures, monitoring plan and capacity building are also given. The implementation budget will enable financing for the ESMPs to be an integral part of financing for the rehabilitation/maintenance projects.

35.1 Implementation Stages, Safeguard Measures and Institutions

The general outline of the ESMP implementation by the various actors will involve the following stages:

- ESMP preparation and approval;
- Contract specifications on E&S safeguards obligations;
- Rehabilitation/project contract award;
- E&S safeguards implementation plan and schedule;
- Rehabilitation/project commencement;
- Capacity building on E&S safeguards (and other awareness programme);
- E&S safeguards and mitigation implementation;
- Monitoring of safeguard/mitigation measures;
- Reporting; and
- Compliance and other periodic verification monitoring.

The main environmental and social safeguard measures in the ESMPs cover the following:

- Water resources, erosion control and flood prevention management;
- Noise and vibration exposure management;
- Dust control management;
- Public and occupational health and safety management;
- HIV/AIDS and health awareness management;
- Waste management;
- Road diversion and accident prevention; and
- Temporary office site reinstatement.

The key actors in the implementation of the ESMPs include:

- The contractor- to be awarded the rehabilitation contract and be required to implement the environmental and social safeguard measures;
- DFR - to ensure that E&S safeguards and other mitigation measures are duly implemented;
- EPA - to ensure compliance with the ESMP and other relevant approval conditions;
- MRH - to oversee the effective implementation of the road works and related E&S safeguards;
- MEST - to address complaints of any aggrieved parties on E&S safeguards, especially with respect to any 'unfavourable' decision (action or inaction) by the EPA.

The other components of the ESMPs include capacity building for the relevant actors and a proposed budget to facilitate implementation. The specific E&S safeguard obligations of the contractor that can be incorporated into the contract specifications are provided in Appendix 2. This is in addition to other contractual provisions made in the General Items of the Bills of Quantities, such as the following:

- Reinstatement of borrow pits (Item no. E790.1);

- Safe drinking water for site employees including storage facilities (Item no. A420.1);
- Protective clothing, safety equipment for use by site employees (Item no. A420.2);
- Temporary latrines, relocate as necessary, remove and backfill on completion (Item no. A420.3); and
- Assistance to and facilitate site visits by MoH personnel to educate workers and local communities in STDs, HIV/AIDS awareness and consultation meetings (Item no. A420.5).

35.2 Institutional Roles

The key actors in the implementation of the ESMPs whose specific roles are listed below are DFR, EPA, MRH and MEST, as well as the contractor.

Department of Feeder Roads

The DFR is responsible for ensuring that all the environmental and social safeguards associated with the projects are implemented. The system for addressing E&S safeguards comprise of DFR District Engineers, Environmental Desks at Head office and Regional offices and the Planning and Policy Unit. The National Environmental Desk (NED) facilitates preparation of the ESMPs and ascertains the quality for necessary approvals; takes custody of the final ESMPs and makes copies available to the Regional and District offices. The NED also plays a lead role in E&S safeguards capacity building at Regional and District offices as well as for contractors.

35.2.1 District Engineer (DE)

The DEs are the first line of contact with the contractors awarded the rehabilitation works and for implementing the project E&S safeguards. The DEs:

- Have custody of copies of ESMPs;
- Obtains contractors work plan and E&S implementation schedule;
- Adopts a monitoring plan and schedule;
- Conducts bi-weekly site inspection and monitor implementation of E&S safeguards;
- Receives and reviews reports from the contractor;
- Prepares and submits monthly and subsequent quarterly and annual reports to the Regional Environmental Desk.

35.2.2 Regional Environmental Desks (RED)

The RED serves as a link between the District DFR offices and the NED and provides back stopping on safeguard issues for DEs. The RED:

- Conducts bi-monthly monitoring on implementation of project E&S safeguards;
- Receives and reviews reports from the districts;
- Collates performance on the implementation of E&S safeguards in the district; and
- Submits monthly and subsequent quarterly and annual reports to the NED.

35.2.3 National Environmental Desk

The NED:

- Notifies EPA on commencement of the rehabilitation works/project;
- Reviews and collates reports from the REDs;
- Collates quarterly reports on E&S safeguards performance for the attention of Director (DFR) and submission to EPA head office;
- Shares lessons/recommendations with the Policy and Planning Unit (DFR), in order to incorporate E&S safeguards adaptive management in road project designs; and
- Submits quarterly and annual reports to the Ministry of Roads and Highways.

35.2.4 Environmental Protection Agency

EPA is the lead regulator on E&S safeguards and has the mandate to determine the form an ESMP should take. Other specific roles include:

- Review and verify ESMPs in order to grant environmental approval for the ESMPs (with accompanying schedule of conditions);
- Receive quarterly monitoring reports (EPA Head office) from DFR;
- Act on the DFR quarterly monitoring reports (Regional EPA office);
- Conduct quarterly compliance monitoring (Regional offices);
- Submit quarterly monitoring (compliance) reports to EPA Head Office;
- Collate and submit sector (feeder roads) annual report to Head office; and
- Include the sector E&S performance in the overall EPA annual report

35.2.5 Ministry of Roads and Highways

MRH is the supervising ministry for the DFR and the other road sector agencies. It is responsible for road sector policy formulation. The Ministry:

- Receives quarterly reports on the E&S safeguards from DFR during the project works as well as post-rehabilitation lifecycle of the road; and
- Conducts various impromptu and one annual end of year monitoring of the project sites.

35.2.6 Ministry of Environment, Science and Technology (MEST)

MEST is responsible for policy formulation relating to the environment. In respect of the ESMPs, the Ministry may carry out grievance redress or act on complaints by DFR on decisions or actions by the EPA to which DFR may not be in agreement.

35.2.7 Contractor

The E&S safeguards will be included in the contract specification and costed as appropriate, in order that there will be budget to implement the safeguards and other mitigation measures. The contractor will be required to:

- Develop a plan of work which incorporates schedule for E&S safeguards implementation;
- Submit the plan of work and schedule of E&S safeguard implementation to the DE;
- Implement all E&S safeguards and other mitigation measures as planned;
- Train/create awareness of all personnel/workers on relevant E&S safeguard measures and on their obligations; and
- Submit implementation reports on E&S safeguards to DE.

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35.3 Institutional Arrangements

The implementation of this ESMP requires the collaboration and involvement of the key institutions. The Figure 35.1 below illustrates the institutional roles and arrangement in the implementation of the ESMPs.

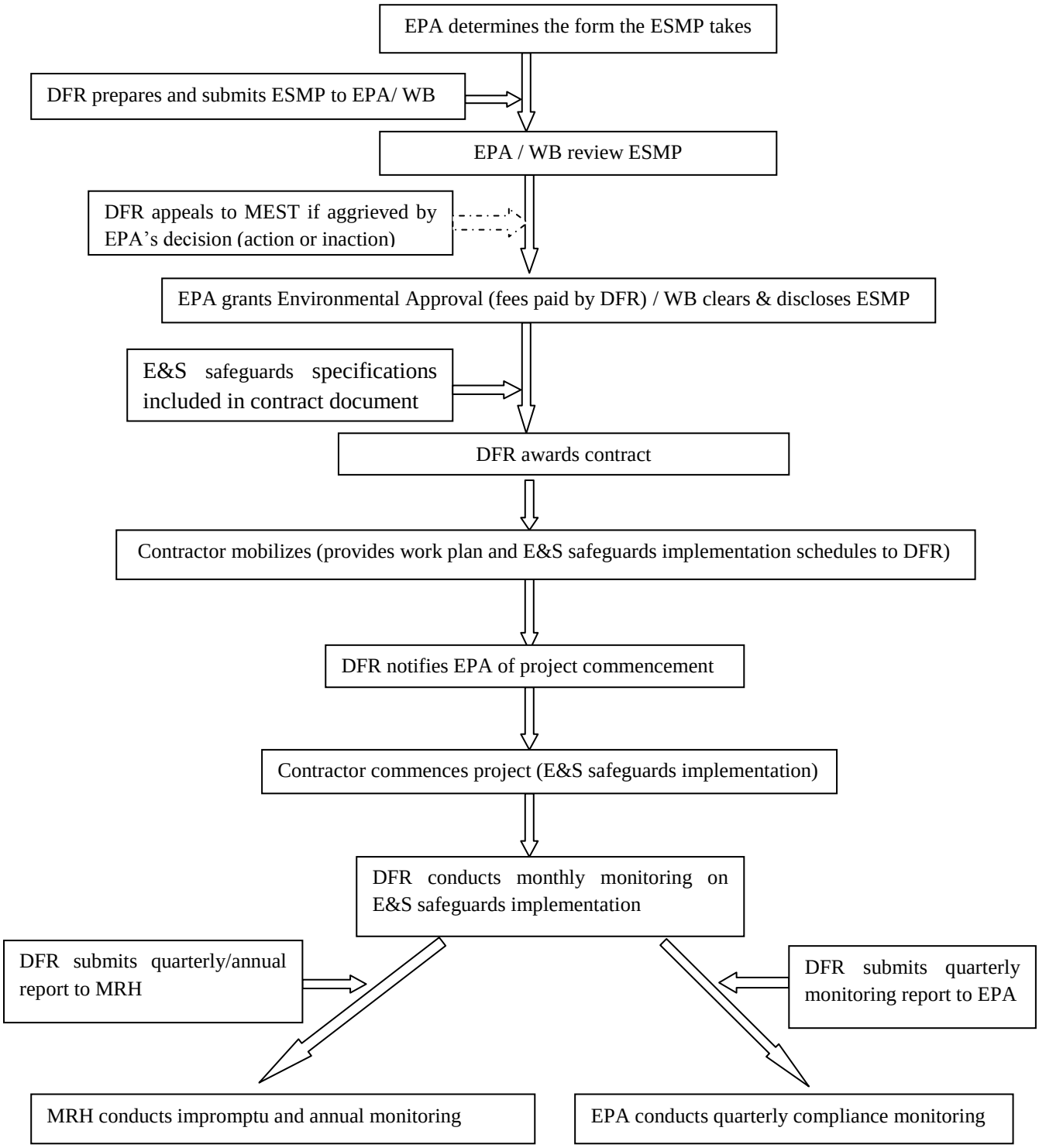

Figure 35. 1 Institutional Arrangement Flow Chart

35.4 Environmental and Social Management Measures

The environmental and social management measures presented below will be implemented or adhered to by the Contractor (Site Engineer), and will also serve as the basis for monitoring.

35.4.1 Water Resources, Erosion Control and Flood Prevention Management

Management measures for affected water resources, erosion control and flood prevention include:

- Location (heaping) of construction material (e.g. sand and other aggregates) not less than 50m from water bodies and drainage channels (i.e. a separation distance of 50m will be observed);
- Site for fuelling of machinery and servicing of equipment will be located at a minimum distance of 100m from water bodies, wetlands and drainage channels;
- Embankment erection around fuelling and other liquid or spillable storage sites in order to limit or contain such material from escape to potentially pollute water resources;
- Side drains (where appropriate) will be provided with settling basins near water bodies to remove silt and debris from road surface and construction site run-off, before discharge to adjoining streams or rivers;
- Adequate side drains provided to carry run-off into drainage channels to prevent erosion;
- Culverts of suitable capacity constructed to contain and direct flow, especially at peak flow and run-off;
- Road maintenance works to be carried out off peak rainy season;
- Provision of toilets and urinal at locations not less than 50m away from water bodies; and
- Adequate worker awareness on sanitation and measures to avoid water resource contamination.

35.4.2 Noise and Vibration Exposure Management

Use of machinery in clearing vegetation, earth (soil) movement and other concrete works such as culvert construction and movement of trucks will be the main sources of noise and vibration.

- Equipment servicing plan will be prepared and strictly followed to ensure efficient machinery performance and optimum noise generation.
- Stationary equipment shall be sited at safe distances from sensitive areas to minimise noise impacts
- Workers operating noisy equipment will not be exposed continuously for more than 3 hours a day.
- Workers will be provided with ear plugs.
- Workers handling vibrating equipment or parts will be given pads to absorb the vibrations and will not be exposed continuously for longer than 3 hours a day.
- Sanctions (ranging from a fine to dismissal) will be instituted by the contractor against workers who do not observe the use of appropriate PPEs

35.4.3 Dust Management

Dust generation will be controlled mainly by the use of water, especially in the dry season. The contractor will acquire a water tanker for purposes of water dousing to control dust emission. Others measures will include:

- Erection of speed control signals and ramps mounted in communities;
- Covering of hauling trucks carrying sand and other aggregates;
- Covering of heaped material e.g. sand will be covered: and
- Use of nose masks by all workers at road maintenance/works sites.

Surfaces of vegetation along the maintenance road will be monitored to verify the effectiveness of dust suppression method.

35.4.4 Public and Occupational Health and Safety Management

Public occupational health and safety management will include:

- Erection of warning signals and use of reflective tapes at approaches to excavations, heaped materials, stationary equipment, etc.
- Posting of speed limits of 40km/hr at approaches to construction sites;
- Tool box (safety) meetings held twice a week and documented accordingly;
- Inductions and awareness programmes held for all employees on occupational health and safety practices;
- A First Aid team formed to provide first aid services to workers and where appropriate make referrals to the District Health Centre;
- First Aid team to be trained by a medical team from the District Health Centre;
- Accident records at construction site and neighbourhoods to be maintained both for workers and the public;
- Stocks of PPEs to be maintained and supplied to workers regularly as needed; and
- Workers required to wear the appropriate PPEs e.g. helmets, ear plugs, nose masks, vibration pads, hand gloves, etc.

35.4.5 HIV/AIDS and Health Management

The work place HIV/AIDS and general health maintenance plan will include the following:

- Quarterly HIV/AIDS awareness programmes for workers and nearby communities;
- Health and HIV awareness team arranged from the District Health Centre for the quarterly programmes;
- Sponsored educational package put together by the team to be implemented to enlighten both workers and communities;
- Training of peer educators within the work force and in communities by the team; and
- The company to provide free condom supplies and encourage free discussions, counselling and testing.

35.4.6 Waste Management

The following waste management measures will be implemented:

- Waste bins to be provided for the disposal of waste generated;
- Waste will be segregated into two at source - organic and plastic and glass wastes;
- Organic waste to be composted near the site office to enrich the soil, while plastics and glass are taken to the district dump-sites;
- Topsoil removed from the right of way for maintenance work to be spread on the land to avoid disrupting drainage network; and
- Toilets and urinals to be sited at least 100m from any stream or drainage channel and decommissioned at the end of project.

35.4.7 Road Diversion and Accident Prevention

Closing one lane of the road while keeping the other open during construction of culverts would expose workers and the general public to imminent accident risks. The following management measures will be taken:

- A temporary structure to be constructed on one lane to allow for traffic flow while work is on-going on the other lane;
- Traffic wardens to be posted at positions 100m from the construction points on either side of the road to ensure orderly movement of traffic;
- Actual working areas to be secured with barricades;

- Adequate road warning signs to be posted at vantage points to warn and direct traffic;
- All measures shall be effectively monitored by Contractor to ensure their implementation.

35.4.8 Temporary office site reinstatement

The plan will require the following:

- Identification of a potential site with no farmland with crops or any physical asset;
- Seeking the consent of the landowner to erect the proposed site office; and
- Reinstatement of the site and agreement to handover structure to the landowner.

Table 35. 1 Summary of Environmental Management Plan

Management Area	**Impact Areas**	**Mitigation/Monitoring Actions & Requirements**	**Implementation & reporting Schedule**	**Responsibility**
Dust and Air Quality Management	• Dust generation due to construction activities	➢ Dousing with water ➢ Erection of speed control signals and ramps ➢ Covering of sand (both heaped and in haulage trucks) ➢ Inspection of surfaces of vegetation	Twice daily Continuous Daily Monthly	**Contractor/ SE** **DE**
Water Resources, Erosion Control and Flood Prevention Management	• Siltation of water bodies resulting from excavation works and material deposition • Contamination of water by oil from vehicle	➢ Completing work on schedule ➢ Deposition of construction materials at least 50m from water bodies ➢ Embankment erection around fuelling and servicing area for vehicles ➢ Awareness creation	Continuous Continuous Continuous Continuous	**Contractor/ SE**
Noise and Vibration Exposure Management	• Noise from machine clearing of vegetation • Culvert excavation, construction and other maintenance works • Concrete mixing machines	➢ Controlling exposure of workers to noisy and vibrating equipment ➢ Regulating distance of stationary noisy equipment from public places	Daily Daily	**Contractor/ SE**
Occupational Health and Safety	• Accidents resulting in injury • Noise from machinery	➢ Tool box (safety) meetings will be held twice a week ➢ Awareness creation ➢ Training of first aid team ➢ Maintenance of accident book ➢ Provision and use of PPE	Bi-weekly Monthly Quarterly Weekly Daily	**Contractor/ SE**
HIV/AIDS and STIs Management	• Spread of infection due to neglectful sexual attitudes	➢ HIV/AIDS and STIs Awareness workshops ➢ Provision of free condoms ➢ Peer group education	Quarterly Weekly Twice monthly	**Contractor/ SE**
Waste Management	• Indiscriminate waste dumping and defecation	➢ Segregation of waste ➢ Composting of organic waste ➢ Emptying of waste bins at waste dump sites provided by Zoomlion Waste Management ➢ Decommissioning of toilets after	Daily Weekly Daily	**Contractor/ SE**

		project		
Road diversion and accident prevention	• Risk of accidents to workers and general public	➢ Posting of traffic wardens to direct traffic flow ➢ Mounting of road signs ➢ Protecting actual working area with barricade ➢ Monitoring implementation of above measures	Daily Daily Daily	**Contractor/ SE**
Office site reinstatement	• Effect on crops and physicals assets	➢ Avioding crops and physical assets ➢ Seeking landowner consent ➢ Reinstating site and agreeing to hand over structure	Project commencement Project commencement Project completion	**Contractor/ DE**

35.5 Capacity Building

Capacity building in environmental and social impact management will be essential. Personnel at the forefront of the various road rehabilitation projects need to understand the purpose of the ESMP implementation and their expected roles. This will stimulate the required collaboration.

The target groups for the training will include:

- DFR District Engineers;
- Contractors;
- Construction workers; and
- Selected members from the nearby communities.

The district engineers and contractors will require capacity building in the implementation of the projects' environmental and social safeguards and general project planning and management inter-faced with E&S components. Capacity requirements are also in the areas of environmental and social management and reporting as well as monitoring of adherence to required environmental and social principles, standards and commitments. The construction workers and selected members of the project communities will undergo training on public awareness creation/educational techniques (on environmental, social and health issues) and first aid procedures.

35.6 ESMPs Implementation Budget

The cost estimates provided in the Table 35.2 is for the implementation of mitigation measures, monitoring plan and capacity building requirements.

Table 35. 2 Proposed Budget for the ESMPI

No.	E&S Management Area/ Institution	Mitigation Measures/ Capacity Gaps Identified	Expected Outcome/ Capacity Building Measures	Rate	Estimated Cost ($)
1.	Water resources, erosion control and flood prevention	• Construction of embankments • Construction of side drains with settling basins	• Limitation and containment of spilled oil at site offices • Reduction of siltation in nearby water bodies	• $1000 per road • $2000 per road	31,000 62,000
Sub-Total					**93,000**
2.	Dust and air quality	• Water dousing • Covering of sand (heaped and during transportation) • Erection of road signals and ramps	• Reduction in dust generation	• $5000 per road • $2000 per road	155,000 62,000
Sub-Total					**217,000**
3.	Public and occupational health and safety	• Provision of PPEs (nose masks, gloves, ear plugs etc.) for workers	• Reduction in the exposure of workers to hazardous conditions	• $3000 per road	93,000
Sub-Total					**93,000**
4.	HIV/AIDS	• Awareness campaigns • Distribution of condoms	• Reduction in the spread of HIV	• $7000 per road	217,000
Sub-Total					**217,000**
5.	Waste management	• Waste segregation • Provision of toilets • Carting of waste to designated dumpsites	• Ensuring proper waste management	• $10,000 per road	310,000
Sub-Total					**310,000**
6.	Department of Feeder Roads (DFR)	• Capacity enhancement in environmental and social safeguard measures implementation, monitoring and reporting	• Training in environmental and social management for DEs (31) for 2 days	• $ 100/p/d	6,200
7.	Contractors	• Inadequate knowledge of staff in environmental & social management implementation	• Training in environmental and social management implementation for the 31 contractors. (1 SE each) (2 days for 31 persons)	• $ 40/p/d	2,480
8.	Peer group educators and first aid team	• Inadequate know-how on HIV management and first aid procedures	• Training on HIV awareness creation methods and first aid procedures for 372 persons (8 for HIV and 4 for first aid) for 2 days	• $8/p/d	5,952

9.	Training Consultants	N/A	• Training of DEs & SEs for a total of 4 days (by 4 Consultants including T&T, accommodation & meals) • Training of peer group educators and first aid team for 2 days (by 2 specialists)	• $1,000/p/d • $200/p/d	16,000 800
	Sub-Total				**31,432**
TOTAL					**961,432**

36.0 CONSULTATIONS

In gathering information for the ESMPs for the selected roads a number of relevant stakeholders were consulted for their inputs. These stakeholders included the Ministry of Food and Agriculture (MoFA), Minstry of Health (MoH) and the Department of Feeder Roads (DRF) in selected districts. The responses provided by these stakeholders are given below in Tables 36.1-36.3. Figures 36.1-36.8 also show the consultations that took place with the stakeholders stated.

Table 36. 1 Reponses from the Department of Feeder Roads (DFR) Asante-Akim South District

	Name of Respondent(s)	**Designation**	**Contacts**
1	Mr. Gideon Osafo	Area Engineer	0244787438

Capacity Building		
1	How limiting and/or available is the capacity in the District Office to perform environmental monitoring and reporting?	- *Capacity available, the only gap is strict enforcement/compliance* - *Currently District Engineer advises and checks Contractors on Environmental Compliance*
2	Is there any relationship between the district and the headquarters to monitor environmental and social safeguard issues?	- *Yes, the Head Office at the Regional level has oversight responsibility and they report to the National Headquarters*
3	What capacity needs would have to be built and what estimated budget would be required?	- *Road engineers of DFR can be trained to better handle environmental and social issues pertaining to feeder roads construction and rehabilitation*

Figure 36. 1 Consultation with DFR, Asante-Akim South District

Ministry of Food and Agriculture (MOFA) **Date: 14th December 2010**

	Name of Respondent(s)	**Designation**	**Contacts**
1	Mr. Kingsford Nyame	District Director	0244433489
2	Mr. P.K Gyapong	Crops Officer	0243878873

Importance of Road to Agriculture		
1	What is the use of the road in terms of agriculture?	- *It connects the area which is an important maize and vegetable cultivation area*
2	Is the current state of the road good enough for the promotion of agriculture in the area?	- *No, the area is cut off by the Alabo River which has no culvert*
3	What other agriculture related problems are associated with the current state of the road?	-
Benefits of the Road Rehabilitation to Agriculture		
1	What will be the immediate benefits of the rehabilitation of the road to agriculture?	- *It will open up the place for the transportation of harvested cereals/maize and vegetables to market centres and reduce post harvest losses*
2	What other benefits will it bring to the District MOFA?	- *MOFA could carry out small dug-outs for maize and cassava inter-cropping in the area* - *It will facilitate the agricultural extension services by the officers of the ministry*

Figure 36. 2 Consultations with MOFA, Asante-Akim South District

Ministry of Health (MoH) **Date: 14th December 2010**

	Name of Respondent(s)	Designation	Contacts
1	Ms. Beatrice Adjei	Deputy Director of Nursing Service	0243136180

Disease Prevalence		
1	What are the predominant diseases in the district?	- *Malaria, Diarrhoea, Schistosomiasis, Yaws, etc*
2	How does the road contribute to health delivery?	- *Used by health workers for immunization and educational programmes* - *Used to combat guinea worm as the area was endemic*
Importance of the Road Rehabilitation to Health Delivery		
1	What are the benefits of the road rehabilitation to health delivery?	- *Will open up the area on more follow ups on the eradication of guinea worm and facilitate immunization programmes*

Figure 36. 3 Consultations with the District Health Directorate, Asante-Akim South District

Table 36. 2 Responses from DFR, Mfantsiman Municipal

	Name of Respondent(s)	Designation	Contacts
1	Christian Kwaku Gameli	District Engineer	0208300364

Capacity Building		
No	**Issues**	**Responses**
1	How limiting and/or available is the capacity in the District Office to perform environmental monitoring and reporting?	*Capacity available among the District Engineer* *Currently District Engineer advises and checks Contractors on Environmental Compliance*
2	Is there any relationship between the district and the headquarters to monitor environmental and social safeguard issues?	*Yes, the district ensures that all tenders include adequate measures on environmental compliance and reported to the Regional officer and headquarters.*

3	What capacity needs would have to be built and what estimated budget would be required?	*Additional in-house capacity for the District Engineer is welcome Budget of about GH¢200 if training is to be conducted at Koforidua Centre for the Department.*

Figure 36. 4 Consultation with DFR, Mfantisman Municipal

Ministry of Food and Agriculture (MOFA)

	Name of Respondent(s)	**Designation**	**Contacts**
1	Diana Isabella Appiah	Secretary/ Administrative Assistant	0276822163/ 02084369
2	John Kojo Baidoo	Agric Extension Agent	0242685231
3	Justina Mireku	Accountant	0244171151

Importance of Road to Agriculture		
1	What is the use of the road in terms of agriculture?	- *It connects the area which is an important maize and vegetable cultivation area*
2	Is the current state of the road good enough for the promotion of agriculture in the area?	- *No, the area is cut off by the Alabo River which has no culvert*
3	What other agriculture related problems are associated with the current state of the road?	-
Benefits of the Road Rehabilitation to Agriculture		
1	What will be the immediate benefits of the rehabilitation of the road to agriculture?	- *It will open up the place for the transportation of harvested cereals/maize and vegetables to market centres and reduce post harvest losses*
2	What other benefits will it bring to the District MOFA?	- *MOFA could carry out small dug-outs for maize and cassava inter-cropping in the area* - *It will facilitate the agricultural extension services by the officers of the ministry*

Figure 36. 5 Consultations with MOFA, Mfantsiman Municipal

Table 36. 3 Reponses from the Department of Feeder Roads (DFR) Asuogyaman District

	Name of Respondent(s)	**Designation**	**Contacts**
1	Mr Alex Nuamah	District Engineer	0242359166

Capacity Building		
1	How limiting and/or available is the capacity in the District Office to perform environmental monitoring and reporting?	- *Capacity available, the only gap is strict enforcement/compliance* - *Currently District Engineer advises and checks Contractors on Environmental Compliance*
2	Is there any relationship between the district and the headquarters to monitor environmental and social safeguard issues?	- *Yes, the Head Office at the Regional level has oversight responsibility and they report to the National Headquarters*
3	What capacity needs would have to be built and what estimated budget would be required?	- *Road engineers of DFR can be trained to better handle environmental and social issues pertaining to feeder roads construction and rehabilitation*

Figure 36. 6 Consultations with the Department of Feeder Roads, Asuogyaman District

Ministry of Food and Agriculture (MOFA)

	Name of Respondent(s)	**Designation**	**Contacts**
1	Mr. Sylvester Nani Kartey	District Director	0244017549/025120059

Importance of Road to Agriculture		
1	What is the use of the road in terms of agriculture?	- *It connects the area which is an important maize and vegetable cultivation area*
2	Is the current state of the road good enough for the promotion of agriculture in the area?	- *No, the area is cut off by the Alabo River which has no culvert*
3	What other agriculture related problems are associated with the current state of the road?	-
Benefits of the Road Rehabilitation to Agriculture		
1	What will be the immediate benefits of the rehabilitation of the road to agriculture?	- *It will open up the place for the transportation of harvested cereals/maize and vegetables to market centres and reduce post harvest losses*
2	What other benefits will it bring to the District MOFA?	- *MOFA could carry out small dug-outs for maize and cassava inter-cropping in the area* - *It will facilitate the agricultural extension services by the officers of the ministry*

Figure 36. 7 Consultations with MOFA, Asuogyaman District

Ministry of Health (MoH)

	Name of Respondent(s)	**Designation**	**Contacts**
1	Mr. Rober O. Yeboah	Assistant Chief Technical Officer-Disease Control	0244088149
2	Mr. Ampah Isaac	Nutrition Officer	0246202481

Disease Prevalence		
1	What are the predominant diseases in the district?	- *Malaria, Diarrhoea, Schistosomiasis, Yaws, etc*
2	How does the road contribute to health delivery?	- *Used by health workers for immunization and educational programmes* - *Used to combat guinea worm as the area was endemic*
Importance of the Road Rehabilitation to Health Delivery		
1	What are the benefits of the road rehabilitation to health delivery?	- *Will open up the area on more follow ups on the eradication of guinea worm and facilitate immunization programmes*

Figure 36. 8 Consultation with the DHD of the Asuogyaman District

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APPENDICES

APPENDIX I

A Project Description

No	Project Features	Response
1	Name of project road	
2	District and distance (of road to the District Capital)	
3	Region	
4	Length of road (and also width of road)	
5	Objective of proposed road work	
6	Current state and relevant features of the road that call for the proposed works	
7	History of Rehab/maintenance works (e.g. last time worked on)	
8	Importance or potential importance of the road	
9	Communities and areas served by the road	
10	Benefits to be derived from the road works(i.e. improved road)	
11	List the specific works intended to be carried out(according to chainage mileage where applicable)	
12	Indicate what each specific work involves	
13	List the types and number of equipment to be used	
14	Work force (numbers)	
15	Type of raw materials and sources(e.g. aggregates and gravel ect.) and distance from the project road	
16	Estimated quantity of raw materials	
17	Duration of road the works	
18	Type of waste(substances) to be generated	
19	Work/Camp site (area) and facilities to be provided	

B Project Corridor and Adjoining Area (Base line) Information

No	Project Features	Response
1	Number and names of communities locate along the road	
2	Other communities and main towns served by the road	
3	Land cover and land use of the area (e.g. vegetation ,farming,grazing/rserve,communities/settlements)	
4	Facilities/resource located along the road corridor(e.g school,clinic,houses,cemeteries,secred groves, farms) and proximity (how close) to the road	

5	Number of water bodies (river, strems, ect. And other drainage channels crossing the road	
6	Name of water bodies(if known) indication of size and seasonal flow pattern (e.g extent of flooding)	
7	Elevation and topography of the area-corridor (flat,hilly,valley,undulating,flood plain)	
8	Existing conditions of the potential borrow pit area (vegetation, farms, ect.)	
9	Regional baseline information on feeder roads	
10	Features /characteristics of feeder roads common to the region or peculiar	
11	State of feeder roads statistics	
12	Importance of feeder roads to the District and the Region	

C. Potential Impacts (Environmental & Social) of the Project (Road Works & Borrow Pts)

1. **Air Quality**-Will the proposed Project:

i Emit during construction

Dust √ Smoke VOCs

ii. Expose workers or the public to substantial emission? Yes No

iii. Result in cumulative increased emissions in the area? Yes No

iv. Create objectionable odour affecting workers / people? Yes No

2. Biological Resource-Will the proposed Project:

i. Have adverse effect on any reserved (Wildlife / Forestry / area). Yes No

ii. Have adverse effect on wetland areas through removal, filling hydrological interruption or other means? Yes No

iii. Interfere substantially with the movement of any wildlife species of organism? Yes No

iv. Be located within 100mm common Environmentally Sensitive Area? YesNo

3. Cultural Resources-Will the proposed Project:

i. Disturb any burial grounds or cemeteries? Yes No

ii. Cause substantial adverse effect on any archeological or historic site? Yes No

iii. Affect the existing visual character and sensibilities of communities e.g. through trees and rock removal? Yes No

4. Water Quality and Hydrology-Will the proposed Project:

i. Generate and discharge during the works:

Liquid waste Liquid with only substance

Liquid with human or animal Liquid with odour/smell

ii. Lead to changes in the drainage patterns of the area, resulting in erosion or siltation? Yes No

iii. Lead to increase in surface run-off, which could result in floating on or off-site? Yes No

iv. Increase run-off, which could exceed the capacity of existing storm water drainage? Yes No

5. Noise Nuisance-Will the proposed Project:

i. Expose workers and other persons to excessive vibration Yes No

and noise

6. Farm, Houses and Community Property-Will proposal Project affect:

i. Farms? Yes No

ii. How many farms will be affected and at what chainage mileage?

iii. How much farmland (total area of farms) will be affected?

iv. How many farmers will be involved and from which communities?

v. Houses Yes No

vi. How many houses and at what chainage mileage?

vii. In what communities will houses be affected?

viii. How many families will be affected?

ix. Community Property / Facility / Resource? Yes No

x. What community proper / facility / resources?

xi. In which communities and at what chainage / mileage?

Any other potential Environmental and Social Impacts

APPENDIX II

Contract Specifications for Contractor

1.0 General

a. All Environmental and Social (E&S) safeguards associated with the contract shall be complied with by the contractor. The Contractor shall also update himself about such issue in the ESMP, and prepare his work strategy and plan to fully take into account relevant provisions of the ESMP.

b. The Contractor shall develop a plan of work indicating all Environmental and Social safeguards at the various stages and indicate the period within which site will be maintained to it's original state after completion of works to ensure that significant E&S safeguards have been addressed appropriately.

c. The Contractor shall adhere to the proposed plan implementation schedule and the monitoring plan to ensure effective feedback of monitoring information to the DFR district Engineer (DE).

d. The Contractor shall implement all measures to avoid undesirable adverse environmental and social impacts wherever possible, restore site officess to acceptable standards, and abide by all environmental performance requirements specified in the ESMP

2.0 Dust Mitigation Measures

e. The contractor shall minimize the effect of dust on the surrounding environment resulting from site clearing, vibrating equipment and temporary access roads.

f. During the rehabilitation project, the contractor shall carry out proper and efficient measures, such as water dousing, whenever necessary to reduce the dust nuisance, and to prevent dust originating from the operations.

3.0 Noise Due to Construction Activities

g. The contractor shall ensure the noise levels emanating from machinery, vehicles and noisy construction activities (e.g. excavation) are kept at a minimum for the safety, health and protection of workers within the vicinity of high noise levels and nearby communities.

4.0 Waste Management

h. Construction waste shall not be left in stockpiles along the road, but removed and disposed of/or reused where needed.

i. All waste shall be segregated into organic waste and plastic and glass. The organic waste will be composted near the site office to enrich the soil while plastics and glass will be taken to the district dump sites

j. All sanitary facilities (e.g. garbage collection and disposal, drinking water facilities, etc.) shall be

k. provided by the contractor in site offices or project sites.

5.0 Water Resource Management

k. No construction water containing spoils or site effluent, especially cement, oil and fuel, shall be allowed to flow into natural water drainage courses.

l. The contractor shall take all possible steps to prevent pollution of streams and other water supplies.

m. Entry of runoff water to the site shall be restricted by constructing diversion channels or culverts to reduce the potential of soil erosion and water pollution.

n. Waste water from washing out of equipment shall not be discharged into water courses.

6.0 Material Excavation and Deposit

o. Vegetation clearing shall be restricted to the area required for safe operation of the rehabilitation work. Vegetation clearing shall not be done more than two weeks in advance of rehabilitation.

7.0 Contractor's Environment and Social Management Plan (ESMP)

p. Within 6 weeks of signing the Contract, the Contractor shall prepare a work plan to ensure the adequate management of E&S aspects of the works, including implementation of the requirements of these general conditions and any specific requirements of an E&S safeguards for the works. The Contractor's work plan will serve two main purposes:

i. For the Contractor, for internal purposes, to ensure that all measures are in place for adequate E&S management, and as an operational manual for his staff.

ii. For the Client, supported where necessary by SE, to ensure that the Contractor is fully prepared for the adequate management of all E&S safeguards issues.

q. The Contractor's E&S document shall provide at least:

- A description of procedures and methods for complying with these general environmental and social conditions, and any specific conditions specified in the ESMP;
- A description of specific mitigation measures that will be implemented in order to minimize adverse impacts;
- A description of all planned monitoring activities and the reporting thereof; and
- The internal organizational, management and reporting mechanisms put in place.

8.0 Health and Safety

r. In advance of the construction work, the Contractor shall mount an awareness and hygiene campaign. Workers and local residents shall be sensitized on health risks particularly of HIV/AIDS.

s. b) Adequate road signs to warn pedestrians and motorists of rehabilitation activities, diversions, etc. shall be provided at appropriate points.

9.0 Reporting

The Contractor shall prepare monthly progress reports to the SE on E&S monitoring with these general conditions, the project E&S safeguards. It is expected that the Contractor's reports will include information on:

- E&S management actions/measures taken, including approvals sought from DFR, DE and EPA
- Problems encountered in relation to E&S aspects (incidents, including delays, cost consequences, etc. as a result thereof);
- Lack of compliance with contract requirements on the part of the Contractor;
- Changes of assumptions, conditions, measures, designs and actual works in relation to E&S aspects; and
- Observations, concerns raised and/or decisions taken with regard to E&S management during site meetings.

10.0 Cost of Compliance

It is expected that compliance with these conditions is already part of standard of good workmanship and state-of-the-art as generally required under this Contract. The item "Compliance with Environmental and Social Management Conditions" in the Bill of Quantities covers these costs. No

other payments will be made to the Contractor for compliance with any request to avoid and/or mitigate an avoidable E&S impact.