

Initial Environmental Examination

September 2019

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

Road Research and Training Center

Prepared by the Roads and Highways Department, Ministry of Road Transport and Bridges for
the Government of Bangladesh and the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 18 July 2019)

Currency unit	–	taka (Tk)
Tk1.00	=	\$ 0.0118
\$1.00	=	Tk84.4750

ABBREVIATIONS

AAQ	-	ambient air quality
AAQM	-	ambient air quality monitoring
ADB	-	Asian Development Bank
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
ECC	-	Environmental Clearance Certificate
ECR	-	Environmental Conservation Rules
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
MOEF	-	Ministry of Environment and Forests
NOx	-	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

In this report, "\$" refers to United States dollars.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
A. Scope of the Study.....	i
B. Extent of IEE 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 (ECA), 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.....	9
12. Occupational Health and Safety.....	9
B. ADB's Safeguard Policy.....	10
C. Project Category	10
II. Description of the Project	11
A. Description of the Project.....	11
B. Project Location	11
C. Project Outline	12
D. Project Components	12
III. Description of the Environment.....	13
A. General.....	13
B. Physical Environment	13
1. Climate	13
2. Temperature Data.....	14
3. Rainfall.....	15
4. Humidity.....	15
5. Wind Speed	15
6. Topography.....	16
7. Geology and Soils.....	16
8. Soil Quality	18
9. Surface Water Quality.....	18
10. Groundwater/ Drinking Water Quality.....	19
11. Ambient Air Quality	21

12. Noise Level.....	24
IV. Impacts and Mitigation Measures.....	27
A. Key Consideration and Scoping.....	27
B. During Pre-Construction Stage	27
1. Removal of Utilities	27
C. During Construction Stage	28
1. Ground Water/Drinking Water	28
2. Air Pollution	28
3. Noise and Vibration.....	29
4. Waste Pollution	29
5. Construction Materials	30
6. Landscape	30
7. Job Opportunities.....	30
8. Occupational Health and Safety.....	30
9. Resettlement.....	31
D. During Operation Stage	31
1. Wastewater Generation	31
2. Solid Waste Pollution	31
3. Air and Noise Pollution.....	31
4. Occupational Health and Safety.....	32
5. Community Health and Safety	32
V. Environmental Management Plan.....	33
A. Implementation Arrangement.....	33
B. Capacity Building	33
C. Environmental Management Action Plan.....	34
D. Environmental Monitoring Program.....	45
E. Environmental Budget.....	50
VI. Information Disclosure and Public Consultation	52
A. Focus Group Discussions	52
B. Summary of Comments	53
C. Information Disclosure	54
D. Compliance with Relevant Regulatory Requirements.....	54
VII. Grievance Redress Mechanism	55
VIII. Emergency Response Plan	57
A. Introduction.....	57
B. Objective of Emergency Response Plan	57
C. Elements of an Emergency Response Plan	57
D. Hazards Associated with the proposed project.....	58
E. On-site Emergency Response and Preparedness Plan of Construction Contractor	58

F.	Emergency Response Procedure	58
1.	Identification of Emergency.....	58
2.	Emergency Action Plan at Project Site.....	58
G.	Establishment of an Emergency Control Centre.....	58
1.	Assembly Points	59
2.	The Key Personnel for Emergency in the project	59
3.	Alarm System	59
4.	Communication System	59
5.	Siren for Emergency	59
6.	Counting of Personnel	60
7.	All Clear Signal	60
8.	Emergency Facilities.....	60
H.	Hazardous Control Measures	60
1.	Fire	60
2.	Natural Disasters	61
3.	Electrical Accidents.....	61
4.	Prevention of Electrical Accidents	61
5.	Personal Protective Equipment.....	62
6.	First Aid.....	62
IX.	Conclusions	63
A.	Findings	63
B.	Recommendations	63
C.	Conclusion.....	64
X.	REFERENCES	65
	APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST	66
	APPENDIX B: LIST OF PARTICIPANTS IN FGDs.....	70
	APPENDIX C: AMBIENT AIR QUALITY RESULTS	72
	APPENDIX D: NOISE LEVEL RESULTS	73
	APPENDIX E: SURFACE WATER QUALITY RESULTS	74
	APPENDIX F: GROUND WATER/ DRINKING WATER QUALITY RESULTS.....	75

LIST OF TABLES

Table 1. Applicability of Key Environmental Legislation	5
Table 2. Relevant International Treaties, Conventions and Protocols Signed by Bangladesh	9
Table 3. Relevant Occupational Health and Safety Laws and Rules.....	9
Table 4. Environmental Regulatory Compliance	10
Table 5. Outline of the (work package-14)	12
Table 6. Surface Water (SW) Sampling Locations	18
Table 7. Surface Water (SW) Quality Results	19
Table 8. Ground Water/ Drinking Water Sampling Location	20
Table 9. Ground Water/ Drinking Water Quality Result	20
Table 10. Ambient Air Quality Sampling Locations.....	22
Table 11. Ambient Air Quality (AAQ) Results	23
Table 12. Noise Level (NL) Sampling Locations	24
Table 13. Noise Level (NL) Monitoring Results.....	25
Table 14. Environmental Mitigation Plan.....	35
Table 15. Environmental Monitoring Plan	46
Table 16. Environmental Budget for Road Research and Training Centre	50

LIST OF FIGURES

Figure 1. Government of Bangladesh Environmental Assessment Process	8
Figure 2. Location Map of Proposed Road Research and Training Centre	11
Figure 3. Climatic Zone	14
Figure 4. Monsoon Actual and Normal Rainfall in Dhaka City.....	15
Figure 5. General Soil Types of Bangladesh including Dhaka	17
Figure 6. Surface Water (SW) Sample Collection	18
Figure 7. Surface Water Sampling Locations	19
Figure 8. Ground Water/ Drinking Water Sample Collection	20
Figure 9. Ground Water/ Drinking Water Sampling Locations.....	21
Figure 10. Ambient Air Sample Collection	22
Figure 11. Ambient Air Quality Sampling Locations	24
Figure 12. Noise Level Sample Location	25
Figure 13. Noise Level Sampling Locations	26
Figure 14. Organizational Chart	33
Figure 15. Photos of Focus Group Discussion	52
Figure 16. Photos of Focus Group Discussion	53
Figure 17. Photos of Focus Group Discussion	53

EXECUTIVE SUMMARY

A. Scope of the Study

1. This report is the initial environmental examination (IEE) for the Road Research and Training Centre (work package-14). It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this work package. This IEE is part of the process of compliance with the Government of Bangladesh and ADB guidelines in relation to Road Research and Training Centre under SASEC Road Connectivity Project-2.

2. This report will identify the potential environmental impacts due to implementation of the Road Research and Training Centre and will suggest appropriate mitigation measures.

B. Extent of IEE Study

3. The proposed Road Research and Training Centre is located in existing Bangladesh Road Research Laboratory and along with the vacant land. Proposed Road Research and Training Centre 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 environmental management plan (EMP). Extensive focus group discussions 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 impact has been defined as 500 meter (m) on either side from the edge of the land alignment. However, the study area has been extended to 500 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.

C. Findings

6. The Road Research and Training Centre offers some new building will be constructed for the entire facility. 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.

7. The finding of IEE indicates that the Road Research and Training Centre is unlikely to cause any significant adverse environmental impacts. The proposed Road Research and Training Centre 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.

8. 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.

9. 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 and air quality. 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.

10. Some trees along the Road Research and Training Centre 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 Road Research and Training Centre. 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. Baseline information of trees will be collected when the detail design is finalized and will be updated in the report.

D. Recommendations

11. The EMP, its mitigation and monitoring programs, contained herewith should be included within the bidding documents for project works. Road Research and Training Centre area is mainly few residential areas. 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. This ensures that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

12. 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.

13. Roads and Highways Department (RHD) has social and environmental circle 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

14. 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.

15. The project is classified *B* in accordance with ADB's Safeguard Policy Statement 2009 requiring preparation of an IEE report. This IEE reveals that construction of the Road Research and Training Centre 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.

16. Essentially primary data of air, noise, surface and ground water was used to assess the environmental impacts in a comprehensive manner. Site survey for trees after detail design will be finalized and incorporate those things in the final IEE report and recommend suitable mitigation measures.

17. The IEE report assesses the potential environmental impacts associated with the Road Research and Training Centre, and suitable mitigation measures have been recommended.

18. In the event that any design details of the Road Research and Training Centre 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 Environmental Impact Assessments (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 1995–2005. 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 (ECA), 1995

5. 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.

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 focuses 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 focuses 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 (DG), 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 DG.
- 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)

9. 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)

10. 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.

11. 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

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.

17. 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, EIA based on approved TOR by DOE, EMP, etc.

18. 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:

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

7. Bangladesh Climate Change Strategy and Action Plan

19. 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

20. The National Land Use Policy was adopted by Bangladesh government in 2001, setting out guidelines for improved land-use and zoning regulations. The main objectives of this policy is to ensure criteria-based 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.

21. 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;
- Improving the environmental sustainability of land-use practices.

9. Relevant other Regulatory Requirements for the Project

22. 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

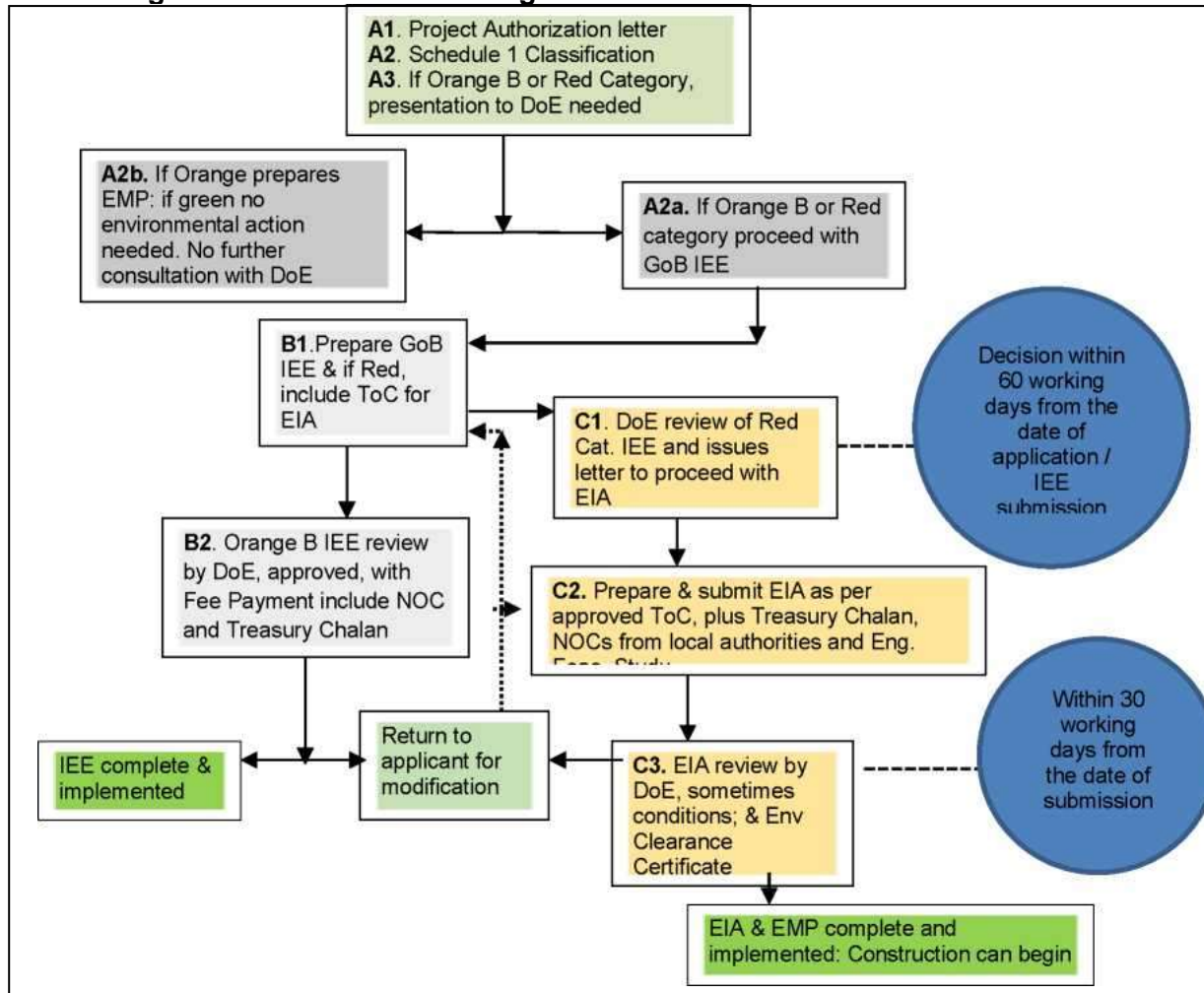
No.	Act/Rule/Law/Ordinance	Responsible Agency-Ministry/ Authority	Key Features-Potential Applicability
1	Bangladesh Environmental Conservation Act, 1995 (ECA, 1995) and Environment Conservation Rules 1997	Ministry of Environment and Forest (MOEF)	Includes categorization of development projects into green, 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	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.

No.	Act/Rule/Law/Ordinance	Responsible Agency-Ministry/ Authority	Key Features-Potential Applicability
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 forestlands, tree felling and hunting of wild animals.
10	The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry)	Forest Department, MOEF	<p>Declare any forests land or wasteland as protected forests.</p> <p>May stop public or private way or watercourse in the interest of preservation of the forest</p> <p>Declare a reserved forest area as Village Forests</p> <p>Declare an area as Social forests or launch a social forestry programme in Govt. land or private land with permission</p>
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	<p>Establishment of six strategic pillars for action, including:</p> <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	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

No.	Act/Rule/Law/Ordinance	Responsible Agency-Ministry/ Authority	Key Features-Potential Applicability
15	Wetland Protection Act 2000	MOWR	Advocates protection against degradation and resuscitation of natural water-bodies 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.
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

23. 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

24. 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 vibration (Geneva)	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

25. 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

26. 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

27. 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.

28. 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

29. 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.

30. 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
Road Research and Training Centre (work package-14)	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

31. The Government of Bangladesh takes the initiative to establish the “National Center of Excellence”. As part of that work, government take initiative for training RHD employees to improve their capacity to road design, operation and maintenance. Also, run the training and education programs for non-RHD engineers to improve the national level of engineering. In SASEC Road Connectivity Project-2, one component is the construction of Road Research and Training Centre (RRTC) and the work package is WP-14. In Paikpara, Mirpur there is existing road laboratory on 42-acre land. Most of the land is vacant. A 9-acre land should be used for the proposed RRTC. The proposed RRTC will comprise the construction of office building, and purchase of facilities and equipment for (i) road asset management, (ii) road safety, (iii) overloading control, (iv) quality control, and (v) research and training.

B. Project Location

32. The proposed RRTC will be established in Paikpara, Mirpur. Already, 42-acre land is there and owned by RHD. From that, 9 acres of land will be used to construct the RRTC. The project location is shown in Figure 2.

Figure 2. Location Map of Proposed Road Research and Training Centre



C. Project Outline

33. There will be several buildings for the proposed RRTC. Main office building and Laboratory building will be constructed under this work package-14. Detail design work is still on going. After finalizing the detail design and layout plan, it will be added in this report. Outline of the work shown in Table 5.

Table 5. Outline of the (work package-14)

1.	Project Title	:	South Asia Sub regional Economic Cooperation (SASEC) Phase 2
2.	Work Package No.	:	WP - 14
3.	Road Sections	:	Road Research and Training Centre
4.	a) Sponsoring Ministry/Division	:	Ministry of Road Transport & Bridges
	b) Executing Agency	:	Roads & Highways Department (RHD)

D. Project Components

34. In proposed Road Research and Training Centre (RRTC) there will be several components. Those are as below:

- Transportation engineering and traffic safety
- Pavement engineering
- Structural engineering
- Geotechnical engineering
- Environmental engineering
- Intelligent transportation systems
- Road asset management

III. DESCRIPTION OF THE ENVIRONMENT

A. General

35. 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. 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.

36. Collection of primary information includes extrapolating environmental features on proposed RRTC location and measurement of socio-cultural features adjoining proposed Road Research and Training Centre. 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

37. 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.

38. 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).

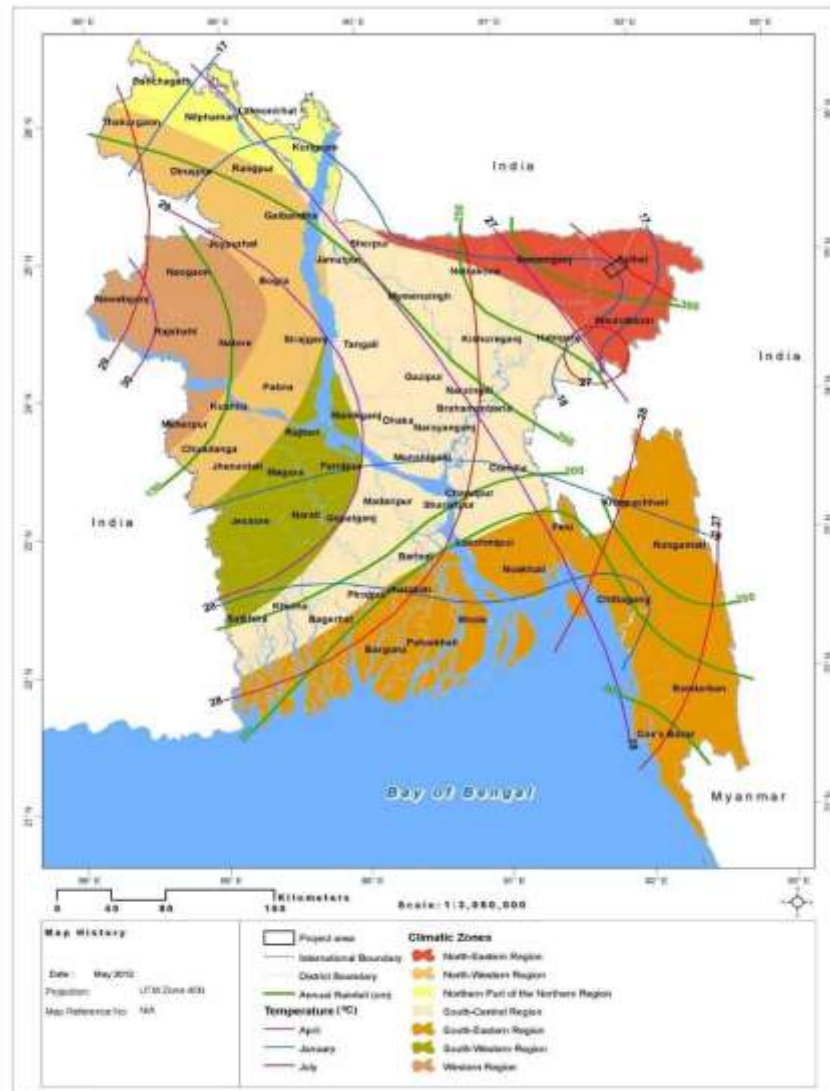
39. The pre-monsoon hot season is characterized by high temperatures and thunderstorms. April is the hottest month in the country with mean temperatures ranging from 27°C in the east and south, to 31°C in the west-central part of the country. After April, increasing cloud-cover reduces the temperature. 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.

40. 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.

41. 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 3. Climatic Zone



Source: Haroun er Rashid, 1991

2. Temperature Data

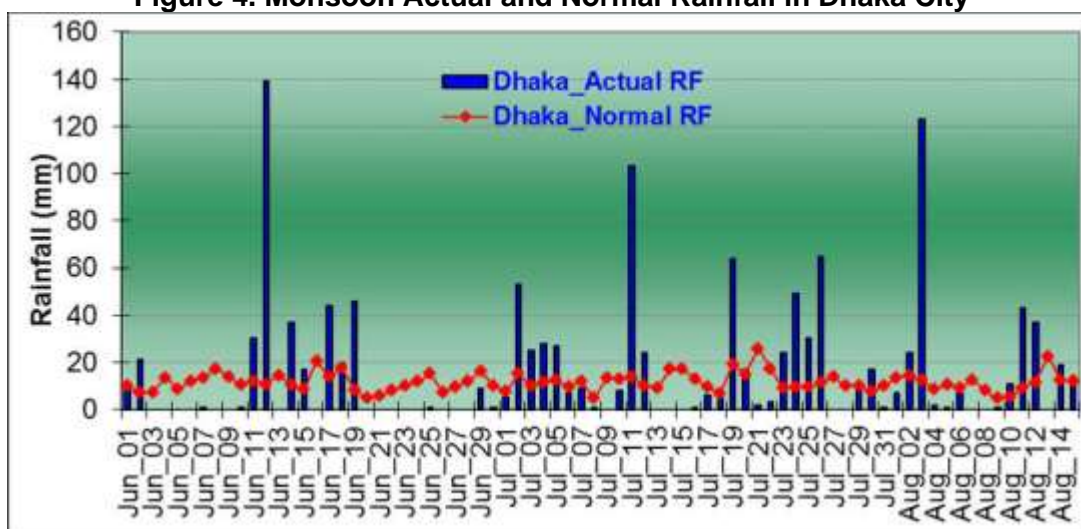
42. Long-term monthly average temperature data (2001-2010) recorded at Dhaka weather station of Bangladesh Meteorological Department reflects that the maximum temperature recorded in the weather station in Dhaka was 39.60 °C in April and 38.5 °C in March. The lowest temperature recorded at the Dhaka weather station was 12.1°C in January and 10.8 °C in

February. Figure 3 represents that the weather remains warmer from March to May in the year and the coldest weather exists from December to February in the year.

3. Rainfall

43. In Bangladesh the amount of rainfall during monsoon season varies from 1000 mm in the west-central part of the country to over 2000 mm in the south and northeast. Changes occur due to weak tropical depressions that are brought from the Bay of Bengal into Bangladesh by the wet monsoon winds. Annual average rainfall varies from 1,200 mm in the west to over 5,000 mm in the north east. Long periods of steady rainfall persisting over several days are common during the monsoon, but sometimes, local high intensity rainfall of short duration is also occurring. About seventy-five percent of rainfall over Bangladesh occurs between the months from June to September. According to the meteorological data the monsoon rainfall from June to mid-August 2017 of Dhaka City indicated the amount of actual rainfalls were higher than the normal trend of rainfall.

Figure 4. Monsoon Actual and Normal Rainfall in Dhaka City



Source: [Bangladesh Meteorological Station](#).

4. Humidity

44. Humidity is one of the climatic variables and interacts with other climatic variables like wind speed, temperature and rainfall. According to the statistical data of Station: Dhaka from 2001 to 2010, it is found that humidity remains highest in percentage in the month of June to November except in August and humidity persists at reduced level during December to May (Table 6 and Figure 5). While considering the minimum percentage of humidity, it is also observed that humidity begins to decrease from October and it continues till March. At this period, humidity ranges from 51 to 31 in percentage.

5. Wind Speed

45. 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.

6. Topography

46. Topographically Bangladesh may be divided into alluvial plains and hilly areas. More than 90 percent of the total area of Bangladesh is low land, an alluvial plain formed by the sediments of the several great rivers and their tributaries and distributaries which traverse the country.

47. The elevation of Greater Dhaka district is 2 to 13 m above the mean sea level, and most of the urbanized areas are at elevation of 6 to 8 m above the mean sea level. The land area (above 8m) above mean sea level covers about 20 square kilometers. The land ranging from 6 to 8 m above mean sea level covers 75 sq. km, while 170 sq. km of Greater Dhaka district is less than 6 m above mean sea level (JICA 1987).

7. Geology and Soils

48. Geologically Dhaka is situated at the southern tip of the Pleistocene terrace, the Madhupur tract. Madhupur Clay of the Pleistocene age and alluvial deposits of recent age cover the two characteristic geological units of the city Dhaka. The Madhupur Clay is the oldest sediment exposed in and around the city area having characteristic topography and drainage.

49. The major geomorphic units of the city are: the high land or the Dhaka terrace, the lowlands or floodplains, depressions and abandoned channels. Low lying swamps and marshes located in and around the city are other major topographic features. Madhupur Clay of the Pleistocene age, characterized by reddish plastic clay with silt and very fine sand particles. The soil is non-calcareous dark grey in color in and around the project area. Moreover, dark grey floodplain soil can be found adjacent to the area of Turag and Buriganga (Figure 5).

Figure 5. General Soil Types of Bangladesh including Dhaka



Source: Banglapedia

8. Soil Quality

50. 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.

9. Surface Water Quality

51. Surface Water sample were collected from two locations along with the proposed Road Research and Training Centre (RRTC). Sampling locations with GPS Coordinate are shown in Table 6.

Table 6. Surface Water (SW) Sampling Locations

SL#	Code	Sampling Locations	Sampling Date	GPS Coordinate
1	SW-1	Near RHD Training Center, Paikpara, Mirpur	19.05.19	23°47'12.31"N 90°21'20.51"E
2	SW-2	Near RAB-4 Office, Paikpara, Mirpur	19.05.19	23°47'16.02"N 90°21'21.93"E

52. Surface Water was collected from two locations on 19 May 2019. Sampling photograph shown in the below Figure 6.

Figure 6. Surface Water (SW) Sample Collection

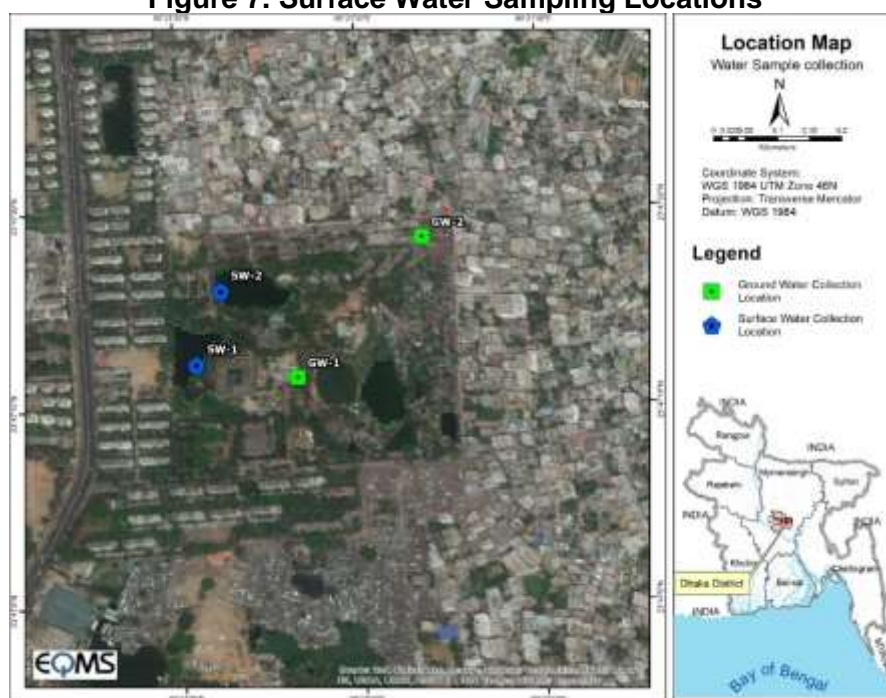


53. Surface Water sample were tested in the laboratory. pH, DO, BOD, COD, Turbidity, TSS, Chloride, Sulphate, Salinity, Total Coliform parameters were tested, and all the parameters are within the Bangladesh Standards. Surface Water quality results shown in Table 7. Laboratory test report shown in Appendix E.

Table 7. Surface Water (SW) Quality Results

Parameter	Unit	SW-1	SW-2	Bangladesh
Temperature	°C	28.9	28.8	25°C
pH	--	8.15	7.47	6.5 – 8.5
DO	mg/l	6.4	4.7	4.5 - 8.0
BOD	mg/l	--	--	6 or less
COD	mg/l	5	21	-
Turbidity	NTU	1	2	-
TSS	mg/l	5	7	-
Chloride	mg/l	20+	20+	-
Sulphate	mg/l	15	16	-
Salinity	ppt	0.38	0.22	-
Total Coliform	N/100ml	17	22	-

54. Surface water sampling location map shown in Figure 7.

Figure 7. Surface Water Sampling Locations

10. Groundwater/ Drinking Water Quality

55. Ground Water/ Drinking Water sample were collected from two locations along with the proposed Road Research and Training Centre (RRTC). Sampling locations with GPS coordinates are shown in Table 8.

Table 8. Ground Water/ Drinking Water Sampling Location

SL#	Code	Sampling Locations	Sampling Date	GPS Coordinate
1	GW-1	Administration Building, RHD training center, Paikpara, Mirpur	19.05.19	23°47'11.57"N 90°21'26.10"E
2	GW-2	RAB Pur Quarter, Paikpara, Mirpur	19.05.19	23°47'18.57"N 90°21'33.11"E

56. Ground Water/ Drinking Water was collected from two locations on 19 May 2019. Sampling photograph shown in the below Figure 8.

Figure 8. Ground Water/ Drinking Water Sample Collection

57. Ground Water/ Drinking Water sample were tested in the laboratory. pH, Chloride, Salinity, Total Hardness, Arsenic, Iron, Ammonium Nitrogen, Manganese, Total Coliform and Fecal Coliform parameters were tested, and all the parameters are within the Bangladesh Standards. Ground Water quality results shown in Table 9. Laboratory test report shown in Appendix F.

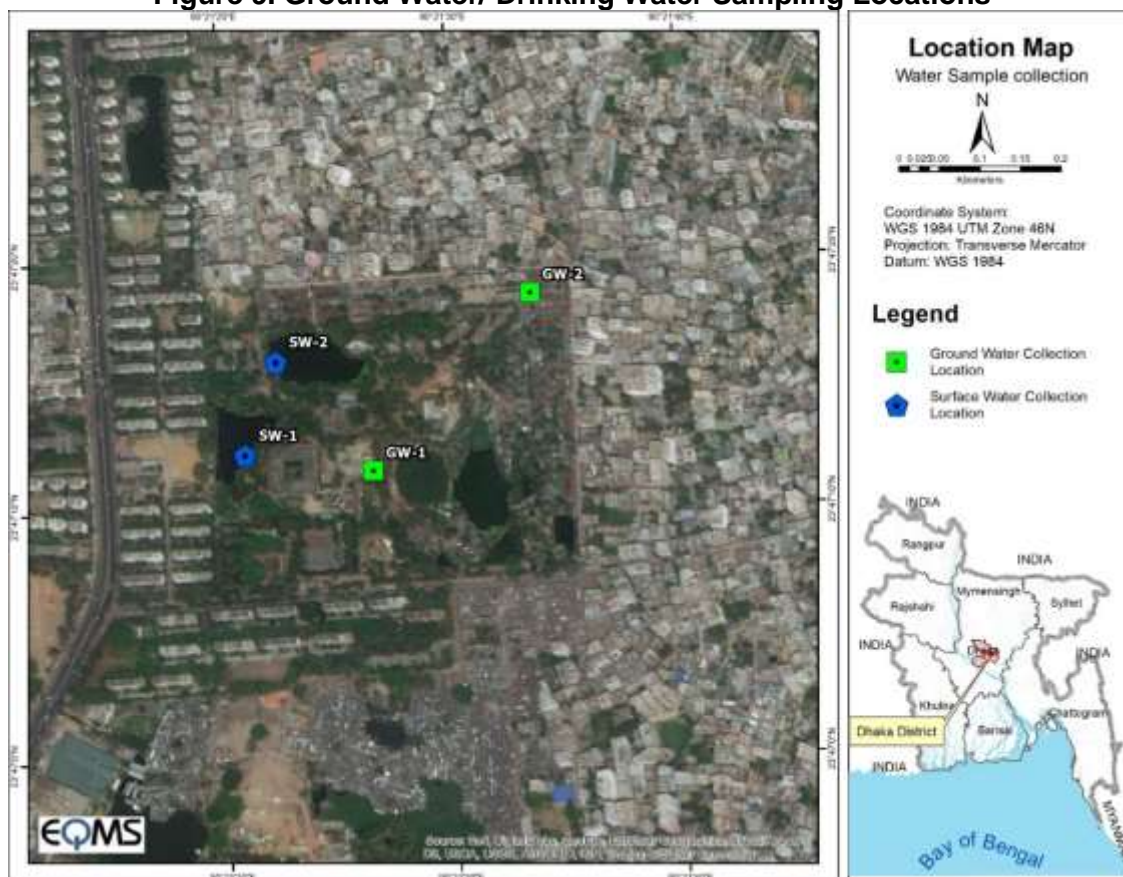
Table 9. Ground Water/ Drinking Water Quality Result

Parameter	Unit	GW-1	GW-2	Bangladesh Standards
pH	-	6.86	6.83	6.5-8.5
Chloride	mg/l	20+	20+	150-600
Salinity	ppt	0.21	0.22	--
Total Hardness	mg/l	165	144	200 - 500
Arsenic	mg/l	<0.010	<0.010	0.05
Iron	mg/l	0.02	0.05	0.3-1

Parameter	Unit	GW-1	GW-2	Bangladesh Standards
Ammonium Nitrogen (NH ₃ -N ₂)	mg/l	0.09	0.08	0.5
Manganese	mg/l	0.1	0.1	0.1
Total Coliform	N/100ml	0	0	0
Fecal Coliform	N/100ml	0	0	0

58. Ground Water/ Drinking Water sampling location map shown in Figure 9.

Figure 9. Ground Water/ Drinking Water Sampling Locations



11. Ambient Air Quality

59. Existing ambient air quality sample were collected from four locations. Sampling points and GPS Coordinate are shown in below Table 10.

Table 10. Ambient Air Quality Sampling Locations

SL#	Code	Sampling Locations	Monitoring Date	GPS Coordinate
1.	AAQ-1	Adjacent to the RHD boundary, Kallyanpur Notun Bazar Road, Paikpara, Mirpur	18.05.19	23°47'6.45"N 90°21'20.38"E
2.	AAQ-2	Kallyanpur Notun Bazar, Mirpur	18.05.19	23°47'7.26"N 90°21'34.94"E
3.	AAQ-3	RAB Pur Quarter, Inside RHD Boundary, Paikpara, Mirpur	19.05.19	23°47'18.59"N 90°21'34.52"E
4.	AAQ-4	In front of Primary School, Adjacent to the RHD boundary, Paikpara, Mirpur	19.05.19	23°47'17.39"N 90°21'20.12"E

60. Ambient air sample were collected from four locations on 18 and 19 May 2019. Sampling photograph shown in the below Figure 10.

Figure 10. Ambient Air Sample Collection

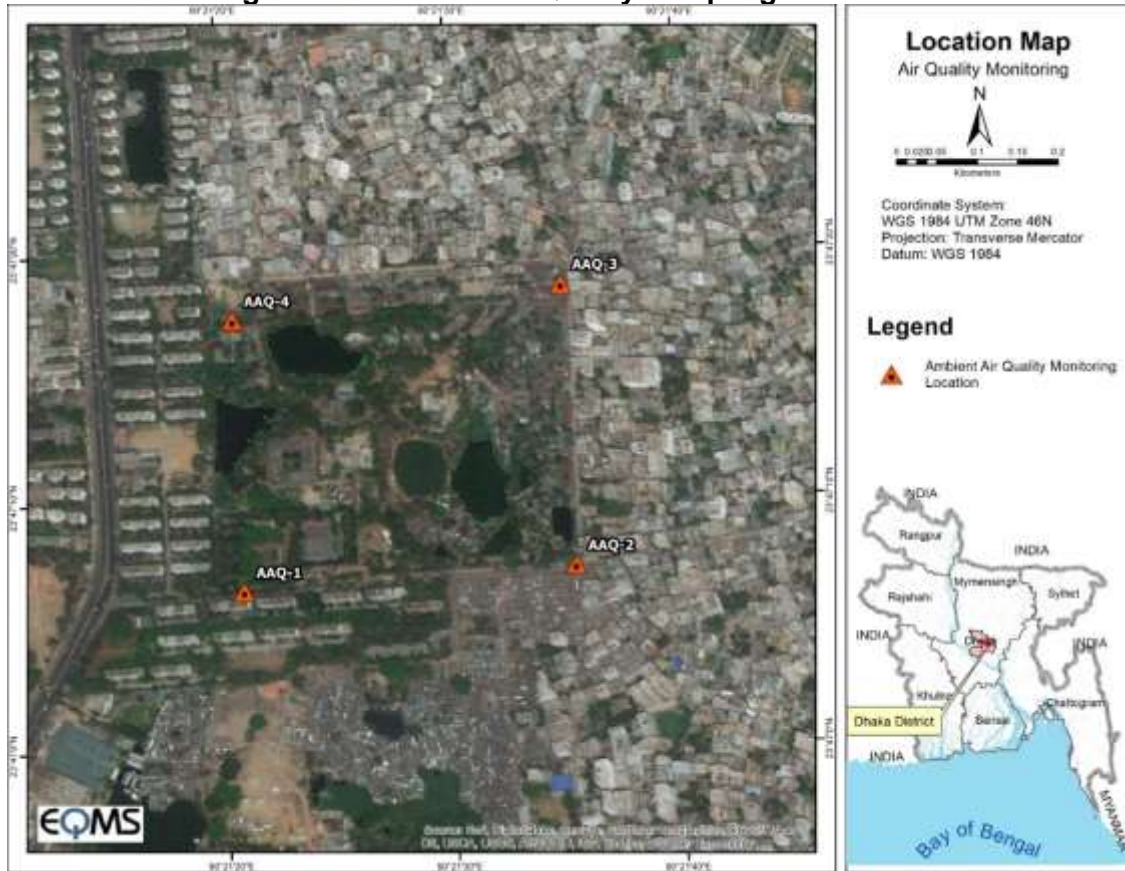
61. Ambient air pollution concentration in $\mu\text{g}/\text{m}^3$ were tested. PM_{10} , $\text{PM}_{2.5}$, SO_2 , NO_x and CO (ppm) parameters were tested, and all the parameters are within the Bangladesh Standards. Ambient Air Quality (AAQ) results shown in Table 11. Compared to WHO air quality standards for particulate matter, nitrogen dioxide and sulfur dioxide (2005), results for particulate matters were within air quality guidelines (AQG) of WHO except for station 1. SO_2 results for all stations did not meet WHO standards. There is no CO standard in the 2005 guidelines. NO_2 instead of NO_x is available under the guidelines. Laboratory test report shown in Appendix C.

Table 11. Ambient Air Quality (AAQ) Results

SI#	Code	Ambient Air Pollution Concentration ($\mu\text{g}/\text{m}^3$)				
		PM_{10}	$\text{PM}_{2.5}$	SO_2	NO_x	CO (ppm)
1	AAQ-1	52.02	38.59	51.69	22.92	0.10
2	AAQ-2	23.43	18.37	69.20	17.09	0.10
3	AAQ-3	21.77	20.67	86.22	15.16	0.05
4	AAQ-4	19.13	20.42	52.74	7.35	0.002
Duration (hours)		24	24	24	24	8
Weather Condition		Sunny				
<i>ECR, 1997 and subsequent amendment in 2005</i>		150	65	365	100	9
<i>WHO</i>		150 – Interim target 1 50 - AQG	75 – Interim target 1 25 - AQG	125 – Interim target 1 20 - AQG	200 (NO_2 , 1 hour)	

62. Ambient air quality (AAQ) sampling location map shown in Figure 11.

Figure 11. Ambient Air Quality Sampling Locations



12. Noise Level

63. Existing noise level were collected from four locations. Sampling points and GPS Coordinate are shown in below Table 12.

Table 12. Noise Level (NL) Sampling Locations

SL#	Code	Location	Category	GPS Coordinate
1.	NL-1	Infront of Kollyanpur Housing estate, Paikpara, Mirpur	Residential	23°47'6.34"N 90°21'23.64"E
2.	NL-2	In front of SOS Medical Center, South Paikpara, Mirpur	Mixed	23°47'7.37"N 90°21'36.47"E
3.	NL-3	RAB Pur Quarter, Inside RHD Boundary, Paikpara, Mirpur	Residential	23°47'18.59"N 90°21'34.52"E
4.	NL-4	In front of Primary School, Adjacent to the RHD boundary, Paikpara, Mirpur	Silent	23°47'17.39"N 90°21'20.12"E

64. Noise level were collected from four locations on 18 and 19 May 2019. Sampling photograph shown in the below Figure 12.

Figure 12. Noise Level Sample Location



65. All four locations Noise level results and little bit higher than Bangladesh Standards. Noise level results shown in Table 13. Laboratory test report shown in Appendix D.

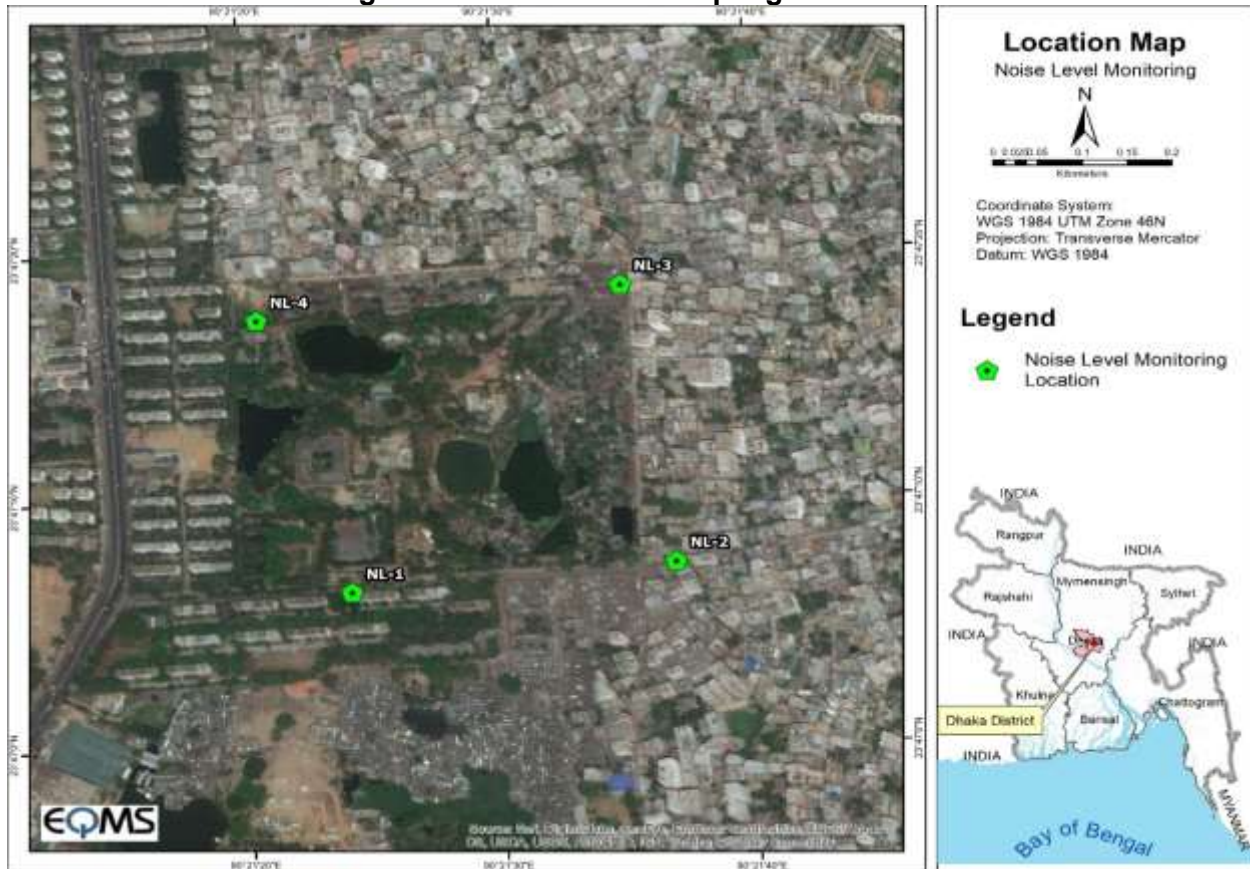
Table 13. Noise Level (NL) Monitoring Results

SL#	Code	Location	Category	GPS Coordinate	Date	Noise Leq	Standard
1.	NL-1	Infront of Kollyanpur Housing estate, Paikpara, Mirpur	Residential	23°47'6.34"N 90°21'23.64"E	18.05.19	61.64	55
2.	NL-2	In front of SOS Medical Center,	Mixed	23°47'7.37"N 90°21'36.47"E	18.05.19	63.75	60

SL#	Code	Location	Category	GPS Coordinate	Date	Noise Leq	Standard
		South Paikpara, Mirpur					
3.	NL-3	RAB Pur Quarter, Inside RHD Boundary, Paikpara, Mirpur	Residential	23°47'18.59"N 90°21'34.52"E	19.05.19	58.65	55
4.	NL-4	In front of Primary School, Adjacent to the RHD boundary, Paikpara, Mirpur	Silent	23°47'17.39"N 90°21'20.12"E	19.05.19	59.25	50

66. Noise level sampling location map shown in Figure 13.

Figure 13. Noise Level Sampling Locations



IV. IMPACTS AND MITIGATION MEASURES

A. Key Consideration and Scoping

67. This section discusses the potential environmental impacts due to construction of the proposed Road Research and Training Centre (RRTC) along with possible mitigation measures to minimize the impacts in the design (preconstruction), construction, and operational stages. An environmental impact is defined as any change to an existing condition of the environment. Identification of potential impacts has been done on the basis of baseline data collected from secondary and primary sources. Identification of potential impacts due to the Road Research and Training Centre (RRTC) site development has been done using the ADB Rapid Environmental Assessment Checklist (Appendix 1). The environmental impacts can be broadly classified as those taking place during preconstruction, construction and operation stages. Activities involved affecting environmental resources at different stages of the proposed Road Research and Training Centre (RRTC) implementation as well as potential /significant environmental impacts are discussed below:

B. During Pre-Construction Stage

1. Removal of Utilities

a. Gas Pipelines

68. **Impact:** The gas supply pipelines of the TITAS, cross under the ground elevation of the Bangladesh Road Research Laboratory area and it need to be relocated prior to start construction. These lines will be hazardous to the workers' health and safety during construction stage. For gas pipeline, one of the potential impacts is disruption of supply and services.

69. **Mitigation:** Prior to start construction, the gas pipelines should be relocated without long time disruption of gas supply with the consultation of TITAS Company. To avoid any accidents, appropriate H&S measures (use PPE such as hand gloves, safety shoes and helmet as well as install H&S signboard) should be taken during relocating of the gas pipelines.

b. Telephone Lines

70. **Impact:** The telephone lines along with poles of the Bangladesh Telephone Company Limited (BTCL) that pass through the Bangladesh Road Research Laboratory area and it need to be shifted prior to commence construction. This line will be hazardous to the workers health and safety during construction phase. For telephone lines, potential impact is disruption of supply and services.

71. **Mitigation:** Prior to start construction, the telephone lines should be shifted without long time disruption of telephone communication. Proper health and safety measures for the workers should be taken during shifting of the gas pipelines to avoid any accidents.

c. Water Supply and Sewerage Pipelines

72. **Impact:** The water supply and sewerage pipelines of the Dhaka Water Supply and Sewerage Authority (DWASA) that cross under the ground elevation of the Bangladesh Road Research Laboratory area and it need to be shifted prior to start construction. These lines will be

hazardous to the workers health and safety during construction phase. Shifting of sewerage pipelines will cause unhygienic conditions such as foul smell, release of sewage into the open environment etc.

73. **Mitigation:** The water supply and sewerage lines of the DWASA that is connected to the Bangladesh Road Research Laboratory area and it need to be shifted prior to commence construction. This line will be hazardous to workers" health and safety during construction phase. Prior to start construction, water and sewerage lines should be shifted without disruption of water supply and sewerage lines with the consultation of DWASA. Inform to the local people by announcement prior to shifting of water/sewerage pipelines.

C. During Construction Stage

1. Ground Water/Drinking Water

74. **Impact:** The proposed Road Research and Training Centre (RRTC) building location can affect the ground water resources due to uncontrolled extraction of groundwater for construction purpose. The water table in this area like other areas of Dhaka city is constantly depleting due to extraction of GW for drinking, bathing, cooking etc. Groundwater will be required for construction in absence of surface water availability in this area. In addition, ground water will be required for domestic and drinking purposes for the workers. Once the required quantity of water for the construction purpose (only for mixing of concrete, curing and washing of stone chips) will not be high, impact on quantity of GW will be insignificant. Quality of DW/GW as presented in Table 9 shown that tested value of all parameters within DOE standard. Drinking and domestic water requirement for workers camp will be the arranged by the contractor. Contamination of groundwater is not envisaged since construction camp will have septic tanks or mobile toilets depending on the number of workers in the camp. However accidental spillage of hazardous liquid on the construction yard may contaminated the GW/DW.

75. **Mitigation:** The contractor will make arrangement for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. It means that due to construction works the nearby communities will not be affected by water scarcity. Quality monitoring should be carried out quarterly during construction. If monitored parameters as mentioned in Table 9 are not within the DOE standard limit, the contractor should provide potable water for all workers at construction site. Handling of hazardous liquid should be done carefully by the experienced labors.

2. Air Pollution

76. **Impact:** Air quality may be affected for short duration in and around the construction site due to various construction activities and construction vehicular movement. The pollutants of primary concern include Sox and SPM. The construction equipment/vehicles, using fuel and diesel and movement of vehicles will also contribute to air pollution releasing hazardous air emissions such as NOX, SO2, etc. This will impact the air quality affecting the working area.

77. Another possible source of air pollution will be dust due to handling of sand, cement, breaking of bricks/boulders, mixing of concrete ingredients and burning of bitumen for internal roads. However, due to the openness of construction sites and wind conditions, the dust and engine emissions are expected to have limited effects on the existing air quality. The anticipated air quality problem will be short lived, localized and minor lasting mainly during the construction.

78. **Mitigation:** In order to keep the pollution level within acceptable limit, construction related emissions should be regulated. Regular water spray on dusty surfaces during dry season to reduce dust generation must be practiced. The rules and regulations of the building specification guideline as mentioned in BNBC should be followed especially by the contractors. Loading and unloading of construction materials likely to generate fugitive emission, shall be done in covered area or provisions of water fogging arrangement may be made around these areas. Regular maintenance of machinery and equipment and vehicular pollution check shall be made mandatory. Ambient air quality monitoring should be carried out quarterly during construction. If monitored parameters are above the DOE standard, suitable control measures must be taken by the contractor.

3. Noise and Vibration

79. **Impact:** A significant increase in noise is expected during construction. Noise levels in and around the construction sites could further increase as a result of operating construction vehicles/equipment and during unloading and loading of construction materials. A number of Vehicles and equipment will be required for the construction of the proposed Road Research and Training Centre (RRTC) and will depend upon the construction methodology for various types of works. However, the equipment will broadly consist of mixture machine, concrete vibrator, brick/boulder breaking machine, crane etc. and construction vehicles will consist of dump trucks, transport vehicles, etc. which will cause noise pollution. Most of these will use diesel engines that generate noise and exhaust emissions. As mentioned in Table 13, the ambient noise level already exceeds the DOE standards. Main source of existing noise pollution is passing vehicles using hydraulic horns.

80. **Mitigation:** The Contractor should apply optimum site activities and site layout so as not to exacerbate existing noise levels at sensitive receptor sites. Brick breaking machine should be confined within a temporary shed so that noise pollution could be kept minimum. Protection devices (ear plugs or ear muffs) shall be provided to the workers operating in the vicinity of high noise generating machines during construction. Construction equipment and vehicles shall be fitted with silencers and maintained properly.

4. Waste Pollution

81. **Impact:** The construction process will take about two years and as a result, the worker camp will take a semi-permanent appearance. The majority of waste generated will include construction wastes (solid wastes: piece of rods, woods, bricks, stones, containers etc. liquid waste: paint, bitumen, oil etc.) and general wastes (solid wastes: papers, plastic containers, residues of food, fruits etc. and Liquid waste: from kitchen and bathroom etc.). These wastes will be generated due to construction camp, construction activities and materials used for construction. If inadequate arrangements exist for the disposal of abovementioned wastes, there will be negative impact on the soil, aesthetic beauty of area and workers' health and safety. Possibilities of bitumen and oil leaks spread of contaminants brought through material transport also may be occurred.

82. **Mitigation:** Solid wastes collection system will be essential, which should include separation and collection of solid wastes in the dustbins/ waste containers throughout the work site, construction yard/labor camp. The wastes such as piece of rods and woods, newspapers, containers etc. can be sold to the vendors and rest wastes can be dumped into the nearby road side waste containers of the DNCC from where DNCC will send these wastes to the Matuail, the Central Waste Dumping Site (CWDS) of Dhaka city regularly by their own arrangement. A log of

the disposal of toxic and other waste materials is to be kept by the Contractor. The toxic waste containers should be deposited at Matuail CWDS, Dhaka. Wastewater from the labor camp should be disposed through sewerage pipeline. Prior to transport, container of all liquid materials such as bitumen, oil etc should be checked by experienced persons properly.

5. Construction Materials

83. **Impact:** Improper selection of construction materials may threaten the environment. For example, traditional brick making process involve burning of trees, emission of sulphur through coal burning, emission of dust etc. which are considered to be detrimental to health and environment.

84. **Mitigation:** Hollow cement bricks as partition materials against bricks may be used. Steel shuttering and steel props can be used instead of wood and bamboo.

6. Landscape

85. **Impact:** Construction activities especially excavation of foundation trench, stock piling of construction materials, placing of construction equipment, parking of construction vehicles etc. will change the local landscape temporarily.

86. **Mitigation:** Stockpiling of construction materials, placing of equipment, parking of vehicles etc. should be done in systematic way to enhance the aesthetics of the site. Duration of stockpiling of construction materials should be minimized as much as possible.

7. Job Opportunities

87. **Impact:** At the peak of construction phase, it is likely to provide employment of minimum 100 personnel in various positions. The contractor will be responsible for creating these employment opportunities. Priority will need to be given to the local community for unskilled labor. This may result in an increase on household income. At the time of construction, business opportunity in this area will also be increased.

88. **Recommendation:** Based on the nature of job, adequate salary with other social benefits should be ensured for the men and women workers in time. In addition to adequate salary, equal pay for same type of work between men and women should also be provided. The demand may create shortfall for the people in the area, as well as people can enhance their businesses in supplying daily needed commodities, over-the-counter medicines, fast/ dry foods and training accessories. The local inhabitants can also boost up their business through laundry and washing facilities during construction. Job opportunities should be arranged for the PAPs.

8. Occupational Health and Safety

89. **Impact:** Construction workers may face occupational health hazards such as minor or major injuries due to lack of general safety requirements and precautions applicable for such sites, malfunctioning equipment, careless use of equipment and vehicles, etc. At the construction site, camp will be constructed for temporary accommodation for about 100 workers. Poorly designed temporary camp and sanitation facilities may pose a health threat and nuisance to the workers. Uncontrolled vending of food and drinking water on the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, Dengue, etc. Construction workers will be required to handle hazardous materials such as cement,

bitumen, paints, chemicals, fuels etc., therefore increasing health risks of workers. In addition, construction workers will be affected if adequate mitigation measures are not taken surrounding the buildings.

90. **Mitigation:** A proper Occupational Health and Safety (H&S) Plan should be prepared and follow it to avoid health hazard of the workers. First Aid Box and Personnel Protective Equipment (PPE) such as ear plugs, helmets, hand gloves, safety shoes, goggles, raincoats (during rains) etc. are provided for the workers on construction site. The safety belts and harnesses must be worn by the workers, working at heights at all times and safe anchorage points provided. Plastic net should be provided surrounding the buildings. In case of major accident, transport should be made available to take the patient to the nearest hospital. Health and Safety Manager (H&SM) should be engaged for the construction period of the project. Workers operating the equipment and drivers driving the construction vehicles at construction site should be skilled. Proper H&S signboards and appropriate information to the local people about the construction activities should be provided.

9. Resettlement

91. **Resettlement** is not anticipated due to the location as the proposed Road Research and Training Centre (work package-14) will construct RHD own land.

D. During Operation Stage

1. Wastewater Generation

92. **Impact.** The operation of RRTC will generate additional wastewater because of additional workers and staff that will use toilet facilities. If not properly treated, wastewater will pollute the receiving body of water nearby the RRTC compound.

93. **Mitigation.** Wastewater will be treated with appropriate wastewater treatment system to ensure that effluent is in accordance with Bangladesh national standard.

2. Solid Waste Pollution

94. **Impact.** The operation of RRTC will employ additional staff, and additional programs and activities to train existing RHD employees which will generate additional wastes. These wastes include biodegradable wastes from cafeteria, recyclable and residual wastes. If there is no proper management of wastes in terms of collection, recycling, treatment and disposal, such wastes will contaminate soil and waterways

95. **Mitigation.** Appropriate waste management has to be instituted within RRTC following the principle of waste prevention as the preferred option, followed by reuse, recycling, recovery and safe disposal. Appropriate waste collection of segregated wastes, and its disposal has to be developed. The management can explore composting organic wastes to make it suitable as organic fertilizer that can be used for vegetation within RRTC compound.

3. Air and Noise Pollution

96. **Impact.** The operation of RRTC will generate both air and noise pollution from the vehicles of RHD employees and visitors in the complex. Idling vehicles while parked inside the compound can exacerbate health risks of people exposed to exhaust, in addition to carbon dioxide emissions

that contribute to global warming.

97. **Mitigation.** RRTC needs to develop regulations that will lessen the impacts of air and noise within the compound. These include restricting the speed limit of vehicles within the compound, prohibition of idling vehicles, and promotion of sustainable pedestrian mobility. There should also be restriction on the use of old vehicles and installation and operation of generators.

4. Occupational Health and Safety

98. **Impact.** The operation of RRTC that will employ workers and train RHD staff will generate the following occupational health and safety risks:

- Accidents from the operation of the laboratories and movement of people
- Fire hazards from operation of equipment and machines
- Quantity and quality of water used for drinking and toilets
- Diseases coming from stagnant water and untidy environment
- Indoor pollution

99. **Mitigation.** All the occupational health and risks must be considered during the planning period to address the occupational health and safety risks mentioned. An Occupational Health and Safety (OHS) Plan must be prepared prior to operation of the center. Health and safety information boards should be installed at different locations within the RRTC compound. The plan should also be complemented by experienced personnel to train workers on OHS implementation.

5. Community Health and Safety

100. **Impact.** To a lesser extent, the operation of RRTC will have an impact on the community through the generation of additional vehicles entering and exiting the compound. Public will be affected through potential accidents while crossing the streets outside the RRTC compound.

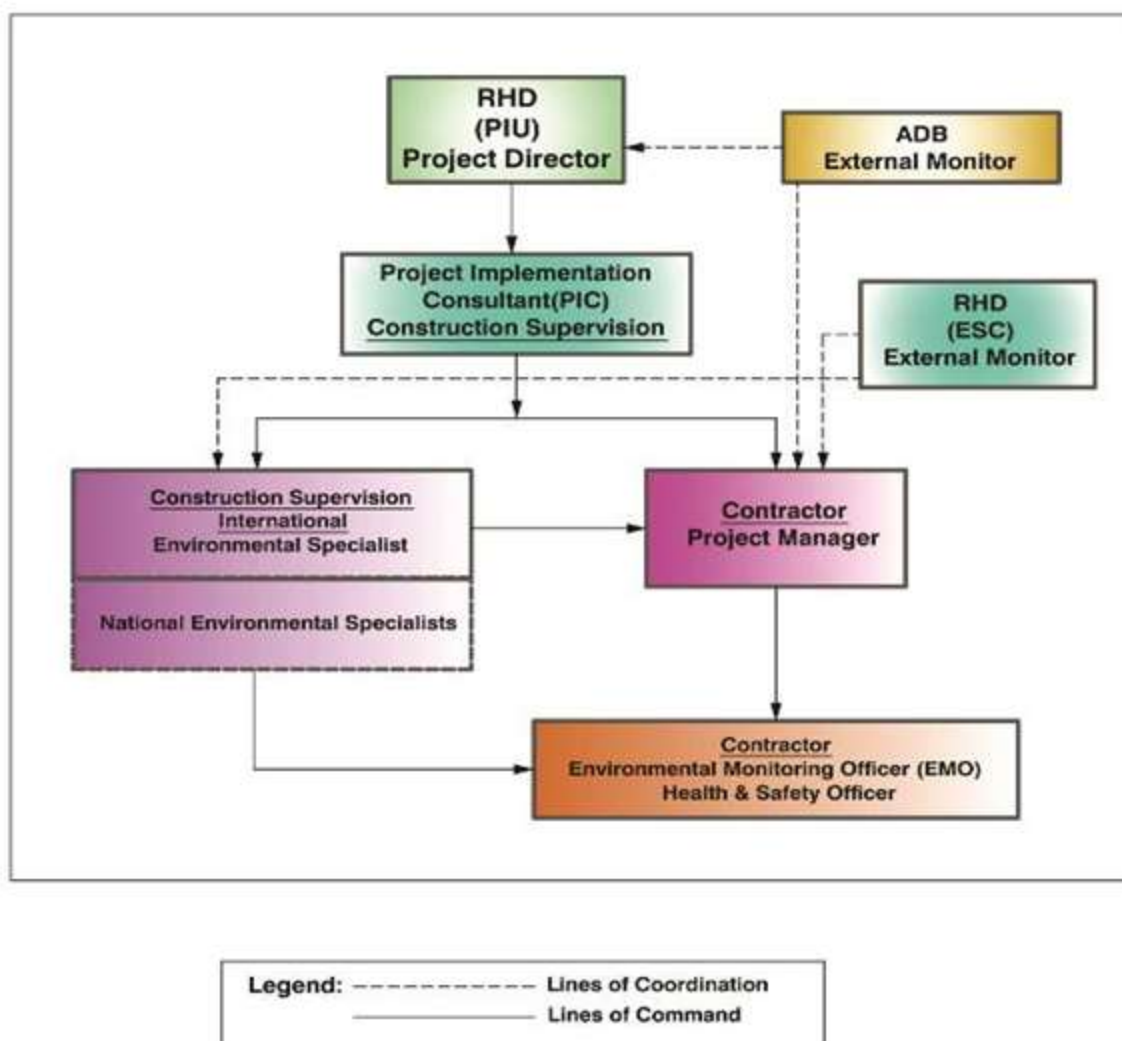
101. **Mitigation.** Traffic management plan must be formulated prior to operation of the center, which should include recommendations for traffic signalization, installation of traffic signs, setting speed limit, and orientation of workers.

V. ENVIRONMENTAL MANAGEMENT PLAN

A. Implementation Arrangement

102. The following Figure 14 is an organization chart showing how the project will be managed and implemented.

Figure 14. Organizational Chart



B. Capacity Building

103. 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.

104. 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 Action Plan

105. 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.

106. Environmental monitoring program prior to commencement of any civil work, the contractors will submit a compliance report. This compliance report will include information on (i) barricades and warning signs; (ii) area for setting up of construction camps; (iii) methodology for surveys; (iv) area for establishing lay-down and storage; (v) sources of materials; (vi) records of environmental awareness, safety training, and orientation of workers prior to deployment to work sites; (vii) contact information of the environmental and resettlement supervisors; and (viii) construction method statements to the PIC ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. The consultants will review the report, and thereafter PIU will allow commencement of civil works.

Table 14. Environmental Mitigation Plan

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
PRE-CONSTRUCTION STAGE:				
Improper design	<ul style="list-style-type: none"> • Earthquake hazard should be considered in the structural design of the Road Research and Training Centre (RRTC). 	Pre-construction/ design stage	DSC	RHD
Lack of environmental specifications	<ul style="list-style-type: none"> • Prepare relevant environmental sections in the tender documents for bidders • Prepare a bid evaluations section for environment, according to ADB bid evaluation format • Prepare environmental contract clauses for contractors (refer to IEE) 	Pre-construction/ design stage	DSC	RHD
Removal of utilities such as electricity line, gas connection, telephone connection, water supply and sewerage pipelines	<ul style="list-style-type: none"> • Necessary planning and coordination with concerned authorities. • Prior to start construction, all utilities should be shifted with the consultation of relevant authorities. Proper health and safety measures for the workers should be taken during shifting of the utilities to avoid any accidents. 	Pre-construction/ design stage	RHD	DWASA/BTCL/ TITAS
Tree cutting	<ul style="list-style-type: none"> • After completing the detail design a baseline survey will be carried out for identify the number of trees cut off. • RHD will replant trees as per the prescription of forest department (FD) e.g min. two tree seedlings to be planted during monsoon period of operation stage for each tree felled. • Cutting, carry out and selling these trees should be as per GOB procedure to avoid any accident. 	Pre-construction/ Operation	RHD/DSC	FD
CONSTRUCTION STAGE:				
Drainage Congestion	<ul style="list-style-type: none"> • Temporary drainage congestion (TDC) in the foundation trench due to rainwater to be removed by pumping. Avoid monsoon period for foundation works. • TDC in construction yard and camp of the proposed RRTC area to be removed by temporary earth or RCC drains. • All rainwater, storm water wastewater etc. should be drain out via sewerage pipelines of DWASA. 	During Construction	Contractor	RHD/DCC

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
Air Pollution	<ul style="list-style-type: none"> • Fit construction vehicles with appropriate exhaust systems and emission control devices. • Maintain construction vehicles and equipment in good working condition including regular servicing. • Operate the construction vehicles in a fuel efficient manner. • Cover hauls vehicles carrying dusty materials moving outside the construction site. • Impose speed limits (maximum 10 km/hr) on all vehicle movement at the worksite and through access roads to reduce dust emissions. • Water spray to the construction materials or cover (especially sand and boulders/brick chips) prior to loading and transport. • Focus special attention on containing the emissions from generators. • Equipment/vehicles causing excess pollution (e.g. visible smoke) should be banned from construction sites or fixed immediately prior to further usage. • Provide filtering systems, dust collectors or humidification or other techniques (as applicable) to the concrete mixing plant to control the particle emissions at all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations. • Water spray to the material stockpiles as and when required to minimize the potential environmental nuisance due to dust. • Increase the watering frequency during periods of high risk (e.g. high winds and dry periods). Stored materials such as boulders and sand should be covered and confined to avoid them being wind-drifted. • Erect dust barriers along the boundary of the complex area to reduce dust movement to the surrounding areas. • Reschedule earthwork activities when practical, if necessary, to avoid during periods of high wind and if visible dust is blowing off- site. • Restore disturbed areas as soon as possible by vegetation/grass- turfing. 	During Construction	Contractor	RHD/DSC/DOE

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	<ul style="list-style-type: none"> Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations. 			
Noise Pollution	<ul style="list-style-type: none"> Maintain all vehicles in order to keep them in good working order in accordance with manufacturers maintenance procedures. Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. (20 km/hr during night time). Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site. Appropriately site all noise generating activities to avoid noise pollution to local residents. Modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines, silencers). Maintain all equipment in order to keep it in good working conditions in accordance with manufacturers' maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. Install acoustic enclosures around generators to reduce noise levels. Fit high efficiency mufflers to appropriate construction equipment. Avoid the unnecessary use of alarms, horns and sirens. Notify adjacent landholders prior any typical noise events outside of daylight hours. Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions. Employ best available work practices on-site to minimize occupational noise levels. Install temporary noise control barriers (wooden or jute or plastic screen), especially at university site. Plan activities on site and deliveries to and from site to minimize impact. 	During Construction	Contractor	RHD/DSC/DOE

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	<ul style="list-style-type: none"> • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas. 			
Sewage Pollution/ Sanitation Hazard	<ul style="list-style-type: none"> • Provide hygienic sanitary facilities and sewerage system. The toilets and domestic wastewater will be collected through a common sewerage. Provide separate latrines and bathing places for males and females workers with total isolation by wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Ensure the sanitary facilities are kept clean and without any odor. • Educate the workers of using the facilities. 	During Construction	Contractor	RHD/DSC
Solid Waste Pollution	<ul style="list-style-type: none"> • Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, so as to cause less offsite environmental impacts. The disposal site should be approved by RHD prior to usage and should be rehabilitated after usage to ensure the land is not exposed to soil erosion, wind and water stagnation. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the wastes, wherever practical. • Prohibit burning of solid waste. • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite and worker camps. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal by Dhaka North City Corporation (DNCC). • Ensure proper collection and disposal of all wastes within the construction camps from where DNCC will take by their truck and dispose at their dumping area. 	During Construction	Contractor	RHD/DSC

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/Supervision
	<ul style="list-style-type: none"> • Insist on waste separation and store by source; organic wastes, inorganic wastes and recyclables in separate containers. • Clear wastes on daily basis to waste collectors. Establish waste collection, transportation and disposal at the dumping site in adequate sizes of concrete chambers/boxes. • Dispose organic wastes in a designated safe place and should be kept covered so that flies, mosquitoes, dogs, cats, rats, etc. are not attracted. Encourage composting of organic waste that can be used for tree planting purposes. • Locate the garbage pit/waste disposal site away from the residence so that peoples are not disturbed with the odor likely to be produced from anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children from entering and playing. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved waste disposal sites. 			
Liquid waste	<ul style="list-style-type: none"> • Train the relevant construction personnel in handling of fuels and spill control procedures. • Refueling shall occur only within enclosed areas. • Provide PPE such as protective clothing, safety shoes, helmets, masks and hand gloves to the construction personnel, to handle construction materials. • Make sure all containers and drums that are used for storage are in good condition and are labeled with expiry date. Any container, drum that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Put containers and drums in permanent storage areas on an impermeable floor and dumping at Matuail CWDS, Dhaka. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Ensure basic firefighting equipment is in place outside these storage areas in case of a fire. 	During Construction	Contractor	RHD/DSC

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
Landscape	<ul style="list-style-type: none"> • Parking of construction vehicles and stockpiling of construction materials should be done in systematic way to avoid any drainage blockages, to enhance the aesthetics of the site. • Duration of stockpiling should be minimized as much as possible. 	During Construction	Contractor	RHD/DSC
Road/Traffics	<ul style="list-style-type: none"> • Prepare and submit a traffic management plan to the PIU for approval at least 30 days before commencing work on project component involving traffic diversion and management. • Include measures in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, access roads, necessary barricades, warning signs / lights, road signs, etc. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Bangladesh Road Traffic Regulations of BRTA. • Restrict truck deliveries to daytime working hours (as common practice in Dhaka) to avoid road accidents and to reduce inconveniences to the road users. • Restrict the transport of oversize loads. • Operate construction vehicles to non-peak periods (night) to minimize traffic disruptions. • Enforce on-site and access road speed limits. 	During Construction	Contractor	RHD/DSC/BRTA
Occupational H&S	<ul style="list-style-type: none"> • Implement suitable safety standards for all workers and site visitors which shall not be less than those laid down on the international standards (e.g. International Labor Office guideline on „Safety and Health in Construction; World Bank Group’s „Environmental Health and Safety Guidelines”) and contractor’s own national standards or statutory regulations, in addition to complying with the national standards of the Government of Bangladesh (e.g. `The Bangladesh Labor Code, 2006”). • Provide the workers a safe and healthy work environment, taking into account inherent risks of this particular construction activity and specific classes of hazards in the work areas, • Provide personal protection equipment (PPE) for workers, such as safety shoes, helmets, masks, gloves, protective clothing, 	During Construction	Contractor	RHD/DSC

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	<p>goggles, safety belt for working at height and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones.</p> <ul style="list-style-type: none"> • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job. • Appoint an environment, health and safety manager to look after the health and safety of the workers. • Not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the Bangladesh Labor Code, 2006 • Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work • Document and report occupational accidents, diseases, and incidents and actions taken. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable the causes of hazards in a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide HIV awareness program, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis. • Provide awareness to the construction drivers to strictly follow the driving rules. • Provide adequate lighting in the construction area and along the roads. • Adequate ventilation in all facilities. • Provide plastic net and others appropriate H&S measures surrounding the buildings to avoid accidents. • Safe and reliable water supply. Water supply from DWASA that meets the national standards. 			

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/Supervision
	<ul style="list-style-type: none"> • Hygienic sanitary facilities and sewerage system. The toilets and domestic wastewater will be collected through a common sewerage. • Carry out regular mosquito repellent spraying during monsoon periods. • Recreational and social facilities. • Safe storage facilities for petroleum and other chemicals. • Solid waste collection and disposal system. • Provide ambulance facility for the laborers to be transported to nearest hospitals during an emergency. • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work. • Establish a code of conduct for the contractor staff. • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. • Provide appropriate security personnel (home guard/private security guards) and enclosures to prevent unauthorized entry into the camp area. 			
Community H&S	<ul style="list-style-type: none"> • All construction activities except movement of trucks should be during day time (6:00 to 21:00) • Construction trucks should be moved during night time to avoid accident. 	During Construction	Contractor	RHD/DSC
Emergency Response	<ul style="list-style-type: none"> • Mitigation measure details in Chapter VIII (Emergency Response Plan) 	During construction	Contractor	RHD
OPERATION STAGE:				
Drainage Congestion	<ul style="list-style-type: none"> • Maintain drains regularly as and when required. • Solid wastes should not be dumped into the drain. • Blocked drains should be cleaned properly and debris disposed at approved sites on a regular basis. 	During Operation	RRTC	RHD/DCC
Noise Pollution	<ul style="list-style-type: none"> • In the project area, noise generation will be occurred due to too much vehicles (about 500 nos.) movement within the RRTC location. Since the noise pollution already exceeds the standard, 	During Operation	RRTC	RHD/DOE

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/Supervision
	<p>therefore strict measures for noise pollution control need to be undertaken during operation stage.</p> <ul style="list-style-type: none"> • A densely tree replantation to protect the nearby university from noise pollution. • The BRTA rules and regulations must be followed to reduce noise pollution. • Restriction should be imposed on the movement of the old vehicles and use of hydraulic horn in the project area. • Continuous monitoring should be carried out. 			
Air Pollution	<ul style="list-style-type: none"> • Number of mitigation measures can be conceived such as to follow BRTA relevant rules and regulations; and ban of old vehicles, etc. 	During Operation	RRTC	RHD/DOE
• Landscape	<ul style="list-style-type: none"> • Maintain the RRTC properly • Maintain replantation of trees • Restrict to rebuild shops at outside of the RRTC complex area. 	During Operation	RRTC	RHD/FD
Solid Waste Generation and Disposal	<ul style="list-style-type: none"> • Setting up of separate waste collectors at different points. • Regular cleaning and replacing of waste collectors. • Waste disposal at a safe place. • DNCC to collect solid waste every day and dispose to the landfill site at Matuail CWDS, Dhaka • Encourage waste sorting by the facility users. 	During Operation	RRTC	RHD/DCC
Sewerage waste	<ul style="list-style-type: none"> • Maintenance sewerage pipes etc. as and when required. • Regular monitoring of water quality. 	During Operation	RRTC	RHD/DCC
Occupational H&S	<ul style="list-style-type: none"> • A proper Maintenance and Operation (O&M) Plan should be prepared during detailed design and act accordingly during operation stage of the RRTC. • Proper acoustic system in the walls of the buildings for minimizing of noise and thermal pollution. • Firefighting equipment should be installed in each floor of the buildings, lift, kitchen, generator room etc. Adequate power capacity of generator (capacity>50kwt), installing in covered room, should be provided • Fire Extinguisher should be installed in each floor, lift, generator room etc. of the buildings. • Adequate lighting facilities and proper ventilation facilities for fresh air should be provided in all the buildings. 	During Operation	RRTC	RHD

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/Supervision
	<ul style="list-style-type: none"> • Before leaving the office rooms, power must be switched off • H&S signboards should be installed at the appropriate locations of the buildings. • First aid facilities and an experienced H&S Manager should be available. • Training on H&S should be provided for all RHD staff. • In case of any accidents, the victim must be sent to nearest clinic/hospital for proper treatment. • 			
Community H&S	<ul style="list-style-type: none"> • Preparaton of traffic management plan • All road safety measures should be followed for the crossing point and meeting point of RRTC entrance road • Follow BRTA rules on traffics • 	During Operation	RRTC	RHD
Environmental Risks	<ul style="list-style-type: none"> • Important issues related with safety during operational phase is monitoring of emergencies and establishing procedures to carry out rescues during sudden disasters such as earthquake, very high flood, fires, and accidents. • Plinth level of the buildings should be above high flood level. • Emergency equipment will be stockpiled in RRTC and personnel will be trained to serve on rescue teams. • Use of latest protective mechanism is recommended to avoid fire and other environmental risks. 	During Operation	RRTC	RHD/DCC

D. Environmental Monitoring Program

107. 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 15. Environmental Monitoring Plan

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
Pre-Construction Stage						
Air Quality	Test parameters: SO _x , NO _x , CO, PM ₁₀ , PM _{2.5}	Air quality standard by DOE, Bangladesh	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
Noise Level	Test parameters: dB(A)	Noise Pollution Control Rules (2006)	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	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 Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
	Test parameters: Groundwater: pH, Mn, As, Fe, Cl-, Total hardness, TC, FC	Groundwater quality standard by DOE, Bangladesh	Groundwater near Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
Wildlife	Wildlife habitat and movement	None Specific	Areas along side the Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
Tree felling	After completing the detail design a baseline survey will be carried out for identify the number of trees cut off	Inspection	Alignment along the Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	During tree felling and site clearing operations	Contractor/ NGOs/RHD	RHD/PIC
Construction Stage						
Air Quality	Test parameters: SO _x , NO _x , CO, PM ₁₀ , PM _{2.5}	Air quality standard by DOE, Bangladesh	Hot mix plant, concrete mixing plant/stone crushers at construction	Twice	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
			sites			
Dust	Dust control	Air quality standard by DOE, Bangladesh	Construction site and ROW along the Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur 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 Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Twice	Contractor	RHD/PIC
	Test parameters: Groundwater: pH, Mn, As, Fe, Cl-, Total hardness, TC, FC	Water quality standard by MoEF, Bangladesh	Drinking water to made available to construction camps and ground water near Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Twice	Contractor	RHD/PIC
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	<ul style="list-style-type: none"> • Check drainage plan implemented correctly • Conduct regular inspection 	Monitoring	Construction site	Weekly during monsoon	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
Soil Pollution	<ul style="list-style-type: none"> • Check liquid waste is carried out by experienced personnel and in proper way • Careful and proper handling of oil and other hazardous liquids 	Monitoring	Construction Yard, dumping site	Regularly	Contractor	RHD/PIC
Wildlife	Wildlife habitat and movement	None Specific	Areas alongside the alignment	Quarterly	Contractor	RHD/PIC
Fisheries	Impact on fish productivity, breeding and spawning	None Specific	All major water bodies	Once in a year	Contractor	RHD/PIC
Waste	<ul style="list-style-type: none"> • Check storage, transportation disposal, handling of hazardous waste • Waste and effluents to be collected and disposed safely from all camps. • Wastes and garbage site to be disposed safely 	Monitoring	Construction Yard, dumping site	Weekly	Contractor	RHD/PIC
Health and Safety	<ul style="list-style-type: none"> • Check quality of food & accommodation at construction camp; • Check safe water supply, hygienic toilet at camps, construction of drain at camp sites; • Check toilets are close to construction site and separate toilet for female workers; • First Aid Box with required tools & medicines; • The heavy construction 	Monitoring	Construction site and labor camp	Regularly	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
	material to handled and stored safely putting due care on public safety; <ul style="list-style-type: none"> Check of personal protective equipment (PPE) for worker at the sites 					
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	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Regular during June/July	RHD	RHD/DOE
Air Quality	Test parameters: SO _x , NO _x , CO, PM ₁₀ , PM _{2.5}	Air quality standard by DOE, Bangladesh	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	RHD	RHD/DOE
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur 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	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Quarterly	RHD	RHD/DOE

E. Environmental Budget

108. The estimated budget for implementation of the mitigation and monitoring measures proposed in EMP is presented in Table 16. 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.

109. The total budget is estimated US\$ 0.0412 million.

Table 16. Environmental Budget for Road Research and Training Centre

Component	Item	Unit	Quantity	Rate (in BDT)	Amount (million BDT)
PRE-CONSTRUCTION STAGE					
Air Quality	Measuring air quality	No.	1	60,000	0.06
Noise	Measuring ambient noise level	No.	2	15,000	0.03
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.	1	20,000	0.02
	Groundwater quality measurement	No.	1	20,000	0.02
SUB TOTAL (PRE-CONSTRUCTION STAGE)					0.13
CONSTRUCTION STAGE					
Air Quality	Measuring air quality	No.	4	60,000	0.24
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
	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	-	1,00,000	0.10
Health	Health checkup camps for construction workers	Camps	Camps/year	2,00,000	0.20
SUB TOTAL (CONSTRUCTION STAGE)					1.38
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	Lump sum	-	1,00,000	0.10
	Monitoring of waste disposal and management	Lump sum	-	2,00,000	0.20
SUB TOTAL (OPERATION STAGE)					0.645
TRAINING					
Training	Environmental training & awareness	Lump sum	As per training details	10,00,000	1.0
SUB TOTAL (TRAINING)					1.00
SUB TOTAL (Pre-construction, Construction, Operation and training)					3.1550
CONTINGENCIES @ 10 % on total Environmental Costs					0.3155
GRAND TOTAL (in million BDT)					3.4705
GRAND TOTAL (in million US\$) (@ 1 US\$ = 84.15 BDT)					0.0412

VI. INFORMATION DISCLOSURE AND PUBLIC CONSULTATION

A. Focus Group Discussions

110. 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 Research and Training Centre (RRTC). The groups consisted of more than four people and they were discussed for approximately half an hour to gather information and opinion they have. Altogether, 2 FGDs were held on 18 May 2019. Approximately 9 participants from different locations have taken part in those consultations.

111. During the consultation, the participants spontaneously expressed their feelings about the importance of developing the Road Research and Training Centre (RRTC). They told that the project will improve the landscape of existing Road Laboratory area.

112. Most of them told that the local air quality has been degraded from the emission of vehicles and construction material as well as noise pollution due to the construction work. 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.

113. During the focus group discussion, people said that there will be no impacts on ground water. In accordance with people's information there are some wildlife found in the area. People also confirmed that there is no protected area in the project area. Finally, all of them were in favor of the project.

114. The discussions were primarily focused on receiving maximum inputs from the participants regarding the project's acceptability and environmental concerns. The purpose of focus group discussion 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.

Figure 15. Photos of Focus Group Discussion



Figure 16. Photos of Focus Group Discussion



Figure 17. Photos of Focus Group Discussion



115. The following suggestions were received from the consultation:

- Excavated materials should be deposited in a proper place that does not harm the local people.
- There should be effective mitigation measures in order to reduce noise pollution and emission from construction vehicles engine and materials.
- Water should be sprayed 2-3 times in a day to reduce the dust pollution.

B. Summary of Comments

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

- The people in the project areas were less concerned about the environmental problems, such as, air and noise pollution, However, they have raised concern regarding dust pollution and noise pollution.
- 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, such as water spray to reduce dust pollution, tree plantation.
- Local people are of strong opinion for the early implementation of the project.

C. Information Disclosure

117. 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, GRM, information disclosure procedures and other relevant information in accordance with SPS. Relevant information will also be made available in both English and local language.

D. Compliance with Relevant Regulatory Requirements

118. 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.

VII. GRIEVANCE REDRESS MECHANISM

119. 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.

120. 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.

121. 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.

122. **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.

123. 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.

124. **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.

125. 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.

126. 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.

127. 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.

128. **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.

129. 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. EMERGENCY RESPONSE PLAN

A. Introduction

130. Disaster or emergency can be defined as any condition, man-made or natural, which results in a significant disruption to human life and materials. The on-set of most disasters is considered to be very rapid, allowing a minimum of time for preparation. The scale of a "disaster" is determined by the loss of life, damage to facilities and the amount of external resources for the place of occurrence to return to its normal activities.

131. Emergency prevention through good design, operation, maintenance and inspection are essential to reduce the probability of occurrence and consequential effect of such eventualities. However, it is not possible to totally eliminate such eventualities and random failures of equipment or human errors, omissions and unsafe acts cannot be ruled out. An essential part of major hazard control has therefore, to be concerned with mitigating the effects of such emergency and restoration of normalcy at the earliest. To overcome such eventualities, an emergency response plan and an emergency response team is required to be formulated.

B. Objective of Emergency Response Plan

132. The overall objective of an emergency response plan is to make use of the combined resources at the proposed project site and outside services to achieve the following:

- (i.) To localize the emergency and if possible eliminates it;
- (ii.) To minimize the effects of the accident on people, environment and property;
- (iii.) Controlling the incident, removing the hazard, preventing escalation;
- (iv.) Effect the rescue and medical treatment of casualties;
- (v.) Safeguard other people;
- (vi.) Evacuate people to safe areas;
- (vii.) Informing and collaborating with statutory authorities;
- (viii.) Initially contain and ultimately bring the incident control;
- (ix.) Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency; and
- (x.) Investigate and take steps to prevent reoccurrence.

C. Elements of an Emergency Response Plan

133. The main elements of an emergency response plan are as follows:

- Leadership and Administration;
- Role and Responsibilities of Key Personnel;
- Emergency action;
- Emergency Light and Power;
- Source of energy control;
- Protective and rescue equipment;
- Communication;
- Medical care/First Aid;
- Public relation;
- Protection of vital records;
- Training; and
- Periodical revision of plan.

D. Hazards Associated with the proposed project

134. The main hazards and causes are like as follows:
- Fire/explosion in the construction site, labor camp and fuel storage area;
 - Accidents from construction activities;
 - Lack of appropriate PPE in the construction site, good housekeeping practices and safety sign;
 - Handling heavy objects;
 - Electricity (electrocution);
 - Sharp objects;
 - Slipping on wet surface;
 - Snake bites; and
 - Mechanical failure.
135. The Natural Hazards/Calamities:
- Earthquake;
 - Flood; and
 - Cyclone and Storm Surges.

E. On-site Emergency Response and Preparedness Plan of Construction Contractor

136. Scope of the onsite emergency response and preparedness plan is as follows:
- The on-site emergency preparedness plan is applicable to all the construction activities carried out at project site for both day and night time operation and also for operations during weekend, off days. It is also applicable to the movement of project personnel to and from the identified locations, on the way to and from the duty assignment.
 - These also apply to all employees, all contractors, sub-contractors & their employees and visitor at proposed project site/office.
 - The emergency preparedness plan is designed to link all the emergency scenarios that are identified as possibly occurring in our project during construction.

F. Emergency Response Procedure

1. Identification of Emergency

137. It is necessary to determine what circumstances or set of circumstances constitute an emerging emergency, which would in turn cause the activation of the emergency response team.

2. Emergency Action Plan at Project Site

138. The action plan should consist of the following:
- Emergency Control Centre; and
 - Key Personnel.

G. Establishment of an Emergency Control Centre

139. It is very important to establish an emergency control center at the project site for managing any kind of emergency. This center will be the main center from where the operations

handle the emergency will be directed and coordinated. The project manager office of the contractor can be used as an emergency control center. After establishing the control center, the following facilities to be made available in the emergency control center:

- Internal and external communication system;
- Computer and other essential records;
- Daily attendance of workers employed in the project site;
- Records of the storage of fuel and hazardous material;
- Pollution records;
- Walky-talky;
- Note Book, Pad and Pencil; and
- List of key personnel with addresses, telephone number etc.

1. Assembly Points

140. A safe place far away from the proposed RRTC construction site should be pre-determined as an assembly point where in case of emergency personnel evacuated from the affected areas are to be assembled. The construction workers, contract workers and visitors should assemble at assembly point in case of emergency and the time office clerk should take their attendance so as to assess the missing persons during an emergency.

2. The Key Personnel for Emergency in the project

141. The following key personnel will be played a vital role during the emergency situation in the proposed project site. Their roles and responsibilities for the emergency management are also given below:

- A. Works Main Controller;
- B. Works Incident Controller;
- C. Other Key Officers.

3. Alarm System

142. Alarm system varies and will depend on the size of the work area - simple fire bell, hand operated siren break open type, fire alarm, etc.

4. Communication System

143. Communication is a key component to control an emergency. The following communication system may be provided in the proposed project: Walky-Talky, Telephone (internal and external), Cell Phone, Intercom, and Runners (verbal or written messages).

5. Siren for Emergency

144. Siren for emergency should be different from the normal siren. The emergency siren should be audible for a distance of 500-meter radius. The emergency siren should be used only in case of emergency.

6. Counting of Personnel

145. All personnel working in the plant should be counted. Time office persons should collect the details of personnel arriving at the assembly point. These should be checked with the attendances of regular workers, contract workers present at the site on the day of the emergency. The accident control should be informed and arrangement should be made for searching missing persons in the emergency affected area. The employees' address, contact number of next to kin should be maintained in the time office so that during emergency relatives of those affected due to emergency may be informed accordingly. Information in respect of emergency should be given to the media and other agency.

7. All Clear Signal

146. After control of emergency the work incident controller will communicate to the works main controller about the cessation of the emergency. The main controller can declare all clear by instructing the time office to sound "All Clear Sirens".

8. Emergency Facilities

147. The following facilities should be provided in the project site to tackle any emergency at any time:

- (i.) Fire protection and firefighting facilities;
- (ii.) Emergency lighting and standby power;
- (iii.) Emergency equipment and rescue equipment: breathing apparatus with compressed air cylinder; fire proximity suit; resuscitator; water gel blanket; low temperature suit; first aid kit; stretchers; torches and ladders; and
- (iv.) Safety equipment: respirators; gum boots; safety helmets; asbestos rubber hand gloves; goggles and face shield; toxic gas measuring instruments; explosive meter; oxygen measuring instruments and wind direction indicator.

H. Hazardous Control Measures

1. Fire

148. To prevent fire mishaps and to manage the emergency situation during fire in the proposed project the following activities and precautions are proposed.

- Automated fire detection alarm system in the labor camp and construction site;
- Proper marking to be made for identification of locations of fuel and lubricating oil storages;
- Periodic training or regular mock drills will be carried out to create awareness on procedures to be followed by the work force at the project site to handle any emergency situation;
- Signboards including emergency phone numbers and 'no smoking' signs should be installed at all appropriate locations;
- It will be advised to keep oxygen cylinders, medical kits and masks to prevent smoke inhalation especially for those with respiratory disorders for whom smoke inhalation can be very dangerous;
- The proposed project will be provided with sufficient firefighting gadgets (sand bucket, water, fire extinguisher etc.).

- Co-ordination with local authorities such as fire, police, ambulance, district administration and nearby industries should be ensured to manage/control, meet any eventuality; and
- The staff shall be trained for first aid and firefighting procedures.

149. Simple steps to be followed during emergency are as follows.

- (i.) **Call the fire rescue department:** During fire in the project site, leave the premises by nearest available exit. Call fire department and do not assume anyone else has called the fire department. If your cloth catches fire, do not get panic or run, stop, drop and roll.
- (ii.) **Cover your nose and mouth with a wet clean cloth:** Stay calm cover your nose and mouth with a wet, clean cloth to prevent smoke inhalation injury and choking. Never jump off or attempt to climb down the side of tall structures, as it will mean certain death.
- (iii.) **Do not run:** During a fire, smoke containing poisonous gases such as CO tends to rise up. When you run in a smoke-filled room, you tend to inhale the smoke faster. CO dulls the senses and prevents clear thinking, leading to panic. To prevent being asphyxiated, dip tissues or cloth in water and cover your nose with it.
- (iv.) **Head-count of the occupants:** During an emergency, make good use of the evacuation procedure and help each other to reach out of plant/building safely. Ensure nobody is left behind by doing a head-count of occupants. Visitors should read and understand the evacuation plan before going into the project area and ensure their safety.

2. Natural Disasters

150. Natural disasters occur without notice. Most disasters are natural such as earthquake, floods, cyclones and storm surges, riverbank erosion, salinity intrusion, drought and landslides. We have no way of stopping them, but we can learn to deal with the difficult situations that arise due to them. During disasters like floods, fire, cyclone, earthquake, landslides, rescue beings at site. Even before external help arrives, people affected by the disasters help each other. The government and many voluntary organizations send teams of workers trained in rescue operations to disaster-affected areas. These teams join hands with the local community helpers such as doctors, nurses, social workers and police officers.

3. Electrical Accidents

151. Electrical hazards can cause burns, shocks, and electrocution, which can lead to serious injury and even death. When dealing with potentially serious electrical hazards stop and think, instead of taking a chance and risking your personal safety, call trained professionals to handle problems. Many times people prefer to take electrical matters into their own hands. Other small aspects of electrical repair in a business setting may be taken care of without needing professional service technicians. If you do decide to take matters into your own hands, safety precautions can avoid injuries and other losses.

4. Prevention of Electrical Accidents

152. Flexible cords connected to appliance should be wired to conform to the international Color code. Color of the insulation on the wire is Brown represents live wire, Blue represents neutral wire and Green/yellow stripes represent earth wire.

153. What you should look for when selecting an electrical appliance is given below:

- (i.) The appliance should be suitable for operation on local electrical supply of 240 volts AC and frequency of 50 Hz.
- (ii.) The appliance should preferably be tested and certified by a national or reputed standards testing authority
- (iii.) Look for certified plugs on the flexible cords connected to the appliances. If the appliance is double insulated and has a 2-pin plug, then it should be fitted with a suitable certified plug.
- (iv.) An essential formality when buying any appliances is a duly completed guarantee card with the dealers/retailer's official stamp and details of the appliance (serial number, etc.).

154. Safety precautions to be taken when using electrical appliances.

- (i.) Avoid using handheld appliances when your hand and/or body is wet.
- (ii.) Do not use or leave appliances where liquid can splash on to them.
- (iii.) Flexible cords connecting the appliance and the plug should be in good condition, if the cord is frayed, chaffed, cut or melted, have the entire cord replaced by a competent person.
- (iv.) Check accessories such as plugs attached to appliances for cracks and burnt marks and have them replaced. If undue overheating occurs or burnt marks appear in any electrical appliance, have it checked.

5. Personal Protective Equipment

155. In certain circumstances, personal protection of the individual maybe required as a supplement to other preventive action. It should not be regarded as a substitute for other control measures and must only be used in conjunction with substitution and elimination measures. PPEs must be appropriately selected individually fitted and workers trained in their correct use and maintenance. PPEs must be regularly checked and maintained to ensure by the contractor that the worker is being protected.

6. First Aid

156. All medical facilities construction camp and work sites will be sufficient for the type of work being performed and the number of personnel at each work location. First Aid kits shall be supplied and maintained current and complete of content by the Contractor and will:

- Be immediately accessible to all personnel;
- Have emergency contact numbers (phone and/or radio) located in the vicinity of the kits along with a content list, treatment log and pen.

157. Be clearly marked and numbered for identification and the contents inspected once every month for acceptability and completeness.

IX. CONCLUSIONS

A. Findings

158. The finding of IEE indicates that the Road Research and Training Centre (work package-14) is unlikely to cause any significant adverse environmental impacts. The proposed Road Research and Training Centre (work package-14) does not pass through or is 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.

159. 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.

160. The impacts are with regard 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 and air quality. 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.

161. During construction Road Research and Training Centre (work package-14) traffic management is a challenge as that is a moderate busy area with many vehicles passing. Some trees along the Road Research and Training Centre (work package-14) 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 Road Research and Training Centre (work package-14). 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. Baseline information of trees will be collected when the detail design is finalized. That will be updated in the report.

B. Recommendations

162. The EMP, its mitigation and monitoring programs, contained herewith should be included within the Bidding documents for project works. Road Research and Training Centre area is mainly few residential areas. 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.

163. 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.

164. RHD has social and environmental circle 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 EA 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.

C. Conclusion

165. 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.

166. 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 requiring preparation of an IEE and EIA. This report is prepared in accordance with the ADB and GOB environmental requirements.

167. This IEE reveals that construction of the Road Research and Training Centre (work package-14) 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 enhancement of 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 a challenge during construction of Road Research and Training Centre.

168. Essentially primary data of air, noise, surface and ground water was used to assess the environmental impacts in a comprehensive manner. Site survey for trees after detail design will be finalized and incorporate those things in the final Initial Environmental Examination (IEE) report and recommend suitable mitigation measures.

169. The IEE report assesses the potential environmental impacts associated with the Road Research and Training Centre (work package-14), and suitable mitigation measures have been recommended.

170. In the event that any design details of the Road Research and Training Centre (work package-14) are changed, the IEE and EMP shall be reviewed and revised accordingly and submitted to DOE and ADB for acceptance.

X. REFERENCES

Rashid, H. (1977) *Geography of Bangladesh*. 1st ed. University Press Limited, Dhaka.

Waste Concern (2009). "Waste Database of Bangladesh", Dhaka, Bangladesh.

Guide to the Environmental Conservation Act 1995 and Rules 1997.

ADB Safeguard Policy Statement, 2009.

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: Road Research and Training Centre (work package -14),
South Asia Sub regional Economic Cooperation (SASEC) Phase 2

Sector Division:

Building

Screening Questions	Yes	No	Remarks
A. Project Siting			
Is the project area adjacent to or within any of the following environmentally sensitive areas?			
• Underground utilities	✓		Underground water supply, sewerage pipelines exist within the project area.
• Cultural heritage site		✓	
• Protected Area		✓	
• Wetland		✓	
• Mangrove		✓	

Screening Questions	Yes	No	Remarks
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
• Bay		✓	
B. Potential Environmental Impacts			
Will the Project cause...			
Encroachment on historical/cultural areas?		✓	
Encroachment on precious ecology (e.g. sensitive or protected areas)?		✓	
Impacts on the sustainability of associated sanitation and solid waste disposal systems?		✓	
Dislocation or involuntary resettlement of people?		✓	
Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	
Accident risks associated with increased vehicular traffic, leading to loss of life?	✓		Movement of the construction vehicles along the proposed main entrance road may cause unwanted accidents during construction.
Increased noise and air pollution resulting from increased traffic volume?	✓		Noise and air pollutions during construction & operation stages.
Occupational and community health and safety risks?	✓		Occupational H&S risks will be occurred during construction and operation stages. H&S risks to the community during construction and operation stages while vehicles crossing the local road in the entrance road.
Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological	✓		Improper safety measures may harm to the worker during construction work

Screening Questions	Yes	No	Remarks
hazards during project construction and operation?			
Generation of dust in sensitive areas during construction?	✓		Temporary dust generation during earth work will affect surrounding area.
Requirements for disposal of fill, excavation, and/or spoil materials?		✓	
Noise and vibration due to blasting and other civil works?	✓		Temporary noise and vibration impact during construction work.
Long-term impacts on groundwater flows as result of needing to drain the project site prior to construction?		✓	
Long-term impacts on local hydrology as a result of building hard surfaces in or near the building?		✓	
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	✓		Temporarily gathering of construction workers during construction stage and official staffs during operation may cause burden on local social infrastructures and services.
Social conflicts if workers from other regions or countries are hired?		✓	
Risks to community safety caused by fire, electric shock, or failure of the buildings safety features during operation?		✓	
Risks to community health and safety caused by management and disposal of waste?		✓	
Community safety risks due to both accidental and natural hazards, 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?		✓	

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	✓		The proposed Road Research and Training Centre is subjected to hazards such as earthquake and flood.
Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		✓	
Are there any demographic or socio- economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		✓	
Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by 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.

APPENDIX B: LIST OF PARTICIPANTS IN FGDs

Focus Group Discussions (FGDs) List of Participants

Focused Group 03 Date & Time 18/05/2019, 11:20am

Location Proposed Road Research and Training Centre, Paikpara, Mirpur.

SL No.	Name	Address	Occupation	Mobile No.	Signature
1	মি. সত্যজিৎ গগৈ	পাটকাইলৈ	স্বতন্ত্ৰ	০১৮৬০৬৪৮১০	
2	মি. সত্যজিৎ গগৈ	পাটকাইলৈ	স্বতন্ত্ৰ	০১৮৬০৬৪৮১০	
3	মি. সত্যজিৎ গগৈ	পাটকাইলৈ	স্বতন্ত্ৰ	০১৬৪১৪৪৬৫৫৪	
4	মি. সত্যজিৎ গগৈ	পাটকাইলৈ	স্বতন্ত্ৰ	০১৬৪১৪৪৬৫৫৪	
5	মি. সত্যজিৎ গগৈ	পাটকাইলৈ	স্বতন্ত্ৰ	০১৬৪১৪৪৬৫৫৪	
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Focus Group Discussions (FGDs)
List of Participants

Focused Group 02Date & Time 18/05/2019 , 12:15 pmLocation Proposed Road Research and Training Centre, Paikpara, Mirpur

SL No.	Name	Address	Occupation	Mobile No.	Signature
1	শোভিতা	নাগরিক সড়ক	ছাত্র	0172424775	শোভিতা
2	আবু মোস্তাফিজ	"	অধ্যাপক	-	আবু মোস্তাফিজ
3	মি. হুমায়ুন	"	সি.এস	0172240776	মি. হুমায়ুন
4	মি. আবু হান্না	"	সি.এস	0167570167	মি. আবু হান্না
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APPENDIX C: AMBIENT AIR QUALITY RESULTS

SL No: **020628**

Ref: EQMS/Ambient Air/001/2019

EQMS ENVIRONMENTAL LABORATORY Test Results of Ambient Air Quality Analysis

Project Name : Air, Noise, and Water Quality Analysis for Proposed Road Research and Training Centre (RRTC) at Paikpara, Mirpur, Dhaka: SASEC Road Project -2

Description of Sample: Ambient Air Quality

Sample Collector : Collected by EQMS Personnel (Md. Mustafizur Rahman)

Date of Analysis : 21 May, 2019

Description of Analysis:

Sampling Code	Sampling Date	Ambient Air Pollutants Concentration in $\mu\text{g}/\text{m}^3$				CO ppm
		PM ₁₀	PM _{2.5}	SO _x	NO _x	
AQ-1	18.03.2019	52.02	38.59	51.69	22.92	0.10
AQ-2	18.03.2019	23.43	18.37	69.20	17.09	0.10
AQ-3	19.03.2019	21.77	20.67	86.22	15.16	0.05
AQ-4	19.03.2019	19.13	20.42	52.74	7.35	0.002
Duration (hr)		24	24	24	24	8
ECR, 1997 and amendment in 2006 Standard (Schedule-2)		150	65	365	100 (Annual)	9
Method of Analysis Instrument Use: Haz-Scanner™ HIM 6000		Light Scattering Nephelometer	Light Scattering Nephelometer	High Sensitivity Electrochemical	High Sensitivity Electrochemical	High Sensitivity Electrochemical

Note:

*Regular Checkup and calibration of the equipment are done by the manufacturers and EQMS personnel to avoid any error

Legend:

PM₁₀ -Particulate Matter of a diameter of 10 micron or less, PM_{2.5} -Particulate Matter of a diameter of 2.5 micron or less, SO_x -Sulphur Dioxide, NO_x -Oxides of Nitrogen, CO - Carbon Monoxide

Received by:

Analyzed By:

Checked by:





Md. Jahidul Islam
Consultant
EQMS Consulting Limited

Saifur Rahman
Assistant Consultant
EQMS Consulting Limited

SK. Salahuddin Ahammad
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Link Road, Dhaka-1212, Bangladesh.



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APPENDIX D: NOISE LEVEL RESULTS

SL No: **020629**

Ref: EQMS/Noise Level /002/2019

EQMS ENVIRONMENTAL LABORATORY

Test Results of Noise Level Analysis

Project Name : Air, Noise, and Water Quality Analysis for Proposed Road Research and Training Centre (RRTC) at Paikpara, Mirpur, Dhaka: SASEC Road Connectivity Project -2

Description of Sample : Noise Level Measurement

Sample Collector : Collected by EQMS Personnel (Md. Mustafizur Rahman)

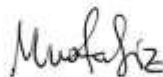
Monitored by : EQMS Consulting Limited (EQMS Monitoring Team)

Date of Analysis : 20 May, 2019

Description of Analysis:

Code	Sampling Date	Leq _{day}	Day (Standard)
NL1	18.05.2019	61.64	55
NL2	18.05.2019	63.75	60
NL3	19.05.2019	58.65	55
NL4	19.05.2019	59.25	45
Standard (ECR'1997) & Noise Pollution (Control) Rules 2006			
Silent area			50
Residential area			55
Mixed area			60
Commercial Area			70
Industrial area			75
World Bank/IFC Standard			
Residential; Institutional; Educational			55
Industrial			70

Collected by:



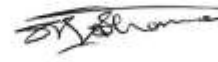
Md. Mustafizur Rahman
Assistant Consultant
EQMS Consulting Limited

Analyzed By:



Md. Jahidul Islam
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APPENDIX E: SURFACE WATER QUALITY RESULTS

SL No: 020651

Ref: EQMS/ Surface Water /001/2019

EQMS WET LABORATORY

Test Results of Surface Water Quality Analysis

Project Name : Air, Noise, and Water Quality Analysis for Proposed Road Research and Training Centre (RRTC) at Paikpara, Mirpur, Dhaka: SASEC Road Connectivity Project -2

Description of Sample: Surface Water Quality

Sample Collector : Collected by EQMS Personnel (Md. Mustafizur Rahman)

Sampling Location : Paikpara, Mirpur

Sampling Date : 19 May, 2019

Description of Analysis:

Parameter	Unit	SW-1	SW-2	Analysis Method	Bangladesh Standards*
Temperature	°C	28.9	28.8	Hanna Combo Meter	-
pH	--	8.15	7.47	Hanna Combo Meter	6.5 - 6.8
DO	mg/L	6.4	4.7	DO Meter	4.5 - 8.0
BOD	mg/L	2.7	2.3	5 Days Incubation	6 or less
COD	mg/L	5	21	USEPA 410.4	-
Turbidity	NTU	1	2	Turbidity Meter	-
TSS	mg/L	5	7	Gravimetric Method	-
Chloride	mg/L	20+	20+	Adaption of the mercury(II) thiocyanate	-
Sulphate	mg/L	15	16	Turbidimetric Method	-
Salinity	ppt	0.38	0.22	Salinity Meter	-
Total Coliform	N/100ml	17	22	Membrane Filtration	-

*ECR 1997 Schedule 3(B), 20+ - Higher than 20

Received by:



Md. Jahidul Islam
Consultant
EQMS Consulting Limited

Analyzed By:



Md. Saifur Rahman
Assistant Consultant
EQMS Consulting Limited

Checked by:



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APPENDIX F: GROUND WATER/ DRINKING WATER QUALITY RESULTS

SL No: 020652

Ref: EQMS/Ground Water/001/2019

EQMS WET LABORATORY

Test Results of Ground Water Quality Analysis

Project Name : Air, Noise, and Water Quality Analysis for Proposed Road Research and Training Centre (RRTC) at Paikpara, Mirpur, Dhaka SASEC Road Connectivity Project -2

Description of Sample: Ground Water Quality

Sample Collector : Collected by EQMS Personnel (Md. Mustafizur Rahman)

Sampling Location : Paikpara, Mirpur

Sampling Date : 19 May 2019

Description of Analysis:

Parameter	Unit	GW-1	GW-2	Analysis Method	Bangladesh Standards
pH	-	6.86	6.83	Hanna Combo Meter	6.5-8.5
Chloride	mg/L	20+	20+	Adaption of the mercury(II) thiocyanate Method	150-600
Salinity	ppt	0.21	0.22	Salinity Meter	--
Total Hardness	mg/L	165	144	Colorimetric Method	200 - 500
Arsenic	mg/L	<0.010	<0.010	Modified Gutzeit method	0.05
Iron	mg/L	0.02	0.05	Phhenantroline Method	0.3-1
Ammonium Nitrogen (NH3-N2)	mg/L	0.09	0.08	Nessler	0.5
Manganese	mg/L	0.1	0.1	Calmagite Method	0.1
Total Coliform	N/100ml	0	0	Membrane Filtration	0
Fecal Coliform	N/100ml	0	0	Membrane Filtration	0


*ECR 1997 Schedule 3(A), 20+ - Higher than 20

Received by:



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Consultant
EQMS Consulting Limited

Analyzed By:



Md. Saifur Rahman
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