

Initial Environmental Examination

September 2019

BAN: South Asia Subregional Economic Cooperation Dhaka–Northwest Corridor Road Project, Phase 2

Hatikamrul Interchange

CURRENCY EQUIVALENTS

(as of 18 July 2019)

Currency unit	–	Bangladesh taka (Tk)
BDT1.00	=	\$ 0.0118
\$1.00	=	BDT 84.4750

ABBREVIATIONS

AAQ	-	Ambient air quality
AAQM	-	Ambient air quality monitoring
ADB	-	Asian Development Bank
AH	-	Asian Highway
BCCSAP	-	Bangladesh Climate Change Strategy and Action Plan
BUET	-	Bangladesh University of Engineering and Technology
BOD	-	Biochemical oxygen demand
BOQ	-	Bill of quantity
COD	-	Chemical oxygen demand
CSC	-	Construction Supervision Consultant
DO	-	Dissolved oxygen
ECC	-	Environmental Clearance Certificate
ECR	-	Environmental Conservation Rules
EA	-	Executing agency
EHS	-	Environment Health and Safety
EIA	-	Environmental impact assessment
EMOP	-	Environmental monitoring plan
EMP	-	Environmental management plan
GOB	-	Government of Bangladesh
GHG	-	Greenhouse gas
GIS	-	Geographical information system
GOB	-	Government of Bangladesh
GRC	-	Grievance redress committee
GRM	-	Grievance redress mechanism
HFL	-	Highest flood level
IA	-	Implementing Agency
MOEF	-	Ministry of Environment and Forests
NO _x	-	Oxides of nitrogen
PAP	-	Project Affected Persons
PD	-	Project Director
PM	-	Particulate Matter
PIC	-	Project Implementation Consultant
PIU	-	Project Implementation Unit
RHD	-	Roads and Highways Department
ROW	-	Right of way
RRTC	-	Road Research and Training Centre
SASEC	-	South Asia Subregional Economic Corridor
SO ₂	-	Sulphur Dioxide
SPM	-	Suspended Particulate Matter
SPS	-	Safeguard Policy Statement
TA	-	Technical assistance
TDS	-	Total dissolved solids
TSS	-	Total Suspended Solids

WEIGHTS AND MEASURES

dB(A)	-	A-weighted decibel
ha	-	hectare
km	-	kilometer
km ²	-	square kilometer
Leq	-	equivalent continuous noise level
µg	-	microgram
m	-	meter
MW (megawatt)	-	megawatt
PM 2.5 or 10	-	Particulate Matter of 2.5 micron or 10 micron size

NOTE

- (i) In this report, "\$" refers to United States dollars.

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

CONTENTS

EXECUTIVE SUMMARY	i
A. Scope of the Study.....	i
B. Extent of Initial Environmental Examination Study	i
C. Findings	i
D. Recommendations	ii
E. Conclusion.....	iii
I. Regulatory Framework.....	1
A. GOB Environmental Policy, Regulations, and Guidelines.....	1
1. National Environmental Policy, 1992	1
2. National Environmental Management Action Plan, 1995.....	1
3. Environmental Conservation Act, 1995	1
4. Environmental Conservation Act (Amendment 2000).....	2
5. Environmental Conservation Act (Amendment 2002).....	2
6. Environmental Conservation Rules (ECR), 1997 and Amendments	3
7. Bangladesh Climate Change Strategy and Action Plan.....	4
8. National Land Use Policy, 2001	4
9. Relevant Other Regulatory Requirements for the Project.....	5
10. International Treaties	8
11. Administrative Framework.....	8
12. Occupational Health and Safety.....	8
B. ADB's Safeguard Policy	9
C. Project Category	9
II. Description of the Project	11
A. Description of the Project.....	11
B. Project Location	11
C. Project Outline	12
III. Description of the Environment.....	15
A. General.....	15
B. Physical Environment	15
1. Climate	15
2. Temperature Data	18
3. Rainfall.....	18
4. Humidity.....	19
5. Wind Speed	19
6. Physiographic Features	20
7. Topography	22
8. Geology	23
9. Seismicity	24
10. Soil	26
11. Agroecological Zones within the Project Area	28
12. Soil Quality	30

13.	Water Resources and Hydrology	30
14.	Groundwater Quality	30
15.	Ambient Air Quality	31
16.	Noise Level	32
C.	Biological Environment	34
1.	General.....	34
2.	Bioecological Zones.....	35
3.	Diversity of Terrestrial Floral and Faunal Species.....	35
4.	Biodiversity/Environmentally Sensitive Areas	42
D.	Socio-Economic Environment	44
1.	Demography	44
2.	Land Use Patterns	44
3.	Water Supply and Sanitation.....	44
4.	Transport and Communication	45
IV.	Impacts and Mitigation Measures.....	46
A.	Key Consideration and Scoping	46
1.	Ambient Air Quality and Noise	46
2.	Water Pollution.....	46
3.	Earth Resources Exploitation	46
4.	Location and Design Impacts.....	46
5.	Screening Out Areas of No Significant Impact.....	47
B.	Potential Significant Impacts	47
C.	Mitigation and Abatement Measures	50
D.	Resettlement.....	53
V.	Environmental Management Plan.....	54
A.	Implementation Arrangement	54
B.	Capacity Building	54
C.	Environmental Management Stages	55
D.	Environmental Management Plan	55
E.	Contractors Environmental Management Plan	62
F.	Environmental Monitoring Program.....	62
G.	Environmental Budget.....	68
VI.	Information Disclosure and Public Consultation	70
A.	Information Disclosure	70
B.	Public Consultation	70
C.	Compliance with Relevant Regulatory Requirements.....	71
D.	Major Comments Received.....	71
1.	Government Officers' Comment.....	72
2.	Focus Group Discussions	74
3.	Suggestions	76
4.	Informal Public Consultations.....	76
5.	Suggestions.....	78

E. Summary of Comments	79
VII. Grievance Redress Mechanism	80
VIII. Conclusions	82
A. Findings	82
B. Recommendations	82
C. Conclusion	83
REFERENCES	84
APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST.....	85

LIST OF TABLES

Table 1. Applicability of Key Environmental Legislation	5
Table 2. Relevant International Treaties, Conventions and Protocols Signed by Bangladesh	8
Table 3. Relevant Occupational Health and Safety Laws and Rules.....	8
Table 4. Environmental Regulatory Compliance	10
Table 5. Outline of the Hatikamrul Interchange.....	12
Table 6. Hatikamrul Interchange Details	12
Table 7. Compensation and Budget for the Properties Displaced within ROW	13
Table 8. Summary of Major Impacts	14
Table 9. Seismic Zonation of Bangladesh.....	24
Table 10. Source of Drinking Water in the Project Area	30
Table 11. Groundwater Field Samples at Hatikamrul	31
Table 12. Ambient Air Quality in Hatikamrul.....	32
Table 13. Noise Level at Hatikamrul Location.....	33
Table 14. Predicted Noise for the Year 2040 where there is	34
Table 15. Bangladesh Standard for Noise Level at Different Types of Areas	34
Table 16. List of Plants along the Project Road	38
Table 17. List of Fauna Identified In and Around the Project Area	39
Table 18. Demographic Status, in the Project Area	44
Table 19. Sanitary Facilities in the Project Area.....	45
Table 20. Fields in which Construction is Not Expected to Have Significant Impacts...	47
Table 21. Potential Impacts During Construction Phase	47
Table 22. Potential Impacts During Operational Phase.....	50
Table 23. Impacts and Mitigation Measures During Construction Phase	50
Table 24. Impacts and Mitigation Measures During Operational Phase	52
Table 25. Contractors Environmental Sub-Plans	62
Table 26. Environmental Monitoring Plan	63
Table 27. Environmental Budget for Hatikamrul Interchange	68
Table 28. Details of Consultation with Government Authorities for Elenga–Hatikamrul	72
Table 29. Details of Consultation with Public in Elenga–Hatikamrul Road Sections.....	76

LIST OF FIGURES

Figure 1. Government of Bangladesh Environmental Assessment Process	7
Figure 2. Location Map of Hatikamrul Interchange	11
Figure 3. Cloverleaf Design of Hatikamrul Interchange	13
Figure 4. Climatic Zone	17
Figure 5. Monthly Maximum and Minimum Temperature at Tangail Station (1991–2012)	18
Figure 6. Average Monthly Total Rainfall at Tangail Station, 1991–2012.....	18
Figure 7. Average Monthly Relative Humidity at Tangail Station, 1991–2012	19
Figure 8. Average Monthly Maximum Wind Speed at Tangail Station, 1991–2012	20
Figure 9. Physiographic Subregions of Bangladesh	21
Figure 10. Topography	22
Figure 11. Geology.....	23
Figure 12. Seismic Zones in Bangladesh	25
Figure 13. General Soil Classification of the Project Area	27
Figure 14. Agroecological Zones of the Project Area	29
Figure 15. Bioecological Zones	37
Figure 16. Environmental Protected Areas	43
Figure 17. Organizational Chart	54
Figure 18. Consultation with Government Officials	74
Figure 19. Photos of Public Consultation.....	75
Figure 20. Photos of Public Consultation.....	75
Figure 21. Photos of Public Consultation.....	76
Figure 22. Photos of Public Consultation.....	78

EXECUTIVE SUMMARY

A. Scope of the Study

1. This report is the initial environmental examination (IEE) for the Hatikamrul Interchange (work package-13). It discusses the environmental impacts and mitigation measures relating to the location, design, construction, and operation of all physical works proposed under this work. This IEE is part of the process of compliance with the Government of Bangladesh and ADB guidelines in relation to Hatikamrul Interchange under South Asia Subregional Economic Cooperation (SASEC) Phase 2.

2. This IEE report will clarify the situation to the Department of Environment (DOE) and fulfill the requirement for obtaining location clearance certificate, environmental impact assessment (EIA) with environmental management plan (EMP), which are based on the terms of reference approved by the DOE and which are required to secure environmental clearance certificate (ECC) from the DOE. This report will identify the potential environmental impacts due to implementation of the work package and will suggest appropriate mitigation measures.

B. Extent of Initial Environmental Examination Study

3. The Hatikamrul Interchange connects 4 roads in a commercial area. The project area mainly comprises shops and market stalls with no residential properties affected. An assessment has been carried out to identify the impacts of the proposed road improvement works on terrestrial and aquatic ecology, land use, air, and water and noise quality. In order to mitigate the potential impacts, appropriate measures have also been proposed in the EMP. Extensive public consultations undertaken as part of the IEE work have been considered for identifying the mitigation measures.

4. This IEE is carried out based on most up-to-date project details and detailed designs provided by the design team during the preparation of this report. The corridor of impact has been defined as 800 meter (m) on either side from the edge of the road alignment. However, the study area has been extended to 800 m wide area on both side of the alignment to analyze the land use, identify potential borrow areas, and environmental sensitive areas. The impacts on ecologically sensitive areas (e.g. national parks, wildlife sanctuaries, biosphere reserve, and protected places) within 800 m of the project areas have also been assessed.

5. The scope of the IEE study has been confined to project-related activities associated with design, construction (e.g. site clearing, earth borrowing, quarrying, material transportation, paving, camping), and operation stages. As per information available from design team, no additional facilities like toll plazas and truck plaza are proposed. Hence, no impacts assessment for such facilities was carried out.

C. Findings

6. The Hatikamrul Interchange offers a cloverleaf option for the enhancement of the existing road-based transportation network. Several actions are required during the detailed design stage to minimize impacts to acceptable levels. On the way to Rangpur from Dhaka at Hatikamrul on the left side, there is a private hospital that will be affected by the project. Part of the hospital is in the Roads and Highways Department (RHD) land. For the proposed Hatikamrul Interchange construction, this hospital needs to be relocated. On the way to Dhaka from Rangpur at Hatikamrul on the left side, there is a commercial residential hotel which is also in the RHD land, which will

also need to be relocated for the proposed Hatikamrul Interchange construction. One electric overhead high-voltage pole and underground gas pipeline with diameter of 0.6 meter will also be affected and needs relocation.

7. The negative environmental impacts from the project will mostly take place during the construction stage. There are no significant cumulative adverse impacts during operation that are identifiable at this stage. The construction impacts should be very predictable and manageable, and with appropriate mitigation few residual impacts are likely.

8. The finding of IEE indicates that the Hatikamrul Interchange is unlikely to cause any significant adverse environmental impacts. The proposed road expansion does not pass through or is located nearby any national park, wildlife sanctuary, reserved forests, or any other ecologically sensitive or areas. No archaeological and/or protected monument is located in the project vicinity. The land use pattern around the alignment is predominantly commercial.

9. However, there are some negative impacts but many bearing benefits to the area. Most of the negative impacts are likely to occur during construction stage and are temporary in nature. Some impacts require design consideration and are suitably addressed. The land use pattern around the Hatikamrul Interchange alignment primarily includes commercial area, settlement, and perennial or non-perennial water bodies.

10. Urban settlements are present; thus, to avoid populated locations, provision of a cloverleaf use is being considered. The impact is primarily caused by land clearing for widening the carriageway, cutting of roadside full-grown trees, borrowing of earth, and transportation of construction material.

11. The impacts are related to loss of terrestrial flora, impact on aquatic fauna, soil compaction, water contamination, and change in ambient air quality, water quality, and increase in ambient noise levels. During the operation, direct local impacts are mostly related to noise levels, air quality, and road accidents. Implementation of the prescribed mitigation measures will minimize the adverse impacts. Moreover, the impacts shall be monitored continually by implementing and updating the EMP and the environmental monitoring plan.

12. During construction, Hatikamrul Interchange traffic management is a big challenge as that is a very busy area with many vehicles passing. Some trees along the road are likely to be cut but if the proposed compensatory afforestation plans are effectively implemented and survival rate is monitored and sustained, the positive benefits are likely to be accrued. Efforts are proposed to minimize cutting of trees with suitable modifications in the Hatikamrul Interchange. However, there are no legislative restrictions in cutting these trees. There are no other environmental sensitive resources found in the project area, which is likely to be affected due to the project.

D. Recommendations

13. The EMP, its mitigation and monitoring programs, contained herewith should be included within the bidding documents for project works. Hatikamrul Interchange area is mainly business area and few residential areas. For this relocation of hospital, people will not be that much affected as there is hospital in Ullapara Upzilla 14.37 km. Hatikamrul Interchange area is mainly business area and closer to the interchange, there is also some hotel which can solve the problem. Also, the affected residential hotel owner is going to construct a new hotel near by Hatikamrul Interchange in his own land. The bid documents state that the contractor shall be responsible for the implementation of the requirements of the EMP through his own site specific environmental

management plan, which will adopt all of the conditions of the EMP and add site specific elements that are not currently known, such as the contractors borrow pit locations. This ensures that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

14. The EMP and all its requirements shall then be added to the contractor's contract, thereby making implementation of the EMP a legal requirement according to the contract. He shall then prepare his CEMP which will be approved and monitored by the Engineer/Environmental Specialist. To ensure compliance with the CEMP, the contractor should employ a national environmental specialist to monitor and report project activities throughout the project construction phase.

15. RHD has social and environmental staff but they need capacity building and practical exposure. Adequate training shall be imparted as proposed under environmental management plan to enhance the capability of concerned executing agency officials. It is recommended to update environmental guidelines focused on effective implementation of mitigation measures. Performance indicators may also be developed as part of these guidelines to monitor and assess the effectiveness of the mitigation measures.

E. Conclusion

16. This IEE concludes that the environmental impacts will be manageable if the mitigation measures are implemented thoroughly. The 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) and DOE environmental guidelines.

17. The project is classified "B" in accordance with ADB's Safeguard Policy Statement 2009 since the anticipated impacts are generally site-specific, largely reversible and mitigation measures can be readily addressed. The project requires the preparation of an IEE Report, including an EMP. As per the Environmental Conservation Act, 1995 of Bangladesh, the project falls under Red category requiring preparation of an IEE and environmental impact assessment (EIA). This report is prepared in accordance with the ADB and GOB environmental requirements.

18. This IEE reveals that construction of the Hatikamrul Interchange will have minor adverse impact on the physico-chemical and ecological environments and social environments. To overcome or off-set these negative impacts as well as enhance the positive impacts of the project, adequate precautionary measures should be considered from beginning to end-use of the project, such as during the design, pre-construction, construction, and operational phases. Traffic management is the big challenge during construction of Hatikamrul Interchange.

19. Essentially, secondary data were used to assess the environmental impacts in a comprehensive manner. Site survey for environmental data collection and public consultation will be carried out in order to complete the EIA and recommend suitable mitigation measures.

20. The IEE report assesses the potential environmental impacts associated with the Hatikamrul Interchange, and suitable mitigation measures have been recommended.

21. In the event that any design details of the Hatikamrul Interchange are changed, the IEE and EMP shall be reviewed and revised accordingly and submitted to DOE and ADB for acceptance.

I. REGULATORY FRAMEWORK

1. Regulatory requirements toward protection and conservation of environment and various environmental resources and toward protection of social environment from adverse impact of projects and activities associated with them have been enunciated by the GOB as well as the ADB. Pertinent requirements are summarized below.

A. GOB Environmental Policy, Regulations, and Guidelines

1. National Environmental Policy, 1992

2. Bangladesh has adopted a National Environmental Policy (NEP) in 1992 aimed at sustainable development. The NEP sets out the basic framework for environmental action together with a set of broad sectoral guidelines for action. Major elements of the policy are as follows:

- maintaining the ecological balance for ensuring sustainable development;
- protection of the country against natural disasters;
- identifying and controlling activities which are polluting and destroying the environment;
- ensuring environment-friendly development in all sectors;
- promoting sustainable and sound management of natural resources; and
- active collaboration with international initiatives related to the environment.

3. With regard to the transport sector, the environmental policy aims at prevention of pollution and degradation of resources caused by roads and inland waterways transport. The policy mentions that EIA should be conducted before projects are undertaken.

2. National Environmental Management Action Plan, 1995

4. The National Environmental Management Action Plan (NEMAP) builds on the NEP and was developed to address specific issues and management requirements during the period 1995 to 2005. The plan includes a framework within which the recommendations of a National Conservation Strategy (NCS) are to be implemented. The NEMAP was developed with the following objectives:

- to identify key environmental issues affecting Bangladesh;
- to identify actions to halt or reduce the rate of environmental degradation;
- to improve management of the natural environment;
- to conserve and protect habitats and biodiversity;
- to promote sustainable development; and
- to improve the quality of life.

3. Environmental Conservation Act, 1995

5. The Environmental Conservation Act (ECA) is currently the main legislation relating to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement.

6. The main objectives of ECA are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

7. The main focus of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA);
- Regulations in respect of vehicles emitting smoke harmful for the environment; Environmental clearance;
- Regulation of industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and Formulation and declaration of environmental guidelines.

8. The main focus of the Act can be summarized as:

- The ECA is currently the main legislation relating to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement.
- Before any new project can go ahead, as stipulated under the ECA, the project promoter must obtain environmental clearance from the Director General, DOE. An appeal procedure does exist for those promoters who fail to obtain clearance.
- Failure to comply with any part of this Act may result in punishment to a maximum of 5 years imprisonment or a maximum fine of Tk.100, 000 or both. The DOE executes the Act under the leadership of the Director General.

9. The Project will be undertaken in line with the aims and objectives of the Act by conserving the environment and controlling and mitigating potential impacts throughout the drilling program.

4. Environmental Conservation Act (Amendment 2000)

10. The Bangladesh Environment Conservation Act Amendment 2000 focuses on ascertaining responsibility for compensation in cases of damage to ecosystems, increased provision of punitive measures both for fines and imprisonment and the authority to take cognizance of offences.

5. Environmental Conservation Act (Amendment 2002)

11. The 2002 Amendment of the ECA elaborates on the following parts of the Act:

- Restrictions on polluting automobiles;
- Restrictions on the sale, production of environmentally harmful items like polythene bags;
- Assistance from law enforcement agencies for environmental actions;
- Break up of punitive measures; and
- Authority to try environmental cases.

12. This amendment of the act introduces new rules and restriction on:

- No individual or institution (Gov. or Semi Gov. / Non Gov. / Self Governing) can cut any Hill and Hillock. In case of national interest; it can be done after getting clearance from respective the department

- Owner of a ship breaking yard will be bound to ensure proper management of their hazardous wastes to prevent environmental pollution and Health Risk;
- No remarked water body cannot be filled up/changed; in case of national interest; it can be done after getting clearance from the respective department; and
- Emitter of any activities/incident will be bound to control emission of environmental pollutants that exceeds the existing emission standards.

6. Environmental Conservation Rules (ECR), 1997 and Amendments

13. These are a set of rules, promulgated under the ECA, 1995 and its amendments. The Environment Conservation Rules provide categorization of industries and projects and identify types of environmental assessment required against respective categories of industries or projects. The Rules set:

- The National Environmental Quality Standards (NEQS) for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc.;
- The requirement for and procedures to obtain environmental clearance; and
- The requirement for IEE and EIA according to categories of industrial and other development interventions.

14. The Environment Conservation Rules, 1997 were issued by the GOB in exercise of the power conferred under the Environment Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered:

- Declaration of ecologically critical areas;
- Classification of industries and projects into four categories;
- Procedures for issuing the Environmental Clearance Certificate (ECC); and
- Determination of environmental standards.

15. Rule 3 defines the factors to be considered in declaring an 'ecologically critical area' as per Section 5 of the ECA (1995). It empowers the Government to declare the area as the Ecologically Critical Areas (ECA), if it is satisfied that the ecosystem of the area has reached or is threatened to reach a critical state or condition due to environmental degradation. The Government is also empowered to specify which of operations or processes may be carried out or may not be initiated in the ecologically critical area. Under this mandate, the Ministry of Environment and Forest (MOEF) has declared Sunderban, Cox's Bazar-Tekhnaf Sea Shore, Saint Martin Island, Sonadia Island, Hakaluki Haor, Tanguar Haor, Marzat Baor and Gulshan-Baridhara Lake as ecologically critical areas and prohibited certain activities in those areas.

16. Rule 7 of the 1997 ECR provides a classification of industrial units and projects into four categories, depending on environmental impact and location. These categories are:

- Green;
- Orange A;
- Orange B; and
- Red.

17. The categorization of a project determines the procedure for issuance of an environmental clearance certificate (ECC). All proposed industrial units and projects that are considered to be low polluting are categorized under "Green" and shall be granted environmental clearance. For

proposed industrial units and projects falling in the Orange-A, Orange-B and Red Categories, firstly a site clearance certificate and thereafter an environmental clearance certificate will be required. A detailed description of those four categories of industry/project is in Schedule-1 of ECR (1997). The Rules were essentially developed for industrial developments, but under Schedule 1 of the Guidelines (Clauses 63 and 64) the following falls into the Orange B Category.

18. All existing industrial units and projects and proposed industrial units and projects, that are considered to be low polluting are categorized under "Green" and shall be granted Environmental Clearance. For proposed industrial units and projects falling in the Orange- A, Orange- B and Red Categories, firstly a site clearance certificate and thereafter an environmental clearance certificate will be issued. A detailed description of those four categories of industries has been given in Schedule-1 of ECR '97. Apart from general requirement, for every Red category proposed industrial unit or project, the application must be accompanied with feasibility report on IEE and EIA based on approved TOR by DOE, EMP, etc.

19. Depending upon location, size and severity of pollution loads, projects/activities have been classified in ECR, 1997 into four categories: Green, Orange A, Orange B and Red respectively, to nil, minor, medium and severe impacts on important environmental components (IECs). Corresponding categories of road projects are based on:

20. Red Category: Clause 67: Construction / reconstruction / expansion of roads and bridge (regional, national and international)

7. Bangladesh Climate Change Strategy and Action Plan

21. The GOB also prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 and revised in 2009. This is a comprehensive strategy to address climate change challenges in Bangladesh. Bangladesh Climate Change Strategy and Action Plan built on and expanded the NAPA.

8. National Land Use Policy, 2001

22. The National Land Use Policy was adopted by Bangladesh government in 2001, setting out guidelines for improved land-use and zoning regulations. The main objective of this policy is to ensure criteria base uses of land and to provide guidelines for usage of land for the purpose of agriculture, housing, afforestation, commercial and industrial establishments, rail and highway and for tea and rubber gardens. Overall, this policy promotes a sustainable and planned utilization of land.

23. The main contents of this policy are

- Stopping the high conversion rate of agricultural land to non-agricultural purposes;
- Utilizing agro-ecological zones to determine maximum land use efficiency;
- Adopting measures to discourage the conversion of agricultural land for urban or development purposes; and
- Improving the environmental sustainability of land-use practices.

9. Relevant Other Regulatory Requirements for the Project

24. The Government of Bangladesh has framed various laws and regulation for protection and conservation of natural environment. The legislation with applicability to this project is summarized below in Table 1.

Table 1. Applicability of Key Environmental Legislation

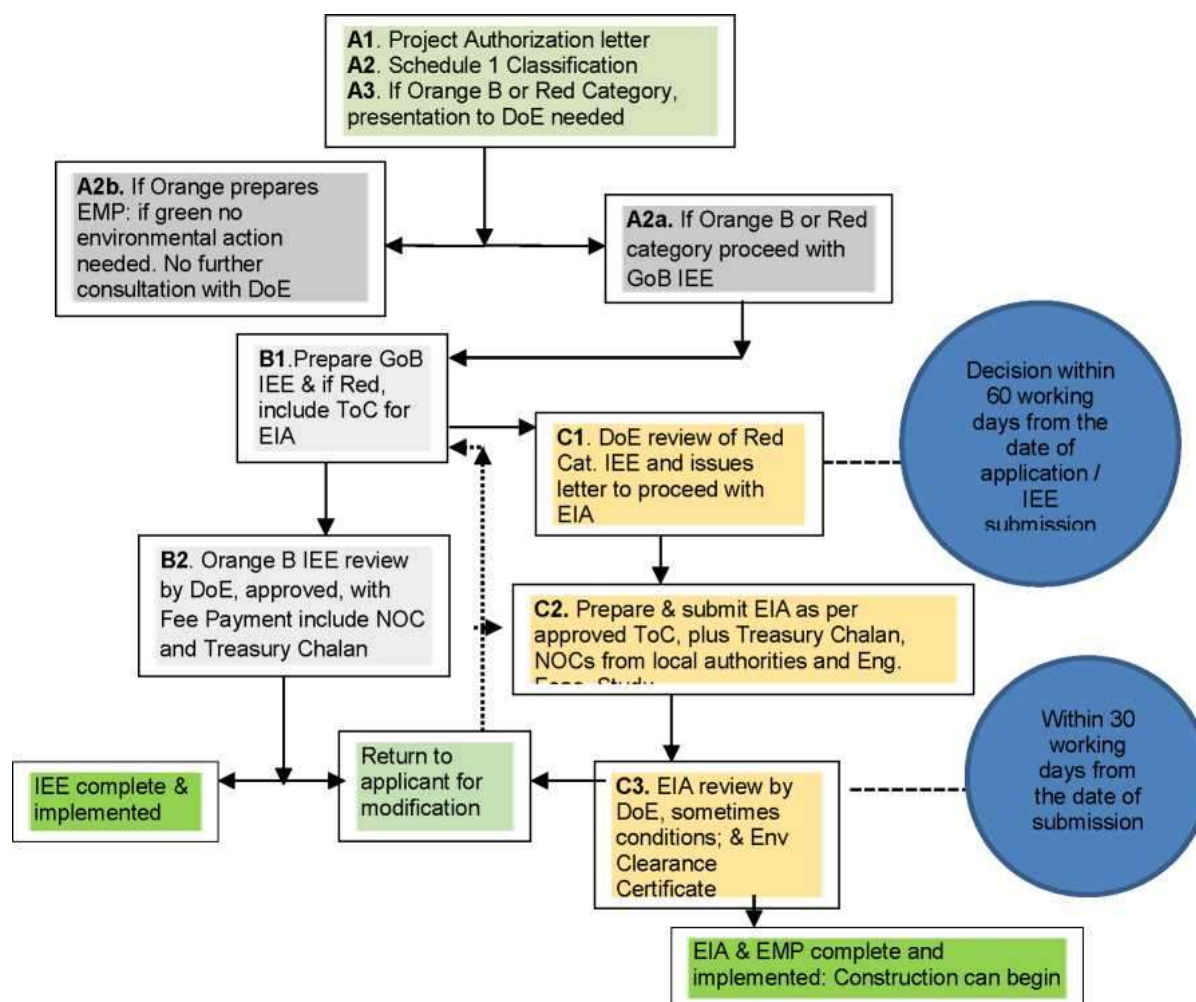
No.	Act/Rule/Law/Ordinance	Responsible Agency-Ministry/ Authority	Key Features-Potential Applicability
1	Bangladesh Environmental Conservation Act, 1995 (ECA,1995) and Environment Conservation Rules 1997 (ECR, 1997)	Ministry of Environment and Forest (MOEF)	Includes categorization of development projects into green, amber A, Amber B and red. Details procedures for securing environmental clearances for projects that are under red category. Also details procedures for obtaining site clearance for projects.
2	Environment Court Act, 2000 and subsequent amendments in 2002	MOEF	GOB has given highest priority to environment pollution and passed Environment Court Act, 2000 for completing environment related legal proceedings effectively
3	Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft)	MOEF	Restricts people from damaging or destroying vegetation in wildlife sanctuaries and hunting and capturing of wild animals
4	The National Water Policy, 1999	Ministry of Water Resources (MOWR)	Protection, restoration and enhancement of water resources; Protection of water quality, including strengthening regulations concerning agro-chemicals and industrial effluent; Sanitation and potable water; Fish and fisheries; and Participation of local communities in all water sector development.
5	The Brick Burning (Control) Act, 1989 The Brick Burning (Control) Amendment Act, 1992 and 2001	MOEF	Control of brick burning Requires a license from the MoEF for operation; Restricts brick burning with fuel wood
6	Water Pollution Control Ordinance 1970	MOWR	Prevents water pollution
7	Bangladesh Labour Law, 2006	Ministry of Labor	This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable working environment and reasonable working conditions.
8	National Land use Policy, 2001	Ministry of Land	The plan deals with land uses for several purposes including agriculture (crop production, fishery and livestock), housing, forestry, industrialization, railways and roads, tea and rubber. The plan basically identifies land use constraints in all these sectors.
9	National Forest Policy and Forest Sector Review (1994, 2005)	Forest Department, MOEF	<ul style="list-style-type: none"> • Afforestation of 20% land. • Biodiversity of the existing degraded forests • Strengthening of agricultural sector • Control of global warming, desertification, control of trade in wild birds and animals • Prevention illegal occupation of the

No.	Act/Rule/Law/Ordinance	Responsible Agency-Ministry/ Authority	Key Features-Potential Applicability
			forestlands, tree felling and hunting of wild animals.
10	The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry)	Forest Department, MOEF	Declare any forests land or wasteland as protected forests. May stop public or private way or watercourse in the interest of preservation of the forest Declare a reserved forest area as Village Forests Declare an area as Social forests or launch a social forestry programme in Govt. land or private land with permission
11	National Biodiversity Strategy and Action Plan (2004)	MOEF	<ul style="list-style-type: none"> • Conserve, and restore the biodiversity of the country; • Maintain and improve environmental stability of ecosystems; • Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations; • Guarantee safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country; • Stop introduction of invasive alien species, genetically modified organisms and living modified organisms.
12	Bangladesh Climate Change Strategy and Action Plan (2008)	MOEF	Establishment of six strategic pillars for action, including: <ul style="list-style-type: none"> • food security, social protection and health • disaster management • protective infrastructure • research and knowledge management, • decreased carbon development, and • capacity building and institutional strengthening.
13	National Fisheries Policy, 1998	Ministry of Fisheries and Livestock (MOFL)	Preservation and management of inland open water fisheries.
14	The Protection and Conservation of Fish Act, 1950 and The Protection and Conservation of Fish Rules, 1985	MOFL	Prohibits and regulates the construction of temporary or permanent of weirs, dams, bunds, embankment and other structures
15	Wetland Protection Act 2000	MOWR	Advocates protection against degradation and resuscitation of natural waterbodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other causes. Prevents the filling of publicly-owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment. Prevents unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.

No.	Act/Rule/Law/Ordinance	Responsible Agency-Ministry/ Authority	Key Features-Potential Applicability
16	Embankment and drainage Act	MOWR	An Act to consolidate the law relating to embankment and drainage.
17	The ground Water Management Ordinance 1985	MOWR	Focuses on management of Ground Water Resources. Disallows digging of tube wells without permission from the Upazilla Parishad
18	Vehicle Act 1927 and Motor vehicle ordinance 1983	BRTA	Road/traffic safety Vehicular air and noise pollutions Fitness of vehicles and registration

25. Under the Environmental Conservation Act (1995) and Rules (1997), the project will be required to obtain a site clearance as well as an environmental clearance. The procedure for obtaining environmental clearance is given in the Figure 1.

Figure 1. Government of Bangladesh Environmental Assessment Process



10. International Treaties

26. Bangladesh has signed most international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversity conservation and the Kyoto protocol on climate change. An overview of the relevant international treaties and conventions signed by GOB is shown in Table 2.

Table 2. Relevant International Treaties, Conventions and Protocols Signed by Bangladesh

Treaty or Convention	Year	Brief description	Responsible Agency
On protection of birds (Paris)	1950	Protection of birds in wild state	DOE/DOF
Occupational hazards due to air pollution, noise and	1977	Protect workers against occupational hazards in the working environment	MOHFW
Occupational safety and health in working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	MOHFW
Occupational health services (Geneva)	1985	To promote a safe and healthy working environment	MOHFW
International convention on climate changes (Kyoto Protocol)	1997	International treaty on climate change and emission of greenhouse gases	DOE/MOEF

11. Administrative Framework

27. Bangladesh has a very clear administrative framework regarding environmental aspects. There is a strong interface between local government and Federal Government. Department of Environment is responsible for grant of environmental clearance to a project. In addition, there are other ministries who deal with specific area of importance such as forests, water and others.

12. Occupational Health and Safety

28. During construction, the project will conform to the labour laws and occupational and health related rules as outlined in Table 3.

Table 3. Relevant Occupational Health and Safety Laws and Rules

Title	Overview
Bangladesh Labor Act, 2006	Provides for safety of work force during construction period. The act provides guidance of employer's extent of responsibility and the workmen's right to compensation in case of injury caused by accident while working.
Labor Relations under Labor Laws, 1996	General concerns during the project implementation state that the project manager must recognize labor unions.
Public Health (Emergency Provisions) Ordinance, 1994	Calls for special provisions with regard to public health. In case of emergency, it is necessary to make special provisions for preventing the spread of disease, safeguarding the public health, and providing adequate medical service, and other services essential to the health of respective communities and workers during construction-related work.

The Employees State Insurance Act, 1948	Health, injury and sickness benefit should be paid.
The Employer's Liability Act, 1938	Covers accidents, risks, and damages with respect to employment injuries
Maternity Benefit Act, 1950	Framed rules for female employees, who are entitled to various benefits for maternity
Bangladesh Factory Act, 1979	Workplaces provisions: these Act and Labor Laws require medical facilities, first aid, accident and emergency arrangements, and childcare services to be provided to the workers at workplace.

B. ADB's Safeguard Policy

29. Asian Development Bank (ADB) has three safeguard policies that seek to avoid, minimize or mitigate adverse environmental impacts and social costs to third parties, or vulnerable groups as a result of development projects. The objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

30. Since the ADB Safeguard Policy Statement had been approved, it supersedes the Involuntary Resettlement Policy (1995), the Policy on Indigenous Peoples (1998), the Environment Policy (2002), and the second sentence of para. 73, and paras. 77-85, and 92 of the Public Communications Policy (2005). The Public Communications Policy (PCP) was updated in 2011, and has been superseded by Access to Information Policy (2018).

C. Project Category

31. The ADB SPS addresses environmental concerns, if any, of a proposed activity in the initial stages of project preparation. For this, the ADB SPS categorizes the proposed components into A, B, or C to determine the level of environmental assessment required to address the potential impacts. The project has been categorized as B in accordance with ADB's Safeguard Policy Statement 2009 since the anticipated impacts are generally site-specific, largely reversible and mitigation measures can be readily addressed. The project requires the preparation of an IEE report, including an EMP.

32. According to GoB ECR Schedule 1, the project is red category because it involves construction, reconstruction, and extension of roads and bridges. In due course, an environmental assessment must be prepared in the prescribed format and be submitted to the DOE for approval. Table 4 shows the summary of environmental regulatory compliance required for the project.

Table 4. Environmental Regulatory Compliance

Component Description	Government of Bangladesh		ADB	
	Category in Accordance with ECR	Environmental Assessment	Category in Accordance with SPS	Environmental Assessment
Hatikamrul Interchange (work package-13)	Red - Under Clause 67 Construction / reconstruction / expansion of roads and bridge (regional, national and international)	IEE, EIA, and EMP	Category B	IEE including EMP

II. DESCRIPTION OF THE PROJECT

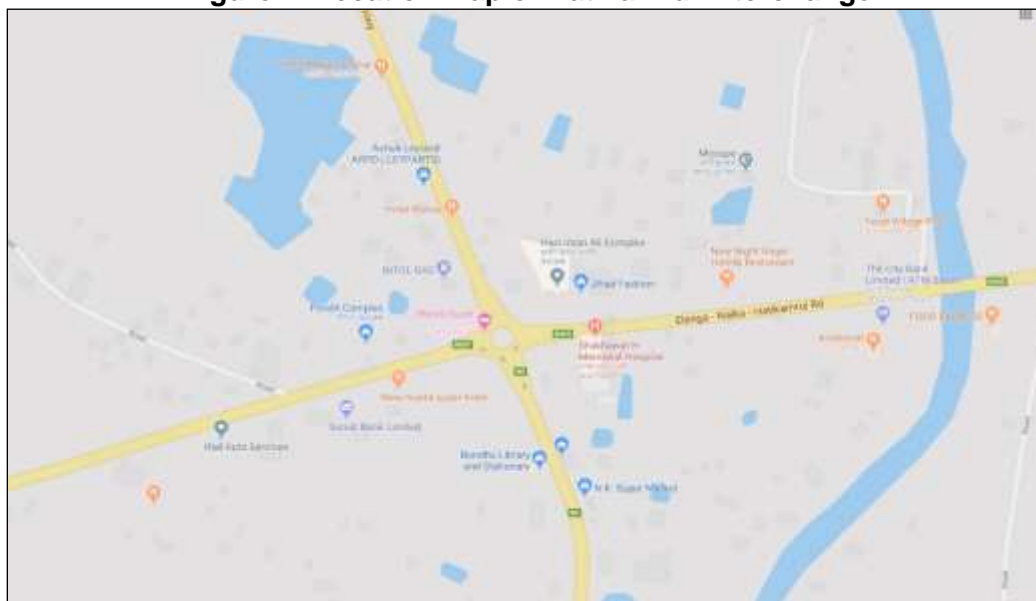
A. Description of the Project

33. The Government of Bangladesh is emphasizing on improved connectivity between each part of the country. In line with this objective, the GOB announced its National Land Transport Policy in 2004 defining long term (20 years) Road Master Plan (RMP). The RMP has identified many feasible and priority projects. One of the priority roads identified is the Elenga-Rangpur road. This road is a vital link in the national highway network and forms part of the Asian Highway Network complementing the government plans to increase trade with India. Within this road network one very important location is Hatikamrul. This road will be improved under Hatikamrul Interchange (work package-13).

B. Project Location

34. Hatikamrul Interchange ($24^{\circ}25'8.97''N$ and $89^{\circ}33'6.97''E$) is in Sirajganj district. The total length is 1500 m. Figure 2 shows the project location.

Figure 2. Location Map of Hatikamrul Interchange



C. Project Outline

35. The details so far of the interchange upgrade are given below (Tables 5 and 6).

Table 5. Outline of the Hatikamrul Interchange

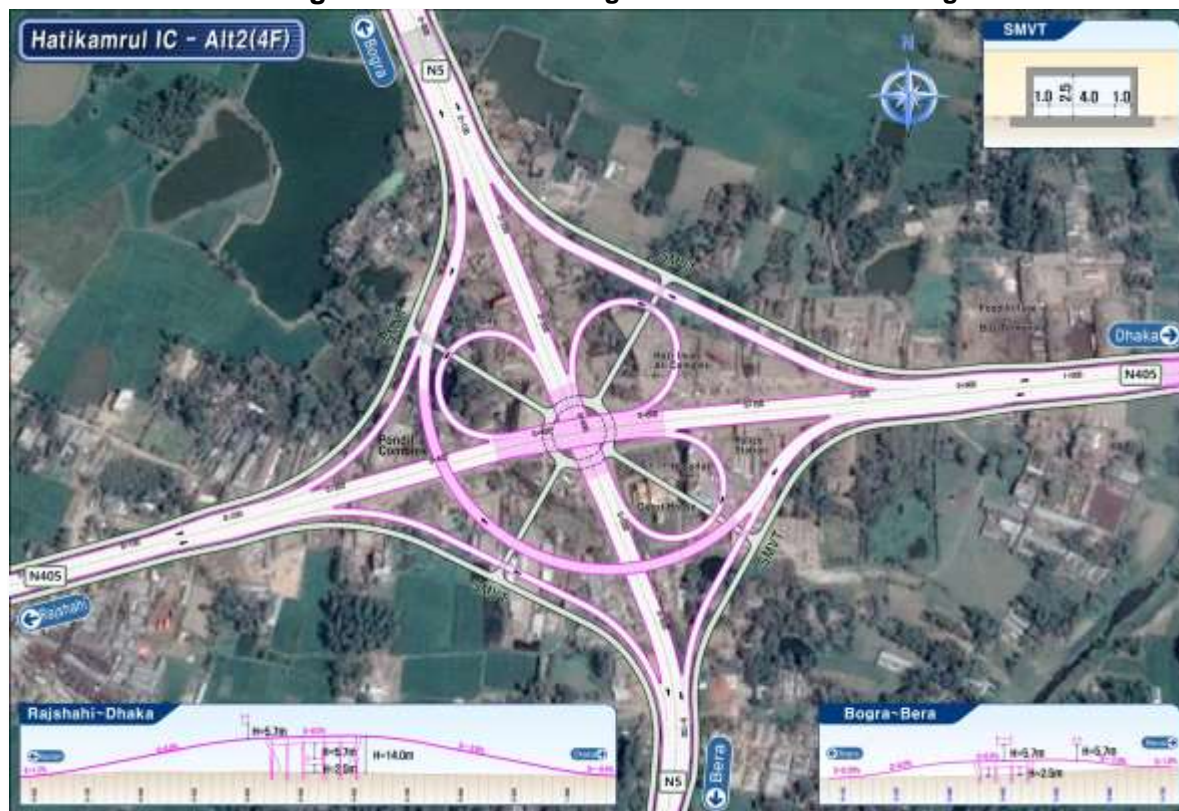
1.	Project Title	:	South Asia Sub regional Economic Cooperation (SASEC) Phase 2
2.	Work Package No.	:	WP - 13
3.	Road Sections	:	Hatikamrul Interchange (1500 m)
4.	a) Sponsoring Ministry/Division	:	Ministry of Road Transport & Bridges
	b) Executing Agency	:	Roads & Highways Department (RHD)

Table 6. Hatikamrul Interchange Details

Subject	Work Package 13
Start Point	Hatikamrul town
End Point	Hatikamrul town
Districts	Rangpur
Start Chainage	0+000
End Chainage	1+500
Length (km)	1.5
Length of New Road Construction (m)	1.5
Total Construction Cost (Crore BDT)	250.00
Earthwork as per BoQ (cum)	
Earthwork Cost (Crore BDT)	
Structure Cost as per BoQ (Crore BDT)	250
Number of Culvert	
Number of Bridge	
Length of Bridge (meter)	
Number of Flyover	
Chainage of Flyover	
Length of Flyover (meter)	
Railway Overpass	
Number of Underpass	
Number of Bus bay	
Number of Pedestrian Overpass	
Number of U Turns	
Side/Link Road	
Intersection	

36. Design team is still working to finalize the design but more or less, it will be cloverleaf design. The proposed project will impact among others, a private hospital, a commercial residential hotel, one electric overhead high-voltage pole and underground gas pipeline with diameter of 0.6 meter. The proposed design has been shown in Figure 3.

Figure 3. Cloverleaf Design of Hatikamrul Interchange



37. Any one of these options will require displacement of Affected Persons and a resettlement survey has been conducted (Table 7).

Table 7. Compensation and Budget for the Properties Displaced within ROW

Compensation/ Budget Items	Package-wise Amount in Million taka
	Package-13 Hatikamrul Interchange 1.50 km
Compensation for Land	0
Compensation for Primary Structures	67.575
Compensation for Secondary Structures	2.75
Compensation for Trees	0
Compensation for Business Loss	85.829
Compensation for Employment Loss	12.798

Compensation/ Budget Items	Package-wise Amount in Million taka
	Package-13 Hatikamrul Interchange 1.50 km
Compensation for Rented-out Structures	2.96
Grants to Income Vulnerable PDHs	0.186
Grants to Renters or Leasers	1.776
Grants for Relocating Graves	0.15
Compensation for Community Properties	7.782
Total Amount of Compensation	181.806
Contingency=10% Total Compensation	18.074
Total Budget	199.88

Source: SASEC-II SRM July – December 2018

38. The major impacts are given below (Table 8).

Table 8. Summary of Major Impacts

Resettlement Plans	Amount of Land affected	No. of affected HHs	No. CPR affected
Hatikamrul Interchange	Total 4.0 ha (Private land)	151 (Titled: 31, Non-Titled: 120)	10

III. DESCRIPTION OF THE ENVIRONMENT

A. General

39. The baseline condition of environmental quality in the locality of project site serves as the basis for identification, prediction and evaluation of impacts. The baseline environmental quality is assessed through field studies within the impact zone for various components of the environment, viz. air, noise, water, land and socio-economic, etc.

40. Data was collected from secondary sources for the macro-environmental setting like climate (temperature, rainfall, humidity, and wind speed), physiographic, geology etc. Firsthand information was collected to record the micro-environmental features within and adjacent to the project corridor.

41. Collection of primary information includes extrapolating environmental features on proposed road design, tree inventories, location and measurement of socio-cultural features adjoining proposed Hatikamrul Interchange. Ambient air, noise, soil and water quality samples were collected at important locations in terms of environment quality to prepare a baseline database. The following section describes the baseline environment in three broad categories:

- Physical Environment - factors such geology, climate and hydrology;
- Biological Environment - factors related to life such as flora, fauna and ecosystem;
- Socio-economic Environment - anthropological factors like demography, income, land use and infrastructure.

B. Physical Environment

1. Climate

42. Although less than half of Bangladesh lies within the tropics, the presence of the Himalaya mountain range has created a tropical macroclimate across most of the east Bengal land mass. Bangladesh can be divided into seven climatic zones (Rashid 1991). According to the classification, the project area is in the North-western climatic zone.

43. In summer, the mean maximum temperature is well above 32°C whereas in winter the mean minimum is below 10°C. The summer is dry, with a scorching westerly wind, but the rainy season is very wet, with 2,000 to 3,000 mm of rainfall. The lower rainfall makes this area both atmospherically and pedologically drier (Banglapedia, 2012). Like other parts of the country, the project area is heavily influenced by the Asiatic monsoon, and it has these three distinct seasons:

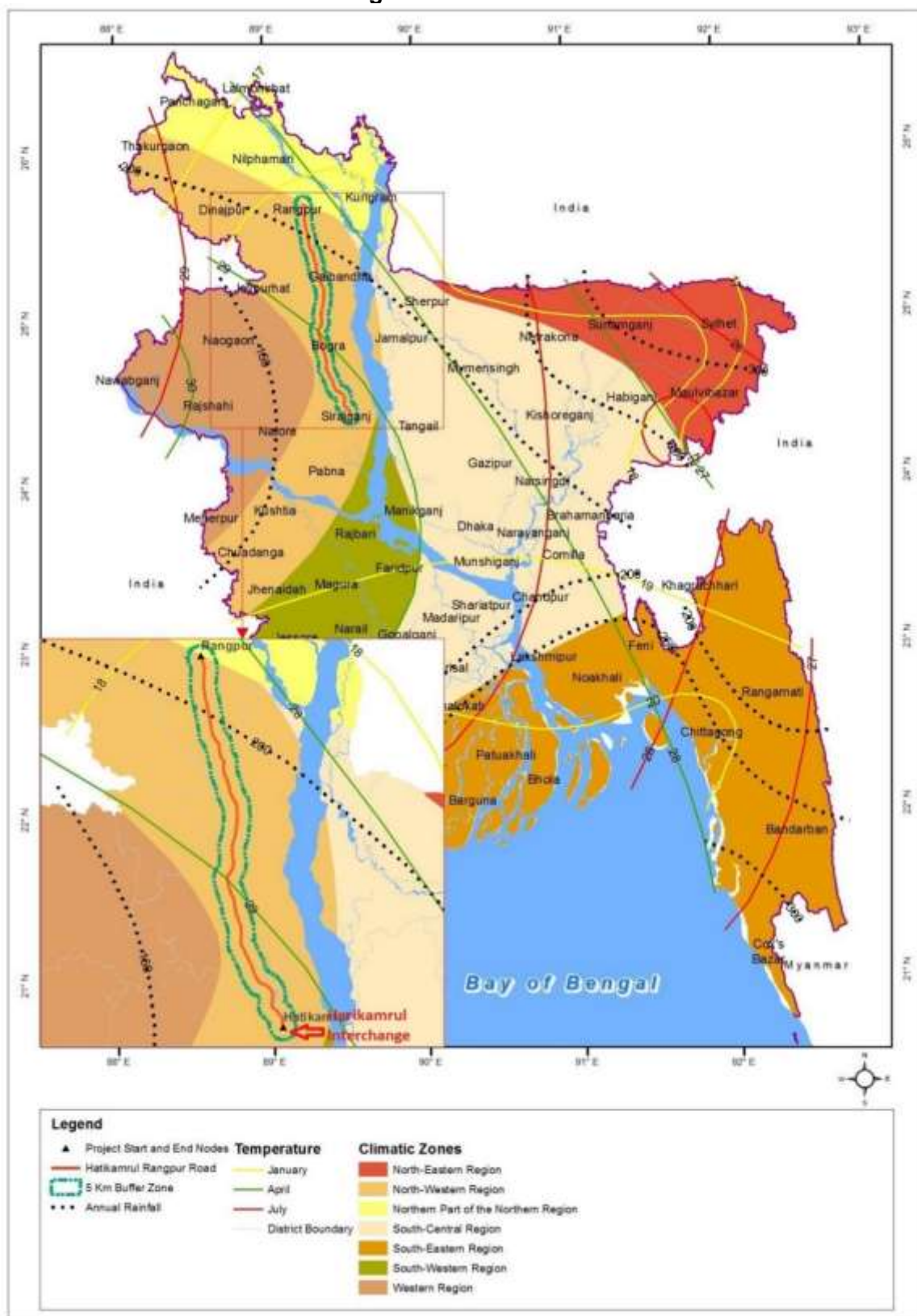
- Pre-monsoon hot season (from March to May),
- Rainy monsoon season (from June to October), and
- Cool dry winter season (from November to February).

44. The pre-monsoon hot season is characterized by high temperatures and thunderstorms. April is the hottest month in the country with mean temperatures ranging from 27°C in the east and south, to 31°C in the west-central part of the country. After April, increasing cloud-cover reduces the temperature. Wind direction is variable during this season, especially during the early part. Rainfall, mostly caused by thunderstorms, at this time can account for 10 to 25% of the annual total.

45. The rainy monsoon season is characterized by southerly or south-westerly winds, very high humidity, heavy rainfall and long periods of consecutive days of rainfall. The monsoon rain is caused by a tropical depression that enters the country from the Bay of Bengal. About 80% of the annual precipitation occurs during the five-month monsoon season from May to September.

46. The cool dry season is characterized by low temperatures, cool air blowing from the west or northwest, clear skies and meagre rainfall. The average temperature in January varies from 17°C in the northwest and north-eastern parts of the country to 20°C to 21°C in the coastal areas. Minimum temperatures in the extreme northwest in late December and early January reach between 3°C to 4°C.

Figure 4. Climatic Zone

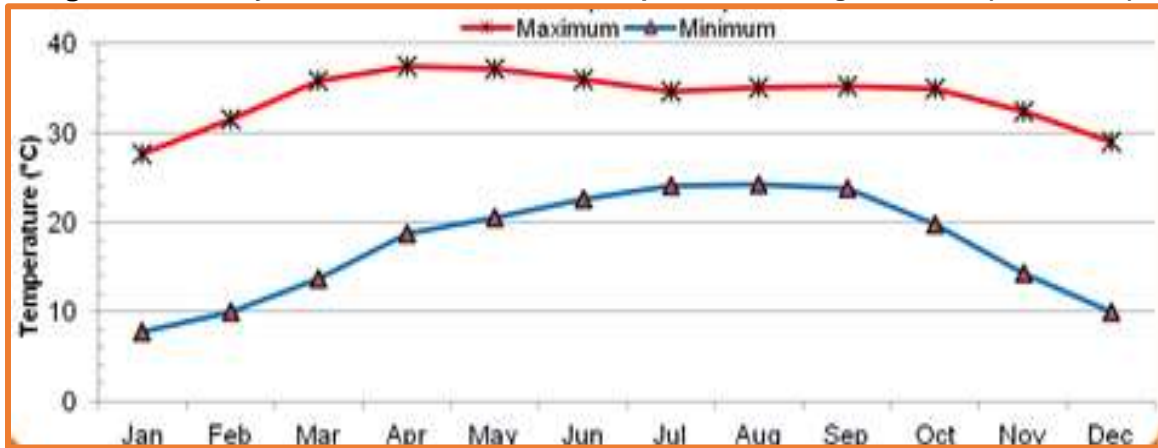


Source: Haroun er Rashid, 1991.

2. Temperature Data

47. Long-term average monthly temperature data (1991-2012) was collected at Tangail weather station from Bangladesh Meteorological Department (BMD). The highest temperature recorded in this station 37.5 °C in April and the lowest temperature was found in the month of January which was 7.7 °C. The average monthly temperature graphs (Figure 6) show that the area faces high temperatures from March to May and lowest temperature during winter from December to February.

Figure 5. Monthly Maximum and Minimum Temperature at Tangail Station (1991–2012)

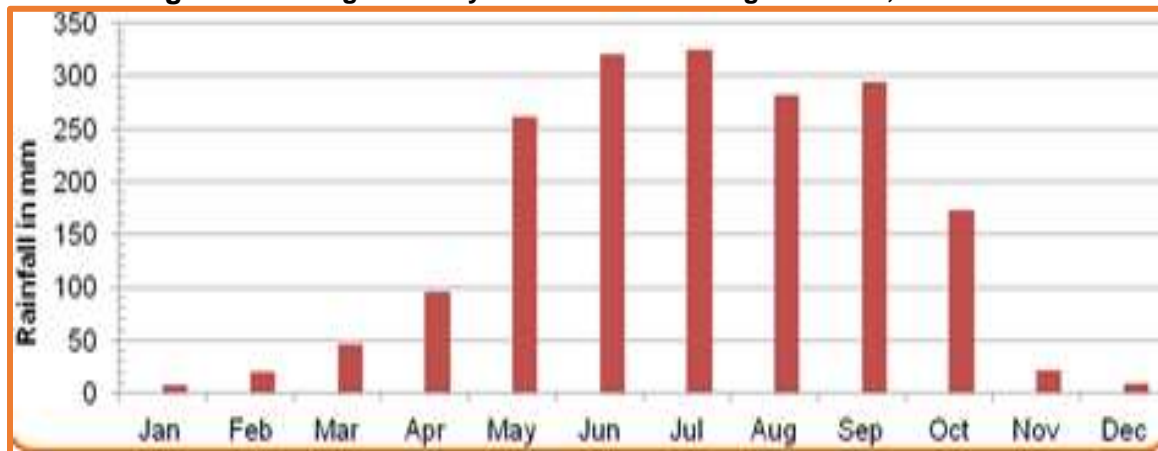


Source: Bangladesh Meteorological Department (BMD)

3. Rainfall

48. The rainfall data collected for the same station shows that maximum rainfall occurs during May to September and the lowest rainfall occurs in November to February during winter season (Figure 4.2.3). Statistical data of 1991 to 2012 shows that the station experiences more than 300 mm rainfall in June and July months during monsoon. In the month of December and January of winter season around 10 mm rainfall occurred in the region of Tangail stations.

Figure 6. Average Monthly Total Rainfall at Tangail Station, 1991–2012



Source: Bangladesh Meteorological Department (BMD)

4. Humidity

49. Humidity is the amount of water vapor in the air. There are three main measurements of humidity: absolute, relative and specific. Relative humidity is an important metric used in weather forecasts and reports, as it is an indicator of the likelihood of precipitation, dew, or fog. While humidity itself is a climate variable, it also interacts strongly with other climate variables.

50. Humidity remains high in summer and comparatively low in winter season. The statistical data of humidity from 1991 to 2012 indicates that humidity in the area maximized in July to September ranging from 80% to 85%. Humidity falls to 60%-75% in February, March and April during the winter season in the considered area (Figure 4.2.4).

Figure 7. Average Monthly Relative Humidity at Tangail Station, 1991–2012



Source: Bangladesh Meteorological Department (BMD)

5. Wind Speed

51. Prior to the onset of the monsoon in March and April, hot conditions and thunderstorms prevail while winds gradually start blowing from the south or southwest - a pattern that continues throughout the monsoon period. Winds are generally stronger in the summer than they are in winter. The direction of prevailing winds is generally consistent during the winter and monsoon seasons and more variable during the transition periods. The Himalayan mountains influence wind patterns. Recirculation of winds during the monsoon season under the influence of the Himalayas can result in winds circling to the east-southeast in the northern parts of the country.

52. The statistical wind speed data (Figure 9) shows that wind speed maximum was consistently 3.3 knots in May and the minimum was 1.9 knots in December.

Figure 8. Average Monthly Maximum Wind Speed at Tangail Station, 1991–2012



Source: Bangladesh Meteorological Department (BMD)

6. Physiographic Features

53. Bangladesh can be divided into three broad categories based on topography, physical features, and geological history (Brammer 1996):

- Floodplains
- Terraces
- Hills

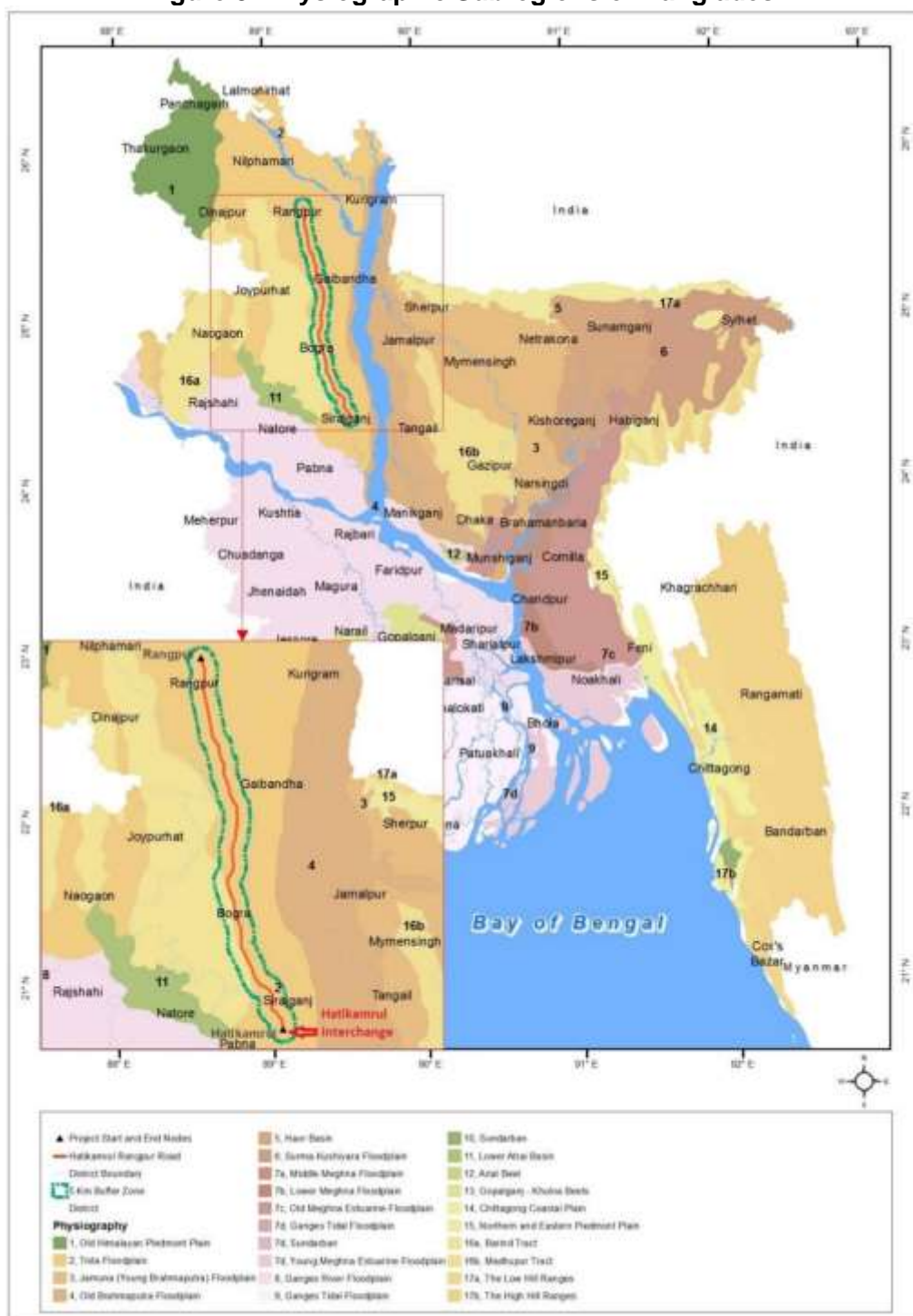
54. Within these 3 broad categories, a number of authors have further divided the land surface into a series of physiographic units based on a combination of topographical/landscape features, underlying geology and surface soils (Bramer, 1996, Rashid, 1991, Morgan and McIntyre, 1959).

55. The Hatikamrul-Rangpur road alignment area lies mostly in the north-western part of the country and depends on the Teesta River for freshwater supply. The entire road alignment runs through the following two physiographic units 2 and 16a.

- (i.) **Tista floodplain (2)** - A big sub-region stretches between the Old Himalayan Piedmont Plain in the west and the right bank of the N-S flowing Brahmaputra in the east. An elongated outlier representing the floodplain of the ancient Tista extends up to Sherpur (Bogra district) in the south. Most of the land is shallowly flooded during monsoons. There is a shallow depression along the Ghaghat river, where flooding is of medium depth. The big river courses of Tista, Dharla and Dudhkumar cut through the plain. The active floodplain of these rivers, with their sandbanks and diyaras, is usually less than six kilometers wide (Banglapedia, 2012).
- (ii.) **Barind Tract (16a)** - It comprises mid and lower western part of Rajshahi division, between the Ganges and Brahmaputra. The largest one of the three Pleistocene upland blocks, the Barind Tract spreads over an area of about 7,770 sq. km. In the south, the Barind Tract is an older pleistocene terrace forming a small plateau with a flat or in some sectors a slightly undulating surface. This terrace consists of reddish and yellowish and partially mottled clays and is characterized morphologically by a dendritic drainage pattern, which is typical of all older Pleistocene terraces in Bangladesh. The Barind unit is comparatively at higher elevation than the adjoining floodplains. The contours of the tract suggest that there are two terrace levels one at 40m and the other between 19.8 and 22.9m. Therefore, when the floodplains go under water during monsoon the Barind Tract

stands free from flooding and is drained by a few small streams. About 47% of the Barind region is classified as highland, about 41% as medium-high land, and the rest are lowland. The depression at the southeast of the Barind Tract is called the Bhar Basin. It includes parts of Rajshahi and Pabna districts, with its center in the vast marshy area called the Chalan Beel (Banglapedia, 2012).

Figure 9. Physiographic Subregions of Bangladesh

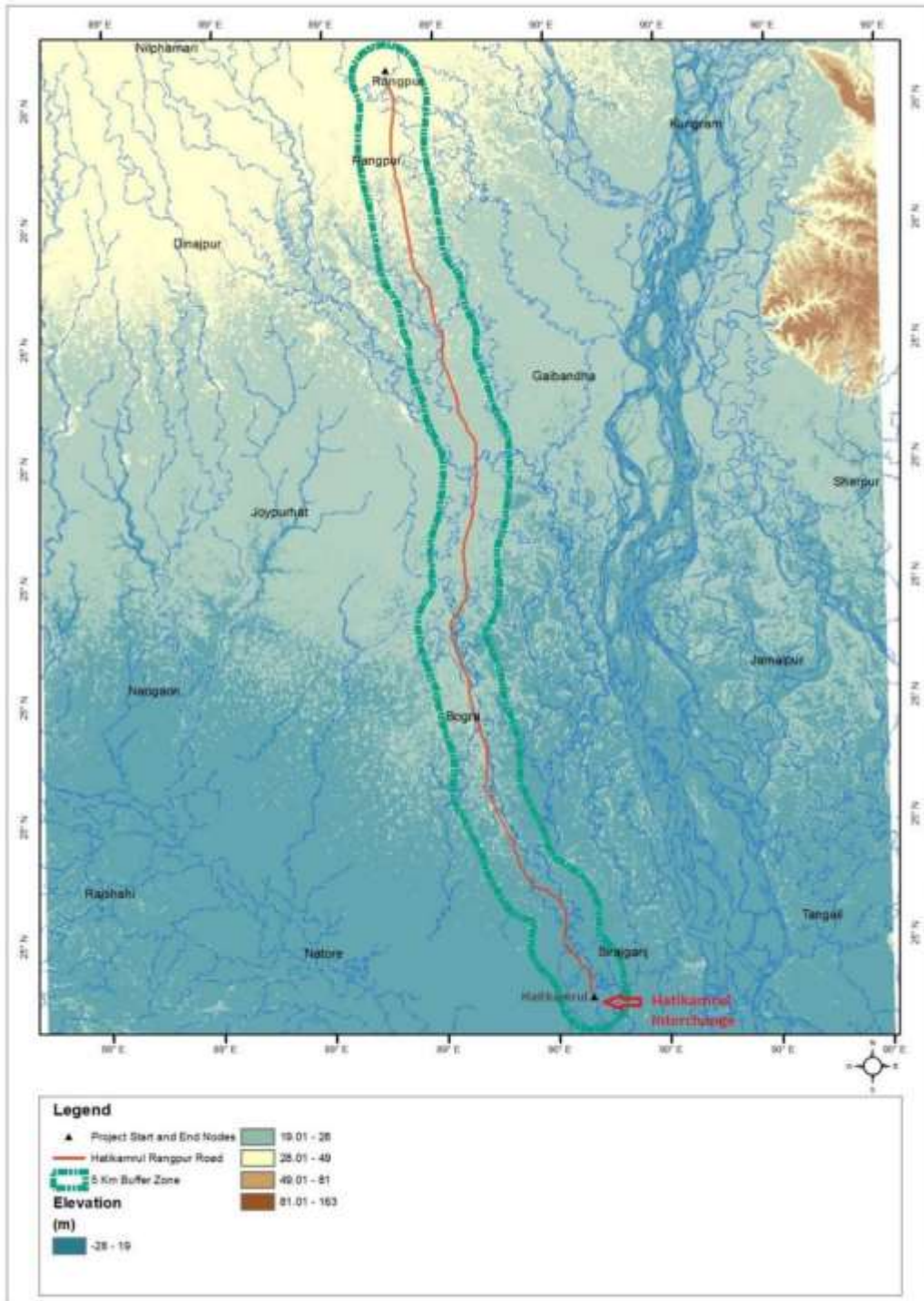


Source: Soil Resource Development Institute, 1997.

7. Topography

56. The general topography of the project area comprises floodplains in the majority of the road and terraces. The topography of the project area slopes from north to south with elevation ranged from 32m a.m.s.l to 15m a.m.s.l (Figure 11).

Figure 10. Topography

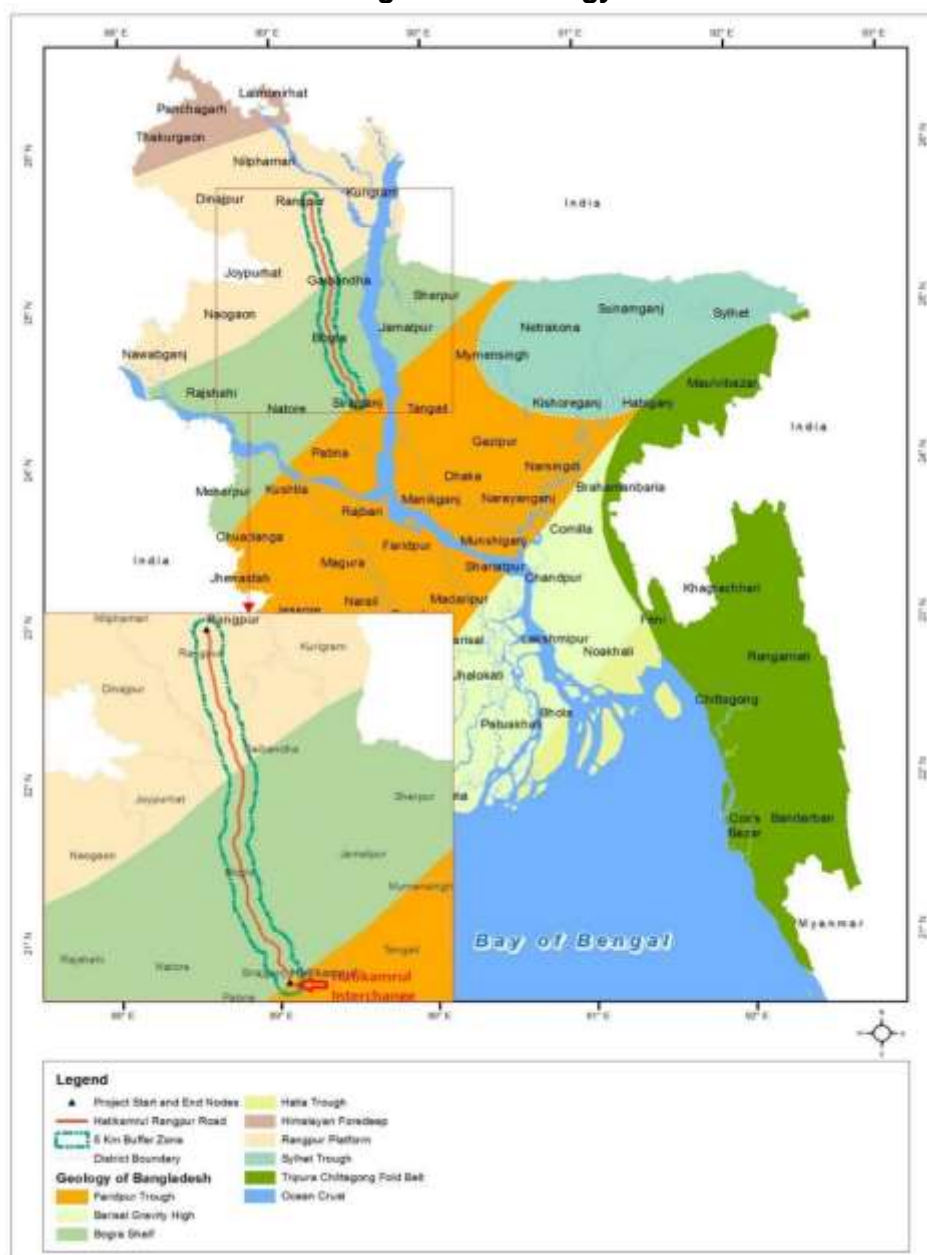


Source: Banglapiada.

8. Geology

57. Bangladesh is situated to the east of the Indian sub-continental plate. Nearly 85% of Bangladesh is underlain by deltaic and alluvial deposits of the Ganges, Brahmaputra, and Meghna river systems. The project area consists of Holocene alluvial deposits flood plain and predominantly consisting of fine sand, silts and clay. The site is on deep Cenozoic deposits that overlie Precambrian basement rock. The Precambrian rocks form the basement of all geological formations of Bengal Basin and shield areas. The materials deposited are a mixture of sediments transported by the old Brahmaputra and by the Jamuna (Brahmaputra) River. The generalized geological features of project area are shown in the geological map of Bangladesh (Figure 12).

Figure 11. Geology



Source: Banglapedia.

9. Seismicity

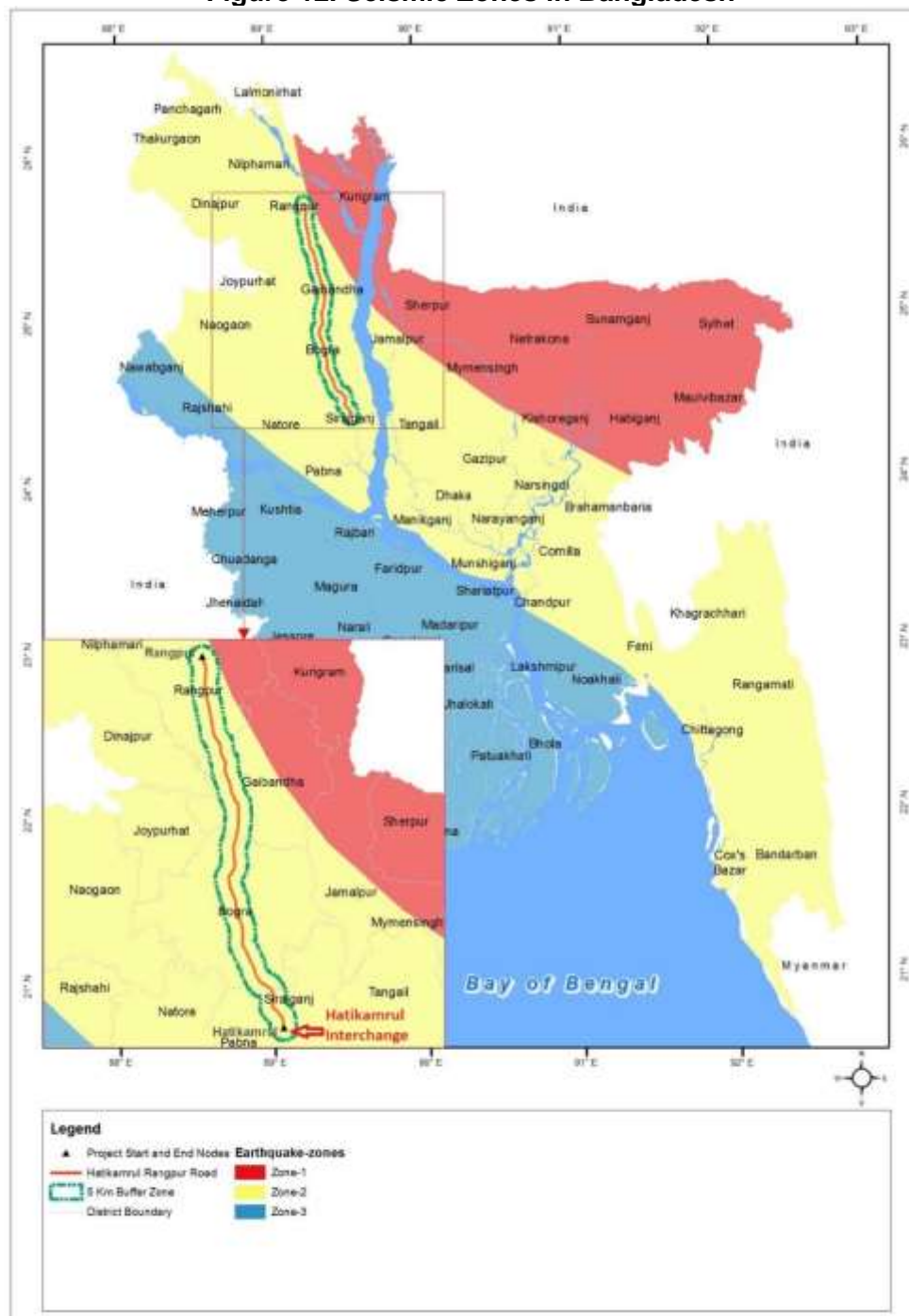
58. Seismic Zone expression of the proneness of a region to earthquake occurrence in the historical past including the expectations in future. A region experiencing more frequent and large earthquakes has a higher seismicity compared to one with less frequent and small earthquakes. Both the temporal and spatial distributions of all earthquakes, small and big, have to be systematically accounted for by determining their past behavior to determine the future trend.

59. Bangladesh is situated in one of the most tectonically active regions in the world. Here is where three major plates meet (the Indian Plate, the Tibet Sub-Plate, and the Burmese Sub-Plate). The project area is located over the Indian Plate, which is moving north. However due to the location of relevant plates, fault lines and hinge zones, Bangladesh itself is divided into three seismic zones (Table 9), based on the ranges of the seismic coefficient (note: the seismic coefficient is a measure of how strong an earthquake has the potential to be based on a combination of the mass of the plate and the seismic forces acting on it, as well as how frequently these quakes are likely to occur). As per the seismic zone map (Figure 13), project road falls in zone II means medium seismic intensity. There is no evidence of major earthquakes in the project areas in the past.

Table 9. Seismic Zonation of Bangladesh

Zoning	Area Mercalli Scale	Bask Seismic Coefficient
I	North and eastern regions of Bangladesh (Seismically most active)	0.08
II	Lalmai, Barind, Madhupur Tracts, Dhaka, Comilla, Noakhali and western	0.05
III	Khulna division S-E Bangladesh (Seismically relatively quiet)	0.04

Figure 12. Seismic Zones in Bangladesh



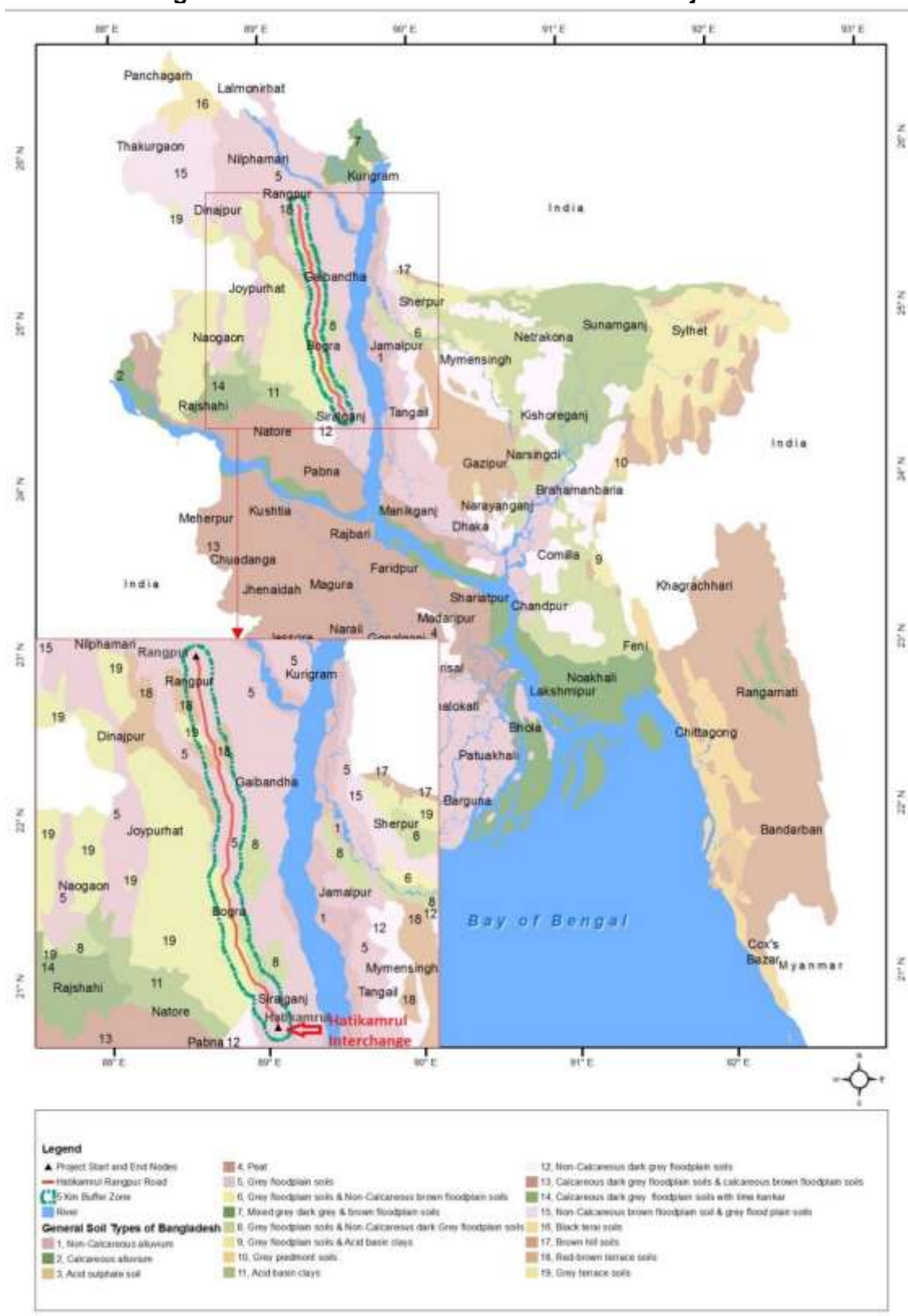
Source: Hossain, 1988 and Zahiruddin, 1993.

10. Soil

60. The project road passes through different soil formation zones (Figure 4.2.10). The general soil types of the project road area predominantly include the following:

- Grey floodplain soil (5): Generally comprise grey topsoil and a cambic B-horizon in the subsoil with a grey matrix or grey gleans. They extensively occupy Teesta, Karatoya-Bangali, Jamuna, middle Meghna and eastern Surma-Kushiyara floodplains. However, there are considerable regional differences in the proportions occupied by individual soil textures. Silt loam texture is dominant in the Teesta meander floodplain whereas silty clays are predominant in the Ganges tidal floodplain and in the Surma-Kushiyara floodplain. But the Jamuna floodplain has a more even distribution of silt loam, silty clay loam and silty clays. Most of these soils have been included in Eutric Gleysols (Banglapedia, 2012).
- Red-brown terrace soil (18): This type of soil can be divided into two classes; one is shallow red-brown terrace soil and deep red-brown terrace soil. Shallow red-brown terrace soil occurs extensively on gently undulating to rolling relief on the Madhupur Tract and locally in the Barind tract. They are pale olive-brown to reddish-brown soils overlying grey, little altered, Madhupur Clay at less than 90 cm depth. The subsoil ranges from a porous yellow brown loam to olive brown, strong or reddish brown structured clay in different soils. Generally, these soils are strongly to extremely acidic. The majority of them have been classified as Haplic and Gleyic Alisols. Deep Red Brown Terrace soils occur extensively in the north-eastern Barind Tract, on the Madhupur Tract and on the Akhaura Terrace. These soils are well to moderately well drained, reddish brown to yellow-brown, strongly to extremely acidic, friable clay soils over deeply weathered, red-mottled, Madhupur Clay. They are mainly Ferric Alisols (Banglapedia, 2012).
- Grey terrace soil (19): This type of soil can be divided into three classes. These are shallow grey terrace soils, deep grey terrace soils and grey valley soils. Shallow Grey Terrace soils occur extensively on the level Barind Tract and the high Barind Tract. The soils are grey, silty and poorly drained, which overlie heavy, grey, little-altered Madhupur Clay at a shallow depth. Below the cultivated layer, there is an E-horizon. They have been classified as Eutric Planosols. Deep Grey Terrace soils occupy extensive parts of the north-eastern Barind Tract and the Madhupur Tract. They also occur in the northwest of the Northern and Eastern Piedmont Plains. The soils are poorly drained, grey and silty and overlie pervious, deeply weathered Madhupur or Piedmont clay. The major part of the subsoil is an E-horizon. The majority of these soils are Albic Gleysols, Gleyic Luvisols and Gleyic Alisols. Grey Valley soils are broadly similar to deep grey terrace soils but differ from them in being developed in valleys and in generally not overlying a strongly red-mottled clay substratum. They are Albic and Eutric Gleysols (Banglapedia, 2012).

Figure 13. General Soil Classification of the Project Area



Source: Soil Resource Development Institute, 1997.

11. Agroecological Zones within the Project Area

61. A 1988 study carried out by the United Nations Development Program (UNDP) classified Bangladesh into a series of Agroecological Zones (AEZs) based on an assessment of commonalities in characteristics such as physiography, soil types, climate and drainage. In total, 34 regions were identified and characterized, however this information has been updated and further refined on numerous occasions since the original study was undertaken.

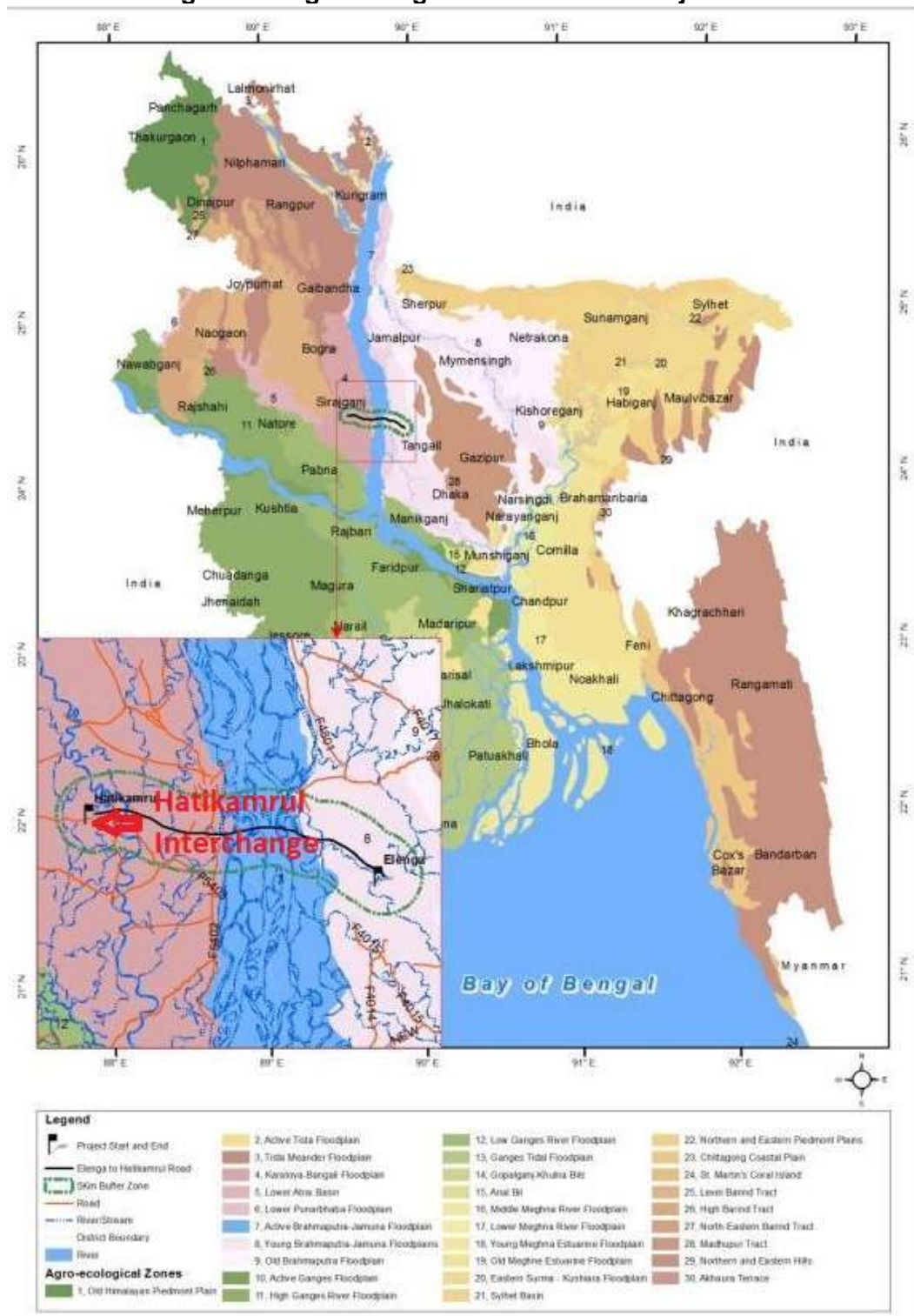
62. The purpose of assessing the AEZs within the project area is to establish a broad overview of expected soil conditions which can be compared against more detailed, Upazila-level data sources.

63. The most recent assessment was completed by the Soil Resource Development Institute (SRDI, 1998) which classified Bangladesh into 30 AEZs. The project area contains 3 AEZs (refer Figure 4.2.10), namely:

- Teesta Meander Floodplain (3): This region occupies the major part of the Teesta floodplain as well as the floodplain of the Atrai, little Jamuna, Karatoya, Dharla and Dudhkumar rivers. Most areas have broad floodplain ridges and almost level basins. There is an overall pattern of olive brown, rapidly permeable, loamy soils on the floodplain ridges, and grey or dark grey, slowly permeable, heavy silt loam or silty clay loam soils on the lower land and parent materials medium in weatherable K minerals. Eight general soil types occur in the region, moderately acidic throughout, low in organic matter content on the higher land, but moderate in the lower parts. Fertility level is low to medium. Soils, in general, have good moisture holding capacity (Banglapedia, 2012).
- Karatoya-Bangali Floodplain (4): This region is very similar to the Teesta Meander Floodplain in physiography and soil, comprises a mixture of Teesta and Brahmaputra sediments. Most areas have smooth, broad, floodplain ridges and almost level basins. The soils are grey silt loams and silty clay loams on ridges and grey or dark grey clays in basins. Five general soil types occur in the region, of which non-calcareous grey floodplain and non-calcareous dark grey floodplain soils predominate. The soil is moderately acidic throughout. Organic matter contents are generally low in the cultivated layer of ridge soils and moderate in basins. General fertility is medium. The eastern half of Bogra and most of Sirajganj districts are included in this zone (Banglapedia, 2012).
- North Eastern Barind Tract (27): This region occupies several discontinuous areas on the north-eastern margins of the Barind Tract. It has silty or loamy topsoil and clay loams to clay subsoil. The soils are strongly acidic in reaction. Organic matter in the soils is low. General fertility is poor (Banglapedia, 2012).

64. The nature and soil characteristics of these zones influence the crops and cropping patterns within the region. Human interventions and modifications in the drainage patterns have already affected the cropping calendar, crop diversity and introduction of new varieties and agricultural products.

Figure 14. Agroecological Zones of the Project Area



Source: Soil Resource Development Institute, 1997.

12. Soil Quality

65. According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service, soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation. The soil in the project area is highly productive and suitable to support different ecosystems in balance. The land in this area is mostly used for agricultural cultivation and there are a lot discrete water bodies for fish cultivation.

13. Water Resources and Hydrology

66. Bangladesh is located over a subsiding basin of tectonic origin overlain with a great thickness of sedimentary strata. This sedimentary stratum is an unconsolidated alluvial deposit of recent age overlaying marine sediments. The recent delta and alluvial plains of the Ganges, Brahmaputra and the Meghna Rivers constitute the upper formation. The near surface Quaternary alluvium contains good aquifer characteristics (transmission and storage coefficients). The groundwater (GW) storage reservoir has three divisions: upper clay and silt layer, a middle composite aquifer (fine to very fine sand) and a main aquifer consisting of medium to coarse sand. Drinking water is generally taken from deep tube wells with strainers set between depths of 200 metres to around 400 metres (DPHE, 2011). The Ground water level is at or very close to the surface during the monsoon; whereas, it is at maximum depth during the months of April and May (Banglapedia, 2012).

67. To assess the current quality of ground water, water samples were collected from Hatikamrul location. The overall quality of surface water around the project site and its surroundings varies throughout the year. Typically, water quality improves during the monsoon due to the influx of fresh rainwater and worsens during the dry season as water evaporates and the concentration of contaminants increases.

68. Based on field observations and interviews with local residents it was found that groundwater in the area is used as a drinking water source in many instances, as well as for irrigation purposes. Water is generally extracted via hand pump (tube wells) from the shallow regions of the composite aquifer, and via machine-driven pumps (deep tube wells) which draw from the deeper main aquifers (Table 10). The groundwater reservoir usually recharges from rainfall, floods and river. In summer season, the water table slightly goes down and goes up in rainy season.

Table 10. Source of Drinking Water in the Project Area

District	Upazila (sub-district)	No. of Households	Source of Drinking Water (%)		
			Tap	Tube-well	Others
Sirajganj	Ullapara	123,630	0.9	94.7	4.4
	Raiganj	77,104	0.7	95.4	3.9

Source: Population Census, 2011.

14. Groundwater Quality

69. In March 2017, groundwater samples were collected by environmental team from shallow tube wells in the project area. The Bangladesh Council of Scientific and Industrial Research (BCSIR) analyzed the samples. The concentration of Mn is higher than the standard value of most the measured water sources and only Fe is higher at Hatikamrul. Table 4.2.3: Results for Groundwater Field Samples

Table 11. Groundwater Field Samples at Hatikamrul

Parameters	Unit	Hatikamrul	Drinking Water Quality Standard, DOE (ECR,97)	Method of Analysis
pH	—	7.20	6.5-8.5	pH Meter
Total Hardness (as CaCO ₃)	ppm	172	200-500	Potentiometric Titration
Chloride (Cl ⁻)	ppm	2.66	150-600	Ion Chromatography
Manganese (Mn)	ppm	0.67	0.1	AAS
Arsenic (As)	ppm	0.022	0.05	AAS with HVG Unit
Iron (Fe)	ppm	12.7	0.3-1.0	AAS
Total Coliform (TC)	CFU/100ml	0	0	Membrane Filtration
Fecal Coliform (FC)	CFU/100ml	0	0	Membrane Filtration

Source: Lab Analysis, April 2017, BCSIR and icddr,b IEE Report Hatikamrul – Rangpur, May 2017.

15. Ambient Air Quality

70. Existing ambient air quality data on various sections of the project corridors was collected to establish a baseline database. The aim was to identify areas that already have high pollution levels or are expected to experience so, on account of the road project, and to design adequate mitigation measures, as applicable.

71. The activities, which modify atmospheric air quality, are transportation (i.e., motor vehicle emissions, which are addressed in this report); industry; domestic and construction. The principal sources of air pollution due to road projects are hot mix plants and machinery used during construction phase and the vehicles that ply over it during the operation phase. The major pollutants of significance to roadside air quality, on account of vehicular emissions, are suspended particulate matter (SPM), sulphur dioxide (SO₂), nitrogen oxides (NO_x), hydrocarbons (HC), carbon-monoxide (CO), total volatile organic carbon (TVOC).

72. Dispersal of pollutants depends upon factors like prevailing wind direction and other weather conditions, atmospheric stability, height of the source, NO_x, SO_x or relevant to photochemical smog rather than roadside.

73. Air pollution in the project area is from road dust, black smoke from diesel engines, construction dust, windblown dust from agricultural lands, domestic heating and cooking, industries, transportations and brick kilns.

74. It is estimated that the project will generate 16,749.43 tons/year of CO₂ at business as usual scenario and 8,272.46 tons/year with induced traffic scenario. The estimate was based on TEEMP study for Hatikamrul – Rangpur road.

Table 12. Ambient Air Quality in Hatikamrul

Air Quality Parameters	Unit	Hatikamrul	Bangladesh Standard (ECR, 2005)
GPS Location		24°27'12.21"N 89°42'9.94"E	
Temperature	°C	26.15	
Relative Humidity	%	79.84	
Wind Speed	Km/h	0.14	
Wind Direction	Degree	194.57° South-West	
O ₃	ppm (µg/m ³)	3.09 (6,087.3)	157 (8-hr Average) 235 (1-hr Average)
NO _x	ppm (µg/m ³)	92.42 (173,749)	100 (annual)
SO ₂	ppm (µg/m ³)	9.85 (25,807)	80 (Annual) 365 (24-hr Average)
CO	ppm	0.0	10 (8-hr Average) 40 (1-hr Average)
VOC	ppb	0.0	NYS
PM ₁₀	µg/m ³	65.78	50 (annual average) 150 (24-hr average)
PM _{2.5}	µg/m ³	27.77	15 (annual average) 65 (24-hr average)

Source: Baseline Survey, March 2017.

Initial Environment Examination Report Hatikamrul – Rangpur, May 2017.

16. Noise Level

75. Excessive noise is a potential issue for both human and biological receivers and can cause a range of negative issues, from mild annoyance and moderately elevated levels of aggression to significant disturbance of behavioral patterns and in severe cases temporary or permanent hearing loss. According to World Health Organization's Guidelines for Community Noise (1999), daily sound pressure levels of 50 decibels (dB) or above can create discomfort amongst humans, while ongoing exposure to sound pressure levels over 85 dB is usually considered the critical level for temporary hearing damage.

76. Primary sources of noise have been identified in the project area:

- Road Traffic: Road traffic is one of the major noise sources in the project area. The project road is common route of transportation for several districts. This highway carries a relatively high volume of both motorized and non-motorized vehicles, resulting in road traffic noise impacts along the road corridors.

- **Commercial Areas:** There are some commercial or refreshment areas where always significant number of people gather and carry out noisy activities. This is another source of noise pollution along the road.

77. Monitoring of ambient noise levels was undertaken by the environment team at Hatikamrul locations for twenty-four hours in March 2017 within the project area. The outcomes of this monitoring are presented in Table 13. Photograph 3 shows some of the snapshots during the monitoring phases.

78. Noise levels at measured location is higher than the standard set by the Bangladesh Noise Pollution Control rules.

79. Additionally, a noise analysis for different sections of the project road is carried out by noise modeling software. The predicted noise during operation period also indicates a high level noise at different places of the road.

Table 13. Noise Level at Hatikamrul Location

Location	Noise Level Description, L_{Aeq} (dBA)
Sirajganj Road Chowrasta /Hatikamrul	64.9

Source: On Site Monitoring, SMEC Environmental Team.
IEE Report Hatikamrul – Rangpur, May 2017.

Photograph 3: Monitoring of Ambient Noise Level



80. Sensitive noise receptors along the corridor were identified such as educational institutions, health complexes and religious centers. Based on the model prediction, the predicted noise for the sensitive receptors is indicated in Table 14. Noise prediction was based on modeling done for Elenga – Hatikamrul – Rangpur road (Appendix G of the IEE).

Table 14. Predicted Noise for the Year 2040 where there is Exceedance vs. Baseline Data

Segment Name	Name of Sensitive Receptor	Type of Establishment	Latitude	Longitude	Baseline Noise (Leq) Under Current Traffic conditions	Predicted Noise (Leq) for the year 2040	Comments (No Change/ Net Increase in Noise)
Hatikamrul-Bhuyangati	Dadupur Sahebgonj Govt. High School	Educational	24.45099	89.5454	68.6	69.9	Marginal increase
	National Skill Development Institute	Educational	24.46188	89.5375	71.0	73.7	Net increase
	Royhati Madrasa Mor	Educational	24.47895	89.52355	70.1	73.4	Net increase

IEE Report Hatikamrul – Rangpur, May 2017.

81. Permitted noise level in different area according to Bangladesh Noise Pollution (Control) Rules, 2006 is listed below in Table 15.

Table 15. Bangladesh Standard for Noise Level at Different Types of Areas

Area Type	Noise Level (dBA)	
	Day	Night
Silent Zone	50	40
Residential Area	55	45
Mixed Area	60	50
Commercial Area	70	60
Industrial Area	75	70

Source: Noise Pollution (Control) Rules, 2006

C. Biological Environment

1. General

82. The countries of South and Southeast Asia are recognized by International Union for Conservation of Nature (IUCN) to be regions of high species diversity. A large number of native plants, including 3,000-4,000 species of woody flora, have been recorded from Bangladesh. The country lies at the meeting point (ecotonal region) of several floristic provinces, including the Manipur-Khasia, Bengal and northern provinces of Myanmar within the Indo-Malayan realm (IUCN, 2002).

83. Bangladesh was once well forested, but most of the native forests have disappeared in recent decades due to mounting pressure from human populations. Only scattered patches of native trees, wetlands and associated fauna habitat remain in isolated locations within the terrestrial environment (IUCN, 2002). In many parts of the country, the abundance of plantations and groves of trees around villages creates an aspect of discontinuous forest (Wahab, 2008).

84. The floodplains of Bangladesh have long been subject to cultivation, the most dominant land use within the project area, with only scattered patches of native trees, wetlands and associated fauna habitat remaining in isolated locations within the terrestrial environment (IUCN, 2002).

2. Bioecological Zones

85. Within a relatively small geographic boundary, Bangladesh enjoys a diverse array of ecosystems. Being a low-lying deltaic country, seasonal variation in water availability is the major factor, which generates different ecological scenarios of Bangladesh. Temperature, rainfall, physiographic variations in soil and different hydrological conditions play vital roles in the country's diverse ecosystems. The ecosystems of Bangladesh could be categorized into two major groups, i.e. (i) land based and (ii) aquatic. The land-based ecosystems include forest and hill ecosystems, agro-ecosystems and homestead ecosystems; while seasonal and perennial wetlands, rivers, lakes, coastal mangroves, coastal mudflats and chars, and marine ecosystems fall into the aquatic category.

86. Each of the ecosystems has many sub-units with distinct characteristics as well. IUCN Bangladesh in 2002 classified the country into twenty-five bioecological zones (Figure 4.3.1). The project road alignment falls below the two bioecological zones.

- Barind Tract (2): Barind Tract is located in the center and western part of Rajshahi division. The greater part of the tract is almost plain and is crisscrossed by only a few minor rivers. This tract is considered an ecologically fragile ecosystem with extremely low vegetation cover. Though this zone was rich with faunal diversity in the past, it has now noticeably reduced mostly due to various pressures like expansion of human habitat, agricultural extension, unwise use of agrochemicals and illegal hunting. (IUCN, 2002).
- Teesta Floodplain (4a): Teesta floodplain spreads over several different landscapes in greater Rangpur and the adjoining regions. The diversity results from the fact that the Teesta river had occupied and later abandoned several different channels during the last few thousand years including the valleys now are occupied by the Mahananda, Punarnava, Atrai, Choto Jamuna, Karatoya and Ghaghat rivers. There were large patches of forests in this zone, but they have in most cases been ruthlessly cut down. However, this zone is still fairly wooded with many valuable indigenous timber species. Although most of the large mammals have been disappeared- form this area but most of common bird species are still found in this location. (IUCN, 2002).

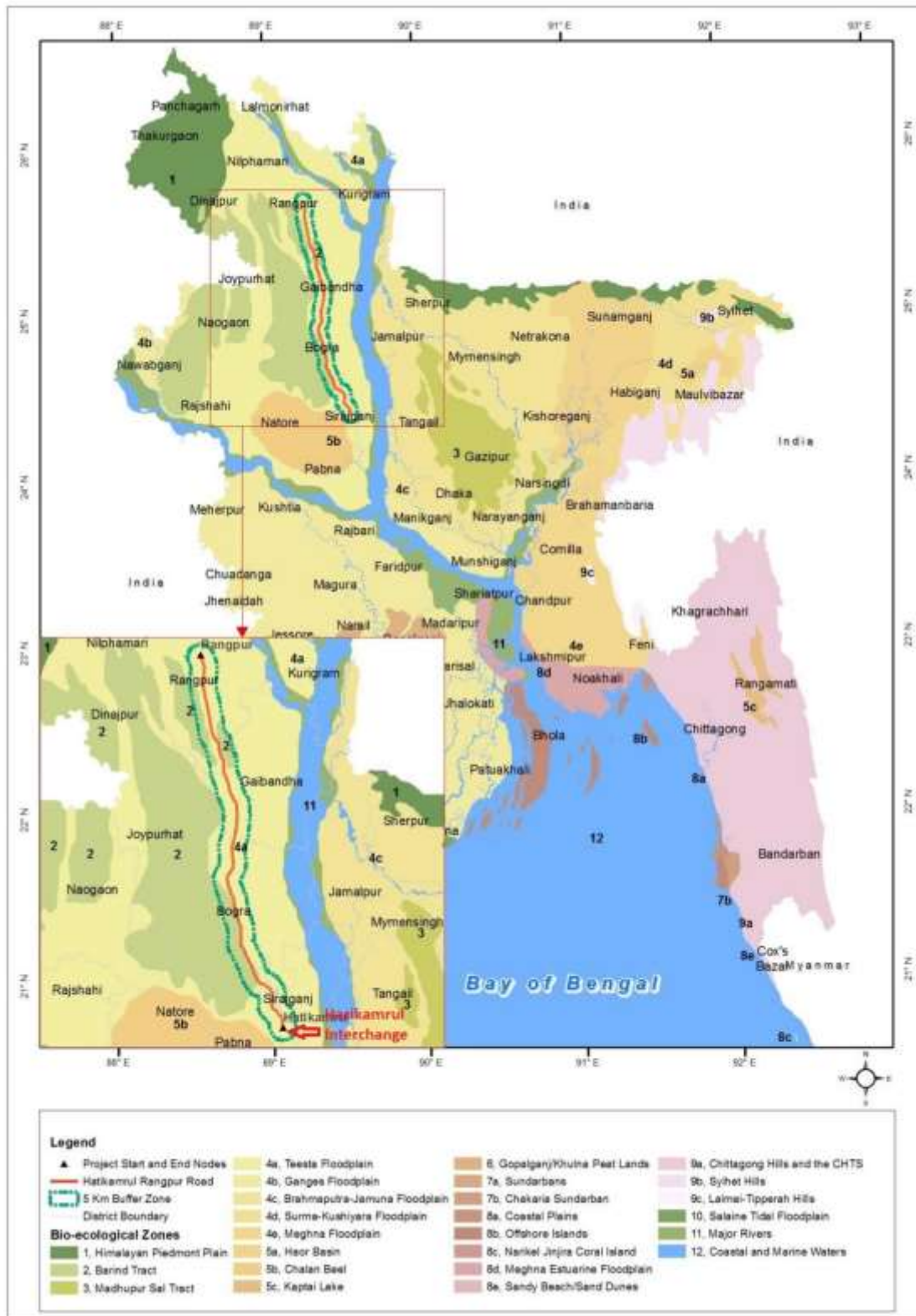
3. Diversity of Terrestrial Floral and Faunal Species

87. The status of terrestrial floras and faunas at the project site were assessed from visual observations, review of literature, and information documented by other agencies. The project area consists of several ecological subsystems e.g. open agricultural land, homesteads, and roadside vegetation. The open agriculture land ecosystem dominates the area providing widespread habitat types for various species of flora and fauna under flooded and non-flooded conditions. The vegetation covers of agricultural lands are different crop species, weeds and other herbaceous plants species. The faunal species in the agriculture land and roadside bush ecosystems include birds, amphibians, fish, snakes, rodents and a few mammals. The homestead ecosystem provides the main tree covered areas within rural Bangladesh including the project

site. The homesteads are covered by fruit, timber, fuel wood, medicinal plants and various multipurpose tree species. The wildlife species in homestead ecosystem include the birds, amphibians, reptiles, rodents and mammals like mongoose, jackal, cats, monkey, etc. Many of the species including mammals are vulnerable or/and endangered in Bangladesh due to habitat loss, over exploitation, natural calamities and lacking management. The project area, including rivers where proposed bridges will be constructed, is not the specific habitat for any particular species of flora and fauna hence none such species will be specifically affected due to project implementation.

88. Terrestrial Flora: The project influence area (PIA) is highland with mixed vegetation. Crops, vegetables are cultivated at the surrounding mainly include rice, wheat, robi crops and variety of homestead vegetables. A sizeable number of fruit trees with economic value have been observed in the PIA. The fruit trees include jackfruit, mangoes, litchi, banana, coconut, blackberry etc. and timber trees include mehegoni, neem, epil-epil, koroï etc. Considerable number of trees and bushes in the PIA site provide habitat for birds and other animals. The composition of plant community includes low growing grasses, trees, herbs and shrubs. The data collected from the field survey and suggests that the predominant species are those of cultivated vegetables and trees (Table 16).

Figure 15. Bioecological Zones



Source: Banglapedia.

Table 16. List of Plants along the Project Road

Common Name	Scientific Name	English Name	Family
Ata	<i>Annona squamosa</i>	Bullock's heart	Annonaceae
Akashmoni	<i>Acacia</i>		
Akanda	<i>Calotropis procera</i>	Swallow wort	Asclepiadace
Ishw Armol	<i>Hemidesmus</i>	Indian	Asclepiadace
Ashok	<i>Saraca indica</i>	Ashoka	Caesalpinioid
Aurjun	<i>Terminalia arjuna</i>	Aurjun	Combretacea
Amra	<i>Spondias pinnata</i>	Wild mango	Anacardiceae
Am	<i>Mangifera indica</i>	Mango	Anacardiceae
Babla	<i>Acacia nilotica</i>		
Bashak	<i>Adhatoda vasica</i>	Malabar Nut	Acanthaceae
Bamboo	<i>Bambusa spp.</i>		
Banana	<i>Musa sapientum</i>		
Bel	<i>Aegle marmelos</i>	Wood apple	Rutaceae
Bet	<i>Calamus rotung</i>		
Ban Chandal/Ban	<i>Codariocalyx</i>		Leguminosae
Banar Lathi	<i>Cassia fistula</i>	Indian laburnum	Caesalpinioid
Bichuti	<i>Girardinia</i>		Urticaceae
Bokna Neem	<i>Melia azadirach</i>		
Boroi	<i>Zizyphusm auritiana</i>		
Bot	<i>Ficus benghalensis</i>	Banyan tree	Moraceae
Bishkatali	<i>Polygonum</i>		Polygonacea
Chatim	<i>Alstonia scholaris</i>	Chatian	Apocynaceae
Chalta	<i>Dellenia indica</i>		
Coconut	<i>Cocos nucifera</i>		
Durba Ghas	<i>Cynodon dactylon</i>	Bermuda grass	Gramineae
Debdaru	<i>Polyalthia longifolia</i>		Annonaceae
Dhundul	<i>Luffa aegyptica</i>	Sponge gourd	Cucurbitacea
Dalim	<i>Panica granatum</i>	Pomegranate	Puniacacaea
Dhotura, Kalo	<i>Datura metel</i>	Downy	Solanaceae
Epil Epil	<i>Leucaena</i>		
Gheta Kumari	<i>Aloe indica</i>	Indian aloe	Liliaceae
Gab	<i>Diospyros</i>	River ebony	Ebeanaceae
Guava	<i>Psidium guajava</i>		
Gandhoraj	<i>Gardenia coronaria</i>		
Olive/Jolpai	<i>Elaeocarpus</i>		
Kalpanath/Kalo	<i>Andrographis</i>	Creat	Acanthaceae
Kamranga	<i>Averrhoa carambola</i>	Carambola apple	Averrhoacea
Kathal	<i>Artocarpus</i>	Jackfruit	
Koroi	<i>Albizzia procera</i>		
Kodbel	<i>Feronia limonia</i>		
Lajjabati	<i>Mimosa pudica</i>	Sensitive plant	Mimosoideae
Lebu	<i>Citrus aurantifolia</i>	Lemon	Rutaceae
Litchi	<i>Litchi chinensis</i>		
Mesta	<i>Hibiscus</i>	Malvaceae	Mesta
Man Kachu	<i>Alocasia indica</i>	Giant taro	Araceae
Mehedi/Mendi	<i>Lawsonia inermis</i>		Lythraceae
Mehogoni	<i>Swietenia mahagoni</i>		
Mochi Ganda/	<i>Pterospermum</i>	Hatipaila	Sterculiaceae
Nayantara	<i>Vinca rosea</i>	Periwinkle	Apocynaceae

Common Name	Scientific Name	English Name	Family
Nishinda	<i>Vitex negundo</i>	Five leaved	Verbenaceae
Papaya	<i>Carica papaya</i>	Papaw tree	Caricaceae
Racta Jaba	<i>Hibiscus rosa-</i>	Rose of china	Malvaceae
Raktadrun	<i>Leucas sibiricus</i>		Labiatae
Racta Chandal	<i>Pterocarpus</i>	Red sanders	<i>Papilionacea</i>
Shimul	<i>Bombax ceiba</i>		
Shishu	<i>Dalbergia sisoo</i>		
Sofeda	<i>Manilkara zapota</i>	Sapota	Sspotaceae
Thankoni	<i>Centella asiatica</i>	Indian pennywort	Umbrelliferae
Telakucha	<i>Coccinea cordifolia</i>		Cucurbitacea
Torup Chandal	<i>Desmodium gyrans</i>		Papilionacea
Tit Begun	<i>Smilax macrophylla</i>		Liliaceae
Tentul	<i>Tamarindus indica</i>	Tamarind	Caesalpinioid
Tulsi	<i>Ocimum canum</i>		
U-caliptas	<i>Eucalyptus</i>		
Ulat chandal	<i>Gloriosa superba</i>	Glory Lilly	Liliaceae
Venna	<i>Ricinus communis</i>		
Zamrul	<i>Syzygium</i>		
Ziga	<i>Lannea</i>		

Terrestrial Fauna

89. Primary and secondary mode was adopted for identification of fauna. Most of the birds are identified through direct observation rather than from people. Most of the Amphibians, Reptiles and Mammals were identified by using books and description of the local people during the field survey. A total of 81 species are identified during field survey among them 2 are Amphibian, 12 Reptilian, 61 Avian faunas and 6 Mammalian faunas. The list of these species with their vulnerability status is given at Table 17. Out of the species identified, 1 is endangered and 7 are vulnerable. No endemic species are found in the project area.

Table 17. List of Fauna Identified In and Around the Project Area

Scientific Name	English Name	Local Name	Local Status
Class: Amphibia			
<i>Bufo melanostictus</i>	Common Toad	Kuno bang	NO
<i>Rana temporalis</i>	Bull Frog	Kola bang	NO
Class: Reptilia			
<i>Hemidactylus</i>	Common House	Tiktiki	NO
<i>Calotes versicolor</i>	Common Garden	Rokto-chosha	NO
<i>Mabuya carinata</i>	Common skink	Anjon	NO
<i>Varanus bengalensis</i>	Bengal monitor	Gui shap	VU
<i>Varanus salvator</i>	Ring lizard	Kalo gui	EN
<i>Xenochrophis piscator</i>	Checked keelback	Dhora shap	NO
<i>Amphiesma stolata</i>	Stripped keelback	Dora shap	NO
<i>Enhydris enhydris</i>	Common smooth	Paina shap	NO
<i>Coluber mucosus</i>	Rat snake	Daraj shap	VU
<i>Ahaetulla nasutus</i>	Common vine snake	Laodoga shap	VU
<i>Atretium schistosum</i>	Olive keelback	Maitta shap	NO
<i>Kachuga tecta</i>	Indian roofed turtle	Kori kaitta	NO
Class: Aves			
<i>Phalacrocorax niger</i>	Little cormorant	Paan-kowri	NO

Scientific Name	English Name	Local Name	Local Status
<i>Dendrocygna javanica</i>	Lesser Whistling-duck	Shorali	NO
<i>Ardeola grayii</i>	Indian pond heron	Kani bok	NO
<i>Casmerodius albus</i>	Great egret	Sada bok	NO
<i>Egretta intermedia</i>	Intermediate egret	Mazla bok	NO
<i>Egretta garzetta</i>	Little egret	Choto bok	NO
<i>Bubulcus ibis</i>	Cattle egret	Go-bok	NO
<i>Nycticorax nycticorax</i>	Black-crowned night	Nishi bok	NO
<i>Ixobrychus</i>	Cinnamon Bittern	Lal bok	NO
<i>Ixobrychus sinensis</i>	Yellow Bittern	Holud bok	NO
<i>Anastomus oscitans</i>	Asian Openbill	Shamuk-khol	NO
<i>Haliastur indus</i>	Brahminy kite	Shankho chil	NO
<i>Milvus migrans</i>	Black kite	Bhubon chil	NO
<i>Spilornis cheela</i>	Crested Serpent-eagle	Khopa Baz	VU
<i>Ichthyophaga</i>	Grey-headed fish	Metematha kura	LC
<i>Metopidius indicus</i>	Bronze-winged	Jolpipi	NO
<i>Columba livia</i>	Rock pigeon	Jalali Kobutar	NO
<i>Streptopelia chinensis</i>	Spotted dove	Tila Ghughu	NO
<i>Streptopelia decaocto</i>	Eurasian collared	Raj Ghughu	NO
<i>S. tranquebarica</i>	Red-collared Dove	Lal Ghughu	NO
<i>Treron phoenicopterus</i>	Yellow-footed Green	Horial	VU
<i>Psittacula krameri</i>	Rose-ringed parakeet	Tia	NO
<i>Amaurornis</i>	White-breasted	Dahuk	NO
<i>Eudynamis</i>	Asian cuckoo	Kokil	NO
<i>Centropus sinensis</i>	Greater coucal	Kanakua	NO
<i>Cuculus micropterus</i>	Indian cuckoo	Bou-kotha-kao	NO
<i>Hierococcyx varies</i>	Common hawk cuckoo	Chokhgelo Pakhi	NO
<i>Athene brama</i>	Spotted owlet	Khuruley Pencha	NO
<i>Tyto alba</i>	Barn owl	Laxmi Pencha	NO
<i>Apus affinis</i>	House swift	Ababil	NO
<i>Cypsiurus balasiensis</i>	Asian palm swift	Nakkati	NO
<i>Alcedo atthis</i>	Common kingfisher	Choto	NO
<i>Halcyon smyrnensis</i>	White-throated	Sada buk	NO
<i>Merops orientalis</i>	Little Green bee-eater	Suichora	NO
<i>Megalaima</i>	Coppersmith barbet	Choto Basanta	NO
<i>M. asiatica</i>	Blue-throated barbet	Basanta Bauri	NO
<i>M. lineate</i>	Lineated barbet	Gurkhod	NO
<i>Dendrocopos macei</i>	Fulvous-breasted	Pakra Kaththokra	NO
<i>Dinopium benghalense</i>	Black-rumped	Kaththokra	NO
<i>L. schach</i>	Long-tailed shrike	Bagha tiki	NO
<i>Oriolus xanthornus</i>	Black-headed oriole	Holdey Pakhi	NO
<i>Corvus splendens</i>	House crow	Pati Kak	NO
<i>C. marorrhynchos</i>	Jungle crow	Darn Kak	NO
<i>Dendrocitta vagabunda</i>	Rufous treepie	Hanrichacha	NO
<i>Dicrurus macrocercus</i>	Black drongo	Fingey	NO
<i>Artamus fuscus</i>	Ashy woodswallow	Latora	NO
<i>Copsychus saularis</i>	Oriental magpie robin	Doel	NO
<i>Acridotheres fuscus</i>	Jungle myna	Jhuti Shalik	NO
<i>A. tristis</i>	Common myna	Bath Shalik	NO
<i>A. ginginianus</i>	Bank myna	Gang Shalik	NO
<i>Sturnus contra</i>	Asian pied starling	Gobrey Shalik	NO

Scientific Name	English Name	Local Name	Local Status
<i>S. malabaricus</i>	Chestnut-tailed	Kath Shalik	NO
<i>Pycnonotus cafer</i>	Red-vented bulbul	Bulbuli	NO
<i>P. jocosus</i>	Red-whiskered Bulbul	Shepahi Bulbul	NO
<i>Turdoides striatus</i>	Jungle babbler	Satbhai	NO
<i>Orthotomus sutorius</i>	Common tailorbird	Tuntuni	NO
<i>Nectarinia asiatica</i>	Purple sunbird	Niltuni	NO
<i>N. zeylonica</i>	Purple-rumped	Moutusi	NO
<i>D. agile</i>	Thick-billed	Fuljuri	NO
<i>Passer domesticus</i>	House sparrow	Charui	NO
<i>Ploceus philippinus</i>	Baya weaver	Babui	NO
<i>Class: Mammalia</i>			
<i>Pteropus giganteus</i>	Flying Fox	Badur	NO
<i>H. auropunctatus</i>	Small Indian	Benji	NO
<i>Vulpes bengalensis</i>	Bengal Fox	Khek shial	VU
<i>Viverricula indica</i>	Small Indian Civet	Khatash	VU
<i>Rattus rattus</i>	Common House Rat	Indur	NO
<i>Suncus murinus</i>	House Shrew	Chicka	NO

Diversity of Aquatic Flora and Fauna

90. **Aquatic Flora:** Different types of aquatic flora species were recorded in the project area. The most abundant hydrophytes in the project area are Kochuripana (*Eichhornia crassipes*), Topapana (*Pistia stratiotes*), Khudipana (*Lemna minor*) Pata Jhajii (*Vallisneria spiralis*), Shapla (*Nymphaea sp.*), Kolmi (*Ipomoea aquatica*), Helenchaa (*Enhydra fluctuans*), and Duckweed (*Spiredella sp.*). Numerous algae (e.g. Spirogyra and Scytonema) and amphibian plant, Dhol kolmi (*Ipomoea fistulosa*) are also found in the roadside water bodies.

91. **Aquatic Fauna:** Fish is the most important aquatic fauna of the project areas, along with other groups. The aquatic fauna includes Prawns (*Macrobrachium spp.*), crabs, snails (Pila, Vivipara, Lymna etc.), freshwater mussels (*Lamellidens sp.*) etc. invertebrates and several species of fish. Kolabang (*Rana tigrina.*); Guishap (*Varanus bengalensis*) and Matia sap (*Atretium schistosum.*) are common. The aquatic birds are - Pancowri (*Phalacrocorax niger*, NO), Kanibok (*Ardeola grayii.*), Sadabok (*Casmerodius albus*), Borobok (*Egretta alba*), Machranga (*Halcyon pileata*), Dahuk (*Amaurornis phoenicurus*), and winter migratory birds - Balihash (*Dendrocygna javanica*), Spotbill duck (*Anas poecilorhyncha*) and Chakha (*Tadorna ferruginea*).

92. **Fishes:** The fisheries in the project area comprises of ponds, canals, rivers, flood lands, Burrow pits, and Khals. The major fresh water fish species are the rui (*Labeo rohita*, LC), katla (*Catla catla*, LC), mrigal (*Cirrhinus cirrhosus*), kalbashu (*Labeo calbasu*, LC); shoal (*Channa striata*), gajar (*Channa marulius*, EN), taki (*Channa punctata*), pangash (*Pangasius pangasius*, EN), boal (*Wallago attu*, VU), tengra (*Mystus tengara*, LC), aier (*Sperata aor*, VU), shing (*Heteropneustes fossilis*, LC), magur (*Clarias gariepinus*), baillya (*Awaous guamensis*, LC), chela (*Salmostoma acinaces*, LC), batashi (*Neotropius atherinoides*, LC), kahalisha (*Colisa fasciata*), puthi (*Puntius puntio*, DD), kai (*Anabas testudineus*, LC), falli (*Notopterus notopterus*, VU), chital (*Chitala chitala*, EN), baim (*Mastacembelus armatus*), chanda (*Parambassis ranga*), etc. Though some of the species are endangered (EN) and vulnerable (VU), according to IUCN Red Book, these are now widely producing in the aquaculture farm in several places of the country.

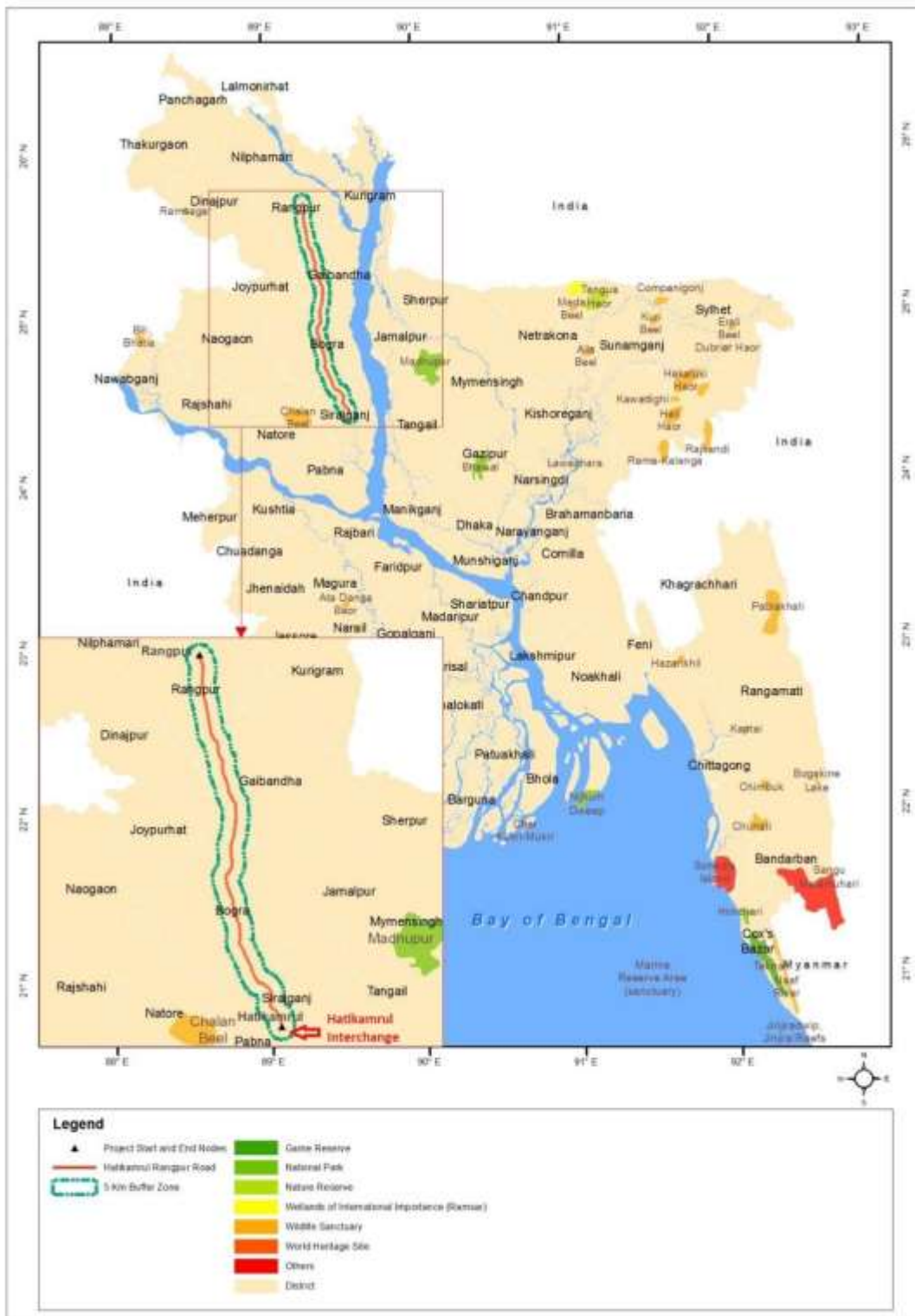
93. The wetlands of this region also support large populations of the commercially important prawn such as *Macrobrachium rosenbergii* (Golda Chingri), *M. malcomsoni* (*Chatka chingri*) and *Leander* sp. (*Gura chingri*). Fresh water Crab is a common aquatic arthropod observed in most of wetlands. Fresh water Crab is a common aquatic arthropod observed in most of wetlands. No aquatic mammal like Dolphin was observed in the Rivers (Fuljor and Karatoya) along the project road.

4. Biodiversity/Environmentally Sensitive Areas

94. Many wildlife species are in stress in Bangladesh, many more are endangered/threatened, and a large number already faced extinction. The status of faunal species in Bangladesh has been published by IUCN (2000). According to the IUCN findings this country has lost 10% of its mammalian fauna, 3% avifauna and 4% reptiles over the last 100 years. More than 50 species are presently critically endangered in Bangladesh of which 23 species are already declared as endangered in the Red Data Book of IUCN. In addition, 83 species are commercially threatened and are included in the appendices of Convention on International Trade in Endangered Species (CITES). Among the most endangered species are: elephant, tiger, wild Cat, Leopard or wild goat, serao, dolphin; birds: white-winged duck, comb duck, stork, carne, pheasant, partridge, and crocodile, python, monitor, lizard, tiger terrapin, roofed turtle, soft turtle, and marine turtles.

95. In and around the project area some wildlife species were identified as locally vulnerable. The name of these vulnerable species are Bengal monitor, Rat snake, Common vine snake, Crested Serpent-eagle, Yellow-footed green pigeon, Common mongoose, Bengal fox, Small Indian Civet. Some species were also identified as locally endangered and these are Ring lizard, Monocellate cobra, and Jungle cat. Any construction must consider impacts on the rate of deforestation, loss of habitat, habitat fragmentation, and interruption of wildlife migration patterns. There is no protected area located within the 5 km buffer zone of this project (Figure 17).

Figure 16. Environmental Protected Areas



Source: Banglapedia.

D. Socio-Economic Environment

96. It is essential for every development project, whether small or large, to understand the social, human and economic aspects of the primary stakeholders, i.e., people living in and around the project site. The following tools and techniques were used to collect the relevant data/information on the social and economic aspects of affected people:

- Literature review;
- Focus Group Discussion (FGD); and
- Informal meeting with various professionals.

97. In addition, data obtained from secondary sources were compared with the primary data/information gathered during the study.

98. Data on population, age/sex composition, household patterns, and sources of drinking water, sanitation facility, and ownership of agricultural land were enumerated from the latest community series census published by the Bangladesh Bureau of Statistics (BBS).

1. Demography

99. With an estimated 164.4 million inhabitants and an annual population growth rate of 1.4%, Bangladesh is considered to be one of the most densely populated countries in the world (UNFPA, 2010). The details of demographic profile of Hatikamrul Interchange area are presented below (Table 18).

Table 18. Demographic Status, in the Project Area

Upazilas Through	District	Total	Male	Female	Sex Ratio	Population density
Ullapara	Sirajganj	540156	269481	270675	100	1320
Raiganj	Sirajganj	317666	158604	159062	100	1223

Source: Population Census, 2011

2. Land Use Patterns

100. Lands at the project area are used for agriculture, fisheries, agro-forestry, homestead, homestead forestry and vegetation, animal husbandry, etc. The areas through which the existing alignment passes is characterized by an agricultural ecosystem with very little of the natural ecosystem remaining. The most heavily vegetated areas along the alignment are the homestead areas where several species of trees of economic value are present.

3. Water Supply and Sanitation

101. Tube well is the most common source of drinking water in both the urban and rural areas. Tap water is accessible only in urban areas. Most households do not treat water prior to drinking. Sewage facilities are available in most of the urban areas. Table 19 below shows the sanitary facilities in the project area.

Table 19. Sanitary Facilities in the Project Area

Upazila Through	District	Number of Households	Toilet Facility (%)			
			Sanitary (water-sealed)	Sanitary (non water-sealed)	Non-sanitary	None
Ullapara	Sirajganj	123630	17.1	50.7	29.2	3.0
Raiganj		77104	15.3	46.5	28.8	9.3

Source: Population Census, 2011.

102. According to the statistical data mentioned above it can be said that the sanitary facilities are better in the urban areas than the rural areas.

4. Transport and Communication

103. The Hatikamrul Interchange areas are connected with national highways and village roads, in certain locations. The common types of transport are bus, truck, microbus, car, CNG, motorcycle, van and rickshaw. Mobile and wire telephone services are available in most of the areas.

IV. IMPACTS AND MITIGATION MEASURES

A. Key Consideration and Scoping

104. The purpose of scoping is to identify the most important environmental components, their distribution, seasonality, dimensions, interactions, ecological and economic significance, historical or cultural importance and management responsibility and practices. The present report assesses the impacts of the proposed activities on various environmental attributes of the Hatikamrul Interchange (WP-13).

105. Issues for consideration have been raised by the following means: (i) input from interested and affected parties, if any; (ii) desktop research of information relevant to the proposed project; (iii) site visit and professional assessment by environment specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's experience.

1. Ambient Air Quality and Noise

106. It is likely that due to implementation of the Hatikamrul Interchange (WP-13), the vehicular movement will gradually rise and create air pollution in the atmosphere and create high noise level to the nearby settlement. Due consideration may be made to minimize the impacts to the environment. However, smoother flowing traffic will decrease air pollution levels and effect an improvement.

2. Water Pollution

107. It is not expected that a high level of water pollution will occur due to the interchange implementation. The leakage of the oils and accidental spillage may be managed by the construction of roadside drains with interceptors at some interval.

3. Earth Resources Exploitation

108. Gravel, sand, and bricks are to be used as fill material for strengthening and elevating embankment. Those are available either by exploiting terrestrial resources.

4. Location and Design Impacts

109. In the case of this project, there are few impacts that can clearly be said to result from the design or location. This is because:

- The Hatikamrul Interchange (WP-13) involves relatively straightforward construction at few single small sites, so it is unlikely that there will be major impacts when the facility is built;
- The proposed locations of the sites are in areas where the pourashava authority is already using and it will be stopped temporarily before the actual construction works will start and also there are no sensitive areas or receptors nearby;

110. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible.

5. Screening Out Areas of No Significant Impact

111. From the descriptions given it is clear that implementation of this Hatikamrul Interchange work package (WP-13) will have no major environmental impacts because the construction work is relatively straightforward, and will be conducted only at Hatikamrul. Because of this, there are several aspects of the environment that are not expected to be affected by the construction process and these can be screened out of the assessment at this stage. These are shown in Table 20 with an explanation of the reasoning in each case. These environmental sectors have thus been screened out and will not be mentioned further in assessing the impacts of the construction process.

Table 20. Fields in which Construction is Not Expected to Have Significant Impacts

Field	Rationale
Climate	Short-term production of dust is the only effect on atmosphere
Geology and seismology	Excavation will not be large enough to affect these features
Agriculture, tourism	There is no negative impact on agriculture or tourism
Fishery and wildlife	There are no fishery and habitat of wildlife species in the area.
Physical or cultural heritage	There are no culturally important buildings or locations at or near these sites
Indigenous Peoples (IP)	The proposed sites are not used by indigenous peoples or minority communities
Archaeology, paleontology	No material of archaeological or paleontological significance has been found by previous construction projects in these areas
Ecological value	There are no protected areas in the vicinity of these sites and no special ecological interest exists within the boundary of the sites under consideration. Construction should therefore have no ecological impacts.

B. Potential Significant Impacts

112. The potential impacts during construction phase are categorized into: (a) specific impacts and (b) general impacts which have shown in the Table 21.

Table 21. Potential Impacts During Construction Phase

Activity/Issues	Potential Impacts	Mitigation Measures
Preconstruction		
Population and community	<ul style="list-style-type: none"> Potential hazards to community health and safety 	<ul style="list-style-type: none"> Barricading of construction sites to prevent people
Health and education facilities	<ul style="list-style-type: none"> Potential disturbance and environmental impacts on facilities (1 hospital and one commercial residential hotel) 	<ul style="list-style-type: none"> Restriction of work hours during daytime Regular spraying of dusts, maintenance of vehicles and regular advisory on construction activities.

Activity/Issues	Potential Impacts	Mitigation Measures
Setting up and operation of bitumen preparation area	<ul style="list-style-type: none"> • Air will be polluted 	<ul style="list-style-type: none"> • Locate plant away from residential settlements • Consider use of emulsified bitumen
		<ul style="list-style-type: none"> • Avoid spills; surround plant area with a ditch with a settling pond/ oil trap at the outlet
Road construction	<ul style="list-style-type: none"> • Traffic congestion will increase 	<ul style="list-style-type: none"> • Employ traffic control measures and limit possible disruption to non-construction traffic • Strict control to avoid spills; provision for adequate clean up
General construction works for sub-projects	<ul style="list-style-type: none"> • Drainage congestion and flooding 	<ul style="list-style-type: none"> • Provision for adequate drainage of storm water • Provision of adequate diversion channel, if required • Provision for pumping of water, if needed • Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season.
	<ul style="list-style-type: none"> • Air pollution 	<ul style="list-style-type: none"> • Ensure that all project vehicles are in good operating condition. • Spray water on dry surfaces/ unpaved roads regularly to reduce dust generation. • Maintain adequate moisture content of soil during transportation, compaction and handling. • Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates). • Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.
	<ul style="list-style-type: none"> • Traffic congestion, traffic problems 	<ul style="list-style-type: none"> • Traffic management during demolition and relocation of utilities • Schedule deliveries of material/ equipment during off-peak hours. • Selection of alternative routes, where possible for sub-project vehicles • Depute flagman for traffic control • Arrange for signal light at night
	<ul style="list-style-type: none"> • Noise Pollution 	<ul style="list-style-type: none"> • Use of noise suppressors and mufflers in heavy construction equipment.

Activity/Issues	Potential Impacts	Mitigation Measures
		<ul style="list-style-type: none"> • Avoid using of construction equipment producing excessive noise at night. • Avoid prolonged exposure to noise (produced by equipment) by workers. • Regulate use of horns and avoid use of hydraulic horns in project vehicles.
	<ul style="list-style-type: none"> • Water & Soil Pollution 	<ul style="list-style-type: none"> • Prevent discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ khals/ drains. • Install sediment basins to trap sediments in storm water prior to discharge to surface water.
	<ul style="list-style-type: none"> • Accidents 	<ul style="list-style-type: none"> • Following standard safety protocol • Environmental health and safety briefing • Provision of protective gear
	<ul style="list-style-type: none"> • Spills and leak of oil, toxic, chemicals 	<ul style="list-style-type: none"> • Good housekeeping • Proper handling • Collection, proper treatment and disposal of spills.
Construction and operation of labor shed for workers	<ul style="list-style-type: none"> • Generation of sewage and solid waste; water/ environmental pollution 	<ul style="list-style-type: none"> • Construction of sanitary latrine/ septic tank system. Erection of “no litter” sign, provision of waste bins/cans, where appropriate • Proper disposal of solid waste
	<ul style="list-style-type: none"> • Health of workers 	<ul style="list-style-type: none"> • Raising awareness about hygiene practices among workers. • Availability and access to first-aid equipment and medical supplies
	<ul style="list-style-type: none"> • Outside labor force causing negative impact on health and social well-being of local people 	<ul style="list-style-type: none"> • Contractor to employ local work force, where appropriate; promote health, sanitation and road safety awareness
Other	<ul style="list-style-type: none"> • Beneficial impact on employment generation • General degradation of environment 	<ul style="list-style-type: none"> • Employ local people in the project activities as much as possible. • Give priority to poor people living in slums within project area in sub-project related works (e.g., excavation and other works, which do not require skilled manpower). • Environmental enhancement measures, such as plantation, landscaping, traffic/ direction signs, boundary wall for road-side educational/ religious institutions (where appropriate)

113. Apart from regular operation and maintenance, a number of issues would require special attention. The potential impacts during operational phase have shown in the following table.

Table 22. Potential Impacts During Operational Phase

Activity/Issues	Potential Impacts
Operation of the Roads	Increase in traffic speed and accidents
	Increase in traffic congestion due to movement of increased number of vehicles
	Damage to road by movement of heavy vehicles, spillage of water
	Increased air and noise pollution affecting surrounding areas

C. Mitigation and Abatement Measures

114. The following mitigation and abatement measures would require reduce/avoid possible adverse impacts.

Table 23. Impacts and Mitigation Measures During Construction Phase

Activity	Potential Negative Effect	Related Adverse Impact	Mitigation Measures
Physical Environment			
Construction of road, site clearance	Change in land use cultivated land	Loss of agricultural land, production, loss of property	Improving agricultural extension services, applying additional protective measures that the remaining land will not be lost due to erosion, temporary lost vegetation on work site will be revegetated after the completion of road. The spoil sites will be stabilized with bio-engineering technologies
Site clearance, excavation	Bank/Slope Instability from	Erosion, landslide, loss of Property	Bio-engineering application will be used to stabilize the slopes.
Construction of Road	Water Management, generation of large volume of surface runoff.	Erosion, landslide, damage to farmland affect aquatic life.	Proper drainage structures and proper spoil disposal. Avoid blockage or diversion of natural channels due to construction of road and disposal of spoils.
	Air pollution due to dust from exposed surface, from construction equipment's and vehicles	Effect on local people and workers health and effect on agriculture.	Use of face mask while working on dust prone areas, covering of dust sources
	Noise pollution	Disturbance and annoyance around school, health posts, forest areas.	Restrict horn near school, health posts etc.
	Water pollution due to sediment level, spills and	Risk of water borne diseases	Proper spoil management, and prevention of leakage and spills of construction chemicals, restriction in defecation in open areas

Activity	Potential Negative Effect	Related Adverse Impact	Mitigation Measures
	leakage of oils and chemicals to water bodies		
	Location of camp sites, storage depots	Encroachment of forest, agriculture land, solid waste, and wastewater may cause pollution	Locate camp site away from productive land and forest area. Use local labor and local houses as camp Pay compensation to landowner of camp area
	Decline in aesthetic value	Scars of Landscape	Check indiscriminate dumping of spoil, rehabilitation of quarry, plantation of local species along the roadside
Construction work	Storage of chemicals	Leakage, spillage and hazards	Store chemicals in a impervious surface with drains, use carefully, prepare for emergency hazards
Biological Environment			
Clearance of vegetation necessary for road formation	Loss or degradation of forests and vegetation	Loss of environmental benefits from vegetation, disturbance in ecological function (dust and noise absorbance, aesthetic value etc.)	Minimize cutting of tree and vegetation, compensatory plantation of trees and bio-engineering measures. Plantation of trees in both sides of road (wherever possible).
Construction activity	Impact on wildlife including birds due to loss of habitat and hunting.	Loss of biodiversity and valuable species of wildlife	Work only in daytime, do not disturb wildlife,
Construction activity	Impacts on flora and fauna	Loss of biodiversity	Minimum site clearance, discouraging workers for collecting fuel wood from forest and hunting/harassing faunas, conservation awareness program.
Socio Economic Environment			
Demolition of structures along road alignment	Impact on Community Infrastructure: Irrigation canal, Water supply pipe, suspended bridge, water hydrant, electric pole etc.	Loss of services provided by them	Restoration or relocation of affected infrastructures.
Occupational health and safety aspects	Health and safety	Injury, fatal accidents, outbreak of epidemics and diseases, decline in capacity to work	First aid facility at sites with health treatment arrangements, contingency planning; Proper drinking water and toilet facility for construction

115. Apart from regular operation and maintenance, a number of issues would require special attention. The potential impacts during operational phase have shown in the table.

Table 24. Impacts and Mitigation Measures During Operational Phase

Activity	Potential Negative Effect	Related Adverse Impact	Mitigation Measures
Physical Environment			
Operation of road	Road slope stability and management	Slides and slope failure, Disturbance to traffic flow, pollution of water bodies, impacts on agriculture land, loss of vegetation.	Regular maintenance of slope protection and management.
Operation of vehicles, Inadequate drainage	Air, noise and water pollution	Disturbance to students, patients, wildlife, effect to nearby agriculture land and crops	Community awareness, no horns near school, health and dust control measures.
Biological Environment			
Road operation	Depletion of forest resources	Loss of timber, forest resources and benefits	Awareness program on conservation of forest, support and manage the forest. Plantation of trees in both sides of road (Wherever possible).
Road operation	Disturbance to the wildlife and illegal poaching	Collision of wildlife with vehicles, disturbance in their normal activities, loss of biodiversity	Prohibition of blowing horns in the dense forest areas and potential areas for wildlife crossing.
Socio Economic Environment			
Easy access by road operation	Ribbon settlement development	Encroachment of RoW, increased accidents, delay in traffic movement, depletion of local resources, water pollution	Regulation of settlement with proper planning; plantations of trees in the RoW so that it is not encroached. Awareness raising program
Operation of road	Change in Social behavior	Social and cultural conflicts	Awareness raising programs (such as women trafficking, child labor, adult illiteracy etc) and strengthens communities against social evils.
Operation of road	Road Safety	Increase in accidents	Appropriate road safety measures, safety signs along the road. Orientation to drivers, school students and housewives on safe use of road

D. Resettlement

116. Resettlement is anticipated due to the location as the proposed Hatikamrul Interchange (work package-13) will encroach on privately owned land.

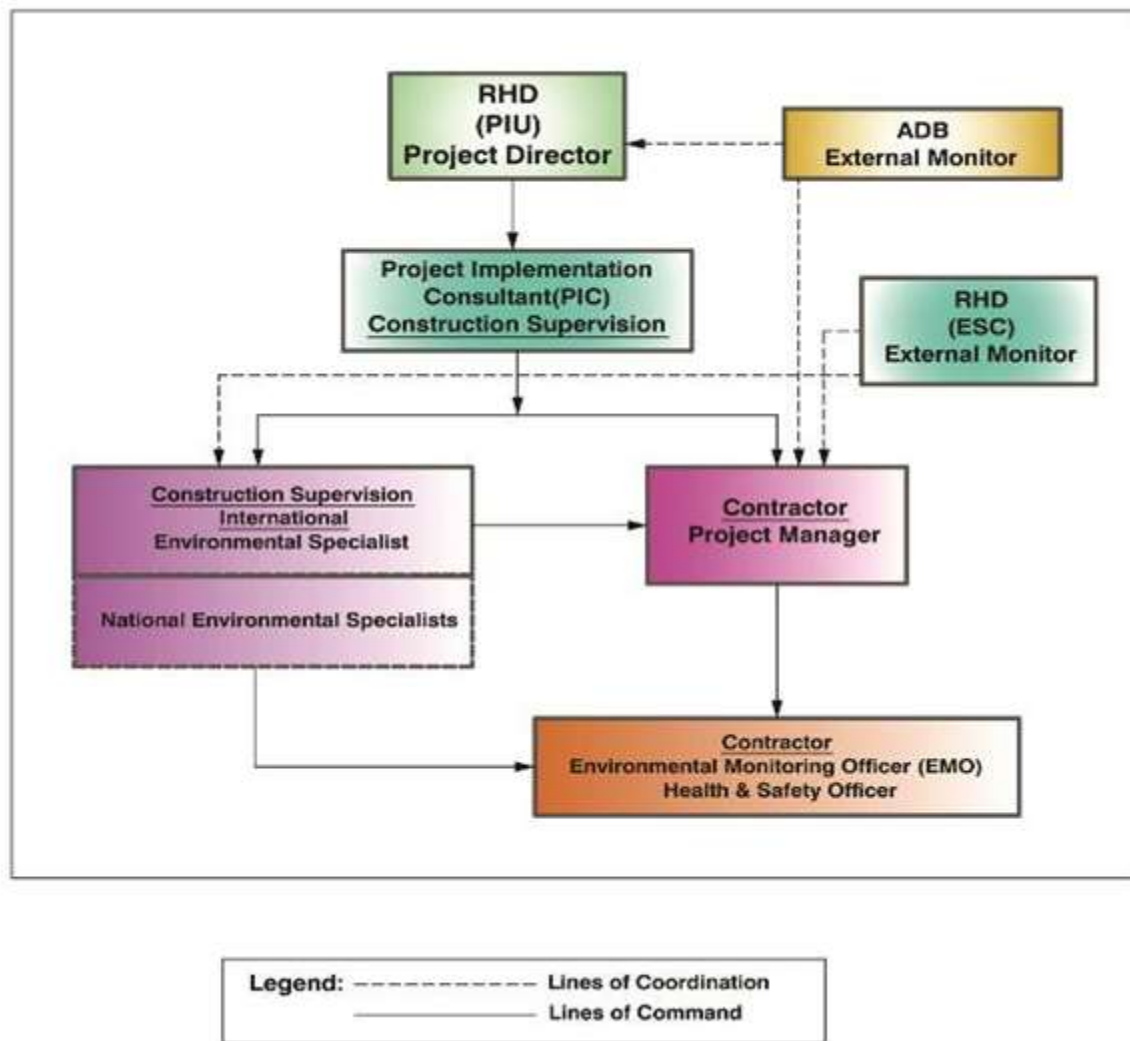
117. Hatikamrul Interchange (WP-13) requires a total of 4.0 ha private land acquisition. There will be 151 AHs among which Titled are 31 and Non-Titled 120.

V. ENVIRONMENTAL MANAGEMENT PLAN

A. Implementation Arrangement

118. The following Figure 17 is an organization chart showing how the project will be managed and implemented.

Figure 17. Organizational Chart



B. Capacity Building

119. In Bangladesh, the environmental assessment process is established, but environmental awareness and capability for implementation of EMP in infrastructure projects are still developing. The project implementation unit (PIU) of RHD had some officers in the Environment and Social Circle Department (ESC) that are delegated environmental duties. The delegated officers have responsibility to bring environmental issues to the notice of senior management. Typically, the delegated officers have been moved to different departments due to promotions and operational needs after about every 3 years, and they move on to other engineering departments in RHD. The status quo is that ESC engineering officers are delegated to check environmental

assessments prepared by consultants. The EIA and EMP are referred to the DOE in the Ministry of Environment and Forests (MOEF) for approval. The ESC in RHD is not directly involved with project implementation but has more administrative responsibility to ensure environmental compliance and a general role to increase environmental awareness for RHD. It is therefore not clear if RHD/ESC has the capacity to check the adequacy of the developed EMP for this project.

120. The most significant challenge for environmental management on this project is the lack of human and financial resources and necessary infrastructure in PIU. To enhance the capacity of the RHD Environmental and Social Circle and PIU for effective implementation of proposed mitigation measures and monitoring the resultant effect, some training programs and awareness workshop are proposed.

C. Environmental Management Stages

121. The EMP will guide the environmentally sound construction of the work package and ensure efficient lines of communication between the PIU, PIC, and contractors. The EMP identifies activities according to the following three phases: (i) site establishment and preliminary activities, including finalizing IEE/EMP; (ii) construction stage; and (iii) post-construction/operational stage. Environmental Monitoring Program outlines the mitigation measures and persons responsible for implementation and monitoring.

D. Environmental Management Plan

122. The Environmental Management Plan (EMP) gives guidance on how to mitigate the environmental concerns identified in connection with this project. The EMP deals with mitigation and management measures to be taken during implementation to avoid, reduce, and mitigate adverse environmental impacts.

123. RHD will ensure that the EMP is included in the tender documents for civil works. It will form part of the contract between RHD and the selected contractor. The conformity of contractors with environmental contract procedures and specifications shall be regularly monitored by the PIU and the ESC. PIU / ESC will be assisted by the detailed design and implementation supervision consultant (DDIS) to undertake EMP monitoring and to prepare corresponding semi-annual reports for submission to ADB.

124. The requirements of the EMP will be contractually binding on the contractor.

125. The EMP is given in tabular form below.

Table 25. EMP Giving Potential Negative Impacts, Mitigation Measures and Responsibilities

Activities	Potential Negative Impacts	Mitigation Measures	Implementing Organization	Supervising Organization
Impacts and Mitigation – Location				
(a) Road alignment	Congestion at existing Hatikamrul interchange during construction. Interference with pedestrians	<ul style="list-style-type: none"> ▪ Prepare traffic management plan with temporary bypasses to PIU for approval before work commences to ensure smooth demolition and relocation of buildings and utilities; and relocation of affected people ▪ Prepare separate pedestrian traffic plan to ensure pedestrians can safely walk past construction works. 	Contractor	RHD
(b) Blockage of drainage structures	Localized flooding	<ul style="list-style-type: none"> ▪ Position drainage structures to ensure that runoff is conveyed into natural drainage lines at controlled velocities. 	Consultant	RHD
(c) Road Widening	Loss of roadside stalls	<ul style="list-style-type: none"> ▪ Compensation to be paid if involuntary resettlement occurs. Displaced stall holders to be relocated elsewhere. 	RHD, Resettlement Consultant	PIU / ESC, RHD
(d) Need for fill material	Loss of agricultural land for borrow pits.	<ul style="list-style-type: none"> ▪ Develop alternative uses for borrow pit areas with agreement of farmers and villagers. Some villagers request borrow pits to be left as water ponds for use by village. 	Contractor	PIU / ESC, RHD
(e) Cutting of roadside trees	No roadside trees or amenity planting will be needed.	<ul style="list-style-type: none"> ▪ No action required. However, if trees need to be cut, they must be replaced with 3 new trees for every 1 tree cut. No tree cutting is planned. 	Consultant	RHD
Impacts and Mitigation – Construction				
(a) Mobilization of equipment	Accident risk from mobilizing construction equipment	<ul style="list-style-type: none"> ▪ Minimize the mobilization of heavy equipment to nighttime. ▪ Submit Traffic Management Plan 	Contractor, Police	PIC / ESC
(b) Mobilizing workforce	The introduction of an outside workforce can have a negative impact on the health and	<ul style="list-style-type: none"> ▪ Conduct special briefing or on-site training on environmental requirement of the project to workers. 	Contractor	PIC / ESC

Activities	Potential Negative Impacts	Mitigation Measures	Implementing Organization	Supervising Organization
	social well-being of local people	<ul style="list-style-type: none"> ▪ Strictly supervise workers not to interfere with local affairs or quarrel with local people. ▪ In case of complaints from local people on the issues caused by workers, the complaints should be solved as soon as possible, by collaboration of contractor and village representatives. ▪ Erect sign board with details of contractor and a phone number for complaints available 24/7. 		
(c) Behaviour of workers	Impacts on local wildlife by workforce	<ul style="list-style-type: none"> ▪ Carry out awareness-raising campaigns on wildlife value for workers. No local wildlife to be used for cooking. ▪ Any worker conducts hunting, or buying wildlife from local people, will be dismissed from job. ▪ Supply workers with sufficient food from outside the project. 	Contractor	PIC / ESC
(d) Protecting workers safety	Accident risk from mobilizing	<p>The following safety precautions should be provided to workers.</p> <ul style="list-style-type: none"> ▪ Warning and/or Precaution Signs on safety. ▪ Provide full PPE; Helmets, boots, warning jackets etc. ▪ Instruction on health and safety. ▪ Establishment of all relevant safety measures required by law and good engineering practices. ▪ Any worker not complying with HSE requirements can be dismissed. 	Contractor	PIC / ESC.RHD
(e) Health Aspects	Outbreak of disease	<ul style="list-style-type: none"> ▪ The contractor shall have all his workers undergo a medical screening prior to their arrival on site, to check for HIV/AIDS, sexually transmitted diseases, and to provide an awareness program. 	Contractor	PIC / ESC, MoH

Activities	Potential Negative Impacts	Mitigation Measures	Implementing Organization	Supervising Organization
		<p>Any workers screening positive for such diseases shall not be allowed on the site.</p> <ul style="list-style-type: none"> ▪ Site construction camps far away from local communities. ▪ If possible, rent local accommodation instead of establishing camp. ▪ Provide enough water supplies for workers, and ensure sufficient sanitation for the camp: arrange proper solid waste disposal. ▪ Make medical treatment available for workers. Provide workers mosquito nets and malaria-prevention medication, if needed, spray around camp area with chemicals against mosquitoes. ▪ Have first aid kit on site. 		
(f) Providing fuel for workers	Depletion of natural resources through demand for building materials, fuel and food for workers.	<ul style="list-style-type: none"> ▪ Do not harvest wood resources within forests. ▪ Where local materials must be used, make agreements with local communities about the areas or the volume that can be harvested without significant impact. ▪ Support community development by paying an adequate price for any local resources used. ▪ All supplies for building camps should be brought from outside area. 	Contractor	PIC / ESC
Impacts and Mitigation – Construction and Workers Camps				
(a) Construction work area	Sediment run off.	<ul style="list-style-type: none"> ▪ Revegetation of construction area. This relates to grass seeding of slopes of new embankments for soil stabilization and control of sediment run off. 	Contractor	PIC / ESC, RHD
(b) Work in drainage channels	Localized flooding, Loss of water quality	<ul style="list-style-type: none"> ▪ Limit work in channels to low flows. Diversionary works to be completed in dry season. 	Contractor	PIC/ ESC, RHD

Activities	Potential Negative Impacts	Mitigation Measures	Implementing Organization	Supervising Organization
(c) Fuel, lubricants and asphalt	Loss of soil and water quality	<ul style="list-style-type: none"> ▪ Fuel storage in properly designed facilities, careful refueling systems 	Contractor	PIC / ESC, RHD
(d) Solid waste disposal	Attraction of vermin and vectors	<ul style="list-style-type: none"> ▪ Implement solid waste management procedures. Arrange daily collection and removal of waste. 	Contractor	PIC / ESC, RHD
(e) Dust impacts	Loss of air quality	<ul style="list-style-type: none"> ▪ Road watering, cover stock piles 	Contractor	PIC / ESC, RHD
(f) Noise impacts	Nuisance to residents and noise sensitive receptors. Of particular concern is nearby hospital.	<ul style="list-style-type: none"> ▪ Restrict timing of work to 0700 to 1900. ▪ No work on weekends or public holidays ▪ Liaise with hospital management in case of any potentially noise activities such as piling. 	Contractor	PIC / ESC, RHD
(g) Vibration impacts	Damage to buildings and disturbance to occupants	<ul style="list-style-type: none"> ▪ Schedule work to minimize nuisance. Keep vibration levels below 3mm/ second PPV in nearby buildings, 	Contractor	PIC / ESC, RHD
(h) Damage to utility services	Interruption with electric, gas, water, telephone and fibre optic supply.	<ul style="list-style-type: none"> ▪ RHD and Contractor liaise with utility company on location of services. 	RHD/Contractor	PIC / ESC, RHD
(i) Damage to pavements	Loss of access	<ul style="list-style-type: none"> ▪ Truck overloading must be controlled 	Contractor	RHD/Police
(j) Altered road conditions	Driver hazards	<ul style="list-style-type: none"> ▪ Erect warning signs, use flag men to avoid accidents 	Contractor	RHD/Police
(k) Inadequate sanitation	Increased disease	<ul style="list-style-type: none"> ▪ Temporary camps to be in rented accommodation with existing sanitation, and extra water provided by tanker if needed. 	Contractor	PIC / ESC, RHD
(l) Being ready for accidents and injuries	Slow response to injury, no treatment for illness	<ul style="list-style-type: none"> ▪ Implementing the Worker Health and Safety Plan. First Aid officer must be on site full time and formal link must be established with the nearest medical facility for treatment of any accident or health issues of construction workers. 	Contractor	Contractor, Consultant, RHD

Activities	Potential Negative Impacts	Mitigation Measures	Implementing Organization	Supervising Organization
(m) Transmission of sexually communicable diseases	Spread of diseases to communities	<ul style="list-style-type: none"> ▪ Pre-employment worker screening, Regular public education and HIV, AIDS, STD awareness programs. 	Contractor	RHD/
(n) Stagnant water areas	Breeding habitats for mosquito vector	<ul style="list-style-type: none"> ▪ Emptying of stagnant water containers every day 	Contractor	PIC / ESC, RHD
(o) Discovery of artifacts and relics	Permanent loss of cultural items	<ul style="list-style-type: none"> ▪ Contractor to follow chance find procedure. 	Contractor	PIC / ESC, RHD
(p) Construction near watercourses	Loss of riverside vegetation	<ul style="list-style-type: none"> ▪ Avoid clearing riverside vegetation during road construction except where absolutely necessary. Revegetate riverbanks where clearing is unavoidable. 	Contractor	PIC / ESC, RHD
(q) Construction of detour	Blocking access for pedestrians while road being upgraded.	<ul style="list-style-type: none"> ▪ Install pedestrian walkways with safety barriers. 	Contractor	PIC / ESC, RHD
(r) Construction near water supplies	Encroachment on water supply systems from road construction activities	<ul style="list-style-type: none"> ▪ Contractors should pay for damage to water system 	Contractor	PIC / ESC, RHD
(s) Construction Causing Air Pollution	Dust / Air pollution	<ul style="list-style-type: none"> ▪ Use water bowsers to water the road when dust occurs, particularly in the dry season. ▪ Maintain all construction vehicles to minimize vehicle emission. ▪ All vehicles carrying friable material to have tarpaulin covers. 	Contractor	PIC / ESC, RHD
(t) Construction Causing Noise	Noise and Vibration	<ul style="list-style-type: none"> ▪ All road construction vehicles must have working mufflers and be properly maintained. ▪ Avoid working at night near settled areas 	Contractor	PIC / ESC, RHD
(u) Excavation of Borrow pits	Creation of stagnant water bodies in borrow pits, quarries	<ul style="list-style-type: none"> ▪ Incorporate adequate drainage and fill in borrow pits and quarries. ▪ Maintain borrow pits and quarries by landscaping and revegetating after operation. ▪ Provide warning signs against drowning 	Contractor	PIC / ESC, RHD

Activities	Potential Negative Impacts	Mitigation Measures	Implementing Organization	Supervising Organization
(v) Construction Camps Operation	Solid waste	<ul style="list-style-type: none"> ▪ Provide garbage bins & sanitary facilities for workers. Waste in the bins should be cleared periodically. ▪ Special attention should be paid to the sanitary condition of camps. ▪ No open burning to be allowed on site. 	Contractor	PIC / ESC, RHD
Impacts and Mitigation - Operation				
(a) Higher speeds	Increase in road accidents	<ul style="list-style-type: none"> ▪ Speed limits enforced. Driver and community awareness; road signs 	Police	Police
(b) More traffic volume	Increased air pollution and noise	<ul style="list-style-type: none"> ▪ Control of vehicle air and noise emissions from vehicles. Paved road will decrease noise and dust. 	DoE	MoE, Police

E. Contractors Environmental Management Plan

126. After contract signing and before mobilization the contractor must prepare his own version of the EMP known as the Contractors EMP (CEMP). This must give specific details of locations of borrow areas, borrow roads, workers camps and other facilities.

127. Contract documents shall explicitly state that construction cannot start until the CEMP has been approved. To ensure that the Contractor allocates sufficient funds to prepare and implement the CEMP, the Tender and Bid documents will require that the cost of implementing the EMP and CEMP is included in the Contractor Bid price.

128. Before the construction starts and any sites occupied the CEMP must be submitted to the CSC for review and approval. The CEMP must be accompanied by the Environmental Health and Safety Sub-Plans listed below.

Table 25 Contractors Environmental Sub-Plans

No.	Contractor's Environmental Sub-Plans
1	Waste Handling and Management Action Plan
2	Traffic Management Action Plan
3	Runoff and Erosion Control Action Plan
4	Borrow-Pit Operations and Restoration Action Plan

129. These plans may be submitted separately or as part of the EMP.

F. Environmental Monitoring Program

130. A program of monitoring will be conducted: (i) to ensure that all parties take the specified action to provide the required mitigation, (ii) to assess whether the action has adequately protected the environment, and (iii) to determine whether any additional measures may be necessary. Apart from general monitoring of mitigation/enhancement measures, important environmental parameters (e.g. air quality, noise level, water quality, traffic problem, and drainage congestion) will be monitored during construction phase. Post-construction monitoring will be conducted by Road and Highways Department as well as PIU as part of the overall management of the operating infrastructure.

Table 26. Environmental Monitoring Plan

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/ Sampling, No/Year	Responsibilities	
					Implementation	Supervision
Pre-Construction Stage						
Building structures demolition	Dust control	Air quality standard by DOE, Bangladesh	Hatikamrul intersection ROW	Twice during demolition	Contractor	RHD/PIC
Dredged materials	Test parameters: Lead (Pb), Cadmium (Cd), Chromium (Cr), Copper (Cu), Zinc (Zn), Manganese (Mn), Arsenic (As), Selenium (Se), and Mercury (Hg)	Government of Bangladesh (GoB) and international standard	Proposed dredging sites	Once prior to start dredging	Contractor	RHD/PIC
Air Quality	Test parameters: SO _x , NO _x , CO, TVOC, PM ₁₀ , PM _{2.5}	Air quality standard by DOE, Bangladesh	Hatikamrul intersection	Once	Contractor	RHD/PIC
Noise Level	Test parameters: dB(A)	Noise Pollution Control Rules (2006)	Hatikamrul intersection	Once	Contractor	RHD/PIC
Water Quality	Test parameters: Surface water pH, TDS, EC, TSS, Fe, NH ₃ – N, Cl ₂ , DO, COD, BOD ₅	Surface water quality standard by DOE, Bangladesh	Surface water near Hatikamrul intersection site	Once	Contractor	RHD/PIC
	Test parameters: Groundwater: pH, Mn, As, Fe, Cl ⁻ , Total hardness, TC, FC	Groundwater quality standard by DOE, Bangladesh	Groundwater near Hatikamrul intersection site	Once	Contractor	RHD/PIC
Wildlife	Wildlife habitat and movement	None Specific	Areas along the Hatikamrul intersection alignment	Once	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/ Sampling, No/Year	Responsibilities	
					Implementation	Supervision
Tree felling	Monitoring activities outlined in RP; Check whether proper compensation as mentioned in RP is received by PAPs.	Inspection	ROW along the alignment	During tree felling and site clearing operations	Contractor/ NGOs/RHD	RHD/PIC
Construction Stage						
Air Quality	Test parameters: SO _x , NO _x , CO, TVOC, PM ₁₀ , PM _{2.5}	Air quality standard by DOE, Bangladesh	Hot mix plant, concrete mixing plant/stone crushers at construction sites	Twice	Contractor	RHD/PIC
Dust	Dust control	Air quality standard by DOE, Bangladesh	Construction site and ROW along the Hatikamrul intersection alignment	Regularly	Contractor	RHD/PIC
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Construction sites and inhabited locations and sensitive areas	Twice	Contractor	RHD/PIC
Water Quality	Test parameters Surface water: pH, TDS, EC, TSS, Fe, NH ₃ – N, Cl ₂ , DO, COD, BOD ₅ , Oil & Greases	Water quality Standard by MoEF, Bangladesh	Surface water near Hatikamrul intersection	Twice	Contractor	RHD/PIC
	Test parameters: Groundwater: pH, Mn, As, Fe, Cl ⁻ , Total	Water quality standard by MoEF, Bangladesh	Drinking water to made available to construction camps and	Twice	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/ Sampling, No/Year	Responsibilities	
					Implementation	Supervision
	hardness, TC, FC		ground water near Hatikamrul intersection			
Soil Erosion	Visual check for Soil erosion and siltation	None Specific	All major water bodies	Once during rainy seasons of the construction period.	Contractor	RHD/PIC
Drainage congestion	<input type="checkbox"/> Check drainage plan implemented correctly <input type="checkbox"/> Conduct regular inspection	Monitoring	Construction site	Weekly during monsoon	Contractor	RHD/PIC
Soil Pollution	<input type="checkbox"/> Check liquid waste is carried out by experienced personnel and in proper way <input type="checkbox"/> Careful and proper handling of oil and other hazardous liquids	Monitoring	Construction Yard, dumping site	Regularly	Contractor	RHD/PIC
Waste	<input type="checkbox"/> Check storage, transportation disposal, handling of hazardous waste <input type="checkbox"/> Waste and effluents to be collected and disposed safely from all camps. <input type="checkbox"/> Wastes and garbage from site to be disposed	Monitoring	Construction Yard, dumping site	Weekly	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/ Sampling, No/Year	Responsibilities	
					Implementation	Supervision
	safely					
Health and Safety	<input type="checkbox"/> Check quality of food & accommodation at construction camp; <input type="checkbox"/> Check safe water supply, hygienic toilet at camps, construction of drain at camp sites; <input type="checkbox"/> Check toilets are close to construction site and separate toilet for female workers; <input type="checkbox"/> First Aid Box with required tools & medicines; <input type="checkbox"/> The heavy construction material to handled and stored safely putting due care on public safety; <input type="checkbox"/> Check of personal protective equipment (PPE) for worker at the sites	Monitoring	Construction site and labor camp	Regularly	Contractor	RHD/PIC
Operation Stage						
Tree Plantation	Check that the planted trees are maintained as mentioned in tree plantation plan	Inspection to ensure proper plantation with proper species	Along the road	Regular during June/July	RHD	RHD/DOE

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/ Sampling, No/Year	Responsibilities	
					Implementation	Supervision
Air Quality	Test parameters: H ₂ S, SO _x , NO _x , CO, CO ₂ , TVOC, SPM, PM ₁₀	Air quality standard by DOE, Bangladesh	Hatikamrul intersection	Once	RHD	RHD/DOE
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Hatikamrul intersection and inhabited locations and sensitive areas	Once	RHD	RHD/DOE
Accident and Public Safety	Record of accidents, different level of disabilities/fatalities.	None Specific	Thought out the project section	-----	RHD	RHD
Soil Erosion	Visual check for soil erosion and siltation	None Specific	All major water bodies	After first precipitation	RHD	RHD
Wildlife	Wildlife habitat and movement	None Specific	Areas alongside the road alignment	Quarterly	RHD	RHD/DOE
Fisheries	Impact on fish productivity, breeding and spawning	None Specific	All major water bodies	End of First year of Operation	RHD	RHD/DOE

G. Environmental Budget

131. The estimated budget for implementation of the mitigation and monitoring measures proposed in EMP is presented in Table 27. The overall costs of the EMP will comprise:

- Environmental monitoring through sample collection and analysis;
- Any remedial measures necessary to reduce or avoid environmental damage;
- Designing and implementing all mitigating and enhancement measures;
- Supervision staff from RHD and consultants including direct costs and travel subsistence.

132. The total budget is estimated US\$0.0612 million.

Table 27. Environmental Budget for Hatikamrul Interchange

Component	Item	Unit	Quantity	Rate (in BDT)	Amount (million BDT)
PRE-CONSTRUCTION STAGE					
Dredged Material	Measuring dredged material quality	No.	2	20,000	0.04
Air Quality	Measuring air quality	No.	2	60,000	0.12
Noise	Measuring ambient noise level	No.	4	15,000	0.06
Flora	Clearing of Research and Training Centre (RRTC) plantation	No. of tree	After getting the site plan	Covered in Eng. Cost	--
Water Quality	Surface water quality measurement	No.	2	20,000	0.04
	Groundwater quality measurement	No.	2	20,000	0.04
SUB TOTAL (PRE-CONSTRUCTION STAGE)					0.30
CONSTRUCTION STAGE					
Air Quality	Measuring air quality	No.	4	60,000	0.24
Dust Management	Water sprayer / watering	Covered in Engineering Cost			--
Noise	Measuring ambient noise level	No.	8	15,000	0.12
	Provision for additional tree plantation / Noise Barriers	No.	Covered in Engineering Cost		--
Flora	Clearing of Research and Training Centre (RRTC) plantation	No.	Covered in Engineering Cost		--
Water Quality	Surface water quality measurement	No.	4	20,000	0.08
	Groundwater quality measurement	No.	4	20,000	0.08
	Installation of oil and grease traps at construction sites @ 1 per site and 1 site per construction package (13)	No.	1	60,000	0.06

Component	Item	Unit	Quantity	Rate (in BDT)	Amount (million BDT)
	Construction of soak pits at construction sites @ 2 per construction camp	No.	2	30,000	0.06
Drainage Congestion	Provision of adequate opening	Covered in Engineering Cost			--
Soil	Maintenance cost in soil conservation	Covered in Engineering Cost			--
Dust Management	Water sprayer / watering	Covered in Engineering Cost			--
Waste disposal and management	Disposal and management of construction waste	Lump sum	-	5,00,000	0.50
Construction Safety	Accident risks in construction activity	Covered in Engineering Cost/Insurance			--
	General Safety (provision of PPE like ear muffs, gloves etc.)	Lump sum	-	2,00,000	0.20
Health	Health checkup camps for construction workers	Camps	Camps/year	3,00,000	0.30
SUB TOTAL (CONSTRUCTION STAGE)					1.64
OPERATION STAGE					
Air Quality	Monitoring air quality	No.	3 (1/year)	60,000	0.18
Noise	Monitoring ambient noise level	No.	3 (1/year)	15,000	0.045
Water	Monitoring surface water quality	No.	3 (1/year)	20,000	0.060
	Monitoring ground water quality & levels	No.	3 (1/year)	20,000	0.060
Monitoring of performance indicators	Monitoring tree felling & plantation if needed	Lump sum	-	1,00,000	0.10
	Monitoring of waste disposal and management	Lump sum	-	3,00,000	0.30
SUB TOTAL (OPERATION STAGE)					0.745
TRAINING					
Training	Environmental training & awareness	Lump sum	As per training details	20,00,000	2.0
SUB TOTAL (TRAINING)					2.00
SUB TOTAL (Pre-construction, Construction, Operation and training)					4.6850
CONTINGENCIES @ 10 % on total Environmental Costs					0.4685
GRAND TOTAL (in million BDT)					5.1535
GRAND TOTAL (in million US\$) (@ 1 US\$ = 84.15 BDT)					0.0612

VI. INFORMATION DISCLOSURE AND PUBLIC CONSULTATION

A. Information Disclosure

133. In line with ADB's Public Communications Policy (2005 and 2011) and subsequently, the Access to Information Policy (2018), RHD will disclose locally the draft IEE, including EMP, to stakeholders affected by the project. RHD will provide relevant environment information, including information on the impacts and the corresponding mitigation designed for the project. RHD will also discuss the EMP, Grievance Redress Mechanism (GRM), information disclosure procedures and other relevant information in accordance with SPS. Relevant information will also be made available in RHD as well as site offices in both English and local language.

B. Public Consultation

134. Public consultation is one of the key components of the environmental assessment. A number of informal public consultations were held along the priority road. Two consultation meetings were arranged at Kodda Moor and Pachlia Bazar Sirajganj to inform the potential affected people about goals and objective of the project, probable timeline of starting civil construction, roles and responsibilities of the project authority and affected people/stakeholders, probable impacts and mitigation measures. The local people including representative of the Bazar Committee, local residence, businessmen and potential affected people were present in the meeting.

135. In consultation meeting, both environmental and social issues were examined. The main focus was to dig out information on how indiscriminate use of natural resources cause poverty and environmental degradation by declining the homestead forests, depleting biodiversity and decreasing livelihood of people. The issue on potential impact of construction works has also been raised.

136. Discussions during public consultations were primarily focused on receiving maximum inputs from the participants regarding the project's acceptability and environmental concerns. The purpose of stakeholder consultations is to identify the views of major institutional and project affected persons (PAPs) to the project area being examined, and to identify issues of relevance to the study, as well as any impacts which the project may have on project planned by the stakeholders, and to assess any mitigation measures which may be undertaken to minimize any adverse impacts of the proposals under consideration. This project will indeed be helpful for socio-economic development for central region of the country by timely transporting of essential goods and products required for agricultural and industrial development. Subsequently, stakeholder consultation is one of the important parts of the EIA to address the environmental aspects as well as socio-economic issues from stakeholders' point of view.

137. Stakeholder consultations were held during the site visits from February to May 2013 and 2017 during different stages preparing the environmental assessment report. The Elenka–Hatikamrul–Rangpur road subproject including the Hatikamrul interchange has been under preparation since 2013. Due to lack of funds implementation of the road subprojects could not be taken up earlier. Public consultations and Focus Group Discussions (FGDs) with government officials and local people have been conducted continuously during the environmental study in conformity with the ADB and DOE guidelines. Project staff conducted series of stakeholder consultations at different locations of the project.

138. During consultations, stakeholders were given a brief outline of the project's objectives, type and components of the project in a simplified manner and in their native language. A set of pre-determined common questions were provided to the stakeholders to seek their perception of the project. The discussions with the stakeholders were focused mainly on the following:

- Whether the project will help in providing safety to the people, their property and environment of the area;
- Any significant negative impact of the project on the overall environment of the area,
- Possible effects of the project on fisheries, trees, other habitats, agriculture, wetlands, drinking water availability and local economy;
- Possible impacts of the project during execution and commissioning; and
- Impact on the flora and fauna was mainly discussed with the officers of the forest department.

139. The effect of air and noise pollution due to the project (during the design and construction stage) and effect on river water quality were focus of discussion with Department of Environment. Biological environment, disturbance on fishing activities and fish productivity, and proposed mitigation measures were discussed at length with Fisheries and Wildlife Department.

140. Roads and Highways Department will continue to carry out consultations with affected people and communities in all phases of the project, to identify and help address safeguard issues that may arise.

C. Compliance with Relevant Regulatory Requirements

141. Public consultation was undertaken as per the ADB and DoE requirements. All the five principles of information dissemination, information solicitation, integration, coordination and engagement into dialogue were incorporated during the task. A framework of different environmental impacts likely from the project was strengthened and modified based on opinions of all those consulted, especially in the micro level by setting up dialogues with the village people from whom information on site facts and prevailing conditions were collected. The requirement of public consultation during the implementation of the project is proposed as part of the mitigation plan.

D. Major Comments Received

142. While a wide range of people from different administrative, social and economic backgrounds were consulted, their concerns and outcome of the consultation along with suggestions made by them are detailed in the following section.

143. As observed from their responses, almost everyone interviewed was supportive of the project and believes that it will help to provide the much-needed connectivity and development to the region.

144. During discussions, notes were taken for any issue raised and suggestions made. These were collated for a comprehensive analysis of the concerns raised. References have been taken from public opinion where no official data were available, while the officially available data have been extensively used for understanding of the project area characteristics. Each of the issues was then analysed on practical and scientific basis and accorded a likewise importance in terms

of their magnitude in impacts and mitigation. For any significant concern, preventive or mitigation measures have been suggested drawing points from all the suggested measures.

1. Government Officers' Comment

145. Stakeholders from different departments and institutes were consulted. Their concerns are summarized in table below.

Table 28. Details of Consultation with Government Authorities for Elega–Hatikamrul

Department	Name and Designation of the Government Official	Comments	Suggestions
Roads and Highways Department (RHD)	Rowshan Ara Khanam Superintending Engineer	<ul style="list-style-type: none"> • Priority Roads are priority. • Department will be open to incorporate feasible environmental protection measures in road design. 	<ul style="list-style-type: none"> • Mitigation measures shall be simple and implementable. • RHD is open for the implementable ideas for institutional capacity building
	A. K. M. Mozammel Haque Executive Engineer		
Department of Environment (DOE)	Md. Shahjahan Additional Director General	<ul style="list-style-type: none"> • Sourcing of borrow area earth is a concern in Bangladesh • Needs adequate Baseline Environment Quality Determination for construction and borrow areas. • Effective Measures must be developed for construction and operation stage both. • Sourcing borrow earth from agriculture area is acceptable provided top soil is preserved. 	<ul style="list-style-type: none"> • Obtain prior environmental clearance being it a red category Project. • Collect Soil from Multiple sources such as Char area or from riverbed, which will increase water depth in river and improve navigability of the river.
	Sayed Nazmul Ahsan Deputy Director (Environmental Clearance)		
	Md. Monirul Islam Assistant Director		
	Md. Samsuzzaman Sarker Assistant Director		
Department of Agriculture Extension (DAE)	Dr. Salma Laizu Upazila Agriculture Officer Sirajganj Sadar, Sirajganj	<ul style="list-style-type: none"> • Agricultural land will be affected due to the project implementation • Livelihoods of the families will be affected severely due to acquiring agricultural land. • Noise pollution & Air pollution will be increased during bringing heavy machinery at the stage of construction. 	<ul style="list-style-type: none"> • Avoid agricultural land as much as possible. • Take proper measure to avoid pollution of water reservoirs as these are sources of irrigation. • Tree plantation programme should be according to the government rule and must be in 1:2 ratio. • Ensure the proper sprinkling of water during construction
	Gowro Gobindo Das Upazila Agriculture Officer Kalihati Upazila, Tangail		
	Banani Karmakar Agricultural Extension Officer Kalihati Upazila,		

Department	Name and Designation of the Government Official	Comments	Suggestions
	Tangai		stage to control dust pollution.
Department of Fisheries (DoF)	<p>Alok Kumar Shaha Upazila Fisheries Officer Sirajganj Sadar, Sirajganj</p> <p>Habibur Rahman Talukdar Upazila Fisheries Officer Kalihati Upazila, Tangail</p>	<ul style="list-style-type: none"> • Small water channels/ watercourses may be abandoned due to non-availability of passages across the road. 	<ul style="list-style-type: none"> • Adopt measures to minimise dust, smoke, and noise pollution, and to control spillages from construction machinery • Drainage system will be provided to control surface runoff • Do not wash the construction materials in ponds and ditches. Try to use a fixed place. • Ensure the proper sprinkling of water during construction stage to control dust pollution.
Local Government Engineering Department (LGED)	<p>Moinul Islam Khan Sub Assistant Engineer Sirajganj Sadar, Sirajganj</p> <p>Shahiduzzaman Khan Upazila Engineer Kalihati Upazila, Tangail</p>	<ul style="list-style-type: none"> • This project will reduce some agricultural land because of land acquisition. • Construction activities will cause noise and air pollution. • Tree cutting will create imbalance to local environment. 	<ul style="list-style-type: none"> • Improve general standards of construction • Plant trees along the highway that could reduce air and noise pollution. • To prevent impacts due to noise all the noisy construction activities will be carried out in day time. • Drainage system will be provided to control surface runoff.

Figure 18. Consultation with Government Officials



146. The summary of the stakeholder consultations conducted with some government officials during the preparation of Environmental Assessment report and their opinions and suggestions are detailed in the following paragraphs.

147. Department of Environment, Ministry of Environment and Forests has highlighted that sourcing borrow earth is a concern in Bangladesh. Preference must be given to source borrow earth from char area or riverbed. They also highlight the need of establishing adequate Baseline Environment Quality conditions around borrow areas and road construction areas. They also emphasized that adequate mitigation measures must be planned incorporated in the road design. RHD must also obtain prior environmental clearance before start of construction.

148. Department of Agriculture Extension advised to avoid the agricultural land. They also emphasized that though there is enough land under RHD but it would require additional land which will affect farmers' livelihood. They also indicated twice number of trees should be planted against the number of trees cut.

149. Fisheries officers indicated that most of the ponds in this area are seasonal in nature and road development may not have direct impact on fisheries. However there are some reserved ponds, beels and rivers area for fish breeding and culture in the project location but those are far from the ROW. The project activity will not impact on the fisheries practices directly.

2. Focus Group Discussions

150. A focus group is a group of individuals selected and assembled by the environmental specialists to discuss and comment on, from personal experience. Central to successful group discussion was capturing a wide range of opinions about the impact and mitigation because of the road project. The groups consisted of more than five people and they were discussed for approximately half an hour to gather information and opinion they have. Altogether 8 FGDs were held on 10 to 11 May 2013 and 22 March 2017. Approximately 96 participants, including several women, from different locations have taken part in those consultations.

151. During the consultation, the participants spontaneously expressed their feelings about the importance of developing the road. They told that the project will remove current stress on road traffic and will ease their turmoil and reduce their commuting time. Moreover, business sectors will be greatly benefitted due to the improvement of communication system.

152. Most of them told that the local air quality has been degraded from the emission of vehicles and local small industries and other man made sources. The participants expressed that the dredging materials should not be collected from the agricultural land since people are cultivating there. They believe that there will be no major environmental impacts due to the project except a temporary impact of noise and dust from the engine of the construction transport and materials. Most of the people argued that they are willing to endure the temporary negative impact for the sake of the improvement of communication system which will improve their livelihood.

153. During the focus group discussion, people said that there will be no impacts on ground water and surface water. In accordance with people's information there are some wild life found in the area and rarely cross the road or die because of run over by the transport. People also confirmed that there is no Environmental Protected Area in the project area. Finally, all of them were in favor of the project.

Figure 19. Photos of Public Consultation



Figure 20. Photos of Public Consultation



Figure 21. Photos of Public Consultation

3. Suggestions

154. The following suggestions received from the consultation:

- The excavated materials should be properly managed as though local inhabitants face no troubles.
- Excavated materials should be deposited in a proper place that does not harm the local people and agricultural land.
- There should be effective mitigation measures in order to reduce noise pollution and emission from construction vehicles engine and materials.
- Initiatives need to be taken to stop surface water pollution.
- Water should be sprayed 2-3 times in a day to reduce the dust pollution.
- Tree should be planted in 1:2 ratio.
- The road should be straight or dangerous curve should be minimized.
- Keep provision of foot over bridges and flyovers at busy locations.

4. Informal Public Consultations

155. A number of informal public consultations were held along the priority roads. In all the places, respondents mostly welcomed the project. However, they pointed out few issues of concern like, noise & air pollution, accident hazard along with loss of land and compensation. In the time of field survey 16 local people were interviewed.

Table 29. Details of Consultation with Public in Elenga–Hatikamrul Road Sections

Location	Person Name, Occupation and Contact	Comments	Suggestions
Kalihati, Tangail	Md. Abdus Salam, Cleaner, 01747322624	<ul style="list-style-type: none"> • It is good news and we welcome the project. • Construction stage will create some inconvenience to people but that is tolerable. • Increased traffic may cause 	<ul style="list-style-type: none"> • Footpath and over-bridge should be constructed in appropriate and convenient (heavily used) locations so that people may use it to
	Md. Rohis Uddin, Labour, 01755084699		
	Md. Abdur Sabur, Cleaner, 01727322434		

Location	Person Name, Occupation and Contact	Comments	Suggestions
		air and noise pollution. • Local people will be benefited economically due to more employment opportunities. • Traveling will be fast which will help improve business environment	avoid accident during road crossing. • Speed-breakers should be constructed near schools, hospitals and religious places. • Tree shall be planted wherever there is space available. • Water should be sprayed 2-3 times in a day to reduce the dust pollution.
Sirajganj Sadar, Sirajganj	Md. Shoriful Islam, Business, 01735671741	• Accident prone area • Improved road is essential and we welcome the road.	• Road should be straight as it is sharply turning at this place or road ROW should be reduced. • Require safe passage being a growth centre. • Provide underpass at this location to facilitate easy movement of people who are moving in large number currently.
	Md. Nidan Ali Shak, Business, 01915914416		
	Md. Shafiqul Islam, Business, 01765021257		
	Md. Abu Shama, Labour, 01734381832		
	Md. Obaydul Islam, Business, 01760429673		
	Monowarul Islam, Business, 01718929979		
	Md. Abdul Motaleb, Van Puller		
	Md. Ismail Hossain, Driver, 01710133032		
Kamarkh and, Sirajganj	Md. Nurnobi Sarkar, Farmer, 01745081266	• Very welcome step from Govt. • Local people will be benefited economically due to more employment opportunities. • Commuting will be fast which will help improve business environment	• Provision shall be made for safe passage of kids. • A foot over bridge may be provided near school. • Water should be sprayed 2-3 times in a day to reduce the dust pollution.
	Md. Jakir Hossain, Student, 01717423571		
	Md. Jahadul Islam, Business, 01719617522		
	Munjur Rahman, Employee, 01713731581		

Location	Person Name, Occupation and Contact	Comments	Suggestions
			<ul style="list-style-type: none"> • Tree should be planted in 1:2 ratio.
Royganj, Sirajganj	Md. Alauddin, Student, 01735660100	<ul style="list-style-type: none"> • Difficult to cross the road due to heavy traffic, accident prone • Road development is welcome 	<ul style="list-style-type: none"> • Make appropriate measures in road design for safe passage. • Water should be sprayed 2-3 times in a day to reduce the dust pollution. • Tree should be planted in 1:2 ratio.

5. Suggestions

156. The following suggestions received from the public consultations:

- As most of the people engaged in business at the roadsides so rehabilitation program should consider appropriate measure with decent compensation.
- Local employment need to be created during the construction phases which can be a good option for livelihood development.
- There should be acceptable and effective mitigation measures in order to reduce noise and dust pollution. Tree plantation and construction of noise protection walls is suggested.
- Improved technology can be used to mitigate noise pollution.
- Drainage system should be developed to prevent water logging in that urban area.
- Water could be sprayed at the construction site in order to reduce dust, particularly during the construction phase.
-

Figure 22. Photos of Public Consultation





E. Summary of Comments

157. A brief summary of comments of local people is presented in the following sections:

- Most of the people who were interviewed in the project area welcome the road expansion project as this is expected to improve the connectivity. Farmers have positively reacted to the development considering that better communication facility will fetch them better farm price. However, roadside shopkeepers and farmers have concern of loss of business due to widening of road and loss of livelihood.
- The people in the project areas were less concerned about the environmental problems, such as, air and noise pollution, top soil removal problem that may arise due to pre and post operation of road construction. However, they have raised concern regarding dust pollution and noise pollution near religious places and schools and suggested for adoption of appropriate mitigation measures for the control of it.
- The local people also mentioned that the environmental impact due to the proposed project is minor and short term. However, some mitigation measures should be taken during construction of the road, such as water spray to reduce dust pollution, tree plantation, and working hour should be only in day time and particularly if it will near the residential area.
- People have raised concern of accident during road crossing near village due to increasing traffic. They have strongly demanded provision of foot over bridge and speed breaker. They also demanded for traffic management near big junctions like Elenga, Kodda Moor and Hatikamrul.
- Local people are of strong opinion for the early implementation of the project.

VII. GRIEVANCE REDRESS MECHANISM

158. 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 (GRM) is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns.

159. Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective actions proposed using understandable and transparent processes that are gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. The responsibility for addressing the grievances along with proper timelines will be clearly indicated. Records of grievances received, corrective actions taken and their outcomes will be properly maintained and form part of the environmental monitoring report for submission to ADB.

160. The Project Implementation Unit (PIU) of RHD shall make the public aware of the GRM with the support of PIC through methods such as public awareness campaigns. Grievances can be filed in writing or by phone with any member of the PIU or PIC. The following steps procedures will be followed under the GRM.

161. **First tier of GRM:** The Site Project Manager (PM) under the PIU shall be the designated officer for grievance redress at the first tier. Resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

- initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and
- closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed off.

162. The updated register of grievances and complaints will be available to the public at the PM office, construction site, and other key public offices along the project area. Should the grievance remain unresolved within 7 working days, it will be elevated to the second tier.

163. **Second tier of GRM:** The respective site level PM will activate the second tier of GRM by referring the unresolved issue (with written documentation). The GRC shall be established by the PIU before commencement of site works. The GRC will consist of the following persons: (i) project director; (ii) representative of city ward; (iii) representative of the affected persons; (iv) representative of the local deputy commissioner's office (land); and (v) representative of the Department of Environment (DOE) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concerns and issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days.

164. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

165. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land acquisition, asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

166. The respective APD and PM will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

167. **Third tier of GRM:** In the event that a grievance cannot be resolved directly by the Project Implementation Unit (PIU) (first tier) or GRC (second tier), the affected person can seek alternative redress through the city ward committees or in appropriate courts. The PIU or GRC will be kept informed by the city mayor authority.

168. The monitoring reports of the EMP and the resettlement plan implementation shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

VIII. CONCLUSIONS

A. Findings

The Hatikamrul Interchange (work package-13) offers a cloverleaf option for the enhancement of the existing road-based transportation network. Several actions are required during the detailed design stage to minimize impacts to acceptable levels. On the way to Rangpur from Dhaka at Hatikamrul on the left side there is a private hospital. Part of the hospital is in the RHD land, for the proposed Hatikamrul Interchange construction need to relocate this hospital.. On the way to Dhaka from Rangpur at Hatikamrul on the left side, there is a commercial residential hotel which is also in the RHD land, which will also need to be relocated for the proposed Hatikamrul Interchange construction. One electric overhead high-voltage pole and underground gas pipeline with diameter of 0.6 meter will also be affected and needs relocation.

169. The finding of IEE indicates that the Hatikamrul Interchange (work package-13) is unlikely to cause any significant adverse environmental impacts. The proposed road expansion does not pass through or located nearby any national park, wildlife sanctuary, reserved forests, or any other ecologically sensitive or areas. No archaeological/protected monument is located in the project vicinity. The land use pattern around the alignment is predominantly commercial.

170. Negative impacts are likely to occur during construction stage and are temporary in nature. Some impacts require design consideration and are suitably addressed. The land use pattern around the Hatikamrul Interchange (work package-13) alignment primarily includes commercial area, settlement, and perennial or non-perennial water bodies.

171. The cloverleaf option will minimize impacts on the urban settlements. The main impacts are primarily caused by land clearing for widening the interchange, transportation of construction material.

172. The impacts relate to changes in ambient air quality, water quality, and increase in ambient noise levels. During the operation, direct local impacts are mostly related to noise levels, air quality and road accidents.

173. Implementation of the prescribed mitigation measures will minimize the adverse impacts. Moreover, the impacts shall be monitored continually by implementing and updating the Environmental Management Plan and Environmental Monitoring Plan.

174. During construction of Hatikamrul Interchange (work package-13) traffic management is a big challenge as it is a very busy area with many vehicles. Some trees along the road are likely to be cut but if the proposed compensatory afforestation plans are effectively implemented and survival rate is monitored and sustained, the positive benefits are likely to be accrued.

175. Efforts are proposed to minimize cutting of trees with suitable modifications in the Hatikamrul Interchange (work package-13). However, there are no legislative restrictions in cutting these trees. There are no other environmental sensitive resources found in the project area, which is likely to be affected due to the project.

B. Recommendations

176. The EMP, its mitigation and monitoring programs, contained herewith should be included within the Bidding documents for project works. Hatikamrul Interchange area is mainly business area and few residential areas. For this relocation of hospital people will not be that much affected

as there is hospital in Ullapara Upzilla 14.37 km. Hatikamrul Interchange area is mainly business area and closer to the interchange there is also some hotel which can solve the problem. Also, the affected residential hotel owner is going to construct a new hotel near by Hatikamrul Interchange in his own land. The Bid documents state that the contractor shall be responsible for the implementation of the requirements of the EMP through his own Site Specific Environmental Management Plan which will adopt all of the conditions of the EMP and add site specific elements that are not currently known, such as the Contractors borrow pit locations. This ensures that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

177. The EMP and all its requirements shall then be added to the contractor's contract, thereby making implementation of the EMP a legal requirement according to the contract. He shall then prepare his CEMP which will be approved and monitored by the Engineer/Environmental Specialist. To ensure compliance with the CEMP the contractor should employ a national environmental specialist to monitor and report project activities throughout the project construction phase.

178. RHD has social and environmental staff but they need capacity building and practical exposure. Adequate training shall be imparted as proposed under environmental management plan to enhance the capability of concerned Executing Agency officials.

179. It is recommended to update environmental guidelines focused on effective implementation of mitigation measures. Performance indicators may also be developed as part of these guidelines to monitor and assess the effectiveness of the mitigation measures.

C. Conclusion

180. This initial environmental examination (IEE) concludes that the environmental impacts will be manageable if the mitigation measures are implemented thoroughly. The 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) and DoE environmental guidelines.

181. The project is classified "B" in accordance with ADB's Safeguard Policy Statement 2009 requiring preparation of an Initial Environmental Examination Report. As per the Environmental Conservation Act, 1995 of Bangladesh, the project falls under Red category and requiring preparation of an IEE and EIA. This report is prepared in keeping with the ADB and GOB environmental requirements.

182. Essentially secondary data was used to assess the environmental impacts in a comprehensive manner. Site survey for environmental data collection and public consultation will be carried out in order to complete the environmental impact assessments (EIA) and recommend suitable mitigation measures. Traffic management is the big challenge during construction of Hatikamrul Interchange.

183. The IEE report assesses the potential environmental impacts associated with the Hatikamrul Interchange (work package-13), and suitable mitigation measures have been recommended. In the event that any design details of the Hatikamrul Interchange (work package-13) are changed, the IEE and EMP shall be reviewed and revised accordingly and submitted to DOE and ADB for acceptance.

REFERENCES

- Banglapedia, 2010. National Encyclopedia of Bangladesh Online [Online]. Available at <http://www.banglapedia.org> (accessed on 15-04-2013)
- Banglapedia, 2006. National Encyclopedia of Bangladesh Online [Online]. Available at <http://www.banglapedia.org> (accessed on 15-04-2013)
- Bangladesh Bureau of Statistics, 2006. Population Census 2011. [Online], Available at: <http://www.bbs.gov.bd/home.aspx#> (accessed on 15-04-2013)
- Brammer, H., 1996. The Geography of the Soils of Bangladesh. Dhaka: University Press Limited.
- IEE (Initial Environmental Examination), 2017: BAN: South Asia Subregional Economic Cooperation Dhaka – Northwest Corridor Road Project, Phase 2, Elenga - Hatikamrul Road
- IEE (Initial Environmental Examination), 2017: BAN: South Asia Subregional Economic Cooperation Dhaka – Northwest Corridor Road Project, Phase 2, Hatikamrul–Rangpur Road
- IPCC (Intergovernmental Panel on Climate Change), 2007. Climate change 2007: Synthesis Report. Contribution of Working Groups I, II, III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland.
- International Union for Conservation of Nature (IUCN), 2002. Bioecological zones of Bangladesh. Dhaka: IUCN Bangladesh.
- IUCN Bangladesh. ed. 2002f. Bioecological Zones of Bangladesh. Dhaka: IUCN-The World Conservation Union.
- MoEF, 2009. Bangladesh Climate Change Strategy and Action Plan 2009, Ministry of Environment and Forest, Bangladesh.
- MoEF/UNDP, 2005. National Adaptation Programme on Action (NAPA). Final Report. Ministry of Environment and Forests, GOB, Bangladesh.
- Morgan, J.P. and McIntyre, W.G., 1959. Quaternary Geology of the Bengal Basin, East Pakistan and India. Bulletin of the Geological Society of America, Vol 70, pp 319-342.
- Rashid, H., 1977. Geography of Bangladesh. Dhaka: University Press Limited.
- Soil Resource Development Institute (SRDI), 1997. Physiography of Bangladesh. Dhaka: SRDI,
- Soil Resource Development Institute (SRDI), 1998. Agro-ecological regions of Bangladesh. Dhaka: SRDI, Ministry of Agriculture.
- United Nations Population Fund (UNFPA), 2010. State of World Population 2010- From Conflict and Crisis to Renewal: generations of change [Online]. Available at: http://www.unfpa.org/webdav/site/global/shared/swp/2010/swop_2010_eng.pdf (accessed on 15-04-2013)
- Wahab, A., (2008), Bangladesh Introduction (Ramsar Wetland Information). [Online] Available at: <http://ramsar.wetlands.org/Portals/15/Bangladesh.pdf> (accessed on 15-04-2013)

APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Rapid Environmental Assessment (REA) Checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

Bangladesh: Hatikamrul Interchange (work package -13), South Asia Sub regional Economic Cooperation (SASEC) Phase 2

Sector Division:

South Asia Transport and Communications Division

Screening Questions	Yes	No	Remarks
A. Project Siting			
Is the project area adjacent to or within any of the following environmentally sensitive areas?			
Cultural heritage site		✓	The Hatikamrul Interchange (WP-13) passes through bazars and few community resources like school, and mosque are located near the roads. Some of these cultural sites will be directly affected because of the widening of the existing road.
Protected Area		✓	There are no protected areas in or within 5km of the project area that might be directly affected because of the project.
Wetland	✓		There are small ponds linked to certain rivers. However, none of them are protected or rich in biodiversity.
Mangrove		✓	None
Estuarine		✓	None

Screening Questions	Yes	No	Remarks
Buffer zone of protected area		✓	The Hatikamrul Interchange (WP-13) does not pass through any buffer zone of protected area.
Special area for protecting biodiversity		✓	None
B. Potential Environmental Impacts			
Will the Project cause...			
Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	✓		No encroachment on historical but some religious areas are envisaged. The topography of Hatikamrul Interchange (WP-13) is mainly flat. However, minor impacts on landscape are unavoidable due to increase in elevation and widening of road embankment and side roads for slow moving vehicles.
Encroachment on precious ecology (e.g. sensitive or protected areas)?		✓	The Hatikamrul Interchange (WP-13) does not pass through any National Park/Wildlife Sanctuary.
Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	✓		The Hatikamrul Interchange (WP-13) have flyover which may cross the wetland which may temporarily increase the sedimentation level in the river around bridge construction site. However, this would only be temporary and short term in nature. All measures shall be taken during construction stage so that watercourses are not affected and temporary soil and rock stockpiles will be designed so that runoff will not induce sedimentation of waterways.
Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	✓		Suitable siltation prevention measures such as silt fencing is included in the EMP. Adequate measures for sanitary and construction related waste such as chemicals shall be taken to prevent contaminating local water resources.
Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	✓		Local air pollution level will likely increase for short duration during construction period particularly due to earth work. Appropriate distance from settlement area and wind direction will be considered to

Screening Questions	Yes	No	Remarks
			locate air polluting facility like stone crushing unit etc. if required.
Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?	✓		Construction activities could cause accidents and health risks to workers. Occupational health and safety measures will be mandatory for the contractor.
Noise and vibration due to blasting and other civil works?	✓		<p>Ambient noise level is expected to increase in the range of 80-90 dB(A) due to various construction activities, maintenance workshops, and earthmoving equipment for short durations. The impact due to noise during construction activities will be minimal to inhabitants since most of the built-up areas are located at safe distances from the road. However, there is little noise sensitive locations especially schools, mosque, etc. close to the alignment that will be affected adversely.</p> <p>Impact due to noise to the workers and local community will be avoided/minimized through mitigation measures such as occupation health and safety gear, restriction of construction timing and others</p>
Dislocation or involuntary resettlement of people?		✓	<p>There will be minimal resettlement impacts.</p> <p>Further details are provided in the Resettlement Plan.</p>
Dislocation and compulsory resettlement of people living in right-of-way?		✓	
Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	
Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		✓	No major impacts anticipated. However, efforts will be made to minimize air pollution through appropriate measures such as wet spraying, covering of trucks, location of hot mix plants and other stationary equipment away from settlement areas and others.

Screening Questions	Yes	No	Remarks
Hazardous driving conditions where construction interferes with pre-existing roads?	✓		Proper safety measures such as barricades, flagman, sign boards etc. will be placed to prevent accidents.
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?	✓		Appropriate waste management shall be adopted in construction camps. Worker health checks and awareness rising will be implemented to educate workers on communicable diseases.
Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?	✓		Breeding habitats maybe created in labor camps, garbage disposal sites borrow pits and material storage yards. Appropriate sanitation requirements in labor camps and avoidance of stagnant water included in the EMP.
Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	✓		Temporarily during construction Stage. Adequate measures will be provided to prevent them such as speed reduction, provision of crash barrier & proper traffic signage system at sensitive places will ensure smooth traffic flow which will reduce accidental risk
Increased noise and air pollution resulting from traffic volume?	✓		Due to improvement in road riding conditions the net effect on noise and air pollution will be negligible. However, the number of traffic will increase and the pollution will also increase consistently.
Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		✓	EMP recommendations are designed to mitigate water pollution due to construction related activities.
Social conflicts if workers from other regions or countries are hired?		✓	EMP suggests to hire most workers from the local area and to ensure gender equality.
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Most workers will be hired locally, hence this is not anticipated.
Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as	✓		Transport, storage, use and disposal of fuel and chemicals will be required.

Screening Questions	Yes	No	Remarks
explosives, fuel and other chemicals during construction and operation?			Appropriate safety, storage and disposal measures recommended in the EMP.
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.	✓		Safety and injury related risks will arise from the presence of equipment's and construction activities. Clear demarcation of restricted areas and prevention of open access to construction areas is included in the EMP.

Climate Change and Disaster Risk Questions	Yes	No	REMARKS
The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.			
Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes	✓		As in most parts of Bangladesh, parts of the project road face problems of flooding. Required design measures for adapting to flooding events in further EIA study.
Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (eg., increased erosion or landslides could increase maintenance costs, permafrost melting or increased soil moisture content could affect subgrade).		✓	With the incorporation of recommendations from the climate change study of IEE, it is expected that the Hatikamrul Interchange (WP-13) will be able to withstand with future changes of various climatic parameters.
Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		✓	There is no potential impact identified in the project area yet.
Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by		✓	A separate climate change study in IEE showed that the project will significantly reduce the GHG emissions.

encouraging settlement in areas that will be more affected by floods in the future, or encouraging settlement in earthquake zones)?			
---	--	--	--

Note: Hazards are potentially damaging physical events.