Initial Environmental Examination

Project Number: 45084
July 2012

Bangladesh: Coastal Climate Resilient Infrastructure Project

Prepared by the Local Government Engineering Department, People's Republic of Bangladesh for the Asian Development Bank.

CURRENCY EQUIVALENTS

as of 10 July 2012

Currency unit		Taka (Tk)
Tk.1.00	=	$0.0122
$1.00	=	Tk. 81.80

ABBREVIATIONS

ADB	-	Asian Development Bank
BCCSAP	-	Bangladesh Climate Change Strategy and Action Plan
BWDB	-	Bangladesh Water Development Board
CCA	-	climate change adaptation
CCRIP	-	Coastal Climate Resilient Infrastructure Project
DOE	-	Department of Environment
DRR	-	disaster risk reduction
EA	-	Environmental Assessment
ECA	-	Environment Conservation Act
ECoP	-	Environmental Codes of Practice
ECR	-	Environment Conservation Rules
EIA	-	Environmental Impact Assessment
EMAP	-	Environment Management Action Plan
EMP	-	Environmental Management Plan
GCM	-	growth centre market
GDP	-	gross domestic product
GRM	-	grievance redress mechanism
IEE	-	Initial Environmental Examination
LCS	-	labor contracting societies
LGED	-	Local Government Engineering Department
MOEF	-	Ministry of Environment and Forest
MOLGRD&C	-	Ministry of Local Government Rural Development & Cooperatives
NGO	-	Non-Government Organization
PIC	-	Project Implementation Consultant
PIU	-	Project Implementation Unit
RRA	-	Rapid Rural Appraisal
SLR	-	sea level rise
UNDP	-	United Nations Development Program

GLOSSARY

Baor	An oxbow lake or wetland formed in an abandoned arm of a river
Beel	A saucer-shaped depression which generally retains water throughout the year
Haor	A back swamp or bowl-shaped depression located between the natural levees of rivers and may comprises of a number of *beels*
Khas land	Public lands not registered in the name of any individual or corporate body, regarded by land administration officials as belonging to the state
Union Parishad	Lowest administrative unit in the rural areas
Upazila	Sub-district

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EXECUTIVE SUMMARY

A. Introduction and Project Background

1. The Coastal Climate Resilient Infrastructure Project (CCRIP) is a result of the Government of Bangladesh's participation in the Strategic Program for Climate Resilience (SPCR) prepared under the Pilot Program for Climate Resilience (PPCR). The PPCR is a program under the Strategic Climate Fund (SCF)[1] within the Climate Investment Funds (CIF),[2] to pilot and demonstrate ways to mainstream climate resilience in development planning and management. As one of the projects approved for enhanced climate resilience under the SPCR, the CCRIP will improve livelihoods in the rural coastal districts vulnerable to climate variability and change.

2. The project is the first of it kinds in Bangladesh which will climate proof coastal infrastructure and improve livelihoods in 12 rural coastal districts[3] vulnerable to climate variability and change and have deficient mobility and accessibility. The project aims to provide climate resilience measures that deliver a degree of climate proofing commensurate with both the task that structures have to perform and the level of acceptable risk as well as being sensibly within available budgets. Each of the project components, roads; growth centers, markets; and cyclone shelters have their specific usage and levels of acceptable risk to the impacts of sea level rise (SLR), high wind, increasing temperature and increasing likelihood of severe cyclone, storm surge and other extreme weather events. Accordingly, a special focus of this project is to increase the climate resilience of existing and new infrastructure, where technically and economically feasible, to ensure that the intended economic benefits are achieved over the long-term. "Climate-proofing" measures include enhanced resilience to present climate effects plus forecast future climate change impacts.

3. The overall project outputs include (1) improved road connectivity; (2) improved market services; and (3) enhanced climate change adaptation capacity. The project will upgrade 130 km of upazila roads, 174 km of union roads, and 233 km of village roads, providing year-round connectivity between agricultural production areas and markets and to the other parts of the country. 3,050 meters of bridges/culverts will be constructed or upgraded. About 88 growth centre and large markets will be improved under the project with 15% of space allocated to women. Each market will be connected either to an existing paved road or to one of those to be improved under the project. The project will also construct or extend around 15 multipurpose cyclone shelters, improve about 10 existing cyclone shelters and upgrade around 15 km of cyclone shelter access tracks. The project will strengthen the capability of Local Government Engineering Department (LGED) staff and local government units through training and initiation of a knowledge management system, with particular emphasis on incorporating climate resilience and adaptation measures during the design, implementation and maintenance of rural infrastructure.

B. Objectives of IEE

4. The objective of this Initial Environmental Examination (IEE) is to produce an

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[1] The SCF is to finance targeted programs with dedicated funding to pilot new approaches with potential for scaling up. It includes PPCR, Forest Investment Program, and Scaling up Renewable Energy Program in Low Income Countries.

[2] The CIF are a unique pair of financing instruments designed to support low-carbon and climate-resilient development through scaled-up financing channeled through ADB, the African Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, and World Bank Group.

[3] These districts are: Satkhira, Khulna, Bagerhat, Perojpur, Barisal, Jhalokati, Bhola, Patuakhali, Barguna, Madaripur, Gopalganj, and Shariatpur.

environmental screening document for the ADB that follows ADB's Safeguard Policy Statement (2009).

5. The IEE has been carried out to ensure that the potential adverse environmental impacts are appropriately mitigated, and to present the environmental assessments for the project. The IEE evaluates the potential impact of the project activities on the significant environmental components. Implementation of the rural road network bears significant positive impact on the socioeconomic condition of the local people. The IEE evaluates both the potential positive and negative impacts and reveals that the potential adverse impacts are not significant and temporary in nature.

6. The objectives and scope of this IEE are to (i) assess the existing environmental conditions of the project area and the subproject or project components; (ii) identify potential environmental impacts from the proposed activities; (iii) evaluate and determine the significance of the impacts; (iii) assessment of the potential climate and disaster risks on the project, and suggestion for feasible adaptation and disaster risk reduction measures (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities, and cost estimates to address adverse environmental impacts; and (v) carry out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. This IEE is submitted to ADB by the LGED under the Ministry of Local Government Rural Development & Cooperatives (MOLGRD&C), Government of Bangladesh, and the IEE report will be disclosed to the public through the ADB website and LGED's website.

C. Categorization

7. The project is classified as category 'Orange B' for Department of Environment (DOE) and 'category B' in accordance with ADB's Safeguard Policy Statement (SPS), as no significant impacts are envisioned.

D. Implementation Arrangements

8. The executing agency for the project is the LGED. The Environment Unit (EU) of LGED will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. A suitable staffed project management office (PMO), to be established by LGED at its headquarters in Dhaka, will implement the project. The Chief Engineer of LGED, assisted by the project monitoring and evaluation unit, will be responsible for project implementation and coordination. The PMO will have one office in each of the three regions. A project director in the Dhaka headquarters will be assisted by two deputy project directors; regional office will be responsible for the day-to-day implementation and supervision of project activities. The Project Director will be responsible to the Chief Engineer of the LGED for the overall implementation, monitoring and supervision. The PMO will initiate and supervise all project actions, implement the mitigation and monitoring tasks of the IEE, and the Gender Action Plan, undertake overall monitoring/ evaluation activities, maintain financial accounts, prepare periodic progress reports and the project completion report. The LGED district offices, headed by executive engineers, will be responsible for implementing subprojects under the guidance of the PMO. The project will also coordinate with Bangladesh Water Development Board (BWDB) for development interventions.

9. The EU of LGED will monitor and measure the progress of implementation of the EMP. The extent of monitoring activities will be commensurate with the project's risks and impacts. In addition to recording information to track performance, the LGED will undertake inspections to

verify compliance with the EMP and progress toward the expected outcomes. Environmental and climate risks assessment and related monitoring/ supervision tasks will be carried out by an environmental consultant with climate change expertise. During the project implementation period, the consultant will work in close collaboration with the Department of Environment (DOE) in order to remain updated on all environmental assessment requirements and comply with all the rules and regulations.

E. Policy, legal, and administrative framework

10. The project shall comply with the requirements of the ADB's SPS (2009) and the government's guidelines or initiatives on implementation of Environmental Conservation Rules 1997 and Environmental Conservation Act 1995.

F. Potential Environmental Impacts and Mitigation Measures

11. The project has no major adverse environmental impacts and it will make a significant contribution to the environmental enhancement. It is envisaged to have significant social and economic benefits including poverty alleviation, income generation, climate change adaptation (CCA), disaster risk reduction (DRR), etc. Some potential adverse environmental impacts are likely to be in the construction phase include: (i) soil erosion, silt runoff and gully erosion; (ii) drainage blockage/ congestion, water logging and localized flooding; (iii) surface and ground water contamination; (iv) air (dust) and noise pollution; (v) contamination from storage and transportation of construction materials; (vi) removal of tree and vegetation; (vii) hygiene, sanitation and safety of construction workers;(viii) socioeconomic impacts from slight realignment of the road that may cause relocation of households, and (ix) community disharmony or cultural problems. These adverse environmental impacts can be mitigated through proper engineering designs, including the specific environmental provisions in contract documents, by requiring appropriate construction methods and other appropriate mitigation measures during implementation, as well as institutional strengthening of environmental management as recommended in this report.

12. Both ADB and the Government of Bangladesh require that development projects do not result in unacceptable damage to any physical cultural resources. The CCRIP is involved in the improvement/ upgrading and/ or rehabilitation project comprising a large number of schemes, and does not involve new and major road construction and the project actions do not have any potential for adverse environmental impacts to sites and structures of cultural value (viz., mosques, temples, churches, graves, archaeological remains, aesthetic locations, etc.).

13. Short term mitigation measures will include dry season construction work, erosion control from earthworks, careful location of borrow pits, temporary provision for drainage and traffic diversion, sanitation and hygienic provisions for the construction workers, and safe storage/ transportation of construction materials. Long term mitigation measures will include *inter-alia* efficient soil compaction, intensive scheme of roadside tree plantation, ensuring 1:1.5 ratio for the embankment slopes, rehabilitation of borrow pits by the contractors, careful design of cross drainage structures to allow flood water passage, ensure fish migration and prevent water-logging, minimizing agricultural land loss and prompt compensation for any acquisition, and adequate number of road safety signs and markings at vulnerable or hazardous sections. The Project will integrate CCA and DRR into policy formulation and infrastructure development. A key feature is climate proofing and disaster resilient designs for rural infrastructure to ensure that upgraded roads are less vulnerable to floods, storm surge, landslides and impacts of other extreme weather events.

14. To ensure these impacts are mitigated to the greatest extent feasible, the EU of LGED shall prepare draft site-specific environment management plans during detailed design phase. These Sustainable Environment Management Program (SEMPs) are in the form of management plans which will form part of the bidding and contract documents, which include: (i) temporary drainage; (ii) construction materials management; (iii) runoff control and excavation protection; (iv) waste management and disposal; (v) noise and dust control; and (vi) worker and community health safety.

15. The IEE provides potential mitigations and outlines the Environmental Management Plan (EMP) to reduce the adverse impacts on environment. The IEE found that there will be no significant adverse impact on the environment; therefore some detailed study such as Environmental Impact Assessment (EIA) is not required.

G. Information Disclosure, Public Consultation and GRM

16. The stakeholder consultation process disseminates information to all key stakeholders, including the general public and authorities, through meetings and door-to-door surveys. Information was provided in advance on the scale and scope of the project works, expected impacts, and the proposed mitigation measures by means of consultations with government departments, educational institutions, civil society, local authorities, and the general public through meetings and surveys. The process also gathered information on relevant concerns of the authorities and local communities so as to address these in the project implementation stage. Both in terms of numbers of affected persons (APs) and socio-economically disadvantaged group, the Project impacts are not expected to be significant. There is, however, strong support and a positive public response, as the Project will: (i) benefit the people and the area by improving the road network (ii) enhance economic opportunities due to access to the agricultural products in local and distant market, and (iii) create employment opportunities for the local people during construction and maintenance of the project.

17. Land required for the road and other infrastructure improvement is mainly within the existing right of way or owned by the Government. A grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints, and grievances. The GRM aims to provide a time bound and transparent mechanism to voice out and resolve social and environmental concerns linked to the project.

H. Conclusion and Recommendations

18. The potential long-term negative impacts relate to soil erosion, tree removal, water logging or drainage congestion, air and water pollution, shifting of habitat, agricultural land loss, navigation and traffic/ road safety. These have to be addressed through five sequential stages of the project cycle, viz., design, contracting, construction, supervision and operation and maintenance. Most long-term adverse impacts can be mitigated by giving special emphasis on maintenance.

19. The IEE has revealed that minor negative impacts related to tree removal, agricultural land loss, drainage congestion, pollution and road safety as well as short term (construction phase) effects can be mitigated through appropriate mitigation and adaptive measures, monitoring programs and fulfilment of institutional requirements. There is no need for further environmental impact assessment (EIA) as the provisions in the IEE and EMP will mitigate the impacts.

I. INTRODUCTION

A. Purpose and Scope of the Project

1. The Coastal Climate Resilient Infrastructure Project (the Project) will enhance the accessibility of the rural people to the markets and economic opportunities in 12 districts of south western Bangladesh. The twelve districts are (i) Satkhira, Khulna, Bagerhat and Perojpur in Khulna Division, (ii) Barisal, Jhalokathi, Patuakhali, Barguna and Bhola in Barisal Division, and (iii) Madaripur, Gopalganj and Shariatpur in Dhaka Division. Widening the access to markets and economic opportunities will culminate in improving the earnings, access to basic services like health and education of the rural poor. By improving rural infrastructure (roads, growth center markets, ghats and cyclone shelters), gender equity, peoples participation, training programs and improved local governance the urban and rural dichotomy can be abridged. Development of rural areas shall be achieved by targeting poor areas, closely involving the underprivileged and other stakeholders in implementing subprojects and maintaining rural infrastructure, and strengthening the capability of local institutions.

2. Efficient rural transport and supporting infrastructure are instrumental in reducing poverty and achieving rapid economic development in Bangladesh. Investments in rural infrastructure have been made by the Government with significant assistance from external funding agencies including the Asian Development Bank (ADB). The Project draws on experience and lessons identified from previous projects, particularly in mainstreaming participatory approach and empowering local government. The Project area consists of 12 districts in Khulna, Barisal and Dhaka divisions that were selected because of their poverty level, deficient mobility and accessibility, vulnerability to climate change and need for strengthened local governance.

3. Improving rural roads and associated infrastructure will provide local inhabitants with efficient transport to markets and trading centers and access to social and welfare services. These improvements will reinforce better economic avenues and abet in abating poverty. Strengthening local government units will enable them to plan, manage, and maintain the local infrastructure. Stakeholders from the private sector such as bus owners and operators, rickshaw drivers, farmers, and local traders will be consulted on their transport needs. Local participation will create a sense of ownership and focus greater attention to effective maintenance.

4. The Project will upgrade about 130 kilometres (km) of Upazila roads, 174 km of Union roads, 233 km Village roads, 15 km cyclone shelter access tracks, 88 growth centre and rural markets, 186 community markets, 37 boat landing stages, and 25 cyclone shelters. It will also provide for strengthening the capability of Local Government Engineering Department (LGED) staff and local government units. These complementary elements of rural infrastructure will provide local communities with effective transport to market and access social services. Investments in the Project will effectively reduce poverty by 10 percentage points from 37% in 2012, as small farmers and the functionally landless particularly women, will gain from additional employment. Additional employment will mean increased household income. The improved rural road network will bring increased motorized and other transport services, lower transport costs for goods and passengers, allow substantial savings in vehicle operating costs, and catalyze an overall increase in traffic volume by about 70%. The Project will improve the environment by planting and maintaining trees along the roads and building more effective drainage infrastructure.

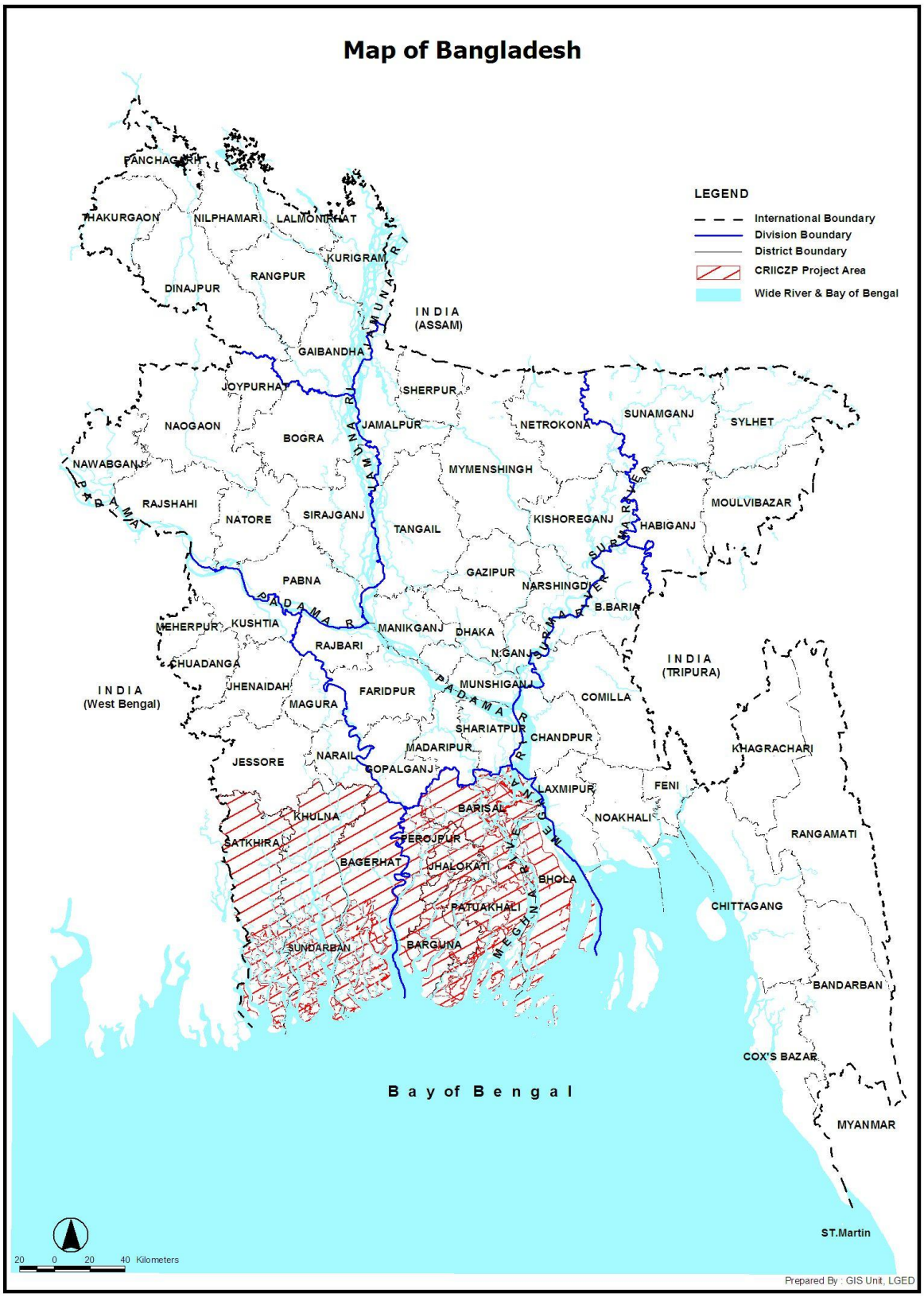

Figure 1: Map of Bangladesh

B. Objective of the IEE study

5. The objective of this Initial Environmental Examination (IEE) is to produce an environmental screening document for the ADB that follows ADB's Safeguard Policy Statement (2009).

6. The scope of IEE includes natural and human/ social environments. Of specific concern is the nature of human use of resources and how this changes as a result of the proposed Project interventions. IEE aims to predict induced changes as a result of the Project, so that any negative impacts can be avoided or minimized and positive impacts can be enhanced. The physical works of the project will comprise a large number of small and dispersed schemes involving the upgrading/ improvement of the existing infrastructure rather than constructing new road alignments or markets. The environmental impacts are thus expected to be limited and localized. Hence, an IEE was carried out during the project preparation stage in accordance with the ADB criteria.

7. The scope of the IEE included:

(i) a review of the policies and guidelines of ADB and the Government of Bangladesh relevant to environmental safeguards and compliances;

(ii) an examination of the salient biophysical and socioeconomic conditions of the project area;

(iii) an identification of the relevant environmental and climatic parameters in the project area through scoping and literature review;

(iv) an assessment of the magnitude of the potential impacts of the project actions;

(v) assessment of the potential climate and disaster risks on the project, and suggestion for feasible adaptation and disaster risk reduction measures; and

(vi) preparing the IEE report in the ADB format, which include mitigation measures and guidelines for compliance monitoring during implementation.

8. The IEE was conducted following the environmental policies and guidelines of ADB. In addition to the Bank's guidelines, the IEE also took into consideration the policies and guidelines of the Department of Environment (DOE) of the Government of Bangladesh.

C. Methodology

9. Environmental assessment (EA) is an integral part of resource development planning. It is essential that environmental issues are properly evaluated in terms of impacts and relevance, and are integrated into each stage of the project cycle. The proposed actions under the CCRIP involve interventions in the implementation of several number of rural infrastructure subprojects in the project area. In conforming to the requirements of preparing an IEE report, a methodology was developed in accordance with the ADB's environmental assessment guidelines. The period of preparing the IEE was from 16 February 2012 to 15 May 2012, and field visits for data collection were done in April 2012. The task of preparing the IEE report consisted of the following sequential components:

(i) Familiarization with and review of various project actions of the LGED projects;

(ii) Identification and screening of the environmental parameters relevant to the proposed project actions in the CCRIP area through a scoping process;

(iii) Assessment of the magnitude of the potential negative impacts for relevant environmental parameters through the use of Rapid Rural Appraisal (RRA) techniques in sample sites;

(iv) Formulation of avoidance/ mitigation measures to address the potential negative impacts, and preparation of a monitoring program during the period of project implementation;

(v) Outlining a set of recommendations/ suggestions for institutional strengthening of the LGED to develop its in-house capability in environmental assessment tasks, especially issues of climate change and disaster risks.

10. A scoping process was used to identify the major environmental issues/ parameters/ components relevant to the project actions, and prepare the checklist for field assessment. Scoping was done using RRA methods, integrating knowledge from the ADB guidelines, relevant literature and opinions from concerned people, and information obtained from the local people (respondents), which included farmers, traders, retailers, school teachers, village elders as well as from direct observation. Field visits to sample sites in the project area also yielded information on the perception and priorities of the stakeholders in different zones.

11. Scoping and field visits to sample sites identified the environmental parameters/ components (relevant to the project actions) which are susceptible to be affected, and the perceptions of the local population on the general environmental health and climate change issues. The checklists were used during the field survey in the sample sites to obtain environmental data.

12. In accordance with the major components of environmental issues mentioned in the LGED guidelines, and in tandem with the ADB's "Environmental Guidelines for Selected Infrastructure Development Projects", a scoping process was used in order to identify the significant environmental impact parameters, which were considered relevant to the physical infrastructure components of the Project. Besides, the information from the literature from the similar projects and field survey including the discussions with concerned officials and the local population of the Project area were also made. The major environmental parameters are mentioned below.

13. The field survey was carried out for both scenarios of 'with Project' and 'without Project'. In the course of the environmental assessment, the current environmental conditions were treated as the reference level, and the potential impacts from the Project actions were evaluated as the departures from it. Both short-term impacts (i.e. during the construction phase) and long-term impacts (i.e. probable permanent changes in the environment due to project interventions) were considered.

14. The questionnaire provided in the 'Environmental Assessment Guidelines for LGED Projects' was used as the basis for the field survey interview. The field survey also included participatory approach, which involved discussions with local people in order to determine the perceptions and priorities of the stakeholders in the Project area. Apart from the local people, information were also obtained from the Upazila Engineers and other related government officials.

D. Limitation of IEE study

15. Surface water hydrology is dominated by the river networks that are part of the Ganges-Jamuna delta system. The part of CCRIP area is combination of wetland, low lying and deep flooding area. The vast network of road, railway embankment, dam, etc. is responsible for changing regional hydrology and creation of drainage congestion in many parts of the project area. Hydro-meteorological information that are needed for the proper planning in the wetland/ low lying area may not be consistent.

16. Bangladesh Water Development Board (BWDB) has constructed flood control, drainage and irrigation (FCDI) projects in some parts of the CCRIP with the objective of reduced flooding and installing proper drainage to save the agricultural crop and infrastructure. Many of the LGED rural networks are within BWDB project. In case of failure and defective design of the BWDB flood embankment the rural road infrastructure may not be safe. Therefore a mechanism should be well established between LGED and BWDB.

E. Policy, legal and administrative framework

17. The national policies and legal framework for environmental safeguard requirements relevant to the Project in Bangladesh were described in Bangladesh Country Environmental Analysis 2011[5] and many of the similar EIA/IEE documents of the projects in Bangladesh are available in ADB website[6] and hence it is not further described in this section. The implementation of the Project related infrastructural works and other subproject will be governed by Asian Development Bank Safeguard Policy Statement (SPS, 2009) and the environmental laws, policies and regulations of the Government of Bangladesh (GOB).

18. Bangladesh has a wide range of laws and regulations related to environmental parameters, and many of them date back to pre-independence days. Some of these are: the Canals Act (1864), the Irrigation Act (1876), the Agriculture and Sanitary Improvement Act (1920), the Forest Act of 1927, amended in 1989, the Factories Act (1965), the Pesticides Ordinance (1971), the Wild Life Preservation Act (1974), and the Environment Pollution Control Ordinance (1977). However, the most recent and the most important of the environmental laws are the Environment Conservation Act (ECA) of 1995, Environment Conservation Rules (ECR) of 1997 and Environmental Court Act of 2000. The ECR spells out rules and regulations for the enforcement of the ECA. Under the ECR, various development interventions are grouped into three main categories: Green (no environmental assessment required), Orange A (IEE required), Orange B (IEE required) and Red (EIA required) – in accordance with increasing potentials for adverse environmental impacts. The project interventions under the CCRIP fall into Orange category, and thus require the preparation of the IEE report. Both the ECA and the ECR cover a wide range of environmental issues, but they are neither fully comprehensive nor clear, and comprised of adhoc rules. A more recent legislation for enforcement has been the formulation of the Environment Court Act of 2000, which is authorized to try cases related to offences under the ECA/ ECR. The Cabinet has also approved the Environment Court Bill 2010.

19. Since the mid-1980s, there had been a growing awareness and understanding in Bangladesh that the natural resources and the environment of the country are being degraded. The Government of Bangladesh recognizes the importance of environmental sustainability as the basis for long term development in the country. In 1989, the Ministry of Environment and

[5] Asian Development Bank. 2011. Country Environmental Analysis: Bangladesh. Dhaka.
[6] http://www.adb.org/Projects/reports.asp?docType=EARF&ctry_id=&subj_id=&keyword=&pg=1

Forest (MOEF) was created, and within the ministry, the Department of Environment (DOE) was formed as the principal implementing line agency for all environmental actions. Bangladesh is a signatory to Agenda 21 of the 1992 Earth Summit, and it is committed to implement the international legal instrument in its national policies and programs. A National Conservation Strategy was prepared by the Government in 1991, which formed the basis for the formulation of the National Environment Policy (NEP) in 1992. The principal objectives of the NEP are:

(i) maintenance of the ecological balance;

(ii) protection against natural disasters;

(iii) prevention of all types of activities related to pollution and environmental degradation;

(iv) ensuring environmentally sound development in all sectors; and

(v) ensuring sustainable, long term, environmentally congenial utilization of all natural resources.

20. Since most development activities in almost all sectors involve environmental issues, the National Environment Policy spelt out specific obligations and tasks for sectors such as agriculture, industry, energy, water, forestry, biodiversity, fishery, urbanization, population and health. At the policy level, environmental awareness is demonstrated by the fact that the Government has so far signed, ratified and acceded to over 25 environment-related international conventions, protocols and treaties. Some of the notable ones are the Ramsar Convention on Wetlands, Montreal Protocol on Ozone Layer Depletion, Agenda 21, United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol, Convention on Biological Diversity, and Convention to Combat Desertification. The close relationship between environment and national development planning is embodied in the National Environment Management Action Plan (NEMAP), completed in 1995 with assistance from the United Nations Development Program (UNDP). As a follow-up of the NEMAP and to concretize its vision, the Government executed a UNDP funded Sustainable Environment Management Program (SEMP) between 1998 and 2004, which emphasized several capacity building components of environmental management.

21. The Government has prepared a National Adaptation Program of Action (NAPA) in 2005 and further revised in 2009, which outlines several climate change adaptation options for the country. A more comprehensive document on climate change, titled ‘Bangladesh Climate Change Strategy and Action Plan’ (BCCSAP), is released in 2008 and further revised in 2009 with 44 programs under six thematic areas. The Government has set up climate change cells in several relevant ministries and line agencies to monitor the activities to mitigate climate change impacts and suggest remedial programs. The Government is planning to set up a climate change department under the MOEF.

II. DESCRIPTION OF THE PROJECT

A. Type and category of project

22. The Project will upgrade about 130 kilometres (km) of Upazila roads, 174 km of Union roads, 233 km Village roads, 15 km cyclone shelter access tracks, 88 growth centre and rural markets, 186 community markets, 37 boat landing stages, and 25 cyclone shelters. Improving rural roads and associated infrastructure will provide local inhabitants with efficient transport to markets and trading centres and access to social and welfare services. Stakeholders from the

private sector such as bus owners and operators, rickshaw drivers, farmers, and local traders will be consulted. Local participation will create a sense of ownership and focus greater attention to effective maintenance.

23. Investments in the Project will effectively reduce poverty by 10 percentage points from 35% in 2012, as small farmers and the functionally landless will gain from additional employment, particularly women. The Project will improve the environment by planting and maintaining trees along the roads and building more effective cross drainage infrastructures.

24. The project is category B for environment as per ADB guidelines and 'Orange B' as per Department of Environment, Bangladesh's categorization. An environmental assessment and review procedures, and an initial environmental examination for core subprojects, were prepared and included.

25. ADB categorizes all projects according to the magnitude or scale of their anticipated environmental impact. Projects with limited potential adverse environmental impact require an IEE, and are classified as Category B. According to the environmental classification criteria given in the ADB documentation, the Project is proposed under Category B.

26. Since the proposed CCRIP is mainly an improvement/ upgrading and/ or rehabilitation project comprising a large number of schemes, and does not involve new and major road construction, it is likely to be considered as a Category B project and accordingly, this report is organized as an IEE report.

B. Need for the project

27. The road network in the coastal districts covered by the project, under present climate conditions, is seriously damaged during extreme climatic events. The maintenance and damage repair requirements of such road sections will increase with climate change and vehicle operating costs will also rise, unless appropriate improvements are undertaken. For many road sections the cross-drainage systems are inadequate under present climate conditions, with poorly maintained canals and drains not having enough hydraulic capacities to efficiently discharge flows to sluice gated outlets through polder embankments. This causes substantial "water-logging" of adjacent land, adversely affecting land-use, and this situation will worsen under climate change. Similarly, for rural markets, maintenance and damage repair requirements, together with spoilage/wastage of perishable goods will also increase with climate change. As demonstrated by recent cyclone events, the present number and capacities of existing cyclone shelters and livestock refuge facilities are inadequate for the communities at risk from such extreme climatic events, even under present climate conditions. The risks associated with extreme events will increase with climate change. Many existing cyclone shelters also have vulnerable access roads and power supplies, together with inadequate water supply and sanitation facilities, which often are not usable during the emergency conditions.

28. The rural producers, especially the poor and the small producers, suffer from two sets of constraints that limit their livelihoods: a) poor transport and market infrastructure that limits their access to markets, increases cost of production because of higher input and transportation costs, and lowers commodity price due to remoteness; and b) limited access to demand-driven financial services, especially seasonal agricultural credit and loan for microenterprises, and limited access to good technology and inputs, knowledge and support services such as vaccination services for livestock. Similar rural infrastructure development projects has demonstrated that paved roads and markets improve communication and benefit households income through higher farm prices, increased wages, enhanced investment in agri-business and trade, better access to higher quality inputs, support services, credit and reduced cost of

production and transport. Access to child education and primary health care also improves due to better transport facilities, especially in wet season. During extreme climatic events the poor lose their assets as well as livelihood options. Often after extreme conditions men tend to migrate leaving the families behind. In the coastal areas fisher folk family's poverty is high and many families are headed by widows and single mothers. Therefore, connectivity and mobility for women is equally important as for men for livelihoods. Climate resilient infrastructure is a priority for recovery and long-term protection and can facilitate mobility for employment, income and livelihoods.

C. Location of the project

29. The Coastal Climate Resilient Infrastructure Project (the Project) covers 12 districts of south western Bangladesh. These districts are (i) Satkhira, Khulna, Bagerhat and Perojpur in Khulna Division, (ii) Barisal, Jhalokathi, Patuakhali, Barguna and Bhola in Barisal Division and Madaripur, Gopalganj and Shariatpur in Dhaka Division.

D. Major components of the project

30. The overall project outcome will be achieved through the following project outputs: (1) improved road connectivity; (2) improved market services; and (3) improved climate capacity and protection including increased availability of climate disaster shelters, improved knolwdge management and improved facilities of existing climate disaster shelters.

1. Output A: Improved Road Connectivity

31. This component comprises (i) **upgrading upazila roads,** and (ii) upgrading **union and village roads**. The underpinning thrust is on improving and climate proofing rural roads in 12 coastal districts. The project will upgrade 130 km of upazila roads, 174 km of union roads, and 233 km of village roads, providing year-round connectivity between agricultural production areas and markets and to the other parts of the country[7]. 3,050 meters of bridges/culverts will constructed or upgraded The road upgrading works will involve widening and raising of embankments, with suitable slope protection against erosion and wave action; and reconstruction or improvement of existing earthen, Herring Bone Brick, and bituminous and concrete surfaced road sections to appropriate "climate-resilient" standards. Specific adaptation measures to increase climate resilience have been considered for: earthworks; pavement; and drainage. The focus will be on ensuring adequate earthworks, appropriate pavements and cross drainage construction. A climate resilient rehabilitation approach has been adopted. This includes constructing the road crest level to 600mm above the maximum normal design life flood level; embankment protection primarily by means of a combination of turf and shrubs, with additional geotechnical measures where there is high risk of active erosion and special measures adjacent to structures together with increased cross drainage.

32. Provisions for road safety such as road signs, delineators and bollards near the approach of bridges and reflectors carved in tree trunks and provision of loading and unloading zones will be incorporated into the design of upazila roads. Women belonging to labor contracting societies (LCSs)[8] will be engaged to raise and enlarge road embankments, clean out drainage canals, plant trees on roadsides, plant of other suitable vegetation on

[7] Final length in km and climate resilience standard for union and village roads are subject to review of IFAD's final design mission.

[8] LCSs comprise poor women with limited income-earning capabilities who carry out routine maintenance on rural roads using basic hand tools and materials supplied by LGED

embankments, and undertake other road maintenance works. Some roads will be block roads and these would be built by LCS. The project will improve the environment by planting and maintaining suitable vegetation in appropriate locations along road.

2. Output B: Improved Market Services

33. **Upgraded growth centers and large markets.** 88 markets (ranging from growth centre markets to large rural markets) will be improved under the project with 15% of space allocated to women. Each market will be connected either to an existing paved road or to one of those to be improved under the project. The market improvements will include (where relevant) paved trading areas, sheds, water supply system, drainage facilities, sanitation facilities, and market offices. At each market, a market management committee (MMC) will be responsible for ensuring proper physical and financial maintenance. In selected large markets, provision of mini water supply, deep hand operated tube wells, and sweet water ponds with pond sand filters (generally in Khulna and Satkhira Districts, where ground water quality is problematic) will be installed. Three suitable markets will be identified where at present no electricity supply is available and Rural Electrification Board has no plans in near future of providing the electricity. In these 3 markets, women market section shops, toilets and street lighting will be electrified using solar photovoltaic cells. The beneficiaries will be trained on judicious use and maintenance of the system, and the responsibility of maintaining the system will be borne by the beneficiaries by contributing towards maintenance charges, which include replacement of batteries every 5 years. Such electrified market place sections will improve the quality of life of the people, especially women, within the influence zone of the market.

34. Some key elements within growth centers or large markets will be made climate resilient. These are: new market sheds; these will be raised on concrete plinths to a level above the existing maximum normal monsoon high tide level plus the effective maximum SLR for the year 2050, with an additional 250mm freeboard. The central market area to be paved will be at maximum level for the year 2030, plus 100mm, with adequate drainage capacity included in the designs. Access into the market will be above normal flood level.

35. **Upgraded village markets and collection points.** The project will also improve 186 community markets and 11 women's markets sections will be established in existing community markets. This subcomponent will build/improve physical markets (common shed, fish shed, open paved/raised area, women section, toilet block, internal drainage etc), build 'commodity collection points, and build 37 boat landing platforms (ghats). LCS group and MMC management system will be used to train LCS members and MMCs to foster community market development.

3. Output C: Enhanced climate change adaptation capacity

36. **Enhanced capacity.** The project will strengthen the capability of LGED staff and local government units through training and initiation of a knowledge management system, with particular emphasis on incorporating climate resilience and adaptation measures during the design, implementation and maintenance of rural infrastructure assets. These complementary elements will provide local communities with more effective transport to markets, and better access to social services under normal and emergency circumstances. Other aspects of capacity development training include contract management, financial management, participatory methods, construction supervision, quality control, and application of knowledge management principles in project implementation, operation and maintenance, gender and development, and monitoring and evaluation.

37. **Enhanced knowledge management.** The project will also enhance knowledge management for climate change. The focus is on development of a framework for enhancing institutional learning and knowledge sharing. This will entail more effective knowledge capture, compilation, storage and sharing on climate resilience principles in the design, construction and maintenance of rural infrastructure assets. The project will develop tools to enhance knowledge management including strengthening the LGED MIS/GIS system, and providing a special web-portal; a portal interface designed for technical planning and design inputs and supporting learning and networking with other external agencies.

38. **Improved climate and disaster shelters.** The project will construct or extend around 15 multipurpose cyclone shelters; improve about 10 existing cyclone shelters and upgrade around 15 km of cyclone shelter access tracks. Designs will take account of future sea level rise and other adjusted design requirements due to climate change effects. Strict compliance with relevant Bangladesh building codes with respect to wind loading and floor bearing capacities will be needed. The emphasis will be on ensuring adequate water storage, sustainable power supply and appropriate toilet facilities which can be used during the extreme climatic event. Associated access roads/tracks will be upgraded to the equivalent of village road climate resilience standard. A provisional sum is allocated to provide for construction of killas in selected locations where there is a demonstrated long-term need, and sufficient land is readily available adjacent to a new or existing cyclone shelter. Complimentary support measures (including e.g. capacity development regarding community-based disaster preparedness, shelter management committees, market management committees up to the extent not undertaken by GIZ at the selected shelter sites; ancillary facilities around shelter locations, e.g. extra deep-tube wells; technical audit(s).

III. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

A. Physical Resources

39. The environmental baseline situation in the project area is well documented in the regional environmental profiles produced for the whole country by the Water Resource Planning Organization (WARPO), as part of the National Water Management Plan (NWMP).

40. **Hydrology.** Surface water hydrology is characterized by the river networks that are part of the Ganges-Jamuna delta system. The Gorai River, which flows on the northeast side of the project area, has been experiencing lower dry season flows in recent years. This is partly due to upstream abstraction from the Ganges system in India and also because of sedimentation in the mouth of its off take near Kushtia. The major rivers in these two divisions are Ganges, Meghna, Bishkhali, Bhairab, Pusur, Rupsha, Shibsha, Mayur, Chitra, Payra, Arial Khan, Kacha, Kirtonkhola, Tentulia, Naya Bhanga, Jayanti, Shawrupkathi, Amtoli, Modhumati, Gorai, Ichamoti, Kobadak, Kumar, etc.

41. Groundwater is the main source of potable water in the area. However shallower aquifers in the coastal areas are saline, so abstraction has to be taken from deep (up to 300m) tube wells, which are relatively costly to construct. Groundwater abstraction north of the coastal area is from the shallower aquifers, but the discovery of natural arsenic in the shallower aquifers is a serious problem.

42. **Geology.** The Khulna and Barisal area consists of late Holocene to Recent Alluvium of the Ganges deltaic plain in north and tidal plain in south. The area is composed of sand, silt and clay in various proportions with small amount of coarse sand, which is classified into seven litho-

stratigraphic units from base to top. Stratigraphic cross-sections and panel diagram through this area indicate presence of seven sedimentary cycles, each cycle resembling fining upward sequence. The entire area constitutes complexes of channels of fluvial/ tidal origin, natural levees, bars, swamps and plains like floodplain, deltaic plains, estuarine plains or coastal plains.

43. **Topography, Landforms and Soils**. The project area is located in the Ganges tidal floodplain. The boundary between this unit and the Ganges floodplain is traditional. The tidal landscape has a low ridge and a basin relief crossed by innumerable tidal rivers and creeks. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the lower Meghna. This unit covers most of Satkhira, Khulna, Bagerhat, Pirojpur, Barisal, Patuakhali, Bhola and the entire Jhalokati and Barguna districts but excludes the Sundarbans in the southwest.

44. The river carries fresh water throughout the year in the northeast and east, but saltwater penetrates increasingly further inland towards the west, mainly in the dry season, but for most or the entire monsoon in the southwest. In the northeast, there is moderately deep flooding in the monsoon season, mainly by rainwater ponded on the land when the Ganges distributaries and the lower Meghna are at high flood levels. Elsewhere, there is mainly shallow flooding at high tides, either throughout the year, or only in the monsoon, except in the extensive areas where tidal flooding is prevented by BWDB embankments. Within embankments, there is seasonal flooding with accumulated rainwater. The soils are non-saline throughout the year over substantial areas in the north and the east, but they become saline to varying degrees in the dry season in the southwest.

45. **Climate.** The climate of the project area can be described as Tropical Monsoon – characterized by warm, humid summers and cool, dry winters. The areas, however, experience noticeable spatial variations in temperature and rainfall. Annual average temperature for Khulna is 35.5^{O} C with a record low of 10^{O} C. Mean temperatures in the southwest range from 18^{O} – 19^{O} C in January to 27.5^{O} – 29^{O} C in July, with April temperature often rising above 40^{O} C in Khulna and Barisal divisions. Annual average temperature for Barisal is $35.1\ ^{O}$ C with a minimum of $12.1\ ^{O}$ C. Variations in mean annual rainfall are more pronounced in the CRIIP area than in the eastern parts of the country. The amount of rainfall generally diminishes from east to west. The average annual rainfall varies from 1710 mm in Khulna division to 1955 mm in Barisal division. Nearly 80 percent of the rainfall is concentrated in the months of June to October. The south western districts occasionally experience drought periods in the pre-monsoon months (March-May), which is likely to become more frequent and severe under climate change impacts. Norwesters (pre-monsoon thunderstorms) and tornadoes are other climatic hazards in the project area.

B. Ecological Resources

46. **Fisheries.** Fish are extremely important in the diet of the people of Bangladesh, providing for nearly 75 percent of the protein intake. Large numbers of people are dependent on fisheries as their primary and secondary occupations, and fisheries account for about five percent of the sectoral contribution of the gross domestic product (GDP). In the Project area, during field visits, such questions were probed as whether the proposed Project interventions will damage or destroy fish breeding grounds and whether fish population will be depleted through blocking fish migration channels.

47. Since the proposed Project does not involve the construction of new roads, the potential for any adverse impact of fish migration and fish breeding/ spawning is nil. Moreover, the rehabilitation of cross-drainage structures and culverts on Upzila roads including provision of additional drainage capacity, in accordance with the design standard of the LGED, will ensure better fish passage and migration opportunities in the flood plain. Culture fishery in ponds has recently become very popular in the Project area, and the Project works are not expected to affect them adversely.

48. **Wetland.** The total area of wetlands in Bangladesh has been variously estimated at between seven and eight million hectares, i.e. about 50% of the total land surface. This includes at least 480,000 ha of permanent rivers and streams, 610,000 ha of estuaries and mangrove swamps, between120,000 and 290,000 ha of *haors*, *baors* and *beels*, over 90,000 ha of large water storage reservoirs, 150,000-180,000 ha of small tanks and fish ponds, 90,000-115,000 ha of shrimp ponds, and some 5,770,000 ha of land which is seasonally inundated to a depth of 30 cm or more. The Sundarbans, located in the project area, is the largest continuous blocks of mangroves in the world. It covers about 1,000,000 ha of land and water, which has been formed from sediments deposited by three great rivers, the Ganges, Brahmaputra and Meghna, converging on the Bengal Basin. The rest of the project area contains large number of rivers, estuaries, mangrove swamps, canals, ponds, shrimp ghers, etc. The farmers generally are interested in draining the wetland during dry period to use for crop cultivation. In absence of large perennial flow many of these wetlands started drying up and as such these have lost their wet land characters. Some parts of seasonally inundated of the flood plain in this zone may be affected to little extent and can be mitigated since no new road alignments will be constructed. Moreover sufficient cross drainage works would not impede water movement. Likewise, the flora and fauna of these seasonally flooded areas do not include any endangered or threatened species, and are not likely to be disturbed in their habitats.

49. **Tree plantation.** The issue of tree plantation will have a high positive impact from the Project actions. Road improvements involving road widening will necessarily require removal of some existing trees and vegetation. However, this need not to be viewed as a negative impact because the practice established by LGED of planting and maintaining trees on the improved embankments more than compensates for this and enhances the environment. With proper care and nurturing, the improved roads will have adequate tree plantations along their embankments, which will also help in reducing or preventing soil erosion.

50. **Forest.** In other areas the Forest Department is actively involved in social forestry programs involving the rural poor through participatory benefit sharing scheme in the Project area. The Forest Department is engaged in tree plantation along canals, railways and roads in association with the agencies owning those lands. Hence, the road improvements in the Project area will benefit the forestry sector through LGED's continued collaboration and cooperation with social forestry programs of the Forest Department.

51. The Checklist of the Environmental Parameters and "best estimates" of the positive and negative impacts of the issue under the ecological component are shown in attached Table 1 and the results are summarized below.

Table 1: Long-Term Impact Assessment: Ecological Component

Environmental Component	Positive	Negative
Fisheries	M	N
Wetlands	L	N
Tree plantation/ removal	H	L
Forest	L	N

Note: H - High, M - Medium, L - Low, N - None

C. Economic Development

52. The Project impact will be to help reduce poverty by 10 percentage points from 37% in 2012 in the rural communities of 12 districts in south western Bangladesh. The impact will be realized through (i) enhanced access for the rural communities to basic services, (ii) increased on-farm income from the greater availability of agriculture inputs such as fertilizer and high-yielding seed varieties and shift towards cash high-value crop production, (iii) enhanced women empowerment through improved access to social services and higher family income, (iv) improved local governance, and (v) effective knowledge management. The project area of these twelve districts, totalling 29,657 square kilometres (km^2), has a low level of development. In these three divisions of Khulna, Barisal and Dhaka where the 12 project districts are located, about 48 - 60% of rural residents live below the poverty line, which is substantially higher than the national average for the rural areas of 35%.

53. 3.5 million people will gain all-weather access to growth centre markets (GCMs). The direct impact of providing these physical facilities and strengthening institutions will be (i) an estimated reduction in poverty in the project area by 10 percentage points from 35% in 2012, (ii) an increase in the average farm family income by about 35%, and (iii) about 10,200 person-years of employment will be generated during the construction period, of which 1500 (about 15%) will be women. 13,000 stakeholders and beneficiaries are expected to be trained in climate resilience, safeguards, knowledge management and project management.

54. The results of the economic analyses show that the Project is economically viable. In addition to the tangible benefits, other non-quantified economic impacts of the Project are better access to markets and essential services, lower prices for farm inputs and consumable goods, better marketing opportunities, and increased employment opportunities in road and market construction, maintenance, and roadside tree plantation programs.

55. Road improvement will permit more reliable access to social and financial services and agricultural and livestock extension. The program to develop human resources proposed under various components of the Project will expand the knowledge and skills of project personnel and enhance the efficiency in their day-to-day activities. This project in particular will benefit the women folk in the project area by giving them employment opportunities, skill training, participation in planning process and decision making. These efforts will certainly bring some change in their life style and quality of life.

D. Social and Cultural Resources

56. The relatively higher social progress of social development at a low level of income is also indicated by the comparison of predicted (for a given level of per capita income) with the actual values of social indicators achieved by the country. Compared with the predicted values, the actual values recorded have been lower for population growth, Infant Mortality Rate (IMR), under-5 mortality rate, Total Fertility Rate, Crude Birth Rate and Crude Death Rate, higher for the contraceptive prevalence rate and life expectancy at birth for both male and female. Review

of actual progress of social indicators against their respective predicted values for the 42 Least Developed Countries (LDCs) where actual progress in all of the nine indicators was better than their predicted values where Bangladesh is visibly lagging behind, notwithstanding the progress in the expansion of primary and secondary education in the nineties, is the literacy rate reflecting the enormous burden of the initial backlog of the illiterate population.

57. The project actions are not expected to have any negative impact on cultural features, provided any road realignment, if necessary, is adjusted to avoid encroaching upon such features or structures.

58. The general landscape through which the road runs is flat with much of it in agricultural use. Agricultural areas tend to cover large areas and usually comprise multiple mono-cultures (e.g. rice paddy). As such the general landscape is both monotonous and featureless. The road improvement works together with tree plantations on roadsides, will also greatly enhance the visual landscape and aesthetic quality of the entire region. There are, however, a number of features that bring variety to the landscape. These include:

(i) Surface Water Bodies – there are numerous surface water bodies present in the landscape, such as shrimp ghers and other numerous depressions, ponds, pools, rivers and canals. These features provide a contrast to the general landscape.

(ii) Homesteads – these are located on raised embankments to avoid present flooding. Homesteads are usually surrounded by trees, and play an important role in breaking up the general landscape.

(iii) Roads – like homesteads, roads are elevated on embankments and usually surrounded by trees. Again they act to break up the landscape.

59. The rivers are being encroached by several constructions at different locations of the project. But still the rivers dominate because of the daily variation of depth of water as well as change of direction of flow due to high tide and low tide. People have to consider the timing of high tide and low tide while using the river route for transportation of passengers and goods. So the river port/ ghats also have importance because these are unavoidable links between the road network and the relatively cheap mode of river transport.

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Environmental Impacts

60. The project is an improvement of the rural road network and no new road is planned. Therefore, additional environmental impact is not expected. But the environmental impacts are always diverse as well as varying in magnitude depending on the local environment and the extent of human occupancy in the area. The potential problematic environmental issues in the construction phase include: (i) soil erosion, silt runoff and gully erosion; (ii) drainage blockage/ congestion, water logging and localized flooding; (iii) surface and ground water contamination; (iv) air (dust) and noise pollution; (v) contamination from storage and transportation of construction materials; (vi) hygiene, sanitation and safety of construction workers; and (vii) community disharmony or cultural problems. The IEE of the proposed project works indicates that they will not have any major negative impact. The few potential adverse impacts of low magnitude, which have been identified, relate to road upgrading/ rehabilitation tasks. The

following paragraphs set out the recommended measures to avoid, minimize and mitigate the potential negative impacts

61. The potential environmental impacts are either short term in the construction stage or long term in the post-intervention stage. Potential short-term adverse impacts include soil erosion, water pollution, blocked drainage, traffic disruption and accident hazards, and dust and noise pollution. These can be minimized by (i) limiting earthworks to the dry season, (ii) carefully planning drainage diversions, (iii) restoration and rehabilitation of borrow pits, (iv) safely transporting and storing construction materials, (v) spraying water to reduce dust hazards and (vi) prohibiting the use of machinery after sunset to reduce noise pollution.

62. The potential adverse impacts from project interventions may include disrupted fishing activities, flooding from drain congestion, the loss of trees, and the loss of agricultural land and other assets from road widening. All potential negative impacts will be minimized by adopting such mitigation measures as (i) tree planting on roadsides to stabilize soil and compensate for tree removal; (ii) providing adequate, and sufficient numbers of, cross-drainage structures to facilitate fish migration and flood passage; and (iii) careful road alignment during road widening to minimize farmland and asset loss. An initial environmental examination (IEE) for the project area was undertaken with a focus on three core subprojects that identifies both positive and negative impacts, suggests mitigation measures, and outlines monitoring needs.

63. In the long run, the Project will (i) benefit the environment by planting trees along roadsides, which will also prevent soil erosion from embankment slopes; (ii) improve regional hydrology by reconstruction and rehabilitation of cross-drainage structures, (iii) reduce dust pollution and improve water quality by bituminizing the pavement, (iv) facilitate and improve access to markets for trade and income generation, (v) allow easy movement of motorized and other traffic, and (vi) generally improve the aesthetic quality of the region. In addition, market improvement measures will enhance the environmental quality of GCMs. Community management and ownership of planted trees has been used in other projects, including rural infrastructure-development projects, and the lessons learned in those projects suggest that the approach taken under the Project should be effective.

1. Physical

a. Soil erosion and Siltation

64. Soil erosion is very common in the banks of the rivers in the project area. One side of the river is eroded and there is deposition of silt on the other side. Local people very carefully study the situation and try to make appropriate planning for their survival and protection of the land and properties. As a result soil erosion and deposition becomes one of the main constraints to the agricultural activities. This physical feature is reflected in the following paragraphs.

65. Soil erosion is one of the most common environmental impacts of the road projects, unless protective measures are undertaken. The degree of soil stability, erosion and siltation varies according to the soil texture, intensity of rainfall and the slope of the embankments. In sandy soils, the instability is greater than on sticky, clayey soils. Hence, in the Project area, measures against soil erosion should take into consideration the nature of the soil texture in specific locations. The risk of erosion will be limited or minimized if the improvement works are done in the dry season. During field visits, a comparative estimate was done between the existing erosion-prone conditions on the Project Upazila roads and the protective measures through vegetation and compaction on the improved roads. It demonstrated reduced potential

for soil erosion and siltation in the latter, indicating high positive impact of the proposed road improvement measures.

b. Regional hydrology

66. Roads can contribute to changes in the flow and volume of surface water affecting regional hydrology. Field survey, however, confirmed that the existing Upazila roads do not impede local and regional drainage. And the potential for increased flooding is nil. Nevertheless, conditions in the low lying areas, being different from the rest of the Project area, have to be dealt with separately and very carefully. Project area, with the provision of additional cross-drainage capacity there will be sufficient numbers of culverts and openings for flood water movement, and the rehabilitation and proper maintenance of these structures will bring moderate positive impacts on the regional drainage conditions.

c. Drainage congestion

67. The impact issue of drainage congestion and resultant water-logging is essentially related to the above mentioned hydrologic parameters. Field visits did not reveal any significant problem of drainage congestion caused by Upazila roads in the Project area, and no potential negative impacts are anticipated from improvement works on such roads. In the context of the experience vis-à-vis the improved roads, it is likely that the rehabilitated and new culverts or cross-drainage structures will facilitate surface runoff and being some positive impacts in terms of drainage and water logging. However, it is necessary to emphasize that provision should be given for adequate cross-drainage structures, and discussion should be made with the local people to define the requirement of drainage in the area.

d. Water quality

68. Water quality on roadsides may be affected during the construction phase. However, field inspection of improved roads indicated no evidence of increased turbidity or pollution of water on either side of the roads. Even after the Project Upazila roads are carpeted with bitumen, the nature and volume of traffic on them will not be of such magnitude as to cause any significant water pollution problem. Nonetheless, it may be advisable not to locate drinking water intake points close to the road embankments in order to avoid chance of contamination from pollutants.

e. Air Pollution

69. The impact issue of air pollution from road improvements must be weighed against the existing situation on those roads. The bitumen surface of the improved roads will necessarily generate more traffic of motorized vehicles and cause certain amount of air pollution from exhaust emissions. But it will also produce positive impact of lesser dust than the present unpaved earthen roads.

Table 2: Long-term Impact Assessment: Physico-Chemical Component

Environmental Components	Positive	Negative
Soil erosion and siltation	H	L
Regional hydrology/ flooding	M	N
Drainage congestion/ water-logging	L	N

Water quality/ pollution	N	N
Air pollution	M	L

Note: H - High, M - Medium, L - Low, N - None

2. Biological (Natural Environment)

a. Aquatic Faunas

70. **Fish and Fisheries**. Fisheries are an important national resource in Bangladesh. In 1995/6 fisheries contributed 10% of the countries agricultural GDP and 3% of Bangladesh's total GDP (SEHD 1998). In addition 11% of all export earnings in this period were earned from the export of fishery products. There are numbers of fish species, and many ways of fishing in Bangladesh. In general there are five types of fish capturing, which are undertaken in the Project. These are:

(i) River capture fishing- Fish are caught year round within all the main rivers and khals across the Project corridor. However, catches tend to peak in May to June, with the mass migration upstream of hilsa (*Tenulosa ilisha*), and in October to November, when the floods subsides and fish start returning from the floodplain to the river (ODA 1994). Fish species caught in the rivers tend to consist of the major carps, catfish, hilsa and small shrimp.

(ii) Major carp spawn capture fishing- There is a high demand for major carp spawn (5-7 mm larvae approximately 5 days old) for use in fishpond stocking (Ali 1997). This high demand means that the spawn generates high value, and one kilogram of spawn can fetch up to BDT 4000= (US$50). Within the context of this Project spawn fishing is undertaken on the rivers of Bhairab, Rupsha, Shibsha, Pashur, Bishkhali, Mayur, Chitra, Payra, Arial Khan, Kacha, Kirtonkhola, Tentulia, Naya Bhanga, Jayanti, Shawrupkathi, Amtoli, Modhumati, Gorai, Ichamoti, Kobadak, Kumar,etc.

(iii) Floodplain subsistence capture fishing- During the flood season there is open access fishing across all flooded areas. Subsistence fishing is therefore undertaken by almost all rural households during this period. The capture of fish in this way is often crucial for these households, as it represents the main (and often the only) source of animal protein available to them during the year. Common species caught include snakehead, live fish and a number of other smaller fish (Department of Fisheries, 1996). Catch rates tend to be low as fish stocks are dispersed across a wide area during this period.

71. **Fisheries.** The fish habitats in the project area include ponds, borrow pits, closed channel, and rivers and canals. Capture fisheries are very common in the rivers and canals; and shrimp culture in local ghers are in many cases become the major source of foreign currency. There is controversy about the loss of agricultural productivity of the area due the increased rate of shrimp culture.

72. The alignment even pass over the wetland or *beel* may not affect the fish culture. Neither it will block any open water body and hence, will not affect capture fisheries in open water bodies or in *beels.*

73. The fish species available in the city market represent mainly the open water fishes e.g. Hilsha (*tenualosa ilisha*), Vetki (*lates calcarifer*), Pangash (*pangsias pangas*), Taposhi (*Sarotherodon melanotheron*), Common Carps (*ctenopharyngodon idellus*), Golsha (*mystus*

cavasius), Aier (*mistus aor*), bacha (*aplocheilus panchax*), Kharulla (*phinomugil corsula*), Faisha (*Setipinna phasa*), Potka (*Tetraodon fluviatilis*), Khalla (mugil), etc. Cathead fishes in the market come from the adjacent *beels* and ponds.

74. Improved fish feeds for fishes for use in Ponds/ dighi and in aquaculture are available in the local market. However, the farmers mostly use shell meat, pressed rice and oil cake as fish feed because these are cheaper than the balanced commercial feeds.

75. **Fish Catch in October.** Capture fisheries in the floodplains get higher nourishment during the monsoon due to movement of high amount of biomass energy through run-off to the open as well as in closed water bodies. Consequently fishes grow faster. Fish population in open and closed water bodies also increases during this season. The fresh water fish spawn during May-July period.

76. These promote big catch of capture fisheries during November-December period. Usually captive fisheries are not explored until March-April period because of relatively low market price of fishes and spawns that are released in June-July are allowed time to grow.

Table 3: Catches in different fisheries type at project site

Fisheries type	Species	Release Period	Harvest Period	Yield (kg/decimal)	
				Cumulative	Final
Captive (Ponds)	Common carps, nilotica, exotic carps, thai puti, galda	June-August	March-April	5-10	10-20*
Channels (Closed)	Common carps,nilotica, exotic carps, thai puti, galda	June-August	March-April	5-10	10-20*
Aquaculture	Galda,thai puti, exotic carps, common carps	June-August	March-April	10-20	20-30*
Capture Rivers, Channel (Open)	Vetki, pangash, faisha, tengra, air, common carps, shrimps, kain, poa hilsa etc.	June-August	March-April	2-4 kg	Nil
Dighi	Galda, big head carp, grass carp, African magur	June-July	Nov.-Dec.	Nil	Galda 40-50 White fish 2-3

Source: Directorate of Fisheries

77. Common fish species in *beels* and borrow pits include taki (*channa punctata*), shoal (*channa striata*), kai (*clarias batrachus*), magur (*clarias gariepinus*), singi (*heteropneustes fossilis*), tengra (*mystus vittatus*), baim (*mastacembelus armatus*), etc. yield in borrow pits is 2-5 kg/decimal where floodwater enters.

78. **Aquatic biology.** The genetic dolphin (*Plastanista gangetica*), known locally as Sisu or Susok, occurs in all the main river systems of Bangladesh, particularly through the monsoon season. The presence of Dolphins usually acts as an indicator of deep water areas with an abundance of large sized fish. The gangetic dolphin was sighted near the Arial Khan ferry ghat in June 1998, indicating its presence in this River. These are also sighted in Serajgonj, Nagarbari and Sariakandi (Bogra) area. The Dolphin is identified as a threatened/ vulnerable species by the IUCN Red Book[9].

[9] IUCN Bangladesh. 2003. Bangladesher Bipanno Bonno Prani, IUCN-The World Conservation Union. 294 p, Dhaka

79. Also identified as an endangered species is the Peacock Softshelled Turtle (*Tionyx hyrum)*. This turtle is a resident of *beels* and rivers. No information was obtained as to whether the turtle is resident in any of the surface water bodies present within the Project corridor.

80. The fresh water aquatic floras include *hydrilla, vellisneria*, bladderwort, water hyacinth, duckweed, water lettuce water lily, water fern, water plantain, *halaincha ipomea* and many species of grasses. The hygrophytes that grow in swampy areas are aroids, ferns, begonias and several grass species. Freshwater wetland plant species e.g. hijal (*baringtonia acutangula*), barun (*crataeva magna*), mandar (*erithrina indica*), pitaly (*trewia nudiflora*), jarul (*lagerstroemia speciosa*),etc. are not very much common in the project site.

b. Terrestrial Flora

81. **Forest and Plantation.** The Community Forests that include homestead plantation, orchards and strip plantation. The project has been aligned avoiding the homesteads and orchards as much as possible. Trees species in various ecosystems and the aquatic floral species at project site are given below.

(i) <u>*Homesteads and Orchards:*</u> betel nut (*areca catechu*), kadam (*anthocephalus chinensis)*, coconut (*cocos nucifera)*, date palm (*phoenix dactylifera*), sofeda (*achras sapota)*, mango (*magnifera indica)*, jackfruit (*artocarpus heterophyllus)*, fig, pome granade, guava (*psidium guajava)*, grapefruit (*citrus grandis)*, lemon (*citrus spp.)*, blackberries (*eugenia jambolana)*, plum, toddy palm, koroi (*albizia sp.)*, shisoo (*dalbergia shishu)*, shirish, rain tree (*samanea saman*), eucalyptus (*eucalyptus spp.)*, bamboo (*bambusa spp.)*, babla (*acacia nilotica*), jeol, neem (*azadirachta indica)*, jamrul (ejavanica*)*, chalta (*dillenia indica)*, bel (*aegle marmelos)*, amra (*spondias pinnata)*, amloki (*phyllanthus embelica)*, segun (*tectona grandis)*, etc.

(ii) <u>*Roadside Plantation:*</u> date palm (*phoenix dactylifera*), road chambol, koroi (albizia spp*.)*, krishnachura (*delonix regia)*, rain tree (*samanea saman)*, shisoo (*dalbergia shishu)*, babla (acacia nilotica), akashmoni (*acacia moniliformis)*, banian (*ficus bengalensis)*, mango (*magnifera indica)*, blackberries (*eugenia jambolana)*, raj koroi (*samanea saman),* etc.

(iii) No natural forest exists in project site or in the surrounding areas.

c. Terrestrial Faunas

82. **Livestock.** The livestock in project site include cow, buffalo, goat, ship, pig, chicken, duck, geese and pigeon. This component of farming system is used as draft power, milk and meat source and as supplements to family nutrition and income. No classified grassland area virtually exists in the project site. The fellow lands, road, highway and embankment sides and homesteads are used as grazing fields for cattle. General health of cattle is deplorable because of low quality and inadequate nutrition.

83. **Livestock in project sites.** Livestock health in the project site appeared to be poor. This was due to shortage of quality green feed during large part of the year, poor living condition and inadequate health care. Animals are mostly confined in the cattle sheds or on homestead platforms for most part of the year. Fallow croplands, roadside slopes and other wastelands are used for grazing the livestock under watch during the dry season.

84. **Wildlife.** The Project will not pass through any areas designated as National Parks or Protected Areas. Terrestrial habitat through which the road passes through can be classified as:

(i) Agricultural Land;

(ii) Strip Plantation; and

(iii) Homestead Plantations

85. Agricultural land in particular is capable of supporting only limited wildlife. Given this no additional wildlife surveys were conducted. A list of common wildlife associated with the above habitats is provided in Table 4.

86. The location, climate and habitats both wetland and terrestrial, etc. of project site will find some of the very nominal and common wildlife population like Jackal/ fox, mongoose, bat, palm civet, jungle cat, otter among the mammals but it is depleting sharply in the recent decades because of destruction of their habitat in bush and low density forest in project area.

87. **Birds.** Crow, doves, pigeon, mynas, weaver bird, magpie robin, house sparrow, storks, herons and egrets, tailor bird, shama, kingfishers (blue lessor pied, white breasted, small fisher), wood packers, bulbul, parakeets, jungle babbler, Indian tree pie, vulture, water hen, owls (spotted owlet, fish owl, hutumpecha), kites (shabaz, koral, tisha, etc.), cormorant, kobo, oriolesm hawk cuckoo, green pigeon and koel.

88. **Reptiles & Lizards.** Snakes, tree tokey, wall gekko, lizards.

89. **Other Vertebrates.** Toads, rodents (mouse, mole, rates, squirrels), bull frog, green frog.

d. Aquatic Faunas

90. **Mammals.** Gangetic dolphin, gharial, otter, shark.

91. **Birds.** Kingfishers, storks, herons, egrets, watermen, snipe, pied wagtail, curlew, green shank, teals, pallas fishing eagle.

92. **Reptiles & Lizards.** Snakes, lizards, monitors tortoises, turtles, green frog, bull frog, tree frog.

93. **Other Vertebrates.** Crabs, snails, mollusc.

e. Wildlife Status in Project Site:

94. Wildlife species identified and reported from the experience of the survey in the area that includes the mammals such as jackal, jungle cat, fox and mongoose. In addition, there are reptiles like the water snake, Jat snake (*dendroapis polylepis*), and darash snake (*xenochropis piscator*); amphibians like the common toad and bullfrog, lizards such as monitors (water monitor, black monitor and golden monitor), tree gekko, house lizard and rodents (rat, mouse, squirrel, mole), etc. The survey of wildlife species of a small and densely populated area may not bring out a reliable result. Because, the wildlife species allocate their time spread over a territory where they are used to feed, rest and recreate.

95. Hence, well planned survey over a prolonged period for collecting the reliable data on population and distribution of wildlife species is necessary. This study therefore does not allow such a survey. It is not necessary either for the purpose. A wildlife warden can be engaged subsequently for doing the job if such a study is felt necessary. A local nongovernment organization (NGO) may also be entrusted for conducting the study on wildlife of the project site.

96. The bird species reported from the field survey include crow, mynas, stork, brahmani kite, sparrow, weaver birds, water hen, parakeet, robin, bulbul, black drongo, vulture, hawk cuckoo, black cormorant, owl, snipe, etc. However, comprehensive studies on wildlife were conducted by the Environmental Specialist during his several field visits and through interrogation of knowledgeable persons in site and local GOB and NGO.

Table 4: Common Wildlife Associated with Habitats

Status	Wildlife Categories			
	Mammals	**Avifaunal species**	**Reptiles/ Lizards**	**Amphibians**
Common	Terrestrial Jackal, bat, mongoose, rodents (rat, mouse, mole, squirrel) Aquatic	Terrestrial Crow, pigeon, dove, mynas (Pied Myna, Common Myna, Brahmoni Myna), weaverbird, magpie robin, oriole (golden), sparrow, bulbul. Aquatic/ Opportunistic Stork (cattle egret, grey heon, pond hereon), king fishers, snipe, hattity, sea gull	Terrestrial Cobra, jat snake, darash snake, tree tokey, wall gakko. Aquatic Water monitor, dora snake	Toad
Occasion	Terrestrial Palm civet, otter, jungle cat Aquatic Dolphin, shark	Terrestrial Orioles, wood packers, parakeets vulture, brahmani kite owl, kobo Aquatic Water hen, curlew, teal (kharali)	Aquatic Tortoise, turtles	Bull frog, tree frog, green frog
Endangered/ Threatened	Terrestrial Palm civet, jungle cat, fishing cat, otter Aquatic Water otter, dolphin	Terrestrial/ Opportunistic Pallas fishing eagle, green pigeon, king vulture, wood packers, fishing own Aquatic Sea pigeon, curlew, water hen, teal (kharali)	Aquatic Water monitor, tortoises, turtles	Green frog, bull frog

3. Socio-economic

97. General Considerations. This section briefs on the socio-economic condition of the region. This section of the report will briefly introduce various components of the human related environment of the project area and its surroundings including socio-economic, demographic, cultural, settlement and health conditions.

98. The project area is located in the Khulna, Barisal and Dhaka divisions and lies on the bank of the rivers like Ganges, Meghna, Bishkhali, Bhairab, Passur, Rupsha, Shibsha, Mayur, Chitra, Payra, Arial Khan, Kacha, Kirtonkhola, Tentulia, Naya Bhanga, Jayanti, Shawrupkathi, Amtoli, Modhumati, Gorai, Ichamoti, Kobadak, Kumar, etc.

99. The general landscape through which the road runs is flat with much of it in agricultural use. Agricultural areas tend to cover large areas and usually comprise multiple monocultures (e.g. rice paddy). As such the general landscape is both monotonous and featureless.

a. Agriculture

100. A brief account of the overall condition of agriculture sector of the site that may be affected by the Project is given. It is felt important especially in regard to maintaining the baseline status record of the area. This will help in monitoring and evaluation of the environmental impacts of project on agriculture sector and will be helpful to the planners, administrators and development agencies in taking up similar projects locally or elsewhere. The data collected can also be used for the purpose of environmental monitoring of the project site during construction and implementation phases.

101. The entire Project site lies on the Agro-Ecological Zone (AEZ) #13 namely, the Ganges Tidal Floodplain. This AEZ unit is poorly drained fine loamy on ridges, poorly and very poorly drained clayey in basins.

102. The scope for further intensification of agricultural crops in the project affected site as well as in the adjacent areas is limited. This is because, the land and water (both surface and underground) is limited. Major crop during the kharif-2 season is rain fed transplanted *aman* paddy (local varieties). Culture fisheries technology locally known as shrimp gher on low land with availability of saline water is popular and brings hard currency from exports.

Table: 5 Cropping patterns in different cropping seasons

Land Classification	Cropping Patterns		
Highland	**Rabi season**	**Kharif-I season**	**Kharif-II season**
Medium High and Lowland	Vegetables/ F Grass bean Fallow/ Grass bean	Aus/Jute-F, vegetables Sesbania-F, sesame	Fallow/ Vegetables, T. aman

b. Crops Grown

103. The crops grown in different cropping seasons and on different land types are given in Table-6. Cultivation of rabi and kharif-I vegetables has gained popularity on highland and made lands in the down town areas of all district town due to availability and access to the local as well as Dhaka City market due to better communication.

Table: 6 Crops grown in different cropping seasons and on different land types

Land type	Cropping Season			Annual Perennial
	Kharif-I	**Kharif-II**	**Rabi**	
Made-land, Non-flooded	Lemarenthus, long bean, bitter gourd, snake gourd,	Lemaranthus, cucumber, long bean sweet gourd,	Maize, millet, potato, sunflower, peanut, radish, chili,	Papaya, banana, ginger, turmeric, sugarcane, etc.

Land type	Cropping Season			Annual Perennial
	Kharif-I	Kharif-II	Rabi	
	sweet gourd, ash gourd, cucumber, ribbed gourd, peanut, jute, sesame, sweet potato, aus and egg plant	ash gourd, ribbed gourd, snake gourd, fodder, etc.	coriander, onion, garlic, carrot, tomato, cabbage, cauliflower, egg plant and spinach	
Medium Highland, slightly saline	B.aus, Sesame (50- 70%). T. aman	T. aman(local)	Barley, millet, chilli and mung bean	
Medium Lowland,	B. aus & aman T. aman	T. aman	Barley, millet, chilli and mung bean Irrigated boro (<5%)	
Homesteads/Orchards, Highland	Vegetables (10%)	Vegetables (5%)	Vegetables (10%)	Betel nut, banana, coconut ipil-ipil, jeol bhadi, pome-granade, sofeda, eucalyptus, akshmoni, date plam mango, shisoo, jack fruit, plum, lemon, jarul, mehgani, koroi, babla, debdaru, shirish, etc.

c. Fertilizer Use

104. Very little or no fertilizer is used for the local boro varieties in project site. However, chemical fertilizers and some organic manure are used for cultivation of HYV boro varieties and rabi vegetable varieties. Some fertilizers are also used for Kharif vegetable varieties.

d. Yield

105. Approximate yield data of major agricultural crops in project site given below was collected from the Thana Agricultural extension (TAE) office and by discussing with the farmers.

Crops	Tons/hectare
T.aman (HYV)	3.5
T.aman (local)	2.0
B. aman	1.5
B. aus	1.0
Sesame	1.0
Vegetables	17-20

e. Agricultural Development Potentials

106. Agricultural Development Potentials at project site are limited because of the following constraints:

(i) Lack of availability of irrigation water
(ii) Lack of adequate surface water storage facility

(iii) Land use conflicts e.g. agriculture and urbanization, agriculture and aquaculture, agriculture and settlement, etc.
(iv) Land speculation for higher prices

107. However, surface water can be stored inside the polders in canals, cut-off channels, creeks and rivers if the regulating structures can be maintained properly. The stored water can subsequently be used to irrigate the Kharif-I and Rabi crops. Proper management and inputs in the form of introduction of HYVs, use of higher doses of balanced fertilisers and practice of environment friendly plant protection measures (IPM) will boost up crop production per unit area.

108. The poor agricultural lands that are deeply flooded should be allotted for expansion of aquaculture, digging the borrow pits for infrastructure development and digging large tanks for storing freshwater. This will permit cultivation of diversified vegetable crops and spices during the rabi and kharif-1 seasons on suitable sites. Use of good and moderate agriculture lands for other purposes may not be allowed.

f. Major Limitations

109. The project site, though a food balanced area, has very limited scope for further agricultural development due to several serious limitations. These are (I) limitation of soil and water (ii) draughts during the dry season (iii) loss of agricultural land to habitation (iv) loss of agricultural land to expanded aqua culture practice (v) delayed draining of the medium low land areas, etc. in addition, speculation of agricultural land for big resale value. These absentee landlords who own large land areas are neither interested for agricultural use nor in other type of development activities. This attitude of the landowners makes agricultural extension activities difficult and ineffective. Lessee of these lands cannot exercise the authority of crop diversification, selection of crop and land management.

4. Human Interest Component:

110. **Agricultural Land loss.** In the project area, agriculture is the major use of land with a high cropping intensity. Road widening will involve elimination of farmland along the right-of-way. Hence, agriculture land loss in an infrastructure development project is a significant negative effect. Borrow pits, however, may be considered as temporary land loss, which could be restored to their former use or converted into fishponds. The proposed project does not involve any new route alignment, only the upgrading of existing roads, though some re-alignment of short sections of existing roads may be necessary, e.g. to ease curve radii. Widening of some of the existing Upazila roads will be necessary to achieve the embankment cross-section standard (7.3m crest width, 1:2 slope), involving a limited loss of farmland.

111. The analysis of the road upgrading works required shows that most embankments will need widening to achieve the full design standard cross section. This will involve the loss of narrow strips of land on either side of the existing embankment. It is envisaged that, for the Project roads, very minimum quantity of land will be required, a strip of land about 1.75 m wide on either side of a typical road embankment. The land acquisition assessment has been carried out which shows that maximum of the land on roadsides is used for agricultural purpose and few for homesteads and other activities. Hence, the actual loss of agriculture land will be insignificant. The losses to individual farmers will be small, a marginal amount of their total holding because only narrow strips of land are required. In view of this small amount of potential agricultural land loss, the negative impact of the Project on this issue will be moderate. On the

other hand, a positive impact of the road improvement works will be an increase in land values (both farmland and homestead) in the adjoining area.

a. Navigation/ boat communication

112. Water transport is progressively losing its importance throughout the country as road transport facilities are developed. Nonetheless, the IEE investigated the question whether the project would interfere with existing navigation/ boat communication facilities. Field investigations did not reveal any conflict between the present route alignment and navigational facilities; however, some bridges and culverts, which are currently damaged, will provide better boat communication facilities after rehabilitation.

b. Employment opportunities

113. The proposed improvement works under the project are expected to generate significant employment opportunities for the local people during the Project construction stage. This is in direct conformity with the concept of stakeholder and beneficiary participation, which is central to the design of the Project. Besides, improved roads will increase accessibility of the rural areas, and will thus have a cascade effect of encouraging commercial activities along the roads and in the connecting growth centre markets, and providing for long-term income-generating opportunities.

c. Access of goods to markets

114. Road improvement works would also have a concomitant high positive impact in terms of the accessibility of local goods to the growth centre markets in the Project area through motorized and faster transport. Economic activities, including local trade and commerce, will be stimulated by these transport opportunities, which in turn, will help in rural poverty amelioration - a principal development objective of the project. Even though the economic benefits cannot immediately be fully quantified, the long-run positive impacts are undeniably high.

d. Traffic

115. Bitumen surfaced of the improved Upazila roads and Union roads will facilitate increased traffic of both motorized and non-motorized transport modes. The better quality of the roads will also ensure greater vehicle safety and reduce travel discomfort, especially in the rainy season. Negative impacts of increased traffic on improved roads relate to the hazards for pedestrians, slow moving transport modes like cycle rickshaw/ vans, and cattle from neighbouring fields. Appropriate safety measures can adequately deal with this impact.

e. Cultural features

116. Cultural features, which include places of worship, burial grounds and historical sites, will be provided with better access through road improvement measures, which may also lead to their better protection and conservation. The project actions are not expected to have any negative impact on cultural features, provided any road realignment, if necessary, is adjusted to avoid encroaching upon such features or structures.

f. Landscape/ Aesthetics

117. The road improvement works together with tree plantations on roadsides, will also greatly enhance the visual landscape and aesthetic quality of the entire region.

g. Growth Center/ markets improvements

118. Environmental issues related to growth centres/ markets relate to sanitation, safe drinking water, drainage, waste disposal, internal and access road conditions, and status of selling area. The current status of the market infrastructure is very poor and totally inadequate. Sanitation facilities are unhygienic and mostly non-existent. Most of the growth centres/ markets have some type of drinking water facilities, but safe drinking water facilities are inadequate and inoperative. The field survey reveals that there are no or little drainage facilities in the growth centre markets, except only few have some sort of kutcha (earthen) and/ or lined drainage system and having problems to reach at outfalls. There is no garbage bin and waste disposal facilities are very rare in the surveyed growth centres/ markets. Access or internal roads are mere dirt paths, which are impassable during rainy season. Most of the growth centres/ markets do not have enough parking, loading and unloading facilities. The selling sheds/ platforms are mostly open, muddy or disorganized and inadequate to accommodate the sellers on market (hat) days. Most of the growth centres/ markets do not have trading facilities for women. The improvement of physical infrastructure in and around the existing growth centres/ markets will have high positive impact on the general environment.

119. The Growth Centres/ markets, where physical facilities have been improved, were examined. The infrastructure improvements in these markets were done in accordance with the guidelines provided in the LGED's Growth Centre Planning Manual. The marketing facilities for the improved Growth Centres/ markets are better than unimproved Growth Centres/ markets (cited above), demonstrating high positive impact of market improvement measures. However, maintenance measures in the 'improved' Growth Centres/ markets are still inadequate.

Table 7: Check list of Environmental Parameters of the project for IEE

Environmental Parameters	Positive Impact				Negative Impact			
	High	**Mod**	**Low**	**None**	**High**	**Mod**	**Low**	**None**
(1) Ecological Component								
Fisheries		√						√
Wildlife			√				√	
Wetland			√					√
Tree Plantation/removal	√						√	
Forest			√					√
(2) Physico-Chemical Component								
Soil Erosion and Siltation	√						√	
Regional Hydrology/Flooding		√						√
Drainage Congestion/Water logging			√					√
Water Quality/Pollution				√				√
Salinity intrusion				√				√
Air Pollution		√					√	
(3) Human Component								
Agricultural land Loss			√				√	
Navigation/Boat			√					√

Communication								
Employment Opportunities	√							√
Access of Goods to Markets	√							√
Traffic	√						√	
Cultural Features	√							√
Landscape/Aesthetics	√							√
Market Improvement	√							√
Ghat Improvement	√							√

Rating Scale: High, Moderate, Low and None

h. Issue of Climate Change

120. The long term impacts of global warming and climate change are far reaching and diverse. For different parts of the world, the current precipitation patterns will change causing more floods and droughts, the ecosystem for crop production will alter affecting the existing land use pattern, biodiversity will be threatened, ice caps and glaciers will melt, sea level will rise, storms and cyclones will be stronger and erratic, human health will be adversely affected, and above all, an extremely high monetary cost will be involved for mitigating and adapting to such changes. Sea level, a vital issue of concern for Bangladesh. Rainfall in project area has trend in lowering from east to west and high temperature experiences in the west of the project area like Satkhira and Khulna.

i. Climate Change and Vulnerability

121. Bangladesh is one of the most vulnerable countries to climate variability and change because of its geographic location, low deltaic floodplain, and hydro-meteorological influence of erratic monsoon rainfall and other extreme climate events. Climate change threatens the significant achievements made by Bangladesh in the last two decades in raising incomes and reducing poverty. In the country, women are relatively more vulnerable to extreme climate events because of poorer access to education and health services and economic opportunities; limited mobility; and various social restraints. By 2050, climate change impact could make an additional 14% of the country extremely vulnerable to floods and dislocate more than 35 million people in the coastal districts. The country has an outstanding adaptation deficit and there exist substantial risks from severe flooding and extreme climatic events like cyclones even in the current climate. According to a recent estimate, 87% of roads in the country will be substantially inundated due to climate change by 2050.[10]

122. In Bangladesh, the climate change will aggravate storm surge-related inundation for two reasons[11]. First, surges will be elevated by a rising sea level as thermal expansion and ice cap(s) continue to melt. Second, a warmer ocean is likely to intensify cyclone activity and thus heighten storm surges. The destructive impact of storm surges will generally be greater when the surges are accompanied by strong winds and large onshore waves. Larger storm surges threaten greater future destruction, because they will increase the depth of inundation and will move further inland threatening larger areas than in the past. The vulnerability of Bangladesh may increase even more as current scientific evidence points towards a probable increase in the frequency of intense tropical cyclones in the Bay of Bengal.

[10] Policy Research Working Paper 5469, Climate Proofing Infrastructure in Bangladesh, The World Bank, Development Research Group, Environment and Energy Team, November 2010.

[11] Dasgupta et al (2010). Vulnerability of Bangladesh to Cyclones in a Changing Climate Potential Damages and Adaptation Cost. World Bank The World Bank Development Research Group Environment and Energy Team, Paper 5280

123. The low-lying coastal zone of Bangladesh is highly vulnerable both to the normal tidally enhanced monsoon floods and to regular impact from tropical cyclones. 58 tropical cyclones have impacted Bangladesh during the period (1960-2010). Of these, 28% hit the coast of Sundarban (Satkhira, Khulna and Bagerhat), 22.% west central coast (Borguna, Potuakhali, Barisal, Bhola and Meghna estuary), 26% east central coast (Noakhali and Chittagong) and 24% south-eastern coast (Chittagong, Cox's Bazaar and Teknaf)[12]. The vulnerability of the physical infrastructure to the impacts of the current climatic environment is a consequence of the impacts of monsoonal rainfall and flood; and the additional severe rainfall, flood and wind effects of tropical cyclones.

124. In addition to the current infrastructure vulnerability, the predicted climate changes will increase this vulnerability as a result of sea level rise (SLR); increased wet season rainfall; increased annual temperatures and increased frequency of severe cyclones. Recent predictions derived from IPCC[13] modeling based on minimum and maximum emission scenarios show temperature rising by between 1.9°C and 2.4°C and wet season rainfall increasing by between 9% and 10%[14]. The increase in temperature has the potential to cause material expansion resulting in damage concrete structures such as buildings, bridges, and culverts. Bitumen seals to roads may be susceptible to softening unless higher temperature resistant bitumens are used. Floods resulting from increased rainfall, cyclones and storm surges have the potential to damage road embankments, markets and housing. Increasingly severe storm events will also increase the potential flood related damage as well as causing additional erosion damage from the over-topping of road embankments. High winds associated with storm events have the potential to damage buildings, as well as cause secondary damage from trees and other debris. Wind driven wave action can have a significant erosive effect on exposed road embankments and bridge abutments. The culmination of these impacts will be a rapidly increasing deterioration of the transport infrastructure, including a significant risk to road connectivity, particularly at times when it may be most needed.

125. Scientific predictions of the yearly relative SLR for coastal Bangladesh range from 1.5 to 10 mm/yr; with a recent value of 7mm/yr being adopted by the World Bank[15]. A general relative SLR of 7mm/yr has been taken for assessment of typical subprojects in the project. The "effective" SLR is actually a combination of relative SLR and land subsidence. This land subsidence has been estimated to be between 2 and 4 mm per year within the project region. For the typical subprojects assessment, an average land subsidence rate of 3mm/yr has been adopted. The adopted figures for a 20 year road design life are 140mm of relative SLR, plus 60mm of subsidence, giving a total effective SLR of 200mm. This 200mm will, with the standard 600mm freeboard figure (minimum road pavement crest level above normal annual flood level), form the basis for the target levels for each road surface within the project.

[12] Quadir D A and Iqbal A, (2008) Investigation on the Variability of the Tropical Cyclones Impacting the Livelihood of the Coastal Inhabitants of Bangladesh. International Union for Conservation of Nature (IUCN) – Bangladesh.

[13] IPCC-WG-I, 2007: Climate Change 2007, AR-4, Scientific Basis, Intergovernmental Panel on Climate Change, WMO, Geneva, Switzerland

[14] Tanner TM, Hassan A, Islam KMN, Conway, D, Mechler R, Ahmed AU, and Alam, M (2007) ORCHID: Piloting Climate Risk Screening in DFID Bangladesh. University of Sussex, UK.

[15] Dasgupta et al (2010). Vulnerability of Bangladesh to Cyclones in a Changing Climate Potential Damages and Adaptation Cost. World Bank. The World Bank Development Research Group Environment and Energy Team.

j. Bangladesh faces an additional hydrological problem

126. Though the overall impacts of climate change are hard to predict, they are likely to have far-reaching consequences. Water-extreme events, such as floods and droughts, are predicted to impact more people and economies over time in South Asia than in any other region of the world. The effects of these trends will be magnified by population growth and the industrialization of South Asian economies, increasing the need to expedite progress in preparing the region to cope with the impacts of climate change. A fundamental challenge facing the water sector will be how to find a balance between increasing variability of water supply and accelerating demand for water. Transboundary water flow regime will also impacts on project activity and will change the regional hydrological regime.

127. **Changes in Runoff Due to Climate Change:** The quantity and nature of runoff is expected to change substantially in South Asia as a result of climate change. Changes in the spatial and temporal distribution of precipitation and temperature are expected to interact in complex ways that alter the balance and characteristics of “green” water (used or lost in catchments before it reaches rivers) and “blue” water (runoff that reaches rivers). By 2050, increased runoff, primarily fed by precipitation changes and glacial melt, is expected in the basins of the Indus, Ganges, and Brahmaputra rivers. Such outcomes will be further complicated by changes in water use in the basins, including diversions, groundwater–surface water interactions, and increased demands for irrigation, hydropower, and domestic, industrial, and municipal water supplies.

B. Mitigation measures

1. Environmental Management Plan

128. The more important short term mitigation measures will include dry season construction work, erosion control from earthworks, careful location of borrow pits, temporary provision for drainage and traffic diversion, sanitation and hygienic provisions for the construction workers, and safe storage/ transportation of construction materials. Long term mitigation measures will include *inter-alia* efficient soil compaction, intensive scheme of roadside tree plantation, ensuring 1:1.5 ratio for the embankment slopes, rehabilitation of borrow pits by the contractors, careful design of cross drainage structures to allow flood water passage and prevent water-logging, minimizing agricultural land loss and prompt compensation for any acquisition, and adequate number of road safety signs and markings at vulnerable or hazardous sections.

129. In order to prevent any deterioration of the hydrological regime and mitigate any potential for water logging or flooding, suitable design and action will be ensured, including providing adequate number of culverts and bridges. Lessons learned from other LGED infrastructure development projects might prove useful in this case. Simultaneously, attention will be focused on probable adverse impacts on boat communication/ navigation. Nonetheless, road structures – wherever boat communication is common – should leave adequate clearance above high flood level for boat passage. In the wetlands or low lying areas, detailed hydrological data should be obtained to help in the design of submersible roads so that they do not interfere with the wetland hydrology and resources.

130. Field investigations revealed that none of the impact issues will produce high degree of negative environmental effect. The potential long-term negative impacts relate to soil erosion, tree removal, water logging or drainage congestion, air and water pollution, agricultural land loss, navigation and traffic/ road safety. These have to be addressed through five sequential

stages of the project cycle, viz., design, contracting, construction, supervision, and operation and maintenance. Most long-term adverse impacts can be mitigated by giving special emphasis on maintenance.

131. The IEE has revealed that minor negative impacts related to tree removal, agricultural land loss, drainage congestion, pollution and road safety as well as short term (construction phase) effects can be mitigated through appropriate measures, monitoring programs and fulfilment of institutional requirements. It is, therefore, concluded that a follow-up detailed EIA is not required, and this IEE report should become the completed EA. The Table 8 provides information about the impacts of different activities/ operations including the appropriate mitigation measures and relevant institutional arrangements. And the Table 9 is a Sample Matrix for Environmental Management Plan detailing different environmental issues, potential impacts, timeframe and responsibility for implementation and supervision.

Table 8: Operation, impacts, mitigation and institutional arrangement

Name of operation	Impacts	Mitigation measures	Institutional arrangement
Diversion of traffic	Inconvenience and disruption of traffic flow due to project const ruction to the present road users, particularly during nighttimes	• Proper diversion schemes will ensure smooth traffic flow minimizes accidents, traffic snarl ups, and commotion. • The diversion signs should be bold and clearly visible particularly at night	Consultants and contractors
Construction Camp Sites	Ensuring proper living condition of workers at site like food, sanitation, water supply, health care, outbreak of epidemic etc.	The construction campsites shall be away from any local human settlements and preferably located on lands, which are not productive barren/waste lands presently. The camps shall have adequate water supply, sanitation and all requisite infrastructure facilities. This would minimize dependence of construction personnel on outside resources, presently being used by local populace and minimize undesirable social friction thereof. • The camps shall have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. • All construction camps shall have rationing facilities particularly for kerosene/ LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The construction camps shall have health care facilities for adults, pregnant women and children. • All construction personnel shall be subjected to routine vaccinations and other preventive/ healthcare measures. • The construction camps shall have in house community/ common entertainment facilities. Dependence of local entertainment outlets by construction camps should be discouraged /prohibited	Environmental Consultant, Supervising engineer with contractor, Department of the Environment

Name of operation	Impacts	Mitigation measures	Institutional arrangement
		to the extent possible	
Work sites	Protecting workers from construction hazards, scheduling working hours, by using protecting gears, noise, dust etc.	• All personnel in work sites shall have protective gears like helmets, boots etc. so that injuries to personnel are minimized. • Children and pregnant women shall not be allowed to work under any circumstances. • No personnel shall be allowed to work at site for more than 10 hours per day (8 hour makes one work shift). Personnel who are likely to exposed to noise levels beyond stipulated limits shall be provided with protective gears like ear plugs etc and regularly rotated. • Regular water sprinkling of water shall be ensured so that dust levels are kept to minimum	Environmental Consultant, Design consultants Supervising engineer with contractor and DOE
Use of Construction Equipment Vehicles	Emission from old machinery valid pollution standard, accidental spills	All equipment/vehicles deployed for construction activities shall be regularly maintained and not older than 5 years. • Vehicles/equipment shall be regularly subjected for emission tests and shall have valid Pollution Under Control certificates. Revalidation of certificates shall be done once in a month. • All vehicles deployed for material movement shall be spill proof to the extent possible. • In any case all material movement routes shall be inspected daily twice to clear off any accidental spills.	Environmental Consultant, Design consultants Supervising engineer with contractor and DOE
Effect of Water resources & Drainage channels on the cross-drainage works	To facilitate the cross-drainage at the drains and streams, various cross drainage (CD) structures are proposed, including improvements in the existing structures. Alteration of drainage can lead to soil erosion of adjacent areas.	• The rural road construction will also require construction of several cross drainage structures, minor and major bridges to facilitate development in accordance with design requirements and standards. • Impacts arising out of construction of drainage structures is not likely to impact drainage pattern since under the road design, pattern of flow and discharge capacities of all drainage structures are reviewed and designed to negate any heading up or flooding problems. • Impacts on water quality are not significant or either negligible since construction activities to be scheduled to complete during dry months of year. • Adequate precaution is to be taken to prevent oil/lubricant/ hydrocarbon contamination of channel beds. Spillage if any shall be immediately cleared with utmost caution to leave no traces.	Environmental Consultant, Design consultants Supervising engineer with contractor and DOE

Name of operation	Impacts	Mitigation measures	Institutional arrangement
		• Channel beds are to be cleaned up (50 m upstream & 50 m downstream sides of water courses) and restored to its previous state after completion of construction but prior to onset of monsoon.	
Borrow areas excavation	Ecologically sensitive, locations, the actual extent of area/zones is to be demarcated, top soil loss, proper/ reuse of borrow area for agriculture and fisheries	• Borrow areas identified/ suggested during project preparation are to be investigated for presence of ecologically sensitive areas if any and cleared thereof. • Within these locations, the actual extent of area/zones to be excavated areas is to be demarcated with signboards. All such operational areas are to be access controlled particularly for locals and for grazing cattle. • Through this project, the borrow areas/ pits may be converted into surface/ ponds wherever possible, as a derivative of development. Some of the ponds could serve as source of water for agriculture, a practice prevalent in some part of the country. • The top soil recovered from newly acquired land areas for road construction is preserved and used for turfing of embankment(s) of project highway.	Environmental Consultant, Supervising engineer with contractor
Air Quality	Operations/ areas of , work sites, haulage roads, hot mix plants, borrow sites, human settlement etc. are concern for air pollution causing workers health and health of local population.	All operational areas under the road construction works are to be regularly monitored (at least once in a season) for air quality parameters such as SPM, RPM, SO2, NOx, HC, CO etc. • This will ensure identification of operations/ areas of concern with regard to air pollution. Operational areas include, work sites, haulage roads, hot mix plants, quarries, borrow sites, human settlement etc. mitigation measures such as water sprinkling for dust suppression, permitting construction equipment/vehicles having Pollution Under Control certificates will reduce work area concentration of air pollutants like RPM, SO2, NOx, HC, CO etc. does not exceed permissible limits and therefore does not contribute to build up of pollutants	Environmental Consultant, Supervising engineer with contractor and DOE
Soil erosion and conservation	Contain erosion and drainage within RoW, stabilization of erodible materials, slope failure, machinery pollution and noise.	• Along rural roads the widening activities will raise, extend and enlarge existing roadway/ tracks all along the alignment therefore mitigation measures to contain erosion and drainage problems are essential along RoW • Measures to ensure embankment stabilization including selection of less	Environmental Consultant, Design consultants Supervising engineer with contractor

Name of operation	Impacts	Mitigation measures	Institutional arrangement
		erodable material, good compaction, re-vegetation, placement of gabions or any suitable measures around bridges and culverts etc. (in case required) are included in technical specification and contract documents. The engineering measures for countering soil erosion, slope protection, drainage wherever required considered for project highway and detailed project report. • Many of impacts on soil due to road construction can be significantly mitigated by some of the following measures a) Minimizing area of ground clearance only to the extent required. b) Balancing the filling and cutting of earth to the extent possible. c) Avoiding creation of cut slopes and embankment which are of an angle greater than natural angle of repose for locally available soil type. d) Replanting disturbed area(s) immediately after disturbance due to construction has stopped and not after construction has been completed.	
Operation of Hot Mix Plants	Air pollution, emission of toxic materials, proper location to avoid noise.	• Hot mix plants shall be at least 1.5 km away from any human settlements and preferably located on leeward side. • Hot mix plants/ sites shall be located on barren/ uncultivable lands. Diversion of cultivable/ agricultural lands, even preferred by local people for economic gain shall not be allowed unless otherwise warranted by specific local conditions.	Environmental Consultant, Design consultants Supervising engineer with contractor and DOE
Borrowing soil from farm land	Loss of Fertile soil	Clearing operations within RoW and at all places of operational areas like borrow areas, work areas, labour camps, construction of new/ upgradation of existing to new haulage roads, hot mix plants, storage areas etc. shall consider preservation of fertile soil . As a first option, topsoil should be restored to its initial place after the specific activity is completed for which the area was vacated, or for enriching some other place like embankment slopes for turfing/ erosion protective measure. The topsoil can also be used for supporting re-plantation activities within RoW/ median.	Environmental Consultant, Design consultants Supervising engineer with contractor and DOE NGOs, LGED

Name of operation	Impacts	Mitigation measures	Institutional arrangement
Location of campsites, storage depots	Loss of productive land, spilling of oil and lubricant, drainage, emergency response.	The location of campsites, storage depots shall preferably on unproductive/ barren lands, away from forest areas (minimum 1.5 km). • Use of agricultural/ cultivable lands shall not be allowed under any circumstances. • All fuel loading, unloading, storage areas shall be spill proof, leakage proof and carried out on paved areas. • The sites shall have suitable system to drain storm water, sanitary facilities and shall not contaminate any nearby water courses/ drains. • The site shall also have a system for handling any emergency situation like fire, explosion etc.	Environmental Consultant, Design consultants Supervising engineer with contractor and DOE , LGED
Storage of hazardous materials	Standard practice handling hazardous material with proper gear, leakage, unauthorized workers safety	• All areas intended for storage of hazardous materials shall be quarantined and provided with adequate facilities to combat emergency situations. • The personnel in charge of such areas shall be properly trained, licensed and with sufficient experience. • The areas shall be access controlled and entry shall be allowed only under authorization	Environmental Consultant, Supervising engineer with contractor and DOE, LGED

Table 9: Environmental Management Plan – Sample Matrix

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
Air quality	Impacts on air quality during construction are due to generation of dust due to earthmoving activities on roadside, generation of dust due to excavation and handling of construction materials and vehicle movements. Emission of gaseous pollutants like sulphur dioxide, nitrogen oxides, hydrocarbon, particulates, carbon monoxide etc. from heavy vehicles are also important sources. Gaseous emission from Asphalt mixing plant is another important source of pollution. The larger sized plant can have serious impact. Dust is produced due to handling of aggregates. Smoke and soot, consisting carcinogenic materials are generated due to partial combustion of mixtures. Heating of bitumen also releases toxic gases. However, the mitigation measures and special attention at the sensitive spots can reduce the impact substantially. Observing environmental regulations regarding use of vehicles, crusher plants and asphalt mixing plants will also mitigate the air pollution within acceptable limits. Impact on air quality during construction phase is temporary and site specific. Thus it is difficult to quantify on an objective level. Overall, impact will not be significant if proper mitigation measures are implemented.	The proposed rural road construction will reduce dust generation due to vehicle movement as paved surface will be created. The asphalt plants, crushers and the batching plants will be sited at least 1.5 km away in the downwind direction from the nearest human settlement. All precautions to reduce the level of dust emissions from the hot mix plants, crushers and batching plants and other transportation of materials will be taken up in line with DOE requirements. Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce spills on haul roads. Water will be sprayed on earthworks, temporary haulages and detour roads on a regular basis. During and after compaction of the sub-grade, water will be sprayed at regular intervals to prevent dust generation. The hot mix plant will be fitted with dust extraction units. For ensuring the control of exhaust gas emissions from the various construction activities, the contractor shall take up the following mitigation measures: - An adequate cyclone/ scrubber to control emissions from the stack of hot mix plants will need to be provided in the event of the emissions exceeding the DOE norms. - The contractor shall obtain a No Objection Certificate (NOC) from DOE prior to the location and operation of plant to ensure the efficacy of the mitigation measures. All vehicles, equipment and machinery used for construction will be regularly maintained and monitored to ensure that the pollution emission levels conform to the DOE norms. A vehicle maintenance schedule prepared by the contractor and approved by the Engineer shall be adhered to. Contractor will take necessary consent from DOE for location of hot mix plants.	Preconstruction and construction stages	Supervising Engineer with the Contractor	Environmental Consultant and DOE
	During operation phase major impact can result from vehicular pollution. These pollutants include sulphur dioxide, nitrogen oxides, particulates, lead, carbon monoxide, hydrocarbon etc. Some secondary pollutants like ozone, Peroxyacetyl nitrate (PAN) etc. are formed depending upon meteorological factors, topography, etc. Dust is another important air pollutant that is generated due to bad maintenance of road, accumulation of wastes on roads etc. Impact during operation	Compensatory plantation to be taken up will also screen the dust and other emissions.	Operation stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	phase is continuous and to some extent unavoidable. The impact of ambient air quality will be insignificant during operation because numbers of vehicles in a day are expected to be 10-15. Due to creation of paved surface dust generation will also be minimized. Bangladesh Emission standard is using Euro 2 and Euro 1 for Petrol/ CNG vehicle and Diesel vehicles respectively. Already lead has been partially abolished from petrol in all metropolitan cities and is expected to be abolished from the entire country very soon. If there is effective enforcement there should be reduction, in impacts as these standards take effect over time. By the time construction will be over stage emission norms will be applicable.				
	The area will be impacted to some extent by air pollution during construction stage only. Construction stage impacts will be of short term and may have adverse impacts on the construction workers as well as on the settlements adjacent to the alignment, especially those in the downwind direction. During pre-construction stage impacts will be due to establishment of construction camp, site clearance and due to construction vehicle movements. It is anticipated that these impacts will be limited within 500m on either side of project road and 500m radius around construction camp. It is anticipated that these impacts will be limited within 1.0 km radius around construction camp.	To mitigate air quality impacts during construction, there will be regular water spray at construction site. All vehicles and machinery will be maintained. There will be regular environmental monitoring and remedial actions taken. At locations of air sensitive receptors the construction activities will be closely monitored by the supervision consultant.	Preconstruction and construction phase	Supervising Engineer with the Contractor	Environmental Consultant and DOE
	During operation stage impact on air quality will be due to increased number of vehicles and vehicular pollution. But air quality impacts are not expected to be significant as vehicular movement is not much.	During operation regular monitoring is planned. The compensatory plantation will alleviate the impacts to a great extent.	Operation phase	Supervising Engineer with the Contractor	Environmental Consultant and DOE
Water resources	To facilitate the cross-drainage at the drains and streams, various cross drainage (CD) structures are proposed, including improvements in the existing structures. The roadside ponds and other water bodies have not been noticed. There are road side ditches. The water table along the road is 3 - 5 m below ground. Due to the high water table along the corridor, wells and tube wells are mostly the sources of potable and irrigation water. The typical impacts on water resources during the construction of a road are summarized below. Alteration of drainage, run off, flooding – (Indicator)	No drainage modification of surface flow of rivers is envisaged and no mitigation is required.	Preconstruction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	Number of cross drainage channels altered; Depletion of ground water recharge - (Indicator) Area rendered impervious; Use of water supply for Construction - (Indicator) Quantum of water used; Contamination from fuel and lubricants - (Indicator) Nature and quantum of contaminants; Contamination from improper sanitation and waste disposal in construction camps - (Indicator) Area of camp/ disposal site and proximity to water bodies/ channels Impacts of road construction in the proposed project will be due to construction of cross drainage structures, etc. Alteration of drainage can lead to soil erosion of adjacent areas. However, as mostly CD works are done in summer when the water levels are low, the impacts due to alteration of drainage can be minimized effectively by planning construction only in the dry season. In the CD works mostly culverts are to be constructed therefore no major impacts on drainage are anticipated.				
	One of the potential impacts of road construction is the increased surface run off. The construction of road in the project area will increase surface runoff due to paved impervious surface of main carriageway. Impacts due to surface runoff include increased soil erosion and local flooding or water logging. However, the rural roads have been designed with side drains to take care of runoff, therefore, this runoff shall be drained to the nearest cross drainage structure. The engineering design includes design of cross drainage structures, which shall take care of the extra flow.	To maintain an efficient storm water flow, the roadside ditches will be cleaned regularly at least once every year prior to the monsoons. The waste collected will be disposed off at locations identified during construction phase.	Operation stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
Increased sediment and degradation of water quality	The degradation of water quality can occur during construction stage from increased sediment load into watercourses near the construction site. This may be aggravated by removal of trees and on sequent increase in soil erosion. As soil in the study area is alluvial-clayey loam type with a low silt composition, the impacts due to the increased sediment load will be insignificant. Degradation of water quality is possible due to accidental discharges into watercourses from drainage of workers' camps and from spillage in vehicle parking and/ or fuel and lubricant storage areas.	*Design Stage:* To ensure efficient cross-drainage and to prevent water logging along the sides, adequately sized and adequate numbers of cross-drainage structures have been provided. Along the settlements, as part of the engineering design, provision has been made for drainage along the sides of main carriageway. *Construction Stage:* The contractor will remove obstructions that may cause any temporary flooding of local drainage channels during construction. No spoil or construction material will be stored outside the Row or at places obstructing the natural drainage system.	Preconstruction and construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
		All necessary precautions such as proper drainage and height of road will be maintained to construct temporary or permanent devices to prevent inundation. Temporary drains for collection and disposal of runoff into natural drainage system will be constructed. The contractor will take all the necessary measures such as proper drainage to prevent temporary or permanent flooding of the work site or any adjacent area.			
Flood hazard	The extent of impact due to the streams/ local rivers may damage the pavement and washing away of road sections of levels of carriageway is not kept above Highest Flood Level (HFL).	Such eventuality will not occur as design takes care of this aspect by providing carriage way level 1 metre above HFL. Further adequately sized drain on either side of rural roads portions will be part of good engineering practice. Adequate numbers culverts have been planned to avoid flooding of road surface. It is expected that overall the rural roads will not be subjected to flooding.	Preconstruction and construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
Loss of productive soil	Loss of productive soil, albeit during the construction stage only, is envisaged at locations of workers camps, stockyards, storage, go downs etc. (for the duration of construction) if these are located on fertile areas. The EMP can ensure that no productive areas are used for these purposes and avoid adverse impact. In any case, though it would be a direct impact, it would be reversible as the soil can be stockpiled and replaced after the construction is complete and the worker camps, etc. are closed.	In the selection of borrow areas for the project, productive agricultural areas have been avoided for borrowing of materials. The workers camps, stockyard, storage and godown will not be established at agricultural land. In case productive areas are taken for borrow areas, stock yards, storage or workers' camp, the post construction rehabilitation will be ensured.	Preconstruction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
	Soils both within and outside the Right of Way (RoW) may be negatively impacted due to the proposed project. The loss of productive topsoil due to road construction is a direct adverse long-term impact. The project road alignment in most of its part will utilize land available in existing RoW hence will not involve loss of much productive soil. In addition to this there will be temporary impact on productive soil at diversions and labour camp due to leasing of land for construction period. The top soil from productive areas will be either utilized in side slopes/ shoulder dressing or will be stored outside and will be spread back during rehabilitation.	Given the practical experience there may be temporary requirement of productively agriculture areas for construction camps, all areas of cutting, borrow area sand etc. in productive lands and all areas to be permanently covered, the top soil will be stripped to a specified depth of 150 mm and stored in stockpiles of height not exceeding 2m. Stockpiles would be covered with tarpaulin to prevent runoff and leaching of nutrients. The stockpiling will be done in slopes of 2:1, to reduce surface runoff and enhance percolation through the mass of stored soil. Since topsoil will be in substantial quantities it is suggested that it will be stored in stockpiles at each km within the RoW. The stored topsoil will be spread back to maintain the physio-chemical and biological activity of the soil. The stored topsoil will be utilized for: - Covering all disturbed areas including the redevelopment of borrow areas; - Top dressing of the road embankments and fill	Construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
		slopes; - Filling up of tree pits, proposed as part of compensatory afforestation. To prevent any compaction of soil in the adjoining productive lands, the movement of construction vehicles, machinery and equipment will be restricted to RoW.			
Soil erosion	The soil in the study area is alluvial-clayey loam. Erosion will be exacerbated if the vegetation is removed from the sides since roots are known to hold soil together. This will, however, be for the duration until the compensatory afforestation and roadside turfing have matured. In stretches where raised carriageway has been planned, slope protection measures are required. To prevent the eroded material from entering the watercourse, silt fencing and/ or sand bags can be provided at the end of ditches or cascade arrangements can be provided at the end of ditches as they enter the watercourse. While the former requires frequent cleaning to prevent built-up, the voids in the cascade will be filled up by eroded material and eventually vegetation will be established there. No soil erosion is envisaged when the road is in operation as all the slopes and embankments of the project road shall be stabilized through sound engineering techniques and checks will be made that the works have been carried out to the required standard. Soil erosion results in the loss of soil cover, slope stability and addition of sediment loading to drainage channels. The problem of soil erosion is likely to be more pronounced during the construction stage along bridge-end fills, over steep banks and embankment slopes.	The slope of the road embankment has been fixed at 1:2, which is stable and reduces the possibilities of slope failures. This protection will mainly be provided at approaches of major and minor bridges. The slope protection will be done in accordance with recommended practice. For treatment of embankment slopes for erosion control: 56-1974. All the culverts to be constructed as cross drainage structures, the slopes will be protected by turfing with grasses and shrubs. To check the slope stabilization of the borrow pits adjacent to the embankment, the depth of the pit will be so regulated that the bottom edge of pit shall not intersect the imaginary line of slope 1:4 drawn from the top edge of the nearest embankment. To avoid embankment slippage and erosion, borrow pits shall not be dug continuously.	Preconstruction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
	Impacts in the construction stage due to soil erosion are mainly at the construction sites of approaches of bridges and culverts and along the edges of the diversion channels. Severe erosion of earth slopes is usually caused by a concentration of storm water flowing from the roadway section or from the area at the top of cut slopes down unprotected embankments or other slopes. Preventing concentration of water in these critical areas is essential. Rainfall on cut and fill slopes will cause erosion to varying degrees, depending on the intensity of rainfall, the type of	Channels, ditches, berms, or shoulder dikes for diverting water to satisfactory outfalls should be constructed at appropriate locations early in the construction of the project. Benches or terraces, enclosed drainage systems, or the mulching or covering of the soil with various materials may be required to reduce slope erosion due to rainfall especially while constructing embankments.	Construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	soil, the degree of slope, the length of the exposed surface, the climatic exposure, and the effectiveness of the vegetative or other protective cover.				
Compaction of soil	Compaction of Soil will occur in the pre-construction stage (particularly during site clearance stage) due to movement of heavy machinery and vehicles. Similarly, compaction will take place during setting up of construction camps and stockyards. However, this is a short duration impact. Compaction occurs beyond the carriageway and within the vegetated area of the RoW by the movement of vehicles and heavy machinery. Movement of vehicles during road construction is the major cause of soil compaction. This impact is direct and will be the maximum in the RoW. It is necessary to ensure that there is no adverse impact of soil compaction in areas other than the RoW, where vegetation can grow and rain infiltration will take place. During the operation period compaction will be restricted to the carriageway. Compaction cannot be said to be an impact of the operation stage as the pavement itself is a function of compacted base and sub base.	Vehicles and machinery will be kept within RoW to minimize the adverse impacts during pre-construction and construction. In case the machineries are needed to be placed/ installed outside the RoW they shall be done on barren or unused land. At construction camp vehicles/ machineries will be parked at designated location. During operation stage no impacts are anticipated as pavement itself is a function of completed base and sub-base.	Preconstruction, construction and operation stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
Contamination of soil	*Pre-Construction Stage:* Contamination of soil in the pre-construction stage may be considered as a short term residual negative impact. Soil contamination may take place due to solid waste contamination from the labour camp set up during pre-construction stage. This impact is significant at locations of construction camps; stockyards, hot mix plants, etc. will come up in this stage. *Construction Stage:* Contamination of soil during construction stage is primarily due to construction and allied activities. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Pollution of soil can also occur in hot-mix plants from leakage or spillage of asphalt or bitumen. Refuse and solid waste from labour camps can also contaminate the soil. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water	At various construction sites, the vehicles and equipment will be maintained and refuelled in such a fashion that oil/ diesel spillage does not contaminate the soil. It will be ensured that the fuel storage and refuelling sites are kept away from drainage channels and important water bodies.	Preconstruction and construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	bodies in case of dumping being done near water body locations.				
Consumption of construction materials	The construction of the rural roads envisages the use of significant quantities of the earth, stone and grit and sand along with bitumen. The excavation of quarries and borrow pits used for obtaining rocks, soil and aggregate materials for road construction can cause direct and indirect long-term adverse impacts on the environment. Significant quantities of materials will be required from quarry and borrow areas for the project road. The impacts of quarrying operations could be significant at various stages of road construction. Quarrying and crushing could have an impact especially on the air quality of the area especially the area downwind to the quarry. The impacts are as described below. The design team has identified some of the quarries not close to project road. The bulk of the materials needed for the construction of the embankments may be procured from these quarries or any other suitable quarry as desired by the PMU. As these quarries are already in operation with the requisite environmental clearances and redevelopment plans, no major impacts, which arise in making new quarries operational, are likely. A major source of dust during the construction stage is from stone crushing operations from the crusher and the vibrating screen. The dust, in addition to being an eyesore, reduces visibility thereby increasing safety concerns. Dust is generated due to procurement and transport of raw materials from quarries and borrows sites to the road construction area. These impacts will persist till the activity ceases. The regions especially downwind to the quarries/ borrow areas are more vulnerable to air pollution. Though the quarry materials are to be transported over long distances to the construction sites, almost all the quarries identified have proper access roads, therefore, no major impacts during the haulage of materials is envisaged. The impacts of crusher goes up to a distance of at least 1km and mainly results in dust generation. In addition to this there is change in physiography of the site due to storage of crushed and uncrushed	As part of the project preparation process, an evaluation of existing quarries in the project influence area has been carried out and the status in terms of the suitability of the quarry material and their adequacy for construction purposes have been assessed The mitigation measures for depletion of natural resources have been considered to be there as Government is issuing licenses of quarries considering all future planning and other development activities. If the contractors decide to use quarries not in the recommended list, they would require obtaining clearance from DOE. The EMPs has incorporated requirements that the contractor will have to fulfil before materials can be procured from quarries and crushers. These include verification of availability, currently valid permissions from regulators for both operations. To offset any possibility of spillage of quarry materials due to transport proper precautionary measures such as the covering of vehicles with tarpaulin shall be carried out. Further, it will be ensured that water sprinkling arrangement at crusher belt is working.	Preconstruction and construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	material at site.				
Borrow pits	Borrowing is to be carried out in accordance to the guidelines laid out by DOE. Also, productive agricultural areas have been avoided for borrowing. However, the borrow area pits, if not treated properly after the borrowing is complete, can form stagnant pools and pose health hazards to prevent which redevelopment of borrow areas need to be worked out. Cartage of the borrow materials to the construction sites is of significance, as almost all such areas are accessible through dirt tracks only and therefore, spillage and compaction of soil along these tracks will be a significant impact. Rehabilitation of borrow areas from which earth has been excavated, is a potential problem, which needs to be addressed. In addition to visual blight, safety issues shall also be considered.	No borrow area shall be opened without permission of the Supervision Consultant. The borrowing shall not be carried out in cultivable lands. Location of source of supply of material for embankment or sub-grade and the procedure for excavation or transport of material shall be in compliance with the environmental requirements. Redevelopment of the identified borrows areas will be worked out, as part of the project will be implemented to mitigate the impacts. These redevelopments will be in the form of fresh water fish ponds, levelled agriculture fields, plantation of trees, etc. To avoid any embankment slippage's, the borrow areas will not be dug continuously. In case borrow areas other than specified is selected, the size and shape of borrows pits will be decided by the Supervision Consultant. Borrowing of earth shall be carried out at locations recommended as per salient features described below: *Non-Cultivable lands:* Borrowing of earth will be carried out up to a depth of 1.0 m from the existing ground level. Borrowing of earth shall not be done continuously. Small drains shall be cut through the ridges, if necessary, to facilitate drainage. Borrow pits shall have slopes not steeper than 1 vertical to 4 horizontal. *Public or private agricultural lands:* Borrowing of earth shall not be carried out on productive lands. However, in the event of borrowing from productive lands, topsoil shall be preserved in stockpiles. A 150 mm layer of the top soil shall be stripped off from the area designated for borrowing and it shall be stored in stock piles in a designated area; having height not exceeding 2 meter and side slopes not steeper than 1:2. At such locations, the depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside. *Borrow pits on the riverside:* The borrow pit should be located not less than 15 meter from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. Precautionary measures like the covering of vehicles will be taken to avoid spillage during transport of borrow materials. To ensure that the spills likely to result from the transport of borrow and quarry	Preconstruction and construction phase	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
		materials do not impact the settlements, it will be ensured that the excavation and carrying of earth will be done during day time only. The unpaved surfaces used for the haulage of borrow materials will be maintained properly. The contractor shall evolve site-specific redevelopment plans for each borrows area location, which shall be implemented after the approval of the Supervision Consultant.			
Noise	Road noise depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/ deceleration/ gear changes by the vehicles depending on the level of congestion and smoothness of road surface. The baseline noise levels monitored at various locations along the project road indicate baseline levels below the permissible limits of DOE. Noise levels will increase significantly during construction phase due to movement of construction machinery and due to movement of vehicles during operation. As per the experience of consultants the noise levels at construction camp and construction site go up to 85 dB (A). But these will be intermittent in nature and during operation of heavy machinery set at site and construction camp. Noise levels during the pre construction stage are mostly expected to be indicative of prevalent baseline levels apart from localized noise levels at locations where preconstruction stage activities are taking place such as establishment of workers camps, stockyards. These increased noise levels will prevail only for a short duration during the pre construction stage. Moreover, as these activities are not likely to be placed near settlement locations the increased noise impact would be negligible.	The baseline monitoring indicates the noise levels below permissible limits of DOE along the existing road. However plantations will be made as precautionary measures.	Preconstruction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
	Due to the various construction activities, there will be temporary noise impacts in the immediate vicinity of the project corridor. The construction activities will include the excavation for foundations and grading of the site and the construction of structures and facilities. Crushing plants, asphalt production plants, movement of heavy vehicles, loading, transportation and unloading of construction materials produce significant noise during construction stage. Though the noise levels presented for the various construction activities far exceed the permissible	The plant and equipment used for construction will strictly conform to DOE noise standards. Vehicles and equipment used shall be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. The noise level from any item of plants (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front-end loaders, concrete mixers, cranes, vibrators and saws shall not exceed 75 dB (A), as specified in the Environmental Protection Rules. Noise mitigation at	Construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	standards, it is important to note that the construction noise is generally intermittent and depends on the type of operation, location and function of the equipment. Noise shall be mitigated at source wherever possible and mitigation measures as to regulate the timings of construction. The mitigation measures will include no construction activity at night in habitations, personal protected equipment to workers, etc.	source will include the use of silenced and super silenced equipment, use of portable noise barriers, wherever and mitigation measures to regulate the timings of construction. In construction sites within 250m of the nearest habitation, noisy construction work such as concrete mixing, batching will be stopped during the night time between 10:00 p.m. and 6:00 a.m. No noisy construction activities will be permitted around the silence zones, a distance of 100m from the sensitive receptors as hospitals, educational institutions, etc. Portable noise barriers will be installed at such locations. To protect construction workers from severe noise impacts, noise standards of industrial enterprises will be strictly enforced, and workers shall be provided with Personal Protective Equipment (PPE) such as earplugs. The construction camp will be located at least 1.5 km downwind direction of habitation. Monitoring shall be taken up at few locations of the alignment in addition to noise sensitive receptors where noise barriers have been provided, so as to ascertain any requirement for the provision of additional measures for the mitigation of ill effects due to increased noise resulting from the operation of the project.			
	The impacts due to noise during operations will be due to increased vehicular activity. This will be due to increase in vehicular flow. During operation the noise levels are not expected to go beyond DOE limits. Since increase in vehicle numbers is not expected to be significant, therefore, expected noise levels are not likely to exceed DOE standards.	During operation phase noise impacts will be mitigated to great extent through plantation.	Operation stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
Flora	The principal impact on flora involves the removal of trees for the creation of a clear zone. Reason for clearing trees is four folds: To prevent single-vehicle collision with the roadside trees, trees very close to the road need to be cleared. Roadside trees are safety hazards, particularly those trees with strong and rigid stems. Some trees are safety hazards because they preclude clear sight distances. Some trees (such as Tamarinds indicia) have a propensity to overturn when old and are potential safety hazards depending upon age and decay condition. All trees that are safety hazards need to be cleared. To ease construction of the embankment	The loss of trees is being compensated in accordance to the principles laid out in the Forest (Conservation) Act. The forest area lost due to widening will be compensated through compensatory forestation. Trees earmarked for felling will be removed only with prior approval of the District Forest Officer. The tree plantation cleared will be replaced and compensated prior to the commencement of construction. The monitoring and maintenance of plantation will be carried out by forest department. Necessary funds will be deposited by LGED in lieu of this assignment.	Preconstruction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	for the widened road formation and, to permit construction of adequate roadside drainage structure, trees located within the clear zone need to be removed. Trees need to be cleared to facilitate construction of traffic detours. The impact on roadside trees and plantation is described in the following sections. The project has a significant, direct and long-term impact on Roadside trees in the Pre-construction stage. The cutting of trees shall have manifold impacts. Most visible impact is the loss of shade. Also, there is a possibility of the local people being deprived of tree products, such as wood, fruits, leaves, etc. Removal of roadside trees will reduce comfort levels for slow moving traffic and pedestrians. This negative implication needs to be taken into consideration by compensating with new plantation along the RoW of the project road. The micro-ecosystems supported by the roadside trees are also a point of environmental concern. The removal of roadside trees will not only leads to erosion, and depletion of the ground water table, but also to the loss of the micro-ecosystems developed on the roadside. No impact is expected on forest as no acquisition of forest land is planned. The tree cutting in forest will not be done.				
	Accidental cutting of roadside trees may occur during the construction stage. It can also occur due to negligence from the construction crew. Therefore, it is essential that all trees that are to be felled be clearly marked. No other trees should be cut on site. Cutting of trees for fuel by workers, especially near their camps is also a concern, therefore adequate training of the workers, and availability of fuel are to be ensured by contractual obligations. As the project road passes through protected forests, the impacts during construction could include use of forest wood for cooking of food by the construction workers. Mitigation measures of these impacts have been given in EMP.	Apart from trees earmarked for felling, no additional tree felling within or outside the RoW will be carried out. No tree will be removed in the zone of construction (apart from those trees earmarked for felling) without the prior approval of the Department of Forests, through the Supervision Consultant. Construction vehicles, machinery and equipment will move or be stationed in the designated area only to prevent compaction of vegetation. In order to minimize impacts the construction activities will be limited during daytime only. In order to discourage the use of firewood for cooking the contractor shall provide supplies of LPG/ Kerosene free to the workforce at the worker camps.	Construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
	The impacts on flora during the operation stage can occur due to accidental collision of vehicles. Though improved safety on the project road is an objective of the project, the increased speed will mean that collisions will be more damaging to the	The tree plantation survival rate should be monitored carefully in initial three years. The minimum survival rate has been recommended as 75%. There is expected positive impact on flora due to compensatory plantation. In order to prevent	Operation stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
	flora than before. Moreover, increased pollutant concentrations on roadsides will mean harsher conditions for the newly planted roadside trees. Improved access to reserve along the project road can also make them vulnerable to illegal logging.	encroachment on the RoW, the plantation would be taken up in vacant spaces available. Monitoring will be taken up after each 5 years from the planting of roadside trees. It is planned to plant three trees for every tree to be cut.			
Fauna	There is no presence of wildlife along the selected rural roads. However, common domestic animals may be affected during the construction.	All construction activities will be carried out in such a fashion that damage and disruption to fauna will be minimum. The construction workers will be given instructions and trained to conserve/ protect natural resources and fauna.	Construction stage	Supervising Engineer with the Contractor	Environmental Consultant and DOE
Land acquisition	There will be no land acquisition for project road widening. However, at some locations land will be taken through involuntary donations. *Loss of Private Properties:* No loss of private properties is anticipated as road construction in habitations will be limited within available RoW.	Since no loss of private properties is anticipated therefore no mitigation measures are warranted.	-	-	-
Land use change	Since the existing cart tracks, poorly maintained roads are to be improved/ constructed change in land use is not expected. Reduced transportation costs and availability of high-speed transportation facilities for raw materials and products will be the most important advantage of the proposed construction of rural roads.	No mitigation measures are warranted as no change in land use along proposed rural roads is anticipated.	-	-	-
Exploitation of resource base	Development of a road in areas previously not easily accessible can work like a double-edged sword for the environmental resources in the area. While the road would unlock potential value in the area, stimulate growth and make the environment hospitable, at the same time, the rapid depletion of natural resources is also possible. Development of such vital infrastructure will lead to over exploitation of the environmental resources (e.g. too much groundwater pumping, indiscriminate wastewater disposal, etc.). While the medium term impacts may not be large enough to be noticed, the long-term implications of such depletion are potentially disastrous.	Proper planning and use of licensed quarries will avoid impacts on natural resource base.	-	-	-
Safety	The concern for safety stems from the proposals for faster vehicular movement along the highways. Though speedy travel is one of the objectives of the project, it also increases the intensity of loss in case of an accident. The project design takes care of safety measures for road users. Safety of pedestrians as well as of the vehicles plying on the road is given highest importance and adequate measures have been incorporated in the design of the alignment.	Construction activities cause hindrance to traffic movement. Traffic management plans shall be prepared. Signboards indicating construction sites on the road and flags shall be erected. All the signboards giving caution, barricades for diverting the traffic shall be as per specifications.	-	-	-

Environmental Issues	Impacts	Mitigation Measures	Time-frame	Responsibility	
				Implementation	Supervision
Archaeological/ protected monuments and other cultural properties	There is no archaeological/ cultural property in the influence area of the rural roads selected. Construction Stage, which involves not only the actual road construction process, but also allied activities such as movement of road machinery, hauls vehicles, etc. as well. These heavy vehicles need a belt of about 2m on the roadside for movement. Also, mixing, etc. activities need space along the road edge. Heavy and big machinery is not expected to be used in rural road construction. The movement is expected to be within the RoW. Hence no impact is envisaged.	The contractor shall keep a watch for any arte facts such as fabrics, coins, arte facts structures, or other archaeological relics. If there are discovered, the construction works will be stopped pending directions from the Archaeology Directorate who will be informed promptly. At these chance find locations, the contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and shall, immediately upon discovery thereof and before removal acquaint the PMU of such discovery and carry out instructions for dealing with the same, pending which all work shall be stopped 100m all directions from the discovery site. The PMU shall seek direction from the Directorate of Archaeology, before instructing the Contractor to recommence work on the site. Archaeologists will supervise the excavation to avoid any damage to the relics.	Construction stage		
Social	Significant negative social impacts in project are not anticipated. The rural roads are expected to have significant positive impact which will be assessed and monitored as per the approved document for the project.	-	-	-	-

2. Climate Change Adaptation Strategies/ Options

132. More recently, the Government outlined the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), a 10-year program to build capacity and resilience within the country to meet climate change challenges over the next 20–25 years, with six thematic areas: (i) food security, social protection, and health; (ii) comprehensive disaster management; (iii) infrastructural development; (iv) research and knowledge management; (v) mitigation and low-carbon development; and (vi) capacity building and institutional strengthening.

133. An important aspect of adaptation strategy will be awareness building among the stakeholders/ beneficiaries about climate change vulnerabilities through orientation workshop, capacity building of Local Government Engineering Department (LGED) staff and vulnerable community, demonstrations and motivation of the stakeholders to comprehend the climate change impacts on their livelihood and adaptation needs.

134. The BCCSAP expressed its concern by mentioning “we are still uncertain about the timing and exact magnitude of the likely impacts of climate change”. It is also necessary to understand the effect of sea level rise in our coastal areas within the context of our geo-physical and tectonic processes including tidal basin dynamics, dynamics of 600 million ton sediment load that our country annually receives, runoff and river morphological processes, the size of the river basin and so on before making any inference.

135. The area covered under the project is quite extensive. The area has variable micro climate condition and high hydrological variability is perceived. As such many of the areas are unique in its hydrological condition and are vulnerable to climate change. The project area consists of vulnerability from river erosion, wetland, low lying area, area prone to flood, draught, salinity intrusion, etc. The project should take care of this climate risks and vulnerability assessment during its design stage. Construction of the climate change resilience infrastructure will need hydrological investigation for fixing the crest level of the road embankment. Other community based adaptation activities will also be considered to reduce the vulnerability of the project adjacent communities.

a. Climate Change Resilience Infrastructure

136. The project aims to mainstream climate risk reduction into policy formulation and infrastructure development planning; capacity development to increase understanding of current and emerging climate risks and promote resilient decisions at central and local planning levels; and the demonstration of ways to effectively ‘climate-proof’ infrastructure with a view to systematically develop and apply climate resilient building codes and standards. A central element of the project is to examine climate change related risks with local communities and officials, and to make the experiences gained from the climate-proofing of critical infrastructure work for vulnerability reduction at all levels, using entry points of policy and regulatory revisions as well as climate-resilient development planning. Beside these, adaptation in terms of raising the height and strength and protecting the roads from damages due to climate change is essential from economic and social points of view. Specific affected water–related road infra-structural components are: flood proofing of roads, raising of coastal embankments with concrete top to be used as roads, water management for the road-crossing water-courses, etc. In addition, there would be requirement of repairing and maintenance of existing vulnerable rural infrastructures.

137. Due to Construction of an extensive network of rural road by LGED, the hydrological regime of many low lying areas has changed. In addition to that protecting the land from flooding and river erosion, BWDB has constructed high embankments and polders in and around the LGED built rural infrastructures. Data are not available to design those responding to the climate change scenario. Neither BWDB nor owner of the rural infrastructure i.e. LGED, has planned to collect information related to hydrological regime changes to design climate change resilience structure. Either LGED or concerned national agency responsible should collect the necessary and relevant hydrological data for designing the resilience structure that can mitigate and adapt climate change situation.

138. Major river bank erosion vulnerable to project area. A number of major rivers have passed through project area. The area of the project lying on the bank of River Bhairab, Rupsha and Shibsha is in the district of greater Khulna and on the bank of Mayur, Meghna and Pyra is in the district of greater Barisal. BWDB is facing serious problem every year in maintaining this huge embankment. The breaching of embankment is a very common phenomenon. The rural infrastructure including the road network is likely to be seriously affected by the breaching of the higher crest level of BWDB embankment. Moreover the lands are being taken away by river particularly those close to the major rivers. More detailed study and hydrological information needed in the design phase should be taken into consideration. The extent of vulnerability of the rural roads is highly dependent on the safety of the embankment and polders constructed by BWDB and other national agency.

139. The Project vulnerable to the wetland area. The project area is crisscrossed by many rivers. These rivers are flooded and water overflows on the banks. On inspection it can be found the LGED feeder road is at lower level than RHD road. The network of rural road has ravaged the whole wet land. The flood protection of BWDB failed many times creating damage to the rural road net work. Climate Change adaptability should consider more study on the change of hydrological regime that not only affects the hydrology of the wetland but also drainage congestion and creation of local flooding. Hydrological analysis may be required at design stage for constructing climate change resilience road embankment and other rural infrastructure.

140. Protection against road embankment slope failure: Care should be taken for the protection of the embankment due to possible rise of water level for climate change. The most vulnerable part is its slope. Either the design slope length should be given more than present situation or slope to be protected properly. The slope protection by hard material or geo-textile may be expensive. Protecting the slope by turfing with vegetation like grass is also good and inexpensive option. The other important aspect of embankment is that the soil should be compacted properly. Non compaction of soil needed under standard method may be the other cause of failure of the slope of the embankment. Immediate availability of the grass turfing on completion of the embankment may be a serious constraint. Growing grass turf on the slope is time consuming and may not serve the purpose. The construction of embankment is completed at the advent of the flood/ monsoon. The slopes are damaged not only by water level rise/ waves but there are chances of rain cut due to heavy rainfall. However, the project has plan for forestation of the slope. But caution should be taken to protect the slope before it gets damaged by water rise and rain cut.

141. Flooding created by increasing annual rainfall is a primary concern for protecting the existing road network and a threat for future investments in the transport sector. The project will have inbuilt support (quick mobilization of maintenance staff, dissemination of information etc.) at reducing the road network vulnerability to climate change.

142. The CCRIP will upgrade about 537 kilometers of rural roads through pavement, road asset management and capacity development and road safety measures. The climate change adaptation activities integrated in the project will strengthen the overall objectives of the project by providing protective measures for the infrastructure and by streamlining adaptation measures for future investments.

143. The climate change adaptation measures aim to reduce the severity of climate change impacts on the infrastructure and to improve planning to prevent and respond to climate change effects. Planned activities include vulnerability mapping of rural roads as well as designing and introducing adaptation strategies for roads to improve flood and drought management. Through civil works the resilience of infrastructure can be improved significantly.

b. Plantation and community afforestation/ reforestation

144. Despite all the arguments, Bangladesh might need to plan for several options for mitigating climate change, at least at local levels; emphasis on energy efficiency in the form of renewable energy development, large scale tree plantation projects, and appropriate urban waste management for the reduction of methane gas would be suitable as climate change mitigation. Large scale tree plantation may help to develop microclimatic conditions in an area by lowering temperature, instigating rainfall, helping groundwater recharge by intercepting rainwater, prevent soil erosion, act as wind breaks and so on. In addition to these direct impacts, there are many off spin benefits of vegetation coverage in an area such as, soil formation, habitat maintenance for different species and to keep biodiversity rich. These benefits, in turn, may act as the base of climate change adaptation.

c. Objectives of Tree Plantation

145. Plan for tree plantation should be formulated at the time of finalizing the detailed project report for construction/ upgrading of rural roads. Some of the objectives of tree plantation along rural roads are:

(i) To create a green belt and avenues for meeting aesthetic recreational needs and thereby providing shade to pedestrians and reduce ambient temperature;

(ii) To reduce the surface run-off discharge and checking erosion in the downhill side especially in hilly regions;

(iii) To create a storehouse of genetic diversity by planting all the indigenous trees, shrubs, herbs, climbers, creepers, conifers and green foliages including fruits and medicinal plants;

(iv) To reduce the encroachment of road reserve areas;

(v) Drought proofing (including afforestation and tree plantation) e.g. pasture development, block plantation, horticulture plantation, avenue plantation; and

(vi) The raising of nurseries, plantation of saplings and maintenance of trees would generate employment opportunities for the local people and also provide a sustainable source of fuel wood for the rural communities.

d. Green Road Concept

146. During early nineties, most of the plantation was raised using fast growing exotic plants species like Eucalyptus, Acacia, etc. to meet the urgent demand of local peoples for fuel wood

and timber. Earlier practices for raising roadside plantation were based mostly on community needs and stabilization of roads. However, experience shows that these types of practices was harmful for native biodiversity and these was also criticized by the environmentalist as values for ecosystem service was not considered in most of the past plantation activities. In the recent time environmental practitioners are also considering climate change adaptation (CCA) and disaster risk reduction (DRR) components in plantation design and programs. However the concepts on environmental conservation, CCA and DRR are not much familiar among the agencies (e.g. LGED, FD, BWDB) that are involved with massive roadside plantation. Plantation should also be designed in such a way that it can be used for carbon trading in near future. So the plantation will serve for climate change adaptation as well as for mitigation. Inter-cropping and cover cropping can also be practiced between the spaces of seedlings which could provide intermediate benefit to the local community. ADB is much experienced to design such strip plantation along the roadside as it has gained significant experience during implementation of 'Community Forestry Project', Thana Afforestation and Nursery Development Project, Forestry Sector Project, Coastal Greenbelt Project, etc. So earlier plantation design for road/ embankments should be significantly improved considering the following criteria.

e. Species selection criteria

147. The species selected for plantation should:

(i) reflect the needs, demands and priorities of local communities;

(ii) biologically suitable for the native ecology and popular demand by the community - timber yielding plants, fruit trees, fuel wood, soil binders, fodder, medicinal plants and plants with special conservation value;

(iii) well adapted to the local site, have aesthetic values and conducive for native biodiversity;

(iv) serve as a natural barrier for storm surge and high wind; and

(v) sink significant amount of carbon in near future.

148. Considering above issues, ADB could develop an environment friendly plantation guideline for infrastructure (e.g. road, embankment) project through CRIIP to make the infrastructure project more ecological and climate resilient.

149. LGED should take up the plantation of fruit or other multi-purpose trees on both sides of the rural roads under Smallholder Diary Commercialization Program (SDCP) of Department of Agricultural Extension (DAE), Ministry of Agriculture. However, certain precautions must be taken in design of avenue or cluster plantation so that the trees do not have an adverse impact on road maintenance and/ or safety of the road user. Emphasis must be placed on a greater involvement of communities in planning, maintenance and upkeep of roadside plantation.

V. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

A. Institutional Requirements

1. General

150. The findings from assessment of the potential environmental impacts shows that the Environmental impacts of rural roads are similar with environmental impacts identified in the

standard Environmental Management Plan (EMP). Therefore, the standard EMP has been attached in the bidding document for Project. The environmental management plan from this study will be used as an input for revising the standard EMP. The revision of the EMP includes implementation actions, responsibilities and timeframes specified for each component and an adverse impact. The revision of the EMP will be carried out separately, and when the revised EMP is approved, it will be implemented for the Project.

2. Institutional Requirements for Overall Implementation of EMP

a. Institutional Requirements – Construction Stage

151. The 537 km of roads will be packaged into several construction contract packages (district wise) by the Project Implementation Unit (PIUs). In order to support PIUs on technical matter LGED has appointed Technical Support Consultants (TSC). The technical support consultant has environmental expert in their team. The environmental expert of TSC will continue to periodically review the environmental safeguard compliance at site as well as through report and documentation submitted by LGED. The Project Implementation Consultant (PIC) on behalf of PIU will continue to supervise the construction works and will act as Construction Supervision Consultants. Each of the PICs has one Environmental Consultant (EC) in their team. The contractor shall engage the Field Environmental Officer, who will be responsible in implementing EMP.

152. The EC will be responsible to ensure adherence and implementation of the Environment Management Action Plan (EMAP) at all stages of works by the contractor. The EC, if found warranting may also conduct field tests, independent of the contractor to determine the effectiveness of EMAP under approval of PIC/ PIU.

153. The broad duties/ responsibilities of the Environmental Consultant will continue to include:

(i) Review of project design and specifications to ensure their adequacy and feasibility with respect to the implementation of EMAP and or Environmental Code of Practices (ECoP).

(ii) Collection and dissemination of relevant environmental documents including amendments to environmental protection acts issued by the various agencies, namely, ADB, DOE and local bodies;

(iii) Interact with the counterpart of the Contractor(s), review work progress/ plans and ensure implementation of the EMAP;

(iv) Co-ordination with the nongovernment organizations (NGOs), community groups and Government departments on environmental issues, provide clarifications/ and obtain clearances during project implementation if any, as required from the regulatory authorities and/ or submitting periodic compliance reports as required by the DOE Authorities;

(v) Monitoring sensitive environmental attributes during construction to ensure that the suggested mitigation measures in the EMAP are implemented;

(vi) Documentation of the environmental management/ monitoring activities for the regular project implementation progress report; and

(vii) Conducting environmental training/ awareness programs for the contractors, the project implementation personnel and the communities.

3. Capacity Building of LGED

154. The Environmental Unit (EU) is now headed by a Superintending Engineer, who has full-time responsibilities in another LGED sector. The EU has only two full-time positions at present: one Executive Engineer and one Assistant Engineer. It is highly unlikely that, with such small personnel strength, the EU will have the capacity and expertise to perform oversight responsibilities for the vast number of LGED's ongoing and forthcoming projects. EU should ideally comprise of a team having academic degree in Environmental Science (Environmental Chemist, Biologist, Ecologist), or Environmental Engineering (having courses in Air Quality, Health & Safety, Agronomy, Industrial Hygiene, Water Quality, ETP Designing, etc). The social scientist, economist can be drawn from socio-economic specialist unit and need not be included in EU. It is, therefore, suggested that the EU be expanded into a team of seven full-time environmental scientists/ Engineer: one senior level, two mid-level, and four junior level experts; with provision for mid- and junior level environmental scientists to participate in in-country as well as foreign post graduate diploma program and short training courses on environmental issues. The EU's mandate and responsibilities should include assistance and advice for the consultants in project feasibility studies, project formulation and project implementation, and retaining liaison with the Department of Environment. The EU will also play a proactive role in environmental monitoring during project implementation as well as in undertaking post-project evaluation of projects in order to assess environmental compliance and develop future strategies on the basis of `lessons learned'. The EU will also be entrusted with the task of organizing and administering training modular courses for the LGED staff and other stakeholders on environmental assessment and monitoring, social impact assessment, and public consultation/ participation including Participatory Rural Appraisal techniques. Training on participatory techniques is extremely vital on account of the LGED's current strategy and principle of involving all stakeholders at all stages of the project cycle. Recruiting additional expertise in environmental assessment and monitoring will help enhance the capability of the environmental unit of LGED.

155. In addition, several specific recommendations are listed below:

(i) Participatory planning is a central concept in this project, and this model of participation of beneficiaries/ stakeholders by disclosing the information of the project and undertaking consultation should continue to be the focal mode in its design, implementation, and operation and maintenance.

(ii) The decision makers, the field staff, the contractors, the local government representatives, local NGOs, local community leaders/ elites should be sensitized on environmental issues and concerns through contact meetings, focus group discussions, illustrated booklets, mobile film shows, and in some cases, through short one- or two-days' training modules.

(iii) Embankment height should be carefully designed after detailed local and regional hydro-meteorological data are collected in order to avoid/ prevent any post-project flood proneness and road submergence.

(iv) Hydrological studies should precede any selection, design and construction of submersible roads in `*haor*' or *beels* (wetlands) areas districts to achieve maximum benefits from such roads.

(v) Special caution is advisable in undertaking improvement works in such subprojects which are located near or in the fringes of ecologically sensitive area.

(vi) Subprojects located close to the major rivers and subject to bank erosion and loss of land may consider the construction of flood shelters on roadsides, which might be used as schools or community centres in normal times (to avoid encroachment by squatters).

(vii) The Project Management Office (PMO) must ensure that the destitute women grouped into Labour Contracting Societies or engaged in any caretaking maintenance tasks are paid their committed salaries regularly and transparently.

(viii) The LGED should expand its Environmental Unit (EU) with recruitment of additional environmental expertise and expand its monitoring, supervision and advisory roles.

(ix) Occupational health and safety for the persons engaged in handling chemicals (fertilizer, pesticides, hazardous chemicals, etc.), farm machinery (power tillers, tube well pumps etc), transports (driving, repair etc.) has been investigated and mostly they need some kind of training while discharging their professional duties. Community health and safety is also an important issue for the rural people because they will be coming across all these kind of hazards. Addressing community health issue is connected with healthy work force in the rural area.

4. Training the professionals to develop institutional capacity:

156. To meet climate change challenges over the next 20–25 years LGED professionals need extensive training to build capacity on climate change resilience in the (i) design and implementation of climate change resilient rural infrastructure; and (ii) institutional strengthening for planning through research and knowledge management that acquired for climate change adaptation. This capacity building may be through recruitment of environmental professionals with appropriate degree, present professionals including engineers of LGED with proper academic qualification, and put them in appropriate training, workshop, seminar etc. both within and outside the country.

B. Environmental Monitoring

1. Implementation of EMP at the Project level

157. The LGED through its PMU is responsible to implement the overall EMP. However, during the construction stage, the contractors are responsible to mitigate all environmental impacts related with the construction activities. In this context, the EMP has been included into the Bidding Documents (BD) of all the construction packages so that it serves as a condition of contract for adopting the ECoP by the prospective contractor(s). The implementation of the EMP and/ or ECoP by the contractor (s) is to be supervised by Construction Supervision Consultant in close consultation with the PMO of LGED and the PIC.

2. Implementation of Environmental Monitoring at the Project level

158. The PIU with assistance from PIC will undertake suitable environmental monitoring during the construction and right after the completion of the construction activities.

C. EMP Cost Matrix

Table 10: Environmental Management Action Plan for Pre-Construction & Construction Phases

Project Action/ Environmental Attributes	Mitigation Measures	Implementing/ Responsible Organization	Cost in lacs(BDT)
Diversion of traffic	• Appropriate traffic diversion schemes shall be implemented so as to avoid inconvenience due to project operations to present road users, particularly during nighttimes. • Proper diversion schemes will ensure smooth traffic flow minimizes accidents, traffic snarl ups, and commotion. • The diversion signs should be bold and clearly visible particularly at night.	Consultants and contractors	5.0
Construction Camp Sites	• The construction campsites shall be away from any local human settlements and preferably located on lands, which are not productive barren/waste lands presently. The camps shall have adequate water supply, sanitation and all requisite infrastructure facilities. This would minimize dependence of construction personnel on outside resources, presently being used by local populace and minimize undesirable social friction thereof. • The camps shall have septic tank/ soak pit of adequate capacity so that it can function properly for the entire duration of its use. • All construction camps shall have rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The construction camps shall have health care facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The camps shall have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. • All construction camps shall have rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The construction camps shall have health care facilities for adults, pregnant women and children. • All construction personnel shall be subjected to routine vaccinations and other preventive/ healthcare measures. • The construction camps shall have in house community/common entertainment facilities. Dependence of local entertainment outlets by construction camps should be discouraged /prohibited to the extent possible	Supervising engineer with contractor and Department of Environment	10.0

Project Action/ Environmental Attributes	Mitigation Measures	Implementing/ Responsible Organization	Cost in lacs(BDT)
Work sites	• All personnel in work sites shall have protective gears like helmets, boots, gloves, etc. so that injuries to personnel are minimized. • Children and pregnant women shall not be allowed to work under any circumstances. • No personnel shall be allowed to work at site for more than 10 hours per day (8 hour makes one work shift). Personnel who are likely to exposed to noise levels beyond stipulated limits shall be provided with protective gears like ear plugs etc and regularly rotated. • Regular water sprinkling of water shall be ensured so that dust levels are kept to minimum	Design consultants Supervising engineer with contractor and DOE	5.0
Construction Equipment Vehicles	• All equipment/ vehicles deployed for construction activities shall be regularly maintained and not older than 5 years. • Vehicles/equipment shall be regularly subjected for emission tests and shall have valid Pollution Under Control certificates. Revalidation of certificates shall be done once in a month. • All vehicles deployed for material movement shall be spill proof to the extent possible. • In any case all material movement routes shall be inspected daily twice to clear off any accidental spills.	Design consultants Supervising engineer with contractor and DOE	15.0
Water resources & drainage channels	• The rural road construction will also require construction of several cross drainage structures, minor and major bridges to facilitate development in accordance with design requirements and standards. • Impacts arising out of construction of drainage structures is not likely to impact drainage pattern since under the road design, pattern of flow and discharge capacities of all drainage structures are reviewed and designed to negate any heading up or flooding problems. • Impacts on water quality are not significant or either negligible since construction activities to be scheduled to complete during dry months of year. • Adequate precaution is to be taken to prevent oil/lubricant/hydrocarbon contamination of channel beds. Spillage if any shall be immediately cleared with utmost caution to leave no traces. • Channel beds are to be cleaned up (50 m u/s & 50 m d/s sides of water courses) and restored to its previous state after completion of construction but prior to onset of monsoon.	Design consultants Supervising engineer with contractor and DOE	30.0
Borrow areas	• Borrow areas identified/ suggested during project preparation are to be investigated for presence of ecologically sensitive areas if any and cleared thereof. • Within these locations, the actual extent of area/zones to be excavated areas is to be demarcated with signboards. All such operational areas are to be access controlled particularly for locals and for grazing	Supervising engineer with contractor	10.0

Project Action/ Environmental Attributes	Mitigation Measures	Implementing/ Responsible Organization	Cost in lacs(BDT)
	cattle. • Through this project, the borrow areas/pits may be converted into surface/ ponds wherever possible, as a derivative of development. Some of the ponds could serve as source of water for agriculture, a practice prevalent in some part of the country. • The top soil recovered from newly acquired land areas for road construction is preserved and used for turfing of embankment(s) of project highway.		
Air Quality	• All operational areas under the road construction works are to be regularly monitored (at least once in a season) for air quality parameters such as SPM, RPM, SOx, NOx, HC, CO etc. • This will ensure identification of operations/ areas of concern with regard to air pollution. Operational areas include, work sites, haulage roads, hot mix plants, quarries, borrow sites, human settlement etc. mitigation measures such water sprinkling for dust suppression, permitting construction equipment/vehicles having Pollution Under Control certificates will reduce work area concentration of air pollutants like RPM, SO2, NOx, HC, CO etc. does not exceed permissible limits and therefore does not contribute to build up of pollutants	Supervising engineer with contractor and DOE	5.0
Soil erosion and conservation	• Along rural roads the widening activities will raise, extend and enlarge existing roadway/tracks all along the alignment therefore mitigation measures to contain erosion and drainage problems are essential along RoW • Measures to ensure embankment stabilization including selection of less erodable material, good compaction, re-vegetation, placement of gabions or any suitable measures around bridges and culverts etc. (in case required) are included in technical specification and contract documents. The engineering measures for countering soil erosion, slope protection, drainage wherever required considered for project highway and detailed project report. • Many of impacts on soil due to road construction can be significantly mitigated by some of the following measures a) Minimizing area of ground clearance only to the extent required. b) Balancing the filling and cutting of earth to the extent possible. c) Avoiding creation of cut slopes and embankment which are of an angle greater than natural angle of repose for locally available soil type. d) Replanting disturbed area(s) immediately after disturbance due to construction has stopped and not after construction has been completed.	Design consultants Supervising engineer with contractor	50.0

Project Action/ Environmental Attributes	Mitigation Measures	Implementing/ Responsible Organization	Cost in lacs(BDT)
Hot Mix Plants	• Hot mix plants shall be at least 1.5 km away from any human settlements and preferably located on leeward side. • Hot mix plants/sites shall be located on barren/ uncultivable lands. Diversion of cultivable/ agricultural lands, even preferred by local people for economic gain shall not be allowed unless otherwise warranted by specific local conditions.	Design consultants Supervising engineer with contractor and DOE	5.0
Loss of fertile soil	• Clearing operations within RoW and at all places of operational areas like borrow areas, work areas, labour camps, construction of new/ upgradation of existing to new haulage roads, hot mix plants, storage areas etc. shall consider preservation of fertile soil . • As a first option, topsoil should be restored to its initial place after the specific activity is completed for which the area was vacated, or for enriching some other place like embankment slopes for turfing/ erosion protective measure. The topsoil can also be used for supporting re-plantation activities within RoW/ median.	Design consultants Supervising engineer with contractor and DOE NGOs, LGED	20.0
Location of campsites, storage depots	• The location of campsites, storage depots shall preferably be on unproductive/ barren lands, away from forest areas (minimum 1.5 km). • Use of agricultural/ cultivable lands shall not be allowed under any circumstances. • All fuel loading, unloading, storage areas shall be spill proof, leakage proof and carried out on paved areas. • The sites shall have suitable system to drain storm water, sanitary facilities and shall not contaminate any nearby water courses/ drains. • The site shall also have a system for handling any emergency situation like fire, explosion etc.	Design consultants Supervising engineer with contractor and DOE , LGED	10.0
Storage of hazardous materials	• All areas intended for storage of hazardous materials shall be quarantined and provided with adequate facilities to combat emergency situations. • The personnel in charge of such areas shall be properly trained, licensed and with sufficient experience. • The areas shall be access controlled and entry shall be allowed only under authorization	Supervising engineer with contractor and DOE, LGED	5.0
Total			**170.0**

Table 11: Environmental Monitoring Control Matrix – Construction Phase

Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP of IEE)	Monitoring Frequency
Setting out & clearing RoW	Archaeological evidence/ idols/ tombs if noticed/ found – inform Archaeological Department	Weekly
Relocation of Utilities	Ensure complete restoration without impacting existing users	Weekly
Traffic Diversions & Sign Boards	Diversions to be smooth sign boards in place, clear & bold particularly in night & cause least inconvenience to road users	Weekly
Borrow Areas	Seek prior approval from local environmental regulatory agencies and compliance at all stages of operations. After borrowing ensure re-vegetation, drainage, erosion protection as per EMAP	Monthly
Work sites	Comply with local Environmental regulations for air quality, noise, occupational hazard & safety procedures at all stages of work	Weekly
Ground water level in and around construction tube wells	Bore wells shall be away from human settlements; determine sustainable yield and restrict withdrawal of water within yield recommended for region. Monitor depth of water below ground level in wells in and around construction tube wells before start and after completion of water withdrawal for the day	Monthly
Construction Equipment/Vehicles	Ensure vehicles are regularly maintained; have pollution under control certificates revalidated every month	Quarterly
Air quality at all operational areas under Project	Record SPM, RPM, CO, HC, Nox, SO2 levels for 24 hourly in 8 hr. shifts as per methods/ procedures recommended by Central/ State pollution Control Board	Weekly
Noise at all operational areas	Record noise levels at every 5 minutes for 24 hours (both day time & night time)	Monthly
Top soil from land clearing operations	Preserve and restore the topsoil. If cannot be used for restoration, divert for other applications like re-vegetation, embankment turfing and alike	Weekly
Hot Mix Plants	Located at least 1.5 km from settlements, barren land and not agricultural lands. Monitor air quality, waste discharge and noise levels regularly as mentioned under Sl. No. 10, 11 above. Ensure all operations comply with local environmental Regulations	Quarterly
POL (liquid & solid waste) /Hazardous Storage Areas	POL storage areas have impervious lining, containment ditches, oil & grease traps as per EMAP. Regular inspection & Maintenance. Comply all local environmental regulations	Weekly
Soil erosion and conservation	Borrow areas shall have gentle slopes connected to nearby natural water bodies, re-vegetated	Monthly
Channel / River beds	Ensure most activities are scheduled for dry months reshaping of channel bed after completion of construction	Monthly
Water Supply Sanitation & Health at camp sites	Adequate water supply as per norms septic tanks and soak away pits. Kerosene and LPG supply, health care facilities vaccination for work force camps	Weekly
Construction of Noise Barriers	Consult affected parties like hospitals, educational institutions for eliciting opinion during constructing barriers	Quarterly

159. Estimates for Environmental Specialist Consultant Inputs: Environmental Specialist Consultant's inputs for CCRIP for implementation of EMP are estimated and given below:

Table 12: Estimates for Environment Specialist Consultant Inputs

item	*Input in man months*						Total mm	Budget
Period	2013	2014	2015	2016	2017	2018		(US$)
National Environmental Specialist (intermittent)	----------	----------	----------	----------	---------	---------	36	90,000

VI. PUBLIC CONSULTATION, INFORMATION DISCLOSURE AND GRIEVANCE REDRESS MECHANISM

A. Public Consultation

1. Introduction

160. Successful implementation of the project requires co-ordinated efforts of various stakeholders at different levels. Hence, consultation at different levels was used as a tool to inform and educate stakeholders about the proposed action both before and after the development decisions were made. Public consultation was useful for gathering environmental data, understanding likely impacts and community's needs and preferences.

161. The various alternatives could be evolved and sustainable mitigation measures could be formulated through consultations. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process helped in reducing the public resistance to change and enabled the participation of the local people in the decision making process. The involvement of the various stakeholders ensured that the affected population and other stakeholders are informed consulted and are allowed to participate at various stages of project preparation.

162. The public consultation was carried out on March 2012 to April 2012 as part of the field works.

2. Objectives

163. The main objective of the consultation process was to find out the ways and means to minimize negative impacts of the project and to maximize the benefits of the project. Other objectives of the consultation process were the following:

(i) To promote public awareness about the proposed project especially amongst the potentially impacted communities/ individuals;

(ii) To educate the communities/ individuals close to project roads about the proposed course of action and the project alternatives;

(iii) To solicit the views of communities/ individuals residing near rural roads proposed for construction on environmental and social problems;

(iv) To gather inputs from the affected communities/ individuals in crucial decisions regarding mitigation of the identified environmental and social issues;

(v) To stimulate community's self evaluation and analysis; and

(vi) To ensure lessening of public resistance to change by providing them a platform in the decision making process.

B. Methodology

3. Methodology Adopted for Public Consultations

a. Stages and Levels of Consultation

164. Public consultation was conducted both at screening stage as well as IEE stage. Consultations conducted at screening stage played an important role in scoping the level and extent of consultation to be taken in the project preparation stage. Public consultations have been held at three levels as

(i) Local level (village level/ block level) villagers through which roads are passing;

(ii) District level consultations involving Deputy Commissioner, Executive Engineers, revenue department;

(iii) PIO officials, UZ Engineers of Local Government Engineering Department (LGED); and

(iv) Institutional level consultations.

b. Tools for Consultation

165. Public Consultation was done using various tools including, formal/ informal discussion with Union Parishad chairman and members, Government officials and other stakeholders.

166. During the transect walk, consultations were held with the UP officials and villagers. Also during the reconnaissance survey and site visits, discussions were carried out informally drawing people into dialogue to obtain an overview of likely impacts and concerns of the community. Consultation was held at several locations along the rural roads alignment covering areas where public activity was intense and close to proposed alignment covering owners of houses located close to rural roads.

167. A checklist of questions was kept ready and responses were elicited from people and guidelines were issued to field assistants for the purpose of Institutional Level/ Stakeholders Consultative Workshop.

168. The institutional level consultations were held with representatives of institutions having stakes in implementation of the project. The institutions contacted included fisheries, forest department, local DOE etc.

169. In addition to the official listed above the officials from other departments were also contacted on several occasions. The contacted officials included Tehsildars[16], NGOs, industry department and respective – district and Upazila Offices.

c. Contents

170. The consultation with institutional officials focused on the following issues.

[16] Government officer in charge of the collection of revenues, etc. in a tehsil

(i) Project description: - Need for the construction of rural roads and benefits of the project.

(ii) Social and environmental assessment processes for the government and the multilateral funding agency requirements.

(iii) The extent/ nature of negative social and environmental impact and the need for rehabilitation and resettlement in the project. Avoidance & mitigation aspects in the project.

(iv) People's participation in planning, implementation and Monitoring & Evaluation Stage.

C. Results of Public Consultation

1. Public Hearing, Issues Raised and Community Perception

171. Some of the general issues raised during the different consultation sessions can be summed up as follows.

a. Water Logging and Drainage

172. Participants had a fear that construction of rural roads with new alignment may alter natural drainage pattern in the area and may cause flooding and water logging in the agriculture fields if adequate cross drainage structures are not provided. Loss of Livelihood and Income Restoration Options are necessary.

173. This issue was raised by maximum number of villagers, as loss of fertile land will deteriorate their income sources.

b. Road Safety

174. Safety issues were paramount in all the consultation sessions. Women participants raised the issue of their children's safety.

c. Land Acquisition

175. People were concerned about the land requirements of the project and impact on their agriculture land. They were also of the view that community should be consulted before the road designs are finalized. It was explained to the people that there would not be any land acquisition since the activities would be carried out in the existing land under use by the proposed subprojects.

d. Loss of Idols/ Shrines/ Cemetery

176. Participants showed resistance for shifting of mosque, worship of idols, burial grounds and other religious structures at certain locations.

e. Loss of Trees Due to Road Construction

177. Respondents were of the opinion that trees cutting should be avoided or else minimized. For trees to be cut compensatory plantation should be done. Some villagers expected additional plantation should be done. Recommended tree species for plantation were other local varieties.

f. Impacts on Health

178. Separate consultation sessions were organized by social team to identify issues pertaining to health specifically for sexually transmitted diseases (STDs). Settlements along the rural roads were reported to be getting exposed to such diseases as there are no long distance users on the project roads.

g. Employment during Construction

179. The locals demanded that locals should be given preference in employment during project implementation.

h. Perceptions and Expectations

180. Perceptions and expectations of the community recorded during the consultation sessions can be broadly listed as:

(i) The public and the PAPs appreciate the rural road construction;

(ii) Community in general appreciated overall benefits to the community resulting from project development;

(iii) Aware of the increased access, less travel time in commuting after project implementation; and

(iv) Expect better management of traffic and necessary noise barriers at educational and health facilities during construction;

D. Public Consultation and Information Disclosure

181. The project has tried its best to address all the issues raised during consultations and disclose all the plan for the project so that public is being fully informed about what is going on. Some of the provisions made under the project to disclose plan to the public to address the issues and concerns of the community.

1. Information Disclosure

182. Since the proposed CCRIP is mainly an improvement/ upgrading and/ or rehabilitation project comprising a large number of schemes, and does not involve new and major road construction, it is considered as a Category B project and accordingly, this report is organized as an IEE report.

183. The environmental assessment process under the ADB's Safeguards Policy Statement requires the disclosure of the IEE in an accessible place and language to the public during the completion of the IEE. The LGED is to provide a Bengali version of a summary IEE in public places with providing relevant environmental information, including information from the documents as above in a timely manner, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. For illiterate people other suitable communication methods will be used. The LGED will also organize meeting/ seminar in the locality to inform effectively. This process will be concluded with the EU providing copies of the IEE for display at the district and Upazila level during the same period when the IEE is disclosed on the ADB website.

2. Grievance Redress Mechanism

184. To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a grievance redress mechanism is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns.

185. The EU of LGED will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project. It should address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism should not impede access to the country's judicial or administrative remedies. The affected people will be appropriately informed about the mechanism.

186. The project management unit (PMU) and PIOs shall make the public aware of the grievance redress mechanism (GRM) through public awareness campaigns. The contact phone number of the respective PIOs and the PMU will serve as a hotline for complaints, and shall be publicized through the media and placed on notice boards outside their offices and at construction sites. The project information brochure will include information on the GRM and shall be widely disseminated throughout the corridor by the safeguards officers in the PMU and PIOs, with support from the NGO and communications firm. Grievances can be filed in writing or by phone with any member of the PMO or PIO.

Table 13: Disclosure of the project plan, general issues and concerns under the project

Issue/ Concern	Disclosure of the plan under the project
Water Logging and Drainage	Adequate cross drainage structures have been planned
Road Safety	Adequate safeyy signages have been planned all along the rural road
Land acquisition and Mode of compensation	The proposed RoW is sufficient. No land acquisition is planned in project road.
Loss of trees Compensatory	Afforestation would be done at the ratio of three trees for each tree to be cut
Utilities and basic Infrastructure	All the utilities, electric poles, telephone lines, wells, tube wells etc. to be impacted will be relocated under the project cost
Employment of locals during construction	Locals will be given preference for employment during the project implementation

187. The proposed CCRIP had participatory consultations as one of the basic tasks in project design and formulation. As part of the preparation, it was decided to consult with representatives of different stakeholders and potential beneficiaries as stated above in the project area and receive their feedback with a view to finding out their perceptions, needs, expectations and grievances.

188. Participatory consultations also formed an integral part of field assessment of the environmental impacts and climate change issues in the sample sites. The use of Rapid Rural Appraisal (RRA) methods enabled the investigator to interact. A significant aspect of public consultations on environmental issues is that the local population is generally aware of the important local environmental problems, and they are in favour of local and minor interventions to protect their lands in terms of flood hazards, water logging, irrigation facilities, and improved

forecasts on heavy rainfall. Nonetheless, almost all respondents expressed support and approval of the CCRIP objectives.

VII. FINDINGS AND RECOMMENDATIONS

A. Findings

189. This IEE concludes that the environmental impacts will be manageable if the mitigation measures are implemented thoroughly. The Environmental Management Plan (EMP) is based on the type, extent, and duration of the identified environmental impacts. The EMP has been prepared with close reference to best practices and in line with the ADB's Safeguards Policy Statement (SPS). The responsibilities for the implementation of mitigation measures and the parties responsible will be clearly defined in contracts and agreements, and the implementation by various parties will be monitored by PIUs with assistance from EU. The findings and recommendations of the IEE for the rural road construction works are summarized hereunder:

190. The IEE of rural roads, which represent the CCRIP, was prepared by using the environmental checklist in compliance with the agreed Environmental Assessment Review Framework (EARF) of the Rural Road Project.

191. The potential impacts have been screened in accordance with the Environmental Assessment Guidelines, 2003 of ADB and required adequate mitigation measures have been suggested and have been reflected in the EMP.

192. The anticipated environmental impacts are largely generic in nature and can be mitigated by adopting suitable mitigation measures.

193. The Institutional Requirements for the implementation of mitigation measures has been identified along with the frequency of monitoring EMP.

194. The IEE also indicate that rural road construction works does not warrant further EIA study for subsequent rural road construction works.

195. These findings are based on the environmental checklist that served as IEE and the field work to verify the environmental checklist.

B. Recommendation

196. It is recommended that the EMP given be implemented with input from the local consultant and at the same time providing in house capacity building among LGED official and awareness building among the stakeholders.

197. The CCRIP falls under Category B on the basis of findings from the IEE and the completion of the Rapid Environmental Assessment (REA) checklist, which reviewed the environmental implications of the project. An IEE was carried out to screen the potential adverse impacts of the project interventions and suggest avoidance/ mitigation measures. Environmental issues and parameters that are relevant to the project were identified through literature review and scoping. Apart from direct and current relationships of environmental issues with the program, climate change impacts and adaptation options were also given special attention.

198. Scoping and field visits to 3 core subproject sites, using a field survey checklist, identified the environmental parameters/ components (relevant to the project actions) which are susceptible to be affected, and evaluated the perceptions of the local population on the general environmental health and climate change issues. These parameters include soil, land levels, drainage, flood proneness, general environmental health, use of chemical fertilizers and pesticides, and climate change awareness. Field assessments confirmed that the project actions related to land loss, slope protection, tree cutting, relocation of structure are the only few parameters which have minor negative environmental impacts.

199. An environmental monitoring plan is also proposed, to be carried out during both the project implementation phase and the post-project (long term) phase under the baseline (current) scenario as well as under the climate change scenario (medium to long term). The objectives of environmental monitoring for the CCRIP would be a continuous surveillance program to identify/ detect both positive and negative impacts on the improvement of rural infrastructure. The project staff, trained in environmental issues and climate change impacts, will work out monitoring and compliance programs during the project's implementation.

200. On the basis of the findings of the IEE – including through public consultations at the workshops and at the grassroots level in the field - it is concluded that the project is not expected to impact the environment adversely, and that a detailed Environmental Impact Assessment (EIA) is not required for this project. Hence, this IEE, along with its mitigation, monitoring, and institutional programs, becomes the completed environmental assessment (EA).

201. Whereas the implementation of the environmental mitigation measures during the construction period will be assigned to the contractors, experience suggests that contractors may have little impetus or interest to deal with environmental problems in the absence of performance-linked criteria. Therefore, the required environmental mitigation must be clearly described in the contract documents at the bidding stage, and environmental performance and the completion of mitigation should be linked to payment schedules in the contracts.

202. Environmental impact and compliance monitoring activities will focus on compliance with conditions of licenses from DOE and EMP provisions, recording implementation of mitigation measures, recording environmental parameters, reviewing contractor environmental performance, and proposing remedial actions to address unexpected impacts and complaints.

VIII. CONCLUSIONS

203. Based on the review of the environmental checklist for rural road and verification through field visit as part of the preparation of this IEE report, it shows that associated potential environmental impacts of this project are insignificant, and temporary, which will mostly occur only during the construction stage. All the potential environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EMP.

204. As already mentioned, the proposed project, i.e. widening and strengthening of the road network by creating additional road capacity between different points of the road network will improve operational efficiency and can act as an effective mechanism for reducing economic and environmental costs of the road stretches. The project will bring considerable improvement to possible exposure levels of population when compared with no project scenario.

205. Overall, the major social and environmental impacts associated with the proposed projects are limited to the construction period and can be mitigated to an acceptable level by implementing recommended measures and by best engineering and environmental practices.

206. The IEE for the proposed project was carried out in accordance with the environmental assessment (EA) guidelines of the ADB, supplemented by the guidelines of the Government of Bangladesh. The IEE has determined that the project actions will not have any significant negative environmental impacts. The IEE, however, has revealed that there could be some minor adverse impacts like slope erosion, localized flooding, relocation of structure etc. Special consideration was given to the potential impacts of climate change on the project goals and the IEE has suggested certain adaptation options to deal with changing climatic conditions – including developing and disseminating new climate change resilient structures. Finally, several actions and measures are suggested to strengthen the in-house capacity of the LGED in dealing with environmental issues with special reference to the climate change impacts

ANNEX 1: SUMMARY OF INITIAL ENVIRONMENTAL EXAMINATIONS OF CORE SUBPROJECTS

A. Chater Hat Gc - Banshtola Gc – Joymonirghol (Baddamary) Road, Union Parishad: Sundarban, Upzila: Mongla, Dist: Bagerhat (Road code 20158-2006, total length 10.05 Km But Effective Length 6.50 km up to Banshtola)

1. This road connects Growth Center Chaterhat and Growth Center Banshtola and extends up to the rural market of Joymonirghol (Baddamary). The road is located in Sundarban Union Parishad, which was in the past part of the world's largest mangrove forest Sundarbans. As per road inventory of LGED, the total length of the road is 10.5 km but at this stage the road up to Banshtola GC has been considered for development because there is a flowing canal after the Banshtola GC. One bridge having a span of 80 meters will be necessary to close this gap, which is beyond the scope of this project. At present people can cross this gap of small river by boat. Also there is a bridge made of iron and timber about 500 meters east of this point, where people can cross this gap with motorcycles and light vehicles. The entire length of the road is HBB although damaged in many places. Total 15 numbers of structures having a total span of 94.45 meters are there in the road. The road is operational throughout the year. There is 70% motorized traffic (locally available Tomtom) while the rest is non-motorized. There are 150 houses, 70 shops, 1 Union Parishad building, 2 schools and one dilapidated cyclone shelter within 50 meters distance from the road alignment. The length of road passing through the agricultural land is 6.0 km and the rest 0.5 beside non-agricultural land and residential area. The length of road below highest flood level (HFL) is 90%. The road remains inundated on average 14 – 22 days in a year. There are few palm trees beside the road. The other varieties of trees are not so common because of salinity of water. Shrimp ghers are there in many places beside the alignment. Number of borrow pits is about 1200 having an average size of 5 meters by 15 meters and an average depth of 1.00 meter. There is no boat communication available within the surrounding area of the alignment. There are 4 mosques and 3 graveyards beside the alignment. The IEE concluded that the project activities in this subproject will not cause any significant adverse impact. The crest of the starting point of the subproject is wide. The road embankment is above flood level but some portion of the road will need re-sectioning. The places close to the ghers will need special attention for protection of slope of the embankments. Fishing is important in the area because people in the area are dependent on fishing, and road improvement will positively help the fishing traders to transport their products for marketing. The potential negative impacts include tree removal and (in some cases of narrow stretches of the road) homestead removal on account of road widening needs. New tree plantation – followed by regular caretaking will mitigate the first problem, while compensation for the homesteads and other assets, which have encroached upon the crest and the right-of-way, could be paid to the affected households according to the existing rules. Another negative impact will be that unless carefully planned the hydrology of the area is going to be affected creating drainage congestion of the ghers and nearby agricultural areas causing more flood. Portion of the road passes through low lying agricultural fields and hence, the existing mean embankment height of 1.6 meter should be raised to two meters in order to avoid above average flood levels. The positive impacts of this subproject are: (a) prevention of soil erosion (due to bituminizing the pavement and planting trees on embankment slopes); (b) restoration of regional hydrology and drainage through reconstructing/ rehabilitation bridges/ culverts; (c) reduction of air pollution; (d) access to markets and health services; and (e) potential for establishment of new commercial activities at the markets as well as along the improved road. The subproject does not require any follow-up EIA. Cost estimate of the project will be made as per practice in LGED and criteria fixed by Design Engineer. Cost should include construction and implementation of EMP.

B. Botbunia Market, Union Parishad: Tildanga, Upazila: Dacope, District: Khulna

2. Botbunia GCM is located in the Tildanga Union of Dacope Upazila, District: Khulna. It is on the bank of Daki river which is a connection of Sibsa river and Pasur river. This place is about 10 km southwest from Dacope Upazila headquarters. The shops of the market are on both sides of the BWDB polder embankment. It has one pucca shop, 12 numbers of semi-pucca shops, 67 numbers of kucha shops and 40 open courtyards. There is no cattle market in the GCM. On hat days (Monday) approximately 3000 people visit the market and on other days, numbers of visitors are about 1000. The total market area of land 6.0 acres is on two sides of the BWDB polder embankment. However, development of this market is not possible at the present location because there is possibility of river erosion. So a new location inside the BWDB embankment is feasible for market development. It was reported by the Union Parishad members, market committee, local people etc. that there is available *Khas* land of about 3 acres near the present market location. This place is inside the BWDB embankment and suitable place for market development as it will not require any land acquisition also. Annual lease value of the market is Tk. 70,000. About 10,000 people of surrounding three unions are the beneficiaries. Tildanga union alone has about 4000 households; about 10,000 people are being benefited from this market. Among them 80% belong to the “Hindu” community and 10% of the households i.e. about 400 families are headed by females. The market has a good turnover of goods: one ton of paddy, 150 kgs of fish, 30 kgs of meat, and 150 kgs of fishes. This indicates the importance of market development. There is no tube well in the market and sanitation facilities are also absent. The main crisis is the non-availability of suitable drinking water because of salinity. Tube wells are not feasible as per opinion of local people. There is no storm water drainage system in the market although at the present situation no drainage congestion or water logging was detected within the market area. Solid waste from the market is usually directly dumped in the nearby Daki river. The soil of this area is silty clay and susceptible to erosion. Few numbers of trees were found in the area because trees cannot grow because of salinity of water. There are no archaeological sites near the GCM area but the area is ecologically sensitive. Standard development of GCM would be in terms of providing multipurpose shed, fish shed, meat shed, sanitary latrines, deep tube wells, garbage pits, paved surface, internal roads, as per requirement and as space availability permits. As the GCM is located in a disaster prone area, special requirement for this GCM will be fulfilled by multipurpose shed having 3 storeys, to be used for shopping complex as well as cyclone shelter. This will be equipped with adequate water supply facilities sufficient for the entire GCM area and toilet facilities for normal and emergency requirements during disasters. There will be improvement in the three major areas from market development (1) expansion of trading will occur; (2) income-generating activities of the women will increase. (3) farmers and fishermen will get the right price of their goods and (4) trading activities will enhance if shades are constructed. The subproject does not need any follow-up EIA.

C. Kalir Bazar Chakhar Up (Road code - 506104003, length – 1.37 Km) and Chowlakati Primary School Jangalia School (Road code – 506105013, length – 2.85 Km), Union Parishad: Chakhar, Upazila – Banaripara, District – Barisal

3. This road has two parts. One of them is Kalir Bazar to Chakhar Union Parishad. This road starts from the Upazila road that connects Chakhar UP to Mirer Hat. And the ending point is in Kalir Bazar that is located on the bank of Uzirpur River. The other part of the road starts from Chowlakati Primary School and ends at Jangalia High School. The road is located in Chakhar Union Parishad, which is famous as the birth place of our renowned Leader Shere-Bangla A.K. Fazlul Hoque. As per road inventory of LGED, the total length of this part of the road is 1.37 km. The first part of this road is having flexible pavement of bituminous carpeting of

length 0.60 km and the remaining portion of 0.77 km is HBB although damaged in many places. There are two existing structures having a total span of 25.25 meters in this portion of the road. The average crest width and average right of way is 3.00 meter and 5.00 meters respectively. The other part of the road also starts from the same Upazila road but near the Azad Market and then it passes by Jangalia Government Primary School (GPS) cum Cyclone Shelter, Jangalia High School and Boro Chowlakati GPS and finally extends up to the Kalir Bazar Chakhar UP road. The entire portion of this road is earthen. The average crest width and average right of way is 3.00 meter and 5.00 meters respectively. There are 8 gaps having a total span of 115.00 meter. About 100 meter length of the road is very near the river. Local people informed that the portion of the road is not in danger of being eroded by the river. The road is operational only six months because during the rainy season it becomes too muddy for any traffic movement. The motorized traffic locally known as Tomtom is common mode of transport in the road. Some bicycles are also seen being used by people. There are 30 houses, 20 shops, 1 primary school, and 1 high school one cyclone shelter cum primary school within 50 meters distance from the road alignment. The length of road passing through the agricultural land is 4.0 km and the rest beside non-agricultural land and residential area. The length of road below highest flood level (HFL) is 90%. The road remains inundated on very high floods. There are many trees beside the road. The entire alignment passes through agricultural land. Number of borrow pits is about 50 having an average size of 5 meters by 15 meters and an average depth of 1.00 meter. About one kilometer of the road passes beside borrow pits that look like canals. There is no boat communication available within the surrounding area of the alignment. There are 5 mosques, one temple and 15 graveyards beside the alignment. The IEE concluded that the project activities in this subproject will not cause any significant adverse impact. The crest of the starting point of the subproject is stable and the existing structure is also suitable for movement of traffic. About 33% of the road embankment is above flood level but some portion of it will need re-sectioning. The places close to continuous borrow pits like canal will need special attention for protection of slope of the embankments. The potential negative impacts include tree removal about 500 numbers and (in some cases of narrow stretches of the road) homestead removal on account of road widening needs. New tree plantation – followed by regular caretaking will mitigate the first problem, while compensation for the homesteads and other assets, which have encroached upon the crest and the right-of-way, could be paid to the affected households, if any, according to the existing rules. Another negative impact will be that unless carefully planned the hydrology of the area is going to be affected creating drainage congestion of the agricultural areas causing more flood. Portion of the road passes through low lying agricultural fields and hence, the existing mean embankment height of 1.0 meter should be raised to 1.5 meters in order to avoid above average flood levels. The positive impacts of this subproject are: (a) prevention of soil erosion (due to bituminizing the pavement and planting trees on embankment slopes); (b) restoration of regional hydrology and drainage through reconstructing/ rehabilitation bridges/ culverts; (c) reduction of air pollution; (d) access to markets cyclone shelter cum school and health services; and (e) potential for establishment of new commercial activities at the markets as well as along the improved road. The subproject does not require any follow-up EIA. Cost estimate of the project will be made as per practice in LGED and criteria fixed by Design Engineer. Cost should include construction and implementation of EMP.

Table 14: Chater Hat GC - Banshtola GC – Joymonirghol (Baddamary) Road, Union Parishad: Sundarban, Upzila: Mongla, Dist: Bagerhat (Road Code 20158-2006, Total Length 10.05 km but Effective Length 6.50 km up to Banshtola)

Environmental Components

Ecological	Positive	Negative
Fisheries	H	N
Wetlands	M	N
Flash floods	N	N
Tree removal/ plantation	M	L
Forest	N	N
Physico-Chemical	**Positive**	**Negative**
Soil erosion and siltation	H	L
Regional hydrology/ flooding	M	L
Drainage congestion/ waterlogging	M	L
Water quality/ pollution	L	N
Salinity intrusion	M	L
Air pollution		
Human Interest	**Positive**	**Negative**
Agriculture land loss	L	L
Navigation/ boat communication	N	N
Access to employment	H	N
Access to markets	H	N
Traffic/ road safety	H	L
Sanitation and health	H	N
Cultural features	L	N
Landscape/ aesthetics	H	N

H = High, M = Moderate/ Medium, L = Low, N = None

Table 15: Botbunia Market, Union Parishad: Tildanga, Upazila: Dacope, District: Khulna

Environmental Components

Ecological	Positive	Negative
Fisheries	M	N
Wetlands	M	L
Flash floods	N	N
Tree removal/ plantation	H	L
Forest	N	N
Physico-Chemical	**Positive**	**Negative**
Soil erosion and siltation	M	L
Regional hydrology/ flooding	M	L
Drainage congestion/ water logging	M	L
Water quality/ pollution	L	N
Salinity Intrusion	L	L
Air pollution		
Human Interest	**Positive**	**Negative**
Agriculture land loss	L	M
Navigation/ boat communication	L	N
Access to employment	H	N
Access to markets	H	N
Traffic/ road safety	M	L
Sanitation and health	H	N
Cultural features	N	N
Landscape/ aesthetics	H	N

H = High, M = Moderate/ Medium, L = Low, N = None

Table 16: Kalir Bazar Chakhar UP (Road Code - 506104003, Length – 1.37 km) and Chowlakati Primary School Jangalia School (Road Code – 506105013, Length – 2.85 KM), Union Parishad: Chakhar, Upazila – Banaripara, District - Barisal

Environmental Components

Ecological	Positive	Negative
Fisheries	M	N
Wetlands	M	L
Flash floods	N	N
Tree removal/ plantation	H	L
Forest	N	N
Physico-Chemical	**Positive**	**Negative**
Soil erosion and siltation	H	L
Regional hydrology/ flooding	H	N
Drainage congestion/ water logging	M	N
Water quality/ pollution	M	L
Salinity intrusion	M	N
Air pollution		
Human Interest	**Positive**	**Negative**
Agriculture land loss	L	L
Navigation/ boat communication	L	N
Access to employment	H	N
Access to markets	H	L
Traffic/ road safety	H	N
Sanitation and health	H	N
Cultural features	N	N
Landscape/ aesthetics	H	N

H = High, M = Moderate/ Medium, L = Low, N = None

ANNEX 2: SUMMARY OF ENVIRONMENTAL MITIGATION AND ENHANCEMENT MEASURES

	Mitigation & Enhancement Measure	How	When	Which Institution
NATURAL ENVIRONMENT				
Physical Resource				
Soil:				
Construction	Minimize in design and construction	Draft design note, devise borrow pit strategy	Design and construction stage	Consultants and contractors
Atmosphere:			Construction stage	Supervising engineer with
Dust Pollution	Minimize during construction	Suitable construction management	Post construction	contractor
Traffic Air Pollution	Implement vehicle emission standards	Enforcement of standards		Department of the Environment
Hydrology:		Draft design note	Design/formulation	Design consultants
Changes in Flooding Patterns	Design to ensure no induced flooding	Construction management	stage Construction stage	Supervising engineer with contractor and DOE
Risk of Pollution to Surface Water	Prevent			Supervising engineer with
Risk of Pollution to Ground Water	Prevent	Construction management	Construction stage	contractor and DOE
Erosion/Siltation	Design to consider existing risk and cause no induced impact	Draft design note	Design/formulation stage	Design consultants
Ecological/Biological Resources				
Terrestrial Habitats:				
Removal of Trees	Minimize cutting and have social afforestation program	Design note and construction management	Design, construction and post construction	Design consultants, contractor, NGOs, FD, LGED
Land loss/Conversion	Minimize land acquisition requirement, plant trees	Design note, tree planting program	Design, construction and post construction	Design consultants, contractor, NGOs, LGED
Freshwater Habitats:				
Flood Pattern Change (Permanent	Minimize in design, ensure construction compliance	Draft design note, ensure compliance	Design and construction stage	Design consultants and supervising
Water bodies)	Minimize negative impact in design	Draft design note	Design stage	engineer
Flood Pattern Change (Seasonal Floodplains)		Draft design note	Design stage	Design consultants
Flood Pattern Change (Fish)	Minimize in design			Design consultants
Bio-Diversity/Conservation:	Avoid in design, no	Avoid in subproject	Subproject formulation	Consultant with DOE
Permanent Water bodies	permanent water body is to be reduced	formulation	stage	

	Mitigation & Enhancement Measure	How	When	Which Institution
HUMAN ENVIRONMENT				
Human/Economic				
Homestead Loss	Minimize, compensate, resettle and monitor	Minimize in design, resettlement plan	Design, pre & post-construction stages	Consultant with DC and NGO's
Agricultural Land Loss	Minimize and provide compensation, monitor	Minimize in design, resettlement plan	Design, pre & post-construction stages	Consultant with DC and NGO's
Economic Livelihood:	Minimize and provide	Minimize in design,	Design, pre & post-	Consultant with DC and NGO's
Loss due to Land Loss	compensation/alternative livelihood, monitor	resettlement plan	construction stages	
Construction Employment Opportunities	Target employment opportunities to local people, especially women	Conditions of contract and enforcement	Contract drafting and construction	Consultant, contractor, local authorities
Infrastructure:				
Water Supply	Target deep tube well provision in growth centers, union council centers	Include in subproject formulation	Subproject formulation stage	Design consultants with local government, DPHE
Sanitation	Target sanitation provision in growth centers, union council centers	Include in subproject formulation	Subproject formulation stage	Design consultants with local government, DPHE
Navigation	Consider in design; width, height and depth clearance for bridges	Draft design note	Design stage	Design consultants
Quality of Life				
Health				
Noise Pollution	Implement standards	Enforcement of standards	Construction and post construction stages	Consultant, contractor and DOE
Risk due to In-migrant Workers	Target employment opportunities to local people	Conditions of contract and enforcement	Contract drafting and construction	Consultant, contractor, local authorities
RISKS				
Road Accident	Major awareness and training program needed	Instigate road safety awareness program	Pre-construction	Ministries of Communications and Education
Cyclones: Better Warning and Access	Dual use of growth center and union council center as cyclone shelter	Include in subproject formulation	Subproject formulation stage	Design consultants, LGED, Disaster Management Bureau

ANNEX 3: SUMMARY ENVIRONMENTAL SCOPING MATRIX BY PROJECT COMPONENTS

Main Environmental Issues	130 km Upazila Road, 174 km Union Road and 233 km Village Road	80 Growth Centres, 186 Community Markets, 25 Cyclone Shelters and 37 ghats	Mitigation and Enhancement
NATURAL ENVIRONMENT Physical Resources			
Soil:			
Loss for Embankment Construction	-	-	Minimize in design and construction, devise borrow pit strategy
Atmosphere:			
Dust Pollution	+/-	0	Minimize during construction
Traffic Air Pollution	-	0	Enforce vehicle emission standards
Hydrology:			
Changes in Flooding Patterns	0	0	Design to ensure no induced flooding
Risk of Pollution to Surface Water	-	-	Only in construction period, construction management plan
Risk of Pollution to Ground Water	-	-	Only in construction period, construction management plan
Erosion/Siltation	-	0	Design to consider existing risk and cause no induced impact
Ecological Biological Resources			
Terrestrial Habitats:			
Removal of Trees	-	0	Minimize cutting and have social afforestation program
Land loss/Conversion	-	0	Minimize land acquisition requirement, plant trees
Freshwater Habitats:			
Flood Pattern Change (Permanent Water bodies)	-	0	Try to avoid in design, ensure fish culture in Borrow pits.
Flood Pattern Change (Seasonal Floodplains)	-	0	Minimize negative impact in design
Flood Pattern Change (Fish)	-	0	Minimize in design
Bio-Diversity/Conservation:			
Permanent Water bodies	-	0	Avoid in design, no permanent water body is to be **reduced**
HUMAN ENVIRONMENT Human/Economic			
Homestead Loss	-	-	**Resettlement plan, mitigation/ compensation**
Agricultural Land Loss	-	-	Minimize and provide compensation
Economic Livelihood:			
Loss due to Land Loss	-	-	Minimize and provide compensation / alternative livelihood Target employment opportunities to local

Main Environmental Issues	130 km Upazila Road, 174 km Union Road and 233 km Village Road	80 Growth Centres, 186 Community Markets, 25 Cyclone Shelters and 37 ghats	Mitigation and Enhancement
Construction Employment Opportunities	+	+	people, especially women
Agriculture	+	+	
Fisheries	+/-	+	
Industry	+	+	
Informal Employment Sector	+	+	
Infrastructure:			.
Water Supply	0	+	Target deep tubewell provision in growth centers, union council centers
Sanitation	0	+	Target sanitation provision in growth centers, union council centers
Road Access	+	+	
Navigation	-/+	+	*Consider in design: width, height and depth clearance for bridges*
Quality of Life			
Human Development/GDP	+	+	
Education/Literacy	+	+	
Health:			.
Access to Health Facilities	+	+	
Noise Pollution	-	-	Enforce noise emission standards
Risk due to In-migrant Workers	-	0	Target employment opportunities to local people
RISKS Road Accident Cyclones: Better Warning and Access			Major awareness and training program needed Dual use of growth center and union council center as cyclone shelter
ADB CATEGORY	**B**	**B**	
DOE CATEGORY	**Orange B**	**Orange B**	
Legend = Probable Positive Impact,			

Legend: + = Probable Positive Impact, - = Probable Negative Impact, 0 = No Impact Expected

ANNEX 4: ENVIRONMENTAL SCREENING FORMAT (REA CHECKLIST)

Name of Subproject……District: ……..Upazila:
Union: …….. Village: ……..
Type of Subproject: …….
Major Activities under the Subproject: ……

Screening Questions	Yes	No	Remarks
A. PROJECT SITING **IS THE SUBPROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?**			
▪ **CULTURAL HERITAGE SITE**			
▪ **LEGALLY PROTECTED AREA (CORE ZONE OR BUFFER ZONE)**			
▪ **WETLAND**			
▪ **MANGROVE**			
▪ **ESTUARINE**			
▪ **SPECIAL AREA FOR PROTECTING BIODIVERSITY**			
B. POTENTIAL ENVIRONMENTAL IMPACTS **WILL THE PROJECT CAUSE…**			
▪ Impairment of historical/ cultural areas; disfiguration of landscape or potential loss/ damage to physical cultural resources?			
▪ Disturbance to precious ecology (e.g. sensitive or protected areas)?			
▪ Alteration of surface water hydrology of waterways resulting in increased sediment in streams affected by increased soil erosion at construction site?			
▪ Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?			
▪ Increased air pollution due to project construction and operation?			
▪ Noise and vibration due to project construction or operation?			
▪ Involuntary resettlement of people? (physical displacement and/ or economic displacement)			
▪ Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?			
▪ Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?			

Screening Questions	Yes	No	Remarks
▪ Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?			
▪ Social conflicts if workers from other regions or countries are hired?			
▪ Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
▪ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?			
▪ Risks to community health and safety due to the transport, storage, and use and/ or disposal of materials such as explosives, fuel and other chemicals during construction and operation?			
▪ Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?			
▪ Generation of solid waste and/ or hazardous waste?			
▪ Use of chemicals?			
▪ Generation of wastewater during construction or operation?			

Climate Change and Disaster Risk Questions	Yes	No	Remarks
▪ Is the subproject area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?			
▪ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?			
▪ Are there any demographic or socio-economic aspects of the subproject area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?			
• Could the subproject potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?			

Environments, Hazards and Climate Change

Environment	Natural Hazards and Climate Change
Arid/Semi-arid and desert environments	Low erratic rainfall of up to 500 mm rainfall per annum with periodic droughts and high rainfall variability. Low vegetative cover. Resilient ecosystems & complex pastoral and systems, but medium certainty that 10–20% of dry lands degraded; 10-30% projected decrease in water availability in next 40 years; projected increase in drought duration and severity under climate

	change. Increased mobilization of sand dunes and other soils as vegetation cover declines; likely overall decrease in agricultural productivity, with rain-fed agriculture yield reduced by 30% or more by 2020. Earthquakes and other geophysical hazards may also occur in these environments.
Humid and sub-humid plains, foothills and hill country	More than 500 mm precipitation/yr. Resilient ecosystems & complex human pastoral and cropping systems. 10-30% projected decrease in water availability in next 40 years; projected increase in droughts, heat waves and floods; increased erosion of loess-mantled landscapes by wind and water; increased gully erosion; landslides likely on steeper slopes. Likely overall decrease in agricultural productivity & compromised food production from variability, with rain-fed agriculture yield reduced by 30% or more by 2020. Increased incidence of forest and agriculture-based insect infestations. Earthquakes and other geophysical hazards may also occur in these environments.
River valleys/ deltas and estuaries and other low-lying coastal areas	River basins, deltas and estuaries in low-lying areas are vulnerable to riverine floods, storm surges associated with tropical cyclones/ typhoons and sea level rise; natural (and human-induced) subsidence resulting from sediment compaction and ground water extraction; liquefaction of soft sediments as result of earthquake ground shaking. Tsunami possible/ likely on some coasts. Lowland agri-business and subsistence farming in these regions at significant risk.
Small islands	Small islands generally have land areas of less than 10,000 km^2 in area, though Papua New Guinea and Timor with much larger land areas are commonly included in lists of small island developing states. Low-lying islands are especially vulnerable to storm surge, tsunami and sea-level rise and, frequently, coastal erosion, with coral reefs threatened by ocean warming in some areas. Sea level rise is likely to threaten the limited ground water resources. High islands often experience high rainfall intensities, frequent landslides and tectonic environments in which landslides and earthquakes are not uncommon with (occasional) volcanic eruptions. Small islands may have low adaptive capacity and high adaptation costs relative to GDP.
Mountain ecosystems	Accelerated glacial melting, rock falls/ landslides and glacial lake outburst floods, leading to increased debris flows, river bank erosion and floods and more extensive outwash plains and, possibly, more frequent wind erosion in intermontane valleys. Enhanced snow melt and fluctuating stream flows may produce seasonal floods and droughts. Melting of permafrost in some environments. Faunal and floral species migration. Earthquakes, landslides and other geophysical hazards may also occur in these environments.
Volcanic environments	Recently active volcanoes (erupted in last 10,000 years – see www.volcano.si.edu). Often fertile soils with intensive agriculture and landslides on steep slopes. Subject to earthquakes and volcanic eruptions including pyroclastic flows and mudflows/ lahars and/ or gas emissions and occasionally widespread ash fall.

*Note: Please add any other screening questions relevant to the demonstration. Also provide additional comments and/ or positive impacts in 'remarks' column.

Required level of Environmental Assessment (IEE or DDR)	
Reason:	
Screening done by/ date:	
Environment category approved by/ date:	

Recommendations:

Filled and signed by Assistant Engineer (signature, name and date) ……
Reviewed and signed by Executive Engineer (signature, name and date)

ANNEX 5: PARAMETERS OF ENVIRONMENTAL MONITORING

The following parameters will be monitored:

Table 17: Parameters of Environmental Monitoring

Issues of monitoring	Parameters	Measurement unit	Quantity	Remarks
Water pollution	Turbidity	JTU		
	DO	mg/l		
	pH	-		
	BOD	mg/l		
	COD	mg/l		
	Arsenic	mg/l		
	Iron	mg/l		
	Coliform (fecal)	N/100 ml		
	Salinity	mg/l		
	Manganese	mg/l		
Air pollution	Suspended dust particle	$\mu g/m^3$		
	Carbon monoxide	$\mu g/m^3$		
	Lead	$\mu g/m^3$		
	SO_x	$\mu g/m^3$		
	NO_x	$\mu g/m^3$		
Noise pollution	Shrillness of sound	Decibel		
Soil pollution	Fertility	Increase/ decrease		
Others				

ANNEX 6: ENVIRONMENTAL MANAGEMENT AND MONITORING FRAMEWORK

Monitoring will include:

- Implementation Status of mitigation measures as listed in the Environmental Management Plan (EMP). Please report if the EMP measures are complied/ being complied/ not complied. If not complied, give reasons and recommend corrective measures with implementing agency.

- Impact Monitoring: Impact monitoring will focus on key indicators of the impacts predicted in the EMP. Report on impacts occurred due to implementation of the project and mitigation measures adopted. Assess whether the identified impacts were accurate and the mitigation measure designed and implemented were sufficient/ adequate/ effective. Suggest corrective measures. The corrective measures will be monitored for its compliance and reevaluated next time again.

ENVIRONMENTAL MONITORING FORMAT

Detail of Infrastructure:
Location:
Reporting Date:
Reported by:

Table 18: Environmental Monitoring Format

Sl. No.	Activity (List of activity from EMP of IEE report)	Potential Impact	Mitigation Work (as in EMP)	Current Status (with supporting data*) and Follow-up Required	Remarks

Note: The monitoring format shall be attached to the monthly progress report.
* Data could be numbers and % of female in work group; Numbers of training with numbers of participants (M/F); numbers of trees removed and replanted etc.

A safeguard monitoring report may include the following elements:

- Background/ context of the monitoring report (adequate information on the project, including physical progress of project activities, scope of monitoring report, reporting period);
- Changes in project scope and adjusted safeguard measures, if applicable;
- Qualitative and quantitative monitoring data;
- Monitoring parameters/ indicators and methods based on the monitoring plan/ program previously agreed upon with concerned DPs;
- Monitoring results compared against previously established benchmarks and compliance status (e.g., national environmental emission and ambient standards and/ or standards set out in the ADB's safeguard policy and guidelines; timeliness and adequacy of environmental mitigation measures; IR compensation rates and timeliness of payments, adequacy and timeliness of IR rehabilitation measures including serviced

housing sites, house reconstruction, livelihood support measures, and training; budget for implementing EMP, RP, or IPP, timeliness and adequacy of capacity building, etc.);

- Monitoring results compared against the objectives of safeguards or desired outcomes documented (e.g. IR impacts avoided or minimized; livelihood restored or enhanced; IP's identity, human right, livelihood systems and cultural uniqueness fully respected; IP not suffer adverse impacts, environmental impacts avoided or minimized, etc.);
- If noncompliance or any major gaps identified, include a corrective action plan;
- Records on disclosure of monitoring information to affected communities;
- Identification of key issues, or complaints from affected people, or recommendations for improvement;
- Monitoring adjustment measures recommended based on monitoring experience/trends and stakeholders response;
- Information about actual institutional arrangement for implementing the monitoring program/ plan provided or adjusted, as may be required;
- Proposed items of focus for the next report and due date.

ANNEX 7: TRAINING PROGRAM

1. In order to ensure effective and timely implementation of the EARF, in particular, and to enhance the environmental management capacity of the Project Management Office (PMO), CCRIP, LGED, local contracting agencies, local government institutions such as Union Parishad, Market Management Committees, Local Community Leaders, and NGOs, and other stakeholders, in general, a comprehensive training program has been planned to be implemented during the life of the project. The training program should equip the members of the PMO and other LGED Engineers, who will be directly involved in the planning, design and implementation of the project, to understand and appreciate the EARF requirements; to prepare and review the screening reports, IEE, and EMPs; and to monitor the implementation of the subproject specific EMPs. The PMO staff will further train other engineering staff of the LGED and will expose senior members of the LGED to environmental, social and climate change issues associated with the rural transport and market improvement subprojects. Such a group of senior staff can then be given the responsibility of active dissemination of the culture of environmental/ social/ climate change consciousness and ethics within the rest of the organization. Once the staff of the PMO have received appropriate training and have gained adequate experience through the implementation of the EMP, they are expected to resume leadership role within the LGED in providing training and the implementing future projects. In order to disseminate environmental experience gained by the LGED, each staff would be required to maintain good records and prepare dissemination notes on specific issues and problems encountered and resolved, and how the experience gained could be managed and disseminated within the LGED at different functioning levels. Additional environmental training in the form of on-the-job training on road construction and environmental management on any running ADB assisted projects where good environmental management practices are being followed could also be arranged for the PMO staff. Having received adequate training, these staff will be encouraged to train other staff.

2. Table below lists out the training modules that will be prepared and used for the environmental capacity building initiatives targeted to the various entities responsible for implementing/ monitoring/ supervising the EARF.

Table 19: Training Modules for Environmental Management of CCRIP

Sl. No.	Training Recipients	Mode of Training/ Venue/ Timeframe	Environmental Aspects to be covered in the training module	Training Conducting Resource Personnel/ Agency
1	Environmental staff of EU and PMO, CCRIP, LGED associated with design and construction supervision	Lecture System Workshops day 1) and Group Discussion (day 2)/ LGED HQ/ End of March 2013	• Environmental Management overview • Environmental Regulations and Acts • Environmental Management Framework for CCRIP • Environmental issues associated with rural transport improvement projects in Bangladesh • Planning for environmentally sustainable construction and operation of rural roads and structures • Environmental Screening and Assessment Process	Environmental Specialist, PPTA, CCRIP

Sl. No.	Training Recipients	Mode of Training/ Venue/ Timeframe	Environmental Aspects to be covered in the training module	Training Conducting Resource Personnel/ Agency
			• Environmental Management Plan • Environmentally sound construction practices • Long term environmental issues in rural roads construction management	
2	All technical staff of PMO, District and Upazila staff of LGED, PIC and Contractors	Lecture System Workshops (day 1) and Group Discussion (day 2)/ Each Greater Project Districts/ June/ July – every year during 2013 – 2018	• Environmental and Social Dimensions of Rural Transport Projects • Environmental Management overview • Environmental Assessment • Environmental Management Plan - Implementation, Supervision and Monitoring • Environmental Regulations and Guidelines • Environmental Issues associated with rural road projects in Bangladesh • Environmentally sound construction management Practices • Rural Transport Projects and Environmental and Safety Issues	Environmental Specialist, PIC
3	Environment staff of EU, PMO, concerned LGED staff at HQ, District and Upazila levels, Contractors and PIC	Workshop (1 day/ LGED HQ/ Nov 2013	Salient Features of the following GOB policies which has relevance to CCRIP: • National Environment Management Action Plan (NEMAP) • Sustainable Environment Management Program (SEMP) • National Land Transport Policy • National Road Safety Strategic Action Plan • Land use policy	Experts from DOE / MoEF, Ministry of Communications, Roads and Highways Department, Bangladesh Road Transport Authority (BRTA) and Ministry of Land
4	All staff of EU / PMO entrusted with environmental related matters	Short term training course (2 days)/ LGED HQ/ Oct 2013	• Environmental Safeguard Policies of the ADB • Environmental Assessment for ADB assisted Projects • Environmental Regulations, Acts and Clearance Procedures • Environmental data collection and monitoring analysis • Hands on training on compliance monitoring and operation stage monitoring	BRM, ADB officials/ External Agency
5	EU / PMO Staff for	Visits to case study areas and expert lectures (3	• Erosion and Sedimentation Control Techniques	Environmental Specialist,

Sl. No.	Training Recipients	Mode of Training/ Venue/ Timeframe	Environmental Aspects to be covered in the training module	Training Conducting Resource Personnel/ Agency
	Environmental related matters	days)/ on-going ADB funded road construction/ improvement projects/ April/ May 2014	• Bridge and Culverts Construction and Maintenance • Earth retaining structures on rural roads • Slope stability and re-vegetation of exposed earth • Siting criteria for ancillary sites such as borrow pits, brick-fields, workforce camps, material storage yard, dumping sites etc. • Disposal of Construction Waste • Recycling of Road Construction Materials • Environmental Information Management System	PIC
6	**Stakeholder Training Workshops**			
6A	**Upazila and Union Roads including Structures**			
	Stakeholders of Upazila Roads/ Union Roads viz. Union Parishad/ Pourashava members of the subproject area, Religious and Community leaders in the project area, Representatives from each of the subproject covered villages/ hamlets/ small settlements, NGOs working in the project area and other concerned Government department stakeholders (like service/ utility providers)	Lecture System Workshops or Group Discussion/ 1 day in each Upazila every year, LGED Upazila Office/ June or July, 2014 – 18; Short term training course 1 day in each project district every year, LGED District Offices/ June/ July, 2014 – 18 Audio Visual Communication/ 1 day on each subproject	• Environmental issues related to Construction and Maintenance of rural roads and structures, • Project Implementation schedule, construction methods planned, ancillary sites selected, Institutional hierarchy during implementation of the project with the names of the concerned officials of PIC, LGED and Contractors, Simple do's and don'ts during project implementation etc.	EU/ PIC
6B	**Growth Centre Markets**			
	Stakeholders of Growth Centre Market subprojects viz. Union Parishad /Pourashava Members of the GCM area, Concerned Market Management Committee members, Religious and Community leaders in the project area, NGOs working in the project area and other concerned government department stakeholders (like service/ utility providers)	Lecture System Workshops or Group Discussion/ 1 day in each Upazila every year, LGED Upazila Office/ June or July, 2014 - 18 Short term training course 1 day in each project district every year, LGED District Offices/ June/ July, 2014 – 18 Audio Visual Communication/ 1 day on each subproject	• Environmental issues related to market facilities • Project Implementation schedule, Construction methods planned, Ancillary sites selected, Institutional hierarchy during implementation of the project with the names of the concerned officials of PIC, LGED and contractors, Simple do's and don'ts during project implementation, etc • Operation and maintenance of tube wells, sanitation facilities, slaughterhouse waste treatment systems, solid waste management practices	EU/ PIC

Sl. No.	Training Recipients	Mode of Training/ Venue/ Timeframe	Environmental Aspects to be covered in the training module	Training Conducting Resource Personnel/ Agency
6C	**Cyclone Shelters**			
	Stakeholders of Cyclone Shelters subprojects viz. Union Parishad/ Pourashava members of the Cyclone Shelter area, Concerned Cyclone Shelter Management Committee members, Market Committee members (if any GCM is located adjacent to Cyclone Shelter), Boat Owners Association, Religious and Community leaders in the project area, NGOs working in the project area and other concerned government department stakeholders (like service/ utility providers)	Lecture System Workshops or Group Discussion/ 1day in each Upazila every year, LGED Upazila Office/ June or July, 2014 – 18; Short term training course 1 day in each project district every year, LGED District Offices/ June/ July, 2014 – 18 Audio Visual Communication/ 1 day on each subproject	• Environmental issues related to Construction and Maintenance of cyclone shelter facilities • Project Implementation schedule, Construction methods planned, Ancillary sites selected, Institutional hierarchy during implementation of the project with the names of the concerned officials of PIC, LGED and contractors, Simple do's and don'ts during project implementation etc	EU/ PIC

ANNEX 8: TERMS OF REFERENCE FOR ENVIRONMENTAL SPECIALIST

1. The environmental specialist will (i) assess the environmental impacts of the project, including physical, ecological, and social environments; (ii) conduct a comprehensive appraisal of the environmental impact of the project activities in line with the ADB's Safeguard Policy Statement (2009); and (iii) propose appropriate mitigation measures for the identified environmental impacts. The main outputs from the environmental specialist are (1) supervision and monitoring of the project activities in the field level; (2) reporting about environmental compliance and implementation of suggested mitigation measures; (3) contribution to the environmental part of the monthly, quarterly, annual, midterm and final reports; (4) providing assistance for preparation of environmental audit report to be prepared by the externally deployed consultants; and (5) preparation of environmental due diligence report.

2. The environmental specialist must have a graduate degree in environmental science or environmental engineering or closely related field of study with 15 years experience in related areas including specific expertise in climate change issues in Bangladesh. Inputs may be intermittent over the period of 72 months until the submission of completion report for the CCRIP.

ANNEX 9: FIELD SURVEY CHECKLIST FOR DATA COLLECTION

A. DESCRIPTIVE CHECKLIST FOR ROADS IMPROVEMENT/ MAINTENANCE

District	Upazila	Road ID	Name of Road	Length of Road

Parameter	Description	General Tips	Information
1. Traffic (based on traffic count by Engg. Team /observation consultation)	1.1 Road remains operational month in a year	Month	
	1.2 % of non-motorised traffic		
	1.3 No. and type of accidents on the road during last 5 years	No.	
	1.4 Community's view/ concern on safety of pedestrian/ non-motorised vehicles		
	1.5 Community's suggestions to ensure safety, if any		
2. Road Embankment	2.1 Proposed widening	Symmetric (concentric)/ asymmetric	
		Left (km-km)	
		Right (km-km)	
	2.2 Widening modifications recommended with reasons	Left (km-km)	
		Right (km-km)	
3. Houses/ Shops	3.1 Number of houses/ shops abutting the road	No.	
	3.2 Number of houses/ shops within 50 m (from the centre line) of the road	No.	
4. Topography (To be mapped on suitable scale)	4.1 Length of the road through flood plain/ flood free high land/ forest land/ swamp/ wetland	Km for each category	
	4.2 Length of road passing through agriculture lands and through non-agriculture lands	Km	
5. Regional Hydrology/ Flooding (To be mapped on suitable scale)	5.1 Road length perpendicular to the drainage line and parallel to the drainage line	Km each	
	5.2HFL	m	
	5.3 Length of road below HFL	m	
	5.4 Describe current problem of flooding, if any, as perceived by community		
	5.5 Duration of flooding	Only monsoon/ entire year/ during very high floods	
	5.6 Estimated annual loss of property and type of loss	Taka	
	5.7 Reasons for flooding/ local drainage congestion	River-overtopping/ less cross drainage/ local natural depressions	

Parameter	Description	General Tips	Information
	5.8 Extent of road damage due to floods	Marginal/ medium/ substantial	
	5.9 Communities perceptions regarding floods		
6. Drainage congestion/ water-logging	6.1 Along km-km of road		
	6.2 Average time period and frequency per year		
	6.3 Reasons	Natural depressions/ low lying area/ borrow pits/ flash heavy rains/ insufficient cross-drainage	
	6.4 Problems due to water logging	Mosquito problem/ crop damage/ permanent loss of agricultural land/ water pollution due to dumping of wastes etc.	
	6.5 Option for remedial actions		
7. Road-side avenue tree	7.1 Left/right/both sides		
	7.2 Distance from centreline	M	
	7.3 Average age	Year	
	7.4 Planted under which programme and year		
	7.5 Nos. per km within proposed toe-toe width (7.3 m crest + 4 x height of road		
	7.6 Expected number of trees to be cleared		
8. Borrow areas	8.1 Existing status of borrow pits	Average size	
		Distance from road toe	
		Average depth	
		Drainage pattern	
		Continuous/ irregular	
		Extent of water hyacinth, if any	
		Community's perception on water hyacinth	
		Current practice to use/ growth prevention/ destruction of water hyacinth	
		If converted into ponds, general use pattern	
		Options for improvement	
	8.2 Potential location of borrow areas with land use	Agricultural/ barren/ forest	
		Ownership	
		Distance from road toe	
	8.3 Soil type	Clay/ sand/ silt	
	8.4 Vegetation	Bushes/ Tress	

Parameter	Description	General Tips	Information
	8.5 Options for rehabilitation	Pond/ continuous ditch joining to natural drains	
9. Brick	9.1 Distance of brick kilns		
	9.2 Fuel used	Coal/ firewood	
	9.3 Current practice as regards to rehabilitation of brick-breaking yard		
	9.4 Potential land use/ location of brick-breaking yard		
	9.5 Area required	Acre	
	9.6 Options for rehabilitation		
10. Sand	10.1 Source		
	10.2 Distance from the road	Km	
	10.3 Current practice of dredging		
	10.4 Any environmental concerns		
11. Wetlands (show locations and sizes on the alignment plan)	11.1 Type of wetlands along the road		
	11.2 Number		
	11.3 Distance from the centreline	m	
	11.4 Natural/ artificial		
	11.5 Significance (according to local community)		
	11.6 Current use	Pisciculture (organized/ unorganised)/ bathing/ washing/ irrigation	
	11.7 Type fish		
	11.8 Quantity	Abundant/ scarce	
	11.9 Aquatic birds (waterfowl, if any		
	11.10 Migratory/ resident birds		
	11.11 Fish catching at the cross-drainage structures		
	11.12 Road causing isolation of the fish habitat/ wetland	Area in acre	
	11.13 Community's suggestions for improvement, if any		
	11.14 Height of embankment near the pond		
	11.15 Land use on the opposite side		
12. Ponds	12.1 Number of ponds per km abutting the road		
	12.2 Total number of ponds abutting the road		
13. River/ Stream/ Khal	13.1 km of road parallel to river /stream/ khal	km to km	
14. Forest	14.1 Length of road passing through forest area	Km	
	14.2 Distance from road centreline	M	
(To be mapped on suitable scale)	14.3 Forest type (reserved/ protected/ social forestry/ degraded)		

Parameter	Description	General Tips	Information
	14.4 Type and approximate number of prominent wildlife		
	14.5 Endangered species, if any		
	14.6 Any migratory route through the road (wildlife, fishes etc)		
	14.7 Specific period of migration		
15. Erosion and siltation	15.1 Soil type of embankment	Sand/ silt/ clay/ sandy silt/ silty clay	
	15.2 Extent of erosion of embankment (show/ mark locations of major erosions on the plans)		
	15.3 Rain-cutting-extent, reason, remedy		
Include location map for each such site and discuss with community for possible remedial options for boat anchoring facilities (To be mapped on suitable scale)	15.4 Reasons for erosion	Sandy soil/less batter slope/ wave action/ boat anchoring floods/ absence of vegetation/ others	
	15.5 Land use around eroded site	River/ wetland/ agriculture land/ forest/ homestead	
	15.6 Potential change in erosion and siltation pattern after road construction (to be assessed in consultation with local key informants/ expert opinion)		
	15.7 Suggested options for treatment		
16. Navigation/ Boat communication (show specific location on the map/ plan)	16.1 Available free board during normal monsoon, consult local people		
	16.2 Road length/ road structure interfering with boat communication		
	16.3 Problem of boat navigation through waterway/ bridge		
	16.4 Options for mitigation		
(To be mapped on suitable scale)	16.5 Road side shops/ GC/ traffic parking causing road safety and/ or road use effectiveness-discuss with local people		
17. Archaeological/ cultural sites	17.1 Any archaeological or cultural sites present in the area		
	17.2 Distance of archaeological /cultural site from the road		
18. Mosque, school, graveyard	18.1 Distance of mosque school, temple and graveyard from the road		
19. Any other relevant information			

Comments and Conclusion:

Data collected by:

Signature:

Name:

Designation:

Date:

A. DESCRIPTIVE CHECKLIST FOR MARKET IMPROVEMENT/ MAINTENANCE

District	Upazila	Market ID	Name of Market	Market/ GCM

Parameter	Description	General Tips	Information
1. Population served (based on count by survey team /observation consultation)	1.1 Market remains operational months in a year	Month	
	1.2 Number of people visit on Hat day	No.	
	1.3 Number of people visit on non-Hat day	No.	
	1.4 Number of people to get benefit	No.	
	1.5 Number of Unions to get benefit	No.	
2. Area of market (based on information from market committee)	2.1 Total area of market	Decimal	
	2.2 Area of *khas* land	Decimal	
	2.3 Area of private land	Decimal	
3. Annual lease value (based on information from market committee)	3.1 Current annual lease value	Taka	
4. Number of shops	4.1 Pucca shops	No.	
	4.2 Semi-pucca shops	No.	
	4.3 Kutcha shops	No.	
	4.4 Open courtyard	No.	
	4.5 Others	No.	
5. Goods turnover	5.1 Rice	Kg.	
	5.2 Paddy	Kg.	
	5.3 Fish	Kg.	
	5.4 Meat	Kg.	
	5.5 Vegetables	Kg.	
	5.6 Betel leaf	Kg.	
	5.7 Betel nut	Kg.	
	5.8 Others	Kg.	
6. Cattle market	6.1 How many	No.	
	6.2 Area	Decimal	
	6.3 Days in week	No.	
	6.4 Cow sold	No.	
	6.5 Goats sold	No.	
	6.6 Buffalo sold	No.	
	6.7 Others sold	No.	
7. Slaughterhouse	7.1 How many	No.	
	7.2 Cows slaughtered	No.	

Parameter	Description	General Tips	Information
	7.3 Goats slaughtered	No.	
	7.4 Sheep slaughtered	No.	
	7.5 Others	No.	
	7.6 How slaughter waste is cleaned		
8. Water supply	8.1 Existing working tube wells	No.	
	8.2 Existing tube wells out of order	No.	
	8.3 Any other source of water supply, specify	No.	
9. Sanitation	9.1 Existing public toilets	No.	
	9.2 Working condition	No.	
	9.3 Dilapidated condition	No.	
10. Storm water drainage	10.1 Any drainage facilities available?	Yes/ no	
	10.2 Working well or not?	Yes/ no	
	10.3 Any visible point for drainage congestion	Yes/ no	
11. Water pollution from GCM	11.1 Solid waste from the market pollutes nearby canal	Yes/ no	
	11.2 River	Yes/ no	
	11.3 Ponds	Yes/ no	
12. Ecological/ cultural sites	12.1 Mosque	No.	
	12.2 School	No.	
	12.3 Graveyard	No.	
	12.4 Others, specify	No.	
13. Erosion and siltation	13.1 Erosion from market visible?	Yes/ no	
	13.2 Siltation possible?	Yes/ no	
14. Solid waste management	14.1 How solid waste is managed?		
	14.2 Cleaning regularly done?	Yes/ no	
	14.3 How effective is cleaning?	Poor/ fair/ good	
15. Proposed development suggested	15.1 Multipurpose shed – possibly multi-storeyed building (say 3 storeys); can be used also for cyclone shelter + reduces land area footprint; may have market water supply and toilets	No.	
	15.2 Fish shed	No.	
	15.3 Meat shed	No.	
	15.4 Tube wells	No.	
	15.5 Sanitary latrines	No.	
	15.6 Garbage pits	No.	
	15.7 Composting barrel	No.	
	15.8 Paved surface/ courtyard	No.	
	15.9 Internal roads	No.	
	15.10 Solar energy	No.	

Comments and Conclusion:

Data collected by:

Signature:

Name:

Designation:

Date:

B. DESCRIPTIVE CHECKLIST FOR CYCLONE SHELTER IMPROVEMENT/ MAINTENANCE

District	Upazila	Cyclone Shelter ID, if any	Name of Cyclone Shelter	Cyclone Shelter/ Cyclone Shelter cum School

Parameter	Description	General Tips	Information
1. Population served (based on community consultation)	1.1 Cyclone shelter remains operational months in a year	Month	
	1.2 How many people can take shelter during disaster?	No.	
	1.3 Number of people visit on weekly holidays	No.	
	1.4 Number of people visit on week days	No.	
	1.5 Number of people to get benefit	No.	
	1.6 Number of villages to get benefit	No.	
2. Area of cyclone shelter (based on information from local people)	2.1 Total area of land allocated for the cyclone shelter	Decimal	
	2.2 Area occupied by the cyclone shelter building	Decimal	
	2.3 Total number of storeys	No.	
	2.4 Boundary wall existing?	Yes/ no	
3. Details of the school	3.1 How many classes?	No.	
	3.2 How many students?	No.	
	3.3 When the school was established?	Year	
4. Details of cyclone shelter	4.1 When the cyclone shelter was constructed?	Year	
	4.2 How many rooms	No.	
	4.3 Sizes of rooms	Meter X Meter	
	4.4 Separate rooms for male and female	Yes/ no	
	4.5 Separate toilets for male and female	Yes/ no	
	4.6 Ramps for disabled people	Yes/ no	
	4.7 Arrangements of shelter for cattle	Yes/ no	
5. Existing physical condition of the cyclone shelter	5.1 Roof	Poor/ fair/ good	
	5.2 Ceiling	Poor/ fair/ good	
	5.3 Walls	Poor/ fair/ good	
	5.4 Floor	Poor/ fair/ good	
	5.5 Plastering	Poor/ fair/ good	
	5.6 Painting	Poor/ fair/ good	
	5.7 Doors	Poor/ fair/ good	
	5.8 Windows	Poor/ fair/ good	
6. Water supply	6.1 Existing working tube wells	No.	
	6.2 Existing tube wells out of order	No.	
	6.3 Any other source of water supply, specify	No.	

Parameter	Description	General Tips	Information
7. Sanitation	7.1 Existing toilets	No.	
	7.2 Working condition	No.	
	7.3 Dilapidated condition	No.	
8. Storm water drainage	8.1 Any drainage facilities available?	Yes/ no	
	8.2 Working well or not?	Yes/ no	
	8.3 Any visible point for drainage congestion	Yes/ no	
9. Water pollution from the cyclone shelter	9.1 Solid waste from the cyclone shelter pollutes nearby canal	Yes/ no	
	9.2 River	Yes/ no	
	9.3 Ponds	Yes/ no	
10. Ecological/ cultural sites within 500 meter	10.1 Mosque	No.	
	10.2 School	No.	
	10.3 Graveyard	No.	
	10.4 Others, specify	No.	
11. Erosion and siltation	11.1 Erosion from cyclone shelter courtyard visible?	Yes/ no	
	11.2 Siltation possible?	Yes/ no	
12. Solid waste management	12.1 How solid waste is managed?		
	12.2 Cleaning regularly done?	Yes/ no	
	12.3 How effective is cleaning?	Poor/ fair/ good	
13. Repair/ renovation	13.1 Repair/ renovation possible?	Yes/ no	
	13.2 New construction necessary?	Yes/ no	
14. Proposed development suggested	14.1 Separate rooms for male and female	Yes/ no	
	14.2 Ramps for disabled persons	Yes/ no	
	14.3 Tube wells	No.	
	14.4 Sanitary latrines separate for male and female	No.	
	14.5 Approach/ Internal roads	Yes/ no	
	14.6 Solar energy	Yes/ no	
	14.7 Others, if any		

Comments and Conclusion:

Data collected by:

Signature:

Name:

Designation:

Date:

ANNEX 10: BIBLIOGRAPHY

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