Initial Environmental Examination

Project No: 52174-001
February 2019

Emergency Assistance Project
ADB Project 52174-001 | Grant 0582-BAN

Package

BANGLADESH: Emergency Assistance Project: Improvement of National Highway (N1) From Link Road (Cox's Bazar) To Teknaf

Prepared by Roads and Highways Department (RHD), Government of Bangladesh (GoB) for the Asian Development Bank (ADB).

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BAN: EMERGENCY ASSISTANCE PROJECT

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The “Improvement of National Highway (N1) From Link Road (Cox’s Bazar) To Teknaf “Project will be implemented by two (02) phases. The First Phase of this project will be implemented very soon and the time of implementation of Second Phase will be decided later. In the First Phase of this Project, the Contract Package-01 and Contract Package-02 will be implemented and the Contract Package-03 will be implemented during the Second Phase of this Project. However, this IEE study covers all the three Contract Packages but ADB will review and update this report again before implementation of the Contract Package-03 at the Second Phase of this Project.

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ABBREVIATIONS

AAQ	Ambient Air Quality
ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BECA	Bangladesh Environmental Conservation Act
BRTA	Bangladesh Road Transport Authority
BECR	Bangladesh Environmental Conservation Rules
BWDB	Bangladesh Water Development Board
DoE	Department of Environment
EA	Executing Agency
EAP	Emergency Assistance Project
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FD	Forest Department
GOB	Government of Bangladesh
IEE	Initial Environmental Examination
IECs	Important Environment Components
MOEF	Ministry of Environment and Forest
NGO	Non-Governmental Organization
PPEs	Personal Protection Equipment
RHD	Roads and Highways Department
RoW	Right of Way

EXECUTIVE SUMMARY

The Government of Bangladesh (GoB) requested Asian Development Bank (ADB) for grant support to provide basic infrastructure and essential services to displaced persons. Given the humanitarian need and heart-wrenching condition of the displaced persons, ADB is providing grant financing of $100 million for the first phase of the project. ADB support will be focused, selective, and well-targeted in the areas of (i) road access to and within camps; (ii) water and sanitation; (iii) energy supply; and (iv) disaster risk mitigation. It will build on the support provided by GoB and complement support provided by the United Nations (UN) agencies, the World Bank (WB) and other agencies. With the principle of putting people first, the project will seek to ease the vulnerabilities and risk of hunger, disease, and disaster. The project is known as Emergency Assistance Project (Project No. 52174-001, Grant 0582-BAN).

This report is the Initial Environmental Examination (IEE) study for the following road section:

- National Highway (N1) From Link Road (Cox's Bazar) To Teknaf

The project road has been segmented in to three Contract Packages (CP) for implementation and the bidding document will be prepared accordingly. The Contract Packages are given below:

I. Rehabilitation of National Highway (N1) From Link Road (Cox's Bazar) (Ch: 381+494) to Ukhiya (Ch: 406+494)

II. Rehabilitation of National Highway (N1) From Ukhiya (Ch: 406+494) to Unchiprang (Ch: 431+494)

III. Rehabilitation of National Highway (N1) From Unchiprang (Ch: 431+494) to Teknaf (Ch: 462+254)

The construction of the proposed Project, which will take about 1.5 years to complete and involve hundreds of workers at least 3 work camps, and will lead to permanent environmental changes to the area's topography, surface drainage pattern, air quality, noise conditions, and will establish an improved and widened land barrier across which both local farmers, wildlife and livestock will have to become accustomed to. To make way for the project alignment, the Project is expected to displace around 80 temporary shop owners but no tree cutting will be required to make 7.3m wide carriageway.

This Project was classified as Category Red by the Department of Environment (DoE) and Category B by the Asian Development Bank (ADB), thus a full environmental assessment was completed as per the guideline of DoE covering the requirement of the IEE for ADB as well.

The total length of the proposed road improvement is 80.76 km, passing through four upazilas within the Cox's Bazar district. The start of the Project is at Link Road of Cox's Bazar and extends south to the Teknaf upazila. A total of 27 culverts need to be reconstructed. A 7.3m carriageway will be improved along the existing 5.5m carriageway through the embankment filling material from dredged sources. The workforce deployed along the alignment will be more than thousand, at least three work camps. The waste generated by workers housed in camps will have to be carefully managed. Proximity to water bodies will be carefully regulated by DoE who will give the contractor building permits to

build camps. The Environmental Management Plan (EMP) contains specific instructions on waste management which the contractor will need to comply with.

Potential negative impacts were identified in relation to design, construction, and operation period activities; then mitigation measures were defined to prevent or reduce all negative impacts to acceptable levels. These results were presented in the Environmental Management Plan. The EMP includes a description of when, where and by whom the mitigative action and the monitoring follow-up will be completed.

The EMP contains mitigative items that Roads and Highways Department (RHD) will be directly responsible for during the pre-construction and operating periods of the work. For the contractor, mitigation and monitoring tasks were also defined in the EMP as well as a set of specifications in the contract document.

Most of the pre-construction and operating period measures will be implemented by RHD, while the construction period measures will be the contractor's responsibility and enforced by the Engineer and overseen by RHD. The construction period section of the EMP has been integrated into the construction contract as a set of environmental clauses.

As specified in the EMP, the contractor will be required to conduct quarterly air, water and noise quality monitoring and submit reports to the Engineer and RHD. The contractor's environmental safeguard personnel will have to attend a mandatory training workshop on EMP implementation prior to the start of work.

The monitoring work will be conducted by the contractor and the Engineer will focus on inspection of contractor work areas, their waste disposal sites, their rehabilitation/revegetation, proper landscaping, re-establishment of local access and debris clearance from reconstructed culverts, etc., during the operating period.

Once the road is in operation with improved carriageway, the impacts of access restrictions, air quality and noise degradation in the local area and safety will become permanent issues. The Project Resettlement Plan, provided as part of the Project documentation, addresses these issues in a fair and sensitive manner. To track noise and air quality changes, RHD will implement a semi-annual air and noise quality monitoring programme with sampling taking place at the same locations as the baseline study.

The road will cross two active elephant travel routes but these are already obstructed by building a Cantonment and Rohingya Refugee Camp. The Asian elephant is an internationally endangered species and as such RHD should undertook special protection during construction and operating period of the road. In addition, an elephant awareness programme will be provided to the RHD staff working and related signs will be erected along the road at crossing locations to alert transport operators and maintenance people.

The stakeholders were involved in developing the IEE through consultations with communities along the alignment. The views expressed were incorporated into the IEE and the planning and development of the Project.

An indicative estimate for the implementation of the EMP, including the tree planting programme is around BDT 67,12,650 for the 1.5 construction years and three operating period years. This estimate is tentative and once more construction details are known, the EMP will need to be revised and associated costs adjusted.

A Grievance Redress Mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints, and grievances. The GRM aims to provide a time-bound and transparent mechanism to voice out and resolve social and environmental concerns linked to the Project.

To conclude, the Project will generate a number of environmental impacts, such as those associated with the construction of embankment, culverts, soil import from other places, drainage congestion, obstruction for elephant crossing and good housekeeping issues with the contractor(s). The EMP provides the specific guidelines for the implementation of measures to prevent or mitigate these effects. RHD is committed to implementing the EMP and has fully endorsed the EIA; the basis for the EMP. RHD will ensure that the work is carried out in an environmentally acceptable manner and that the monitoring and reporting is completed in a compliant and timely fashion, acceptable to both DoE and ADB.

I. INTRODUCTION

A. Background

1. The Government of Bangladesh (GoB) requested Asian Development Bank (ADB) for grant support to provide basic infrastructure and essential services to displaced persons. Given the humanitarian need and heart-wrenching condition of the displaced persons, ADB is providing grant financing of $100 million for the first phase of the project. ADB support will be focused, selective, and well-targeted in the areas of (i) road access to and within camps; (ii) water and sanitation; (iii) energy supply; and (iv) disaster risk mitigation. It will build on the support provided by GoB and complement support provided by the United Nations (UN) agencies, the World Bank (WB) and other agencies. With the principle of putting people first, the project will seek to ease the vulnerabilities and risk of hunger, disease, and disaster. The project is known as Emergency Assistance Project (Project No. 52174-001, Grant 0582-BAN).

2. The project is known as the Emergency Assistance Project (EAP). The project will support the Government of Bangladesh in addressing the immediate and urgent needs of the displaced persons from Myanmar in Cox's bazar District, as identified by the United Nations (UN) in its Joint Response Plan (JRP) (displaced persons). The project will mainly support the improvement of water supply and sanitation, disaster risk management, sustainable energy supply, and access roads.

3. The impact of the project will be: Social recovery of affected communities accelerated in the sub-districts of Ukhyia and Teknaf. The outcome will be: Living conditions and resilience of affected communities improved. Four (04) outputs are expected from this project. They are:

- Output 01: Water supply and sanitation improved.
- Output 02: Disaster risk management strengthened
- Output 03: Energy sources provided
- Output 04: Access roads improved.

4. Output 04 of this project is "Access roads improved". This output consists of (a) rehabilitation of sub-district and Union roads to connect food storage centers, food distribution centers, field hospitals, primary health care centers, cyclone shelters, and primary education centers; (b) construction of new emergency access roads to the camp area; (c) rehabilitation of existing access roads and drainage system; (d) resurfacing the road from Cox's Bazar to Teknaf including improvement of critical sections i.e. market areas and culverts.

B. Purpose of Report

6. The Initial Environmental Examination (IEE) has been prepared based on the Environmental Assessment and Review Framework (EARF) developed by the ADB and endorsed by Bangladesh Government the ADB Safeguard Policy Statement (2009).

5. The objective of this study is to identify the environmental issues or parameters that may be affected by the implementation of the project, as well as an assessment of the current status of these issues and parameters related to the construction of the proposed Project. It has also included a consideration of means to avoid or mitigate significant environmentally negative impacts of the project.

6. Moreover, an IEE is an obligatory requirement that application to the Department of Environment (DoE) for Project Site Clearance and EIA document for the Environmental Clearance Certificate (ECC) from the DoE for initiating project implementation.

7. This IEE has been prepared in accordance with the requirements of the Government of Bangladesh defined in the Bangladesh Environment Conservation Act (BECA) and the Asian Development Bank (ADB) as defined in Chapter 2 below. The Format of the IEE following the ADB recommendations as outlined in the ADB Good Practice Sourcebook; Draft Working Document: November 2012.

C. Extent of the IEE Study

8. The IEE for the Link Road (Cox's Bazar) to Teknaf Road has been prepared in accordance with DoE, GoB and ADB guidelines based on primary and secondary data, site visits, completion of a Rapid Environmental Assessment (REA) Checklist (Appendix 1; separate checklist has been prepared for each contract package and the details of these contract package will be discussed later in Chapter III of this report), consultation with Forest Department (FD), Department of Environment (DoE), selected local people and close coordination with the RHD. The influence of impact has been within the 7.3m RoW of the project road alignment during the environmental assessment. However, the study area has been extended up to 100m area on each side of the project alignment for better understanding and also complied with the guideline of DoE, GoB. Geographical Information System (GIS) techniques have also been used based on recent satellite imageries of the project area for above purposes. Assessment is carried out on the following environment components: terrestrial and aquatic ecology, soil, water, air, noise, and socio economic aspects. The impacts on ecologically sensitive areas (e.g. wildlife sanctuaries, biosphere reserve, and protected places) within the influence area of the project alignment have also been assessed.

9. The primary data on physical, ecological, and human conditions collected by the project team during site visits have been incorporated in the IEE. A rapid survey on the roadside trees and Land use were conducted by the environmental study team. Published data relevant to the project area have also been used in preparing the document.

D. Scope of Works

10. This IEE report has been prepared keeping in view the requirement of DoE and ADB. The scope of the present IEE report describes the following most important features:

- A review of the environmental legislative, regulatory and policy guidelines and considerations relating to the implementation of the project;
- A general description of the project and existing physical, biological and socio-economic conditions;
- Analysis of different alternatives to the project in terms of environmental and social perspectives;
- Identification and assessment of the potential impacts on the natural and human environment in the project area, from the construction of the project;
- Consultation with the locals/stakeholder involving concerned people in order to identify and act on any undocumented or perceived environmental issues;
- Identification of mitigation measures in the form of an Environmental Management Plan (EMP); and
- Recommendations and conclusions in order to operate the project works in an environmentally safe and sound manner.

E. Study Methodology

11. In order to establish the baseline biophysical conditions within the study area, relevant secondary and primary data was collected and reviewed, a comprehensive field visit was undertaken, and a number of consultations with local people were carried out. For better assessment the data collection programme was planned as per the segmented contract packages. The data generated allowed to better understand the complex interplay between the various biotic and abiotic factors within the study area and to establish the baseline conditions. Once this baseline was established it was used as a reference point to identify potential changes to the environment that may occur as a result of the proposed Project activities, as well as to allow development of measures to prevent, mitigate or manage these potential impacts.

1. Secondary Data Collection

12. A review was conducted of the biophysical, ecological and legal literature relevant to the Project. The review of secondary sources and informal initial field investigations were undertaken in order to prepare a preliminary assessment of the physical and social environment, biodiversity, and conservation significance of the identified study area. This preliminary literature review also assisted in identifying data gaps which would require collection of additional primary information through physical field survey. The following activities were included in this phase of the Project:

- Data and information was collected from various government relating to site aspects climate (weather), groundwater quality and soils; secondary ecological data sources were collected and assessed;
- An appraisal was made of all legislation having direct and indirect relevance to environmental management within the Study Area including aspects such as biodiversity conservation, water quality, waste management, natural resource management and spill response;
- Previous environmental site studies, where available, were reviewed as well as relevant scientific journal articles; and
- Thereafter, an information gap analysis was undertaken to identify the areas where further primary data collection would be required to complete the IEE.

13. Thereafter, an information gap analysis was undertaken to identify the areas where further primary data collection would be required to complete the IEE. Further detail regarding the titles of the relevant literature, policies, acts and other regulations and guidelines reviewed and applied during the course of this process can be found in legal section of this report.

2. Baseline Data Collection and Analysis

a) Physical Environment Field Survey

14. To comprehensively evaluate the existing Project area baseline conditions, a field visit and data collection program incorporating a number of biophysical investigations was developed and implemented.

15. This survey aimed to identify important environmental components and environmental issues within the study area. It included investigation and observation of the local landforms, Bazar location, ghat location, habitat types, drainage patterns, species abundance and distribution, soil types, water quality (surface water and groundwater), air quality, noise and hydro-morphology.

16. The study area and surrounds were surveyed on foot and by boat. Important environmental features were identified and logged. Hand-held geographic positioning systems (GPS) were used to identify specific features for mapping and further analysis in the Project office. Features that were recorded or ground-truthed with GPS included:

- ✓ Habitation and settlement areas;
- ✓ Cultural Physical Properties (CPR);
- ✓ Plantations;
- ✓ Habitat areas;
- ✓ Sensitive environments; and
- ✓ Transportation routes;

17. Direct field observations were also made for significant portions of the study area including forests, roads, embankments, village groves and zones of intact vegetation, and these were transcribed onto pre-prepared environmental observation checklists. The observations were cross-referenced with primary, secondary and anecdotal information provided by government representative and the local community about key issues such as agricultural practices, flood levels, groundwater quality and presence of significant fauna and flora. Due to the specialist nature of this study, limitation of time, and instrument required for the air, noise, surface water, groundwater, and soil quality, Development Solutions Consultant Limited (DSCL) was engaged by the Individual Consultant to undertake the required work.

Air Quality Monitoring

18. The air quality monitoring was carried out for 8 hours average at 3 locations along the project corridor. All the locations of sample collection are showed in a map (Figure IV.16). The parameters were PM_{10}, $PM_{2.5}$, SOx, NOx, CO, , Humidity, Wind Direction, Wind Speed and Temperature. LATA Envirotech APM 250 with Combined PM_{10} and $PM_{2.5}$ Sampler was used for the measurement of particulate matters and for gaseous pollutants LATA Envirotech LES 411 was used for monitoring. To monitor carbon monoxide (CO) HTC CO-01 meter was used and value is expressed in ppm. For weather data collection Oregon WMR 200 Professional Weather Center was used.

Noise Level Measurement

19. Noise Level was measured at 6 locations in and around the project area. A sample collection map showing all the sampling location (Figure IV.16). Noise measurement at each location was done continuously for 15 minutes both at day and night time. Noise level was measured using a calibrated HTC Sound Level Meter set to A-weighting, slow response and statistical analysis settings.

Surface Water Quality

20. Surface water samples were collected from three project influenced locations. All the locations of sample collection are showed in the map (Figure IV.16). The parameters measured were Temperature, pH, Salinity, ORP, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Dissolved Oxygen (DO), Total Suspended Solids (TSS) and Turbidity. All samples were collected with Kemmerer Bottle and then transferred in 1 liter plastic sampling bottles. The sampling bottles were then kept in an ice cooler. EZDO 8200 Multimeter was used to conduct the on-site test of pH, TDS, EC, ORP and Temperature. Lutron DO-5509 was used to conduct the on-site test of Dissolved Oxygen (DO). The samples were sent to Department of Public Health Engineering (DPHE) for testing remaining parameters within 48 hours of being collected.

Groundwater Quality

21. Groundwater samples were collected from three project influenced locations. All the locations of sample collection are showed in the map (Figure IV.16). The parameters measured were Temperature, pH, Salinity, ORP, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Dissolved Oxygen (DO), Arsenic (AS), Chloride, Coliform (Faecal), Coliform (Total), Color, Hardness, Iron (Fe), Manganese (Mn) and Turbidity. All samples were collected in 1 liter plastic sampling bottles and then kept in an ice cooler. EZDO 8200 Multimeter was used to conduct the on-site test of pH, TDS, EC, Salinity, ORP and Temperature. Lutron DO-5509 was used to conduct the on-site test of Dissolved Oxygen (DO). The samples were sent to DPHE within 48 hours of being collected for testing the remaining parameters.

Soil Quality

22. Soil samples were collected from three possible campsite locations along the project corridor. The samples were collected in a composite sampling method by Auger boring from 10 inch below the surface level using hand Augur. The samples were first placed in zipped lock plastic bags and then transferred to plastic jars. The sample collection map is attached in Figure IV.16. The samples were sent to DU Laboratory for testing within 48 hours of sample collection. The parameters tested were pH, Lead (Pb), Iron (Fe), Sulphate (SO_4), and Organic Matter (OM).

b) Ecological Field Survey

23. Initially, secondary data sources were reviewed in order to compile a potential presence/absence list of significant fauna and flora species. Thereafter two members among the field survey team were deployed to undertake the required sampling and assessment. Sampling and survey was conducted for both aquatic and terrestrial ecosystems, validation checks were confirmed against the earlier-compiled species lists in order to establish a comprehensive baseline.

24. The following activities were undertaken during the terrestrial and aquatic field surveys:

Direct Observation

25. Direct observation on the occurrence and abundance of flora and fauna was made while travelling along road edges, across the agricultural fields, the forest areas and within village groves. As well as direct sightings, identification of animal presence was also based on identification of tracks, foot prints, feeding signs and animal/bird calls. Appropriate field guides and data proformas were used for this activity so that information was accurately recorded.

Interviews with Local Residents

26. Many of the mammalian and reptilian species are cryptic and unlikely to be encountered using standard field sampling methods. As such, experience suggests that interviews with local people are a very useful method for collecting information on local biodiversity. This data is anecdotal and as such should not form the core of any assessment; however it does nonetheless provide useful supplementary information. During the field survey period, extensive interviews with local people were conducted to collect information on animal and plant presence, including occurrences, behavior, breeding, distribution and seasonal appearance.

c) Socioeconomic Field Survey

27. The IEE study mostly used the socio-economic data collected by the Social and Resettlement Expert for social assessment. However, during the environmental survey some consultations were conducted with the local people on environmental issues but social conditions were also discussed.

Consultations

28. For this report, at first the EA study has conducted in-depth consultation meetings with stakeholders mostly with the forest department. Additional Focus Group Discussions (FGD) were conducted along the project corridor. A team of experienced professional and support staff has conducted surveys and consultation meetings after being briefed about the project. The respondents were selected by random sampling method from each of the locations. Respondents' contact information was collected for further verification, if and when required.

d) Geographical Information Systems

29. Geographical Information Systems (GIS) was used as a specialized analysis and presentation tool. Before commencing field investigations, spatial analysis of satellite imagery and present administrative areas and other boundaries/constraints was considered for the environmental assessments. For example, the sanctuaries, forest areas, spawning grounds, infrastructures, and the contract packages were identified. It also supports more detailed on-ground survey, particularly spatial features that may be directly or indirectly influenced by Project activities.

30. Detailed on-ground validation of spatial information – particularly land use – was undertaken using a hand-held, non-differential GPS. The spatial data acquisition team took detailed transect walks through the Project area in order to identify various land use types and confirm the findings of the satellite imagery analysis. This extensive ground-truthing exercise both validated the land use mapping and identified additional sensitive areas to include within the environmental fieldwork for sampling.

F. Contents of the Report

31. This report includes the following main elements;

Chapter I: Introduction and background

This chapter consists of the background of the project along with the objectives, scope and the methodology of preparing the IEE report. This chapter also includes the organization of the total IEE report.

Chapter II: Legislative framework

In this chapter the national and international laws and policies are described which are relevant to the environmental aspects of the project. The relevant guidelines of the funding agency ADB are also described in this chapter. Finally the requirements for making IEE for this project according to DoE and ADB are described.

Chapter III: Project background

This chapter includes the background and objectives of the proposed project. The location of the project, proposed project interventions and project cost are described here. In total, this chapter gives a detailed idea about the project.

Chapter IV: Description of the baseline environment

This chapter gives idea about the baseline condition of the surrounding environment of the project. It describes the physical, biological and socioeconomic environment.

Chapter V: Analysis of alternatives

In this chapter the alternative options of the proposed project are analyzed. It starts from no project alternative and ends at analyzing all the possible alternatives. This chapter concludes with declaring the proposed project as the best solution after analyzing all the other alternatives.

Chapter VI: Anticipated environmental impacts of the proposed project

In this chapter, the impacts likely to be generated during pre-construction, construction and operational phase and their mitigations are discussed.

Chapter VII: Public consultation

In this chapter the consultation process, consultation meetings details and also the outcomes are described.

Chapter VIII: Environmental management plan

This chapter includes the environmental management plan which includes the impacts of the proposed project on environment and society is described. All the anticipated impacts in pre-construction stage, construction stage and operational stage are described here.

Chapter IX: Grievance redress mechanism

This chapter includes the mechanism to redress the grievances from the local people during the implementation of the project.

Chapter X: Conclusion and recommendation

This chapter includes the conclusion and some recommendations are suggested here about the proposed project.

II. ENVIRONMENTAL POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Regulatory Requirements for the Project

32. Regulatory requirements toward protection and conservation of environment and various environmental resources and also 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.

B. National Legal and Institutional Framework

1. National Environmental Policy, 1992

33. 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:

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

34. **Relevance to the project -** 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 (NEMAP), 1995

35. 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:

a. to identify key environmental issues affecting Bangladesh;
b. to identify actions to halt or reduce the rate of environmental degradation;
c.to improve management of the natural environment;
d. to conserve and protect habitats and bio-diversity;
e. to promote sustainable development; and
f. to improve the quality of life.

36. **Relevance to the project -** The plan proposes development and application of guidelines to avoid environmental pollution due to transport and communication system. It particularly puts emphasis on different environmental pollution, hamper of natural drainage pattern and agricultural land acquisition due to development of transport system.

3. Environmental Conservation Act (ECA), 1995

37. 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.

38. The main objectives of ECA are:

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

39. 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.

40. 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.

41. 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.

- ***Environmental Conservation Act (Amendment 2000)***

42. 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.

- ***Environmental Conservation Act (Amendment 2002)***

43. 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.

- ***Environmental Conservation Act (Amendment 2010)***

44. 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 the 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.

45. **Relevance to the project -** According to this law no industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General of Department of Environment (DoE).

4. Environment Conservation Rules, 1997 (Amended in 2002)

46. 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.

47. 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.

48. 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.

49. 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.

50. 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. These are Orange B for work that requires Initial Environmental Examination (IEE) and Red for work that requires full environmental assessment.

51. 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 Initial Environmental Examination, Environmental Impact Assessment based on approved TOR by DOE, Environmental Management Plan (EMP) etc.

52. 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:

<u>Red Category</u>

- Item 67: include construction / reconstruction / expansion of roads (regional, national and international). So, EIA study and ECC are required from the DOE.

53. **Relevance to the project -** In accordance with the Environment Conservation Rules (ECR) of 1997, the Project is classified as a Red Category, requiring a complete Environmental Impact Assessment (EIA) for RHD to obtain clearance for construction.

5. The EIA Guidelines for Industry (1997)

54. The EIA Guidelines is a handbook defining procedures for preparing IEE/EIA and for reviewing them, prepared for the benefit of the development partners, IEE/EIA consultants, reviewers, and academicians.

55. **Relevance to the project -** The Guidelines provide a step-by-step methodology for the completion of IEE/EIA.

6. Environment Court Act, 2000

56. The Environment Court Act, 2000 has been enacted in order to establish environmental courts in each administrative division of Bangladesh. This Act sets out policy for effective pursuance and completion of legal proceedings related to environmental crimes. Under this Act the Director General of the DOE has the power to impose heavy penalties to industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated ETPs.

57. **Relevance to the project -** According to this act, government can take legal actions if any environmental problem occurs due to project interventions.

7. National Land Transport Policy

58. The Land Transport Policy has been formulated in light of the Government pledge to establish a transport system that is safe, cheap, modern, technologically dependable, and environmentally friendly. The objectives of this policy are:

- To introduce long-term network planning.
- To maintain the road network at a level, this protects the value of the investment.
- To secure a sustainable means of funding road maintenance.
- To improve the management of traffic.
- Management of road-side activities.
- To develop an integrated planning approach in road construction.
- To involve the private sector more in infrastructure, services and maintenance.
- To well protect the environment from road construction program

59. **Relevance to the project -** According to the policy, all new roads and major improvements, tolled or otherwise, are subjected to an Environmental Impact Assessment (EIA).

8. RHD's Road Master Plan

60. The objectives of RHD's road master plan are:

- Protecting the value of RHD's road and bridge assets
- Improving the connectivity of the road network
- Enhancing and developing the strategic road network to meet economic and traffic growth targets
- Improving the zilla road network to enhance connectivity to the country's growth targets
- Improving road safety to reduce road accidents
- Provide environmental and social protection
- Outline the institution improvements required for RHD

61. **Relevance to the project -** According to the plan, the physical and social environment must be protected from adverse effects of road construction.

9. The Forest Act (1927) and the Forest (Amendment) Act (2000)

62. The Forest Act (1927) was enacted to control trespass, illegal resources extraction from forests and to provide a framework for the forestry revenue collection system. It is the main legislative context for forestry protection and management in Bangladesh. The Act allows for the notification of forest reserves in which the government, through the Forest Department, regulates the felling, extraction and transport of forestry produce in Bangladesh. The Act grants the government several basic powers, largely for conservation and protection of government forests, and limited powers for private forests.

63. **Relevance to the project -** The Act is relevant to the project as improvement of the project road will pass through several forest areas and among them there are two designated protected areas.

10. National Forest Policy (amendment), 1994

64. The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977. The policy is designed to conserve the existing forest areas, bring about 20 % of the country's land area under the Forestation Programme, and increase

reserve forests by 10 percent per year to 2015 through coordinated efforts of GoB-NGOs and through active participation of the people.

65. **Relevance to the project -** The Act is relevant to the project as improvement of some part of the project road will be along the protected and reserved forest areas.

11. Bangladesh Wildlife (Conservation & Security) Act, 2012 (previously known as Bangladesh Wildlife (Preservation) Order, 1973; amended as Bangladesh Wildlife (Preservation) Act 1974)

66. This Order aims to protect and conserve wildlife in Bangladesh. Wildlife preservation, conservation and management fall within the jurisdiction of the Forestry Department. The previous Wildlife (Preservation) Order, 1973 & Wildlife (Preservation) (Amendment) Act, 1974 have been revamped to Wildlife (Conservation & Security) Act of 2012.

67. The Act has adopted new types of protected areas for conservation and protection of wildlife resources, created avenue for community conserved areas and also community based management of protected areas. This Act protects 1,307 species of plants and animals under four schedules that mandates imprisonment and fines for wildlife poaching, capturing, trapping, and trading. Bangladesh Wildlife (Preservation) Order (1973) and Act (1974) regulates the hunting, killing, capture, trade and export of wildlife and wildlife products. It designates a list of protected species and game animals. Protection of wildlife is provided with lists of species within four schedules of the Order:

- First Schedule - The Schedule -1 (823) represents Protected Animal (Amphibians-14, reptiles-96, birds-578, mammals-110, fishes-25) of Bangladesh which are open to shooting and may be hunted on a special hunting permit (though since 1988 no hunting permits have been issued by the Government).
- Second Schedule – Schedule-2 (424) also represents Protected Animal (Amphibians-18, reptiles-58, birds-44, mammals-3, fishes-27, phylum cnidaria – class anthozoa (coral)-32, molluscs – shells and snails-137, arthropods – crustacea (crabs and lobster)-22, insect (butterflies and moths)-59, Insect – beetles-24 those species that are not to be hunted, killed or captured and CITES Specification;
- Third Schedule – Schedule -3 (6) represents Vermin-6 Protected animals; and
- Fourth Schedule - Schedule -4 (54) represents Protected Plants-41 and Orchid-13.

68. Under this Act, if any person kills any tiger or elephant mentioned in schedule I without obtaining any license under section 24, he shall be deemed to have committed an offence and shall be non-bail able for such offence and, be punished with imprisonment for a term not less than 2 (two) years and not exceeding7 (seven) years and also with a fine of Taka not less than 1 (one) lac and not exceeding Taka 10 (ten) lac and, in case of his repetition of the same offence, he shall be punished with imprisonment for a term not exceeding12 (twelve) years and with a fine of Taka not exceeding15 (fifteen) lac. If any person collects, acquires or purchases or sells any trophy, uncured trophy, meat, parts of body of any tiger or elephant mentioned in schedule 1without obtaining a permit under section 10,he shall be deemed to have committed an offence and for such offence, be punished with imprisonment for a term not exceeding3 (three) years or with a fine of Taka not exceeding3 (three) lac or with both and in case of his repetition of the same offence, he shall be punished with imprisonment for a term not exceeding 5 (five) years or with a fine of Taka not exceeding 5 (five) lac or with both.

69. Additionally, this Act also states punishment for the violators of the act for different kinds of wild animals and plant.

70. **Relevance to the project -** This Act is relevant to the project as intervention may affect wildlife habitation, obstruct movement particularly the Asian Elephants.

12. National Water Policy, 1999

71. The policy aims to provide guidance to the major players in water sector for ensuring optimal development and management of water. The policy emphasizes efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management. It also addresses issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation and water need for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc. The policy has several clauses related to the project for ensuring environmental protection.

72. **Relevance to the project -** Clause 4.6b of this policy states that natural depressions and water bodies in major urban areas must be preserved in order to recharge of underground aquifers and rainwater management. Moreover, measures must be taken to minimize disruption to the natural aquatic environment in streams and water channels (Clause 4.9b). In addition, this policy requires each water resources development project or rehabilitation program to give full consideration to environmental protection, restoration and enhancement measures consistent with National Environmental Management Action Plan (NEMAP) and the National Water Management Plan (NWMP) and adhere to a formal environment impact assessment (EIA) process, if required by the Government (Clause 4.12a and clause 4.12b).

13. National Water Act, 2013

73. The recently published Water Act 2013 is based on the National Water Policy, and designed for integrated development, management, extraction, distribution, usage, protection and conservation of water resources in Bangladesh. In general, if one takes a critical look at the Act, the new law has provided the right framework for better management of water resources in the country. As per this Act, all forms of water (e.g., surface water, groundwater, sea water, rain water and atmospheric water) within the territory of Bangladesh belong to the government on behalf of the people. The private landowners will be able to use the surface water inside their property for all purposes in accordance with the Act. A worthwhile initiative is the requirement for permits/licenses for large scale water withdrawal by individuals and organizations beyond domestic use. Without prior permission issued by the Executive Committee, no individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor they will be allowed to build any structure that impede the natural flow of rivers and creeks. However, the maximum amount of surface water or groundwater that can be withdrawn by individuals or organizations is not mentioned in the Act. Setting up a priority order for water usage in an area where the water resources is in critical condition is also a significant step.

74. **Relevance to the project -** The Act is considered relevant as the intervention involves reconstruction of culverts at the waterways and water reservoirs along the project road. The IEE study is conducted in consideration of relevant section of the Act.

14. National Agriculture Policy, 1999

75. This policy aims to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable and secure food system for all. One of the objectives of this Act is to preserve and develop land productivity. The policy particularly stresses on research and development of improved varieties and technologies for cultivation in water-logged and salinity affected areas. The policy also

recognizes that adequate measures should be taken to reduce water-logging and salinity and provide irrigation facilities for crop production.

76. **Relevance to the project -** According to the policy the proposed road improvement project must be implemented carefully so that fertile agricultural land is not disturbed. Moreover, adequate measures should be taken to reduce water-logging and hamper of irrigation system due to improvement of the project road.

15. National Land Use Policy, 2001

77. 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.

78. The main contents of this policy are:

- Stopping the high conversion rate of agricultural land to nonagricultural 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.

79. **Relevance to the project -** The proposed project must adhere to this policy so that environmental sustainability of land-use practices is assured.

16. Coastal Zone Policy, 2005

80. The Government has formulated the coastal zone policy (CZPo) that would provide a general guidance to all concerned for the management and development of the coastal zone in a manner so that the coastal people are able to pursue their life and livelihoods within secure and conducive environment. The policy emphasized sustainable management of natural resources and conservation and enhancement of critical ecosystem. But, the policy does not indicate the environmental assessment for the development project in the coastal area. The main objectives are:

- Economic growth.
- Meeting basis needs and creating livelihood opportunities for coastal communities.
- Reduction of vulnerabilities and enhancement of coping capacities.
- Equitable distribution of resources and economic benefits across social strata.
- Empowerment of coastal communities.
- Women's advancement and promotion of gender equality.
- Sustainable management of natural resources.
- Preservation and enhancement of critical ecosystems.

81. **Relevance to the project -** In line with this policy the project must be conducted with minimal disturbance to the natural resources (benthic species, inland fisheries & shrimp, marine fisheries, mangrove forest, etc.) in the coastal area with fragile ecosystem.

17. Coastal Development Strategy, 2006

82. The Coastal Development Strategy (CDS) focuses on the implementation of the coastal zone policy. Nine strategic priorities, evolved through a consultation process, guides interventions and investments in the coastal zone:

- ensuring fresh and safe water availability
- safety from man-made and natural hazards
- optimizing use of coastal lands
- promoting economic growth emphasizing non-farm rural employment
- sustainable management of natural resources: exploiting untapped and less explored
- opportunities
- improving livelihood conditions of people; especially women
- environmental conservation
- empowerment through knowledge management
- creating an enabling institutional environment

83. **Relevance to the project -** According to this strategy the project must be implemented in a way that environmental conservation is ensured in the coastal area.

18. The Embankment and Drainage Act, 1952

84. This Act consolidates the laws relating to Embankments and drainage. It provides provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion or other damage by water.

85. **Relevance to the project -** Disposal of embankment material may create drainage obstruction. So adherence to relevant section of the Act must be addressed in the environmental assessment.

19. Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009

86. The GoB 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. It is built around the following six themes:

- ***Food security, social protection and health*** to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programs focus on the needs of this group for food security, safe housing, employment and access to basic services, including health.
- ***Comprehensive disaster management*** to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.
- ***Infrastructure*** to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructure (cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.
- ***Research and Knowledge management*** to predict that the likely scale and timing of climate change impacts on different sectors of economy and socioeconomic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change.
- ***Mitigation and low carbon development*** to evolve low carbon development options and implement these as the country's economy grows over the coming decades.
- ***Capacity building and Institutional strengthening*** to enhance the capacity government ministries, civil society and private sector to meet the challenge of climate change.

87. There are 44 specific programs proposed in the BCCSAP under the above six themes.

88. **Relevance to the project -** Relevant as the country is vulnerable to climate change effect.

C. International Conventions, Treaties and Protocols (ICTPs)

89. Bangladesh is a party to a large number of international conventions; treaties and protocols (ICTPs) related to the Project and are committed to ensuring that these protocols are complied with during all development works. The five applicable ICTPs that BR is also aware of and is complying with are enumerated in Table II-1.

Table II.1: International Conventions, Treaties and Protocols Signed by Bangladesh

Conventions	Years	Ratified/Accessed (AC)/Accepted(AT)/ Adaptation (AD)	Relevance
International Plant Protection Convention (Rome,) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	1951 1999	01.09.1978 04.12.1974 (AC) (Entry into Force)	Ensuring that the Project work or construction materials do not introduce plant pests
Convention on Wetlands of International Importance ("Ramsar Convention":1971)		20.04.1992 (ratified)	Protection of significant wetland and prevention of draining or filling during construction
Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972)		03.08.1983 (AT) 03.11.1983 (ratified)	Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc.
Convention on Biological Diversity, (Rio de Janeiro, 1992.)	1992	05.06.1992	Protection of biodiversity during construction and operation.
Convention on Persistent Organic Pollutants, Stockholm.	2001	In process	Restrict use of different chemicals containing POPs.
United Nations Framework Convention on Climate Change, (New York, 1992.)	1992	15.04.94	Reduction of emission of greenhouse gases.
Convention on Biological Diversity, (Rio De Janeiro, 1992.)	1992	03.05.94	Conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.
Kyoto protocol to the United Nations Framework Convention on Climate Change		21.8.2001 (AC) 11.12.1997 (AD)	Reduction of emission of greenhouse gases.
International Convention for Protection of Birds, Paris	1950	Signed	Protection of the birds in their wild state.
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters (as amended), London-Mexico city-	1972	Signed	Effective control and prevention of all sources of pollution of the sea by the dumping of waste and other

Conventions	Years	Ratified/Accessed (AC)/Accepted(AT)/ Adaptation (AD)	Relevance
Washington			matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.
Convention Concerning the Prevention and Control of Occupational Hazards caused by Carcinogenic Substances and Agents, Geneva.	1974	Signed	To protect workers against hazards arising from occupational exposure to carcinogenic substances and agents.
Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration, Geneva	1977	Signed	Protection of workers' health against occupational hazards in the working environment due to air pollution, noise and vibration.
Convention on the Conservation of Migratory Species of Wild Animals, Bonn.	1979	Signed	Conservation and sustainable use of migratory animals and their habitats
Convention Concerning Occupational Safety and Health and the Working Environment, Geneva.	1981	Signed	Ensuring occupational health and safety of workers in all branches of economic activity.
Vienna Convention for the Protection of the Ozone Layer, Vienna	1985	02.08.90 (AC) 31.10.90 (entry into force)	Preventing human activities that may have adverse effects on ozone layer.
Convention Concerning Occupational Health Services, Geneva.	1985		Convention Concerning Occupational Health Services, Geneva.
Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal.	1987	31.10.90 (entry into force)	Reduction of the abundance of the substances that deplete the ozone layer in the atmosphere, and thereby protect the earth's fragile ozone Layer.
Convention Concerning Safety in the Use of Chemicals at Work, Geneva.	1990	Signed	Regulating the management of chemicals in the workplaces I order to protect workers from the harmful effects of these substances.
London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London.		18.03.94 (AC) 16.06.94 (entry into force)	To strengthen the control procedure and extend the coverage of Montreal Protocol to new substances.
Preparedness, Response and Cooperation (London, 1990.)30.11.90United Nations Framework Convention on Climate Change, New York	09.06.92	15.04.94	Achieving stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Conventions	Years	Ratified/Accessed (AC)/Accepted(AT)/ Adaptation (AD)	Relevance
Convention on Biological Diversity, Rio De Janeiro	05.06.92	03.05.94	Conservation of biological diversity (or biodiversity) and sustainable use of its components.
International Convention to Combat Desertification, Paris.	14.10.94	26.01.1996 (Ratification) 26.12.1996 (entry into force)	Combating desertification and mitigating the effects of drought.
Agenda 21, UNCED, Rio de Janeiro	1992	Signed	Ensuring sustainable development.
Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992	1992	27.11.2000 (AT) 26.2.2001 (Entry into force)	Extending the coverage of Montreal Protocol to new substances
Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal		27.7.2001 (Accepted) 26.10.2001 (Entry into force)	Controls in the trade of ozone depleting substances and the use of licensing procedures to control the import and export of new, recycled and reclaimed ozone depleting substances.

Source: MoEF, 2013

D. Asian Development Bank (ADB) Policies

90. The ADB Safeguard Policy Statement (SPS), 2009 (ADB, 2009) defines, generally, the actions that should be undertaken to avoid, minimise, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalised by the development process. The three operational components of the safeguard policy are: protection of the environment, protection of vulnerable (indigenous) people, and preventing/minimising involuntary resettlement. These three safeguard policies involve a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. The safeguard policies require (i) identifying and assessing impacts early in the Project cycle; (ii) developing and implementing plans to avoid, minimise, mitigate, or compensate for the potential adverse impacts; and (iii) informing and consulting affected people during the Project preparation and implementation.

91. ADB classifies all its projects into three categories to reflect the significance of a project's potential environmental impacts. The projects with significant adverse environmental impacts that are irreversible, diverse, or unprecedented are categorized as Category A and required a full Environmental Impact Assessment (EIA) with Environmental Management Plan (EMP). On the other hand, a proposed project is classified as category B if its impacts are site-specific, few, and mitigation measures can be designed more readily and required an Initial Environmental Examination (IEE). All other projects with minimal or no adverse environmental impacts are classified as Category C requiring only a short project description/justification statement. Category A projects requires two consultation phases as well as the placement of the EIA on ADB's website for 120 days before ADB Board approval.

92. ADB's safeguard policies have provisions for compliance monitoring throughout the Project cycle and an accountability mechanism whereby people adversely affected by ADB-financed projects can express their grievances and seek solutions. The procedure referred

to as the Grievance Redress Mechanism (GRM) must be defined in every IEE and EIA. It is presented in Chapter IX of this EIA.

93. SPS 2009 has also provisions for identify measures to avoid, minimize, or mitigate potentially adverse impacts on and risks to biodiversity, natural resources, safety of both workers and affected community and physical cultural resources during the design, construction, operation, and decommissioning of the project.

E. Legislation Relating to Occupational Health and Safety

94. During construction, the project will conform to the labour laws and occupational and health related rules as outlined in Table II.2.

Table II.2: 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 workman'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.

F. Environmental Categorization by GOB

95. The MoEF enacted the Bangladesh Environmental Conservation Act (BECA 1995) and the Bangladesh Environmental Conservation Rules (BECR, 1997) in accordance with the guidelines of the National Environmental Policy (NEP 1992), as follow- up of the Rio Conference (1992). A National Land Transport Policy (NLTP 2004) was enacted accordingly to reduce the number of deaths and injuries caused every year due to road accidents. The BECR (1997) categorized the various industries/projects in the country as Green, Orange, and Red, depending on their environmental impacts.

96. The road sector projects including bridge construction have been categorized as Red category, as shown below:

- ***Red Item 67:*** Construction/reconstruction/extension of the regional, national, and international roads;

97. A project that falls into the Red category requires the preparation of an Environmental Impact Assessment (EIA). It is therefore concluded that an IEE should be

prepared along with the Terms of Reference for EIA preparation and an EIA during the project preparation stage is required for getting the environmental clearance.

G. Environmental Categorization by ADB

98. The operational policy of ADB includes the Safeguard Policy Statement of 2009 (SPS, 2009) which covers environment safeguards, involuntary resettlement, and indigenous people. Safeguard policies are generally understood to be operational policies that seek to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. The policy under all 3 safeguard issues involves a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. The safeguard policies require that (i) impacts are identified and assessed early in the project cycle; (ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and (iii) affected people are informed and consulted during project preparation and implementation. The policies apply to all ADB-financed projects, including private sector operations, and to all project components.

99. The classification is completed primarily by ADB staff and the Project is implemented with a classification included. Occasionally the Consultant is asked to classify projects, as was the case with this project. However, the ADB also confirmed the categorization prior to the preparation of this report.

100. The project road is part of the National Highway (N1) which is presently runs through several forest areas. Due to several anthropogenic activities the roadside forest areas are already degraded and hardly can be said as forest area. Additionally, the road improvement will be conducted within the RHD land and the direct/indirect impact will remain within the road side areas only. Therefore, due to the nature and small scale of this project and applying safeguard standards the project has been classified as category B project. Category B refers to proposed projects if it is likely to have environmental impacts that are generally site-specific, largely reversible and readily addressed through mitigation measures. In this case an Initial Environmental Examination (IEE) is required.

H. GoB Environmental Clearance

101. Steps to be followed for obtaining the Environmental Clearance Certificate for this road are shown in Figure II-1. For any Orange B or Red Category project, an IEE must be submitted to DoE in order to obtain clearance to proceed to construction, or to undertake the full EIA if Orange B is upgraded to Red by DoE. Once the IEE of Orange B is approved by DoE, the environmental requirements have been met. All Red Category projects require a DoE-approved IEE before proceeding to EIA preparation. Once the EIA has been approved, the clearance certificate is issued.

102. The No Objection Certificate (NOC) – this is a mandatory requirement to obtain environmental clearance from the Department of Environment (DoE). Usually DoE indicates the name of the agencies from whom NOC would be required. DoE requires that proponent obtain NOCs from affected agencies or local/regional administrations, which essentially sign off on the project. It is only after these NOCs are provided that DoE gives the Environmental Clearance Certificate, or green light to proceed to construction.

103. A NOC letter basically contains description of the project including location, justification to obtain NOC from that agency, and proposed measures under the project. In this Project, RHD will submit the NOC letter to the agencies mentioned-above. This is a labour and time intensive process and can take more than a month, and is largely contingent on regular and persistent follow up. Therefore the ECC steps are:

104. RHD submits NOC letter or submits the standard NOC form of DoE, if applicable. The steps are:

- RHD sends letters to head of the agency;
- The requesting agency then evaluate the NOC request that sometime require field investigation for verification;
- RHD will pursue this and generally requires constant follow up to get a result; and
- Once the NOC's are received-signed, they are forwarded by RHD to DOE.

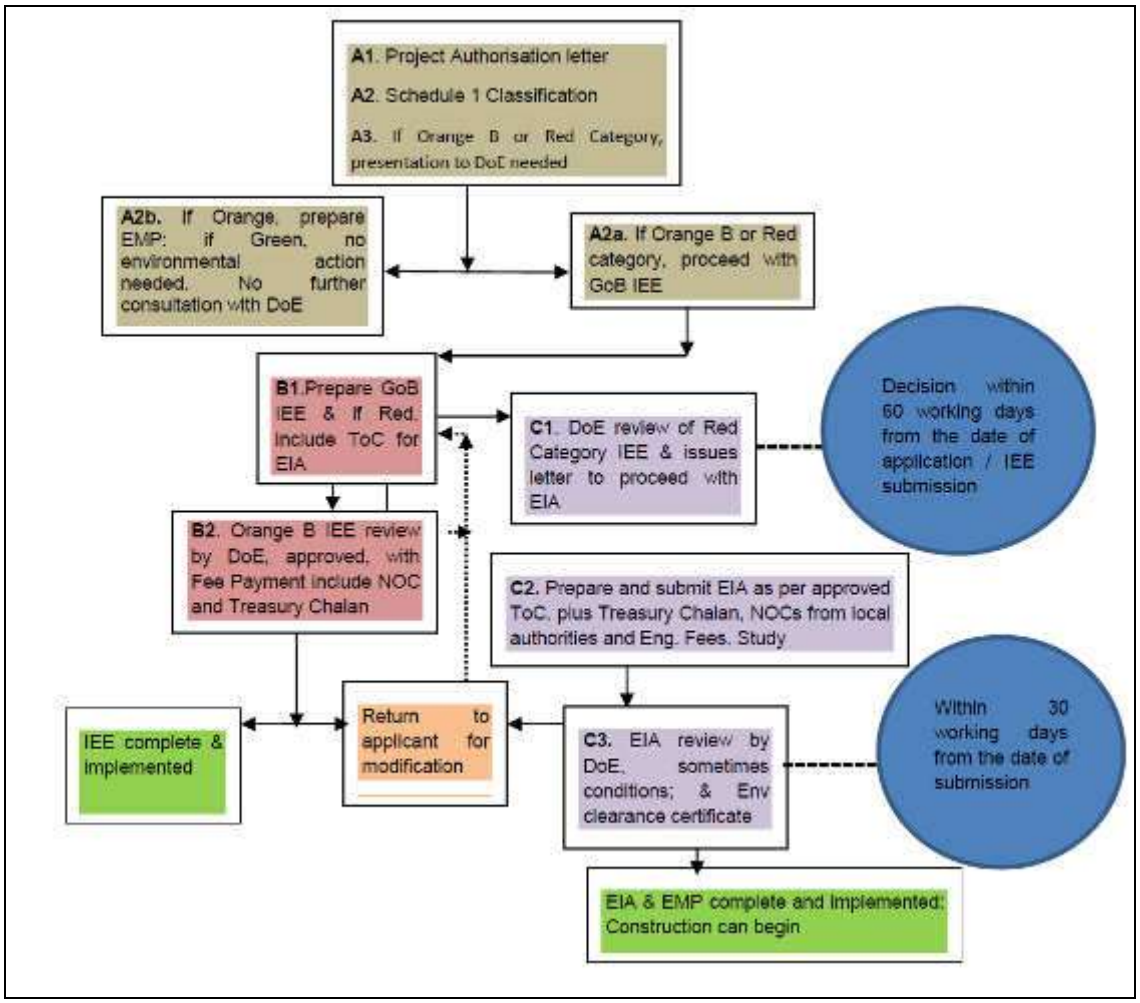


Figure II.1: Government of Bangladesh Environmental Assessment Process

I. Environmental Studies Needed

105. Environmental Assessment (EA) Studies for development interventions are the Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), Environmental Management Plan including Environmental Monitoring Plan. The main objectives of the Environmental studies are:

- To assess the potential environmental impacts of the Project,
- To identify mitigation measures to minimize and /or off set the adverse impacts at pre-construction, construction and operational phase of the Project, and
- To prepare and implement an Environmental Monitoring Plan to ensure that the project is environmentally sound and sustainable.

106. These studies are related to the types of development interventions and impacts on environmental components (Physical, Ecological, Socio-economic, and Pollution) at different implementation stages (Pre-construction, Construction, and Operational). Environmental studies are conducted based on primary data collected during site visits, from the socio-economic, hydrological, topographic, and engineering surveys at project sites, data collected from consultation with a cross-section of the public, consultation with project colleagues and concerned RHD officials, and from secondary data.

107. Implementation of the above interventions will have significant impacts on various environmental components; hence, they will require comprehensive environmental studies in accordance with the DOE and ADB guidelines. The project road involve the improvement and widening with 1.8m, hence their impacts on environmental conditions may be insignificant and will be less compared to new road construction or massive rehabilitation. In addition, the impacts on agriculture, livelihoods, ecological components, infrastructure, and pollution, will be very insignificant.

108. The preparation of IEE and EIA is obligatory under environmental legislations and rules of Bangladesh, as well as for compliance the environmental guidelines of donor agency, ADB. An environmental clearance certificate (ECC) from DoE is required for initiating project implementation activities. The EA study needed is based on the degree of project impacts for decision making and planning, acts as legal document for the implementing agency and as a management tools to stakeholders and guidelines for the Contractor during project implementation phases.

III. DESCRIPTION OF THE PROJECT

A. General

109. The Government and people of Bangladesh have displayed extraordinary generosity towards Rohingya refugees. However, the speed and scale of the refugee influx exceeds the capacity of the host country and humanitarian community stepped up its support to respond to the immense needs on the ground. Months after the influx, the refugees remain forced to rely upon humanitarian assistance for their basic needs and survival. However, the access road to the Rohingya refugee camps is vulnerable due to the growing traffic with humanitarian supports, breakdown of old culverts and inadequate funds for maintenance. The improvement of the present access road is essential for smooth movement of vehicles with proper road safety.

B. Need for the Project

110. The growing road traffic to the Rohingya Refugee Camps with foods, shelter construction materials and the humanitarian support teams along with regular vehicles are creating the existing corridor very congested. Moreover, the existing carriageway is not prepared considering the present traffic volume which is one of the major reasons for road damage. Road safety on the existing access road is inadequate because it is overcrowded with different types of vehicles, including rickshaws, bicycles, motorcycles, cars, buses, and trucks. When vehicles break down this reduces the highway to a single lane leading to traffic delays and congestion. This upgradation will provide enough additional capacity in this important corridor to accommodate future traffic growth and will also meet the demand for a safer and more reliable road connection.

111. The project road is a vital link in the national highway network. The completion of the proposed improvement will substantially improve transport efficiency on the road linking the Cox's Bazar-Teknaf Highway.

C. Location and Size of the Road

112. The project road starts from the intersection with Chittagong-Cox's Bazar Highway (N1) at Link Road, traverse for a length of 80.76 km and ends at the Shapla Chattar at Teknaf. This Road is a part of National Highway (N1) which connects the last upazila of South-east corner of Bangladesh with the other regions. This is also a common route to visit the only coral island 'St. Martins'; one of the major tourist spots in Bangladesh. The location map of the project roads is presented in Figure III-1.

Figure III.1: Location Map of the Project Road

D. Road Design

113. The project road has been segmented in to three Contract Packages (CP) for implementation and the bidding document will be prepared accordingly. For better understanding this report also used the segmentation of the three Contract Packages through the entire reports. The Contract Packages are given below:

I. Rehabilitation of National Highway (N1) From Link Road (Cox's Bazar) (Ch: 381+494) to Ukhiya (Ch: 406+494)
II. Rehabilitation of National Highway (N1) From Ukhiya (Ch: 406+494) to Unchiprang (Ch: 431+494)
III. Rehabilitation of National Highway (N1) From Unchiprang (Ch: 431+494) to Teknaf (Ch: 462+254)

114. The present road is two lanes with 5.5m carriage way and will be upgraded to 7.3m after widening 0.9m at either side of the road. The carriage way at each side typically will have of 1.2 m soft shoulder at either side. The side slope of road embankment will be of 1:2. The RoW required is available throughout the road which is occupied by the RHD and no land acquisition will be required.

115. Typical cross sections of road improvement for normal road and rigid pavement at market sections are given at Figure III-2 and Figure III-3 respectively. The pavement works comprise construction of sub-grade, sub-base, base binder course and wearing course. The road has been designed following road safety requirements as per RHD published guidelines and standards. The overview of the road improvement for all the three contract packages are given in Table III-1, III-2 and III-3 respectively.

Table III.1: Overview of Road Improvement for CP01

Sl. No.	Item	Unit	Quantity
1	Overlay and Strengthening	km	23.00
2	Widening (0.90 m on Both Side)	km	23.00
3	Rigid Pavement in Bazar Portion	km	2.00
4	Earthwork	cum	84187.26
5	Construction of Soil Earthen Shoulder	cum	1500.00
6	Reconstruction of R.C.C Box Culvert (10 nos.)	m	32.00
7	U Drain/ V Drain/ Saucer Drain	m	6500.00
8	Brick Toe Wall	m	1000.00
9	Misc. (Sign Signal, Guide Post, Road Marking etc.)	-	-

Source: RHD, BoQ of EAP, 2018

Table III.2: Overview of Road Improvement for CP02

Sl. No.	Item	Unit	Quantity
1	Overlay and Strengthening	km	21.000
2	Widening (0.90 m on Both Side)	km	21.000
3	Rigid Pavement in Bazar Portion	km	4.000
4	Earthwork	cum	154932.75
5	Construction of Soil Earthen Shoulder	cum	0.00
6	Reconstruction of R.C.C Box Culvert (10 nos.)	m	50
7	U Drain/ V Drain/ Saucer Drain	m	12200.00
8	Brick Toe Wall	m	2000.00

Sl. No.	Item	Unit	Quantity
9	Misc. (Sign Signal, Guide Post, Road Marking etc.)	-	-

Source: RHD, BoQ of EAP, 2018

Table III.3: Overview of Road Improvement for CP03

Sl. No.	Item	Unit	Quantity
1	Overlay and Strengthening	km	28.76
2	Widening (0.90 m on Both Side)	km	28.76
3	Rigid Pavement in Bazar Portion	km	2.00
4	Earthwork	cum	167422.83
5	Construction of Soil Earthen Shoulder	cum	1500.00
6	Reconstruction of R.C.C Box Culvert (10 nos.)	m	24.00
7	U Drain/ V Drain/ Saucer Drain	m	9500.00
8	Brick Toe Wall	m	3600.00
9	Misc. (Sign Signal, Guide Post, Road Marking etc.)	-	-

Source: RHD, BoQ of EAP, 2018

E. Road Improvement Works

1. Earthworks

116. The road alignment will require both filling of low land and cutting through the highland in order to achieve a workable grade and required road width. The proposed embankment will be constructed with suitable fill material, likely obtained by suction dredging from the nearby river or the eroded soil from nearby hills will be collected. Preparation of the road embankment will require of 406542.84m^3 (Source: RHD, BoQ of EAP, 2018) of earth materials.

2. Make-up and Repair Shoulders

117. Sometimes earthen shoulders do not have correct slopes and levels. It requires little filling, re-compaction and bring back to correct slopes and provision of turfing.

3. Restore Damaged Slopes

118. Sometimes existing slope loses correct shape due to sliding and raincut. It requires clearing & Grubbing, earth filling and compaction and turfing.

4. Existing Surface Strengthening

119. The existing surface will be strengthened by providing 150mm Aggregate Base Type-1 and 50mm overlay/wearing course.

5. Rigid Pavement

120. At market section area there will be rigid pavement with the total width of 8000m for proper drainage a rectangular drain will be used.

6. Improvement of the Drainage System

121. In the hill area, the drainage system does not function. It should be improved and replaced to V-shaped gutter. Additionally, the road improvement works also include the construction of longitudinal drains.

7. Road Safety

122. The road does not have proper sign, marking and signaling along the corridor and particularly near sensitive locations. The road improvement works include the road safety issue by providing the adequate sign and making at all required locations.

F. Traffic Survey

123. The existing traffic was surveyed from Link Road (Cox's Bazar) to Teknaf during the project preparation stage by the RHD of Cox's Bazar. The summary of the traffic survey is given in Table III.4.

G. Social and Resettlement Considerations

124. The social safeguard work to be addressed under Project was triggered due to relocation of temporary shops and businesses from the proposed RoW.

125. The scope of social safeguard works for Project preparation thus include (i) consultation with affected communities and stakeholders; (ii) social surveys and census of all affected persons having temporary shops, and (iii) income and livelihood restoration of the affected persons. There are 80 shops/commercial units within the Project alignment (EAP, Social Survey 2018).

H. Schedule of Implementation

126. Completion of the Safeguard Studies and procurement of contractors will be finished by the end of December 2018. The construction of the proposed road improvement will be started on January 2019 and will be continuing for 1.5 years.

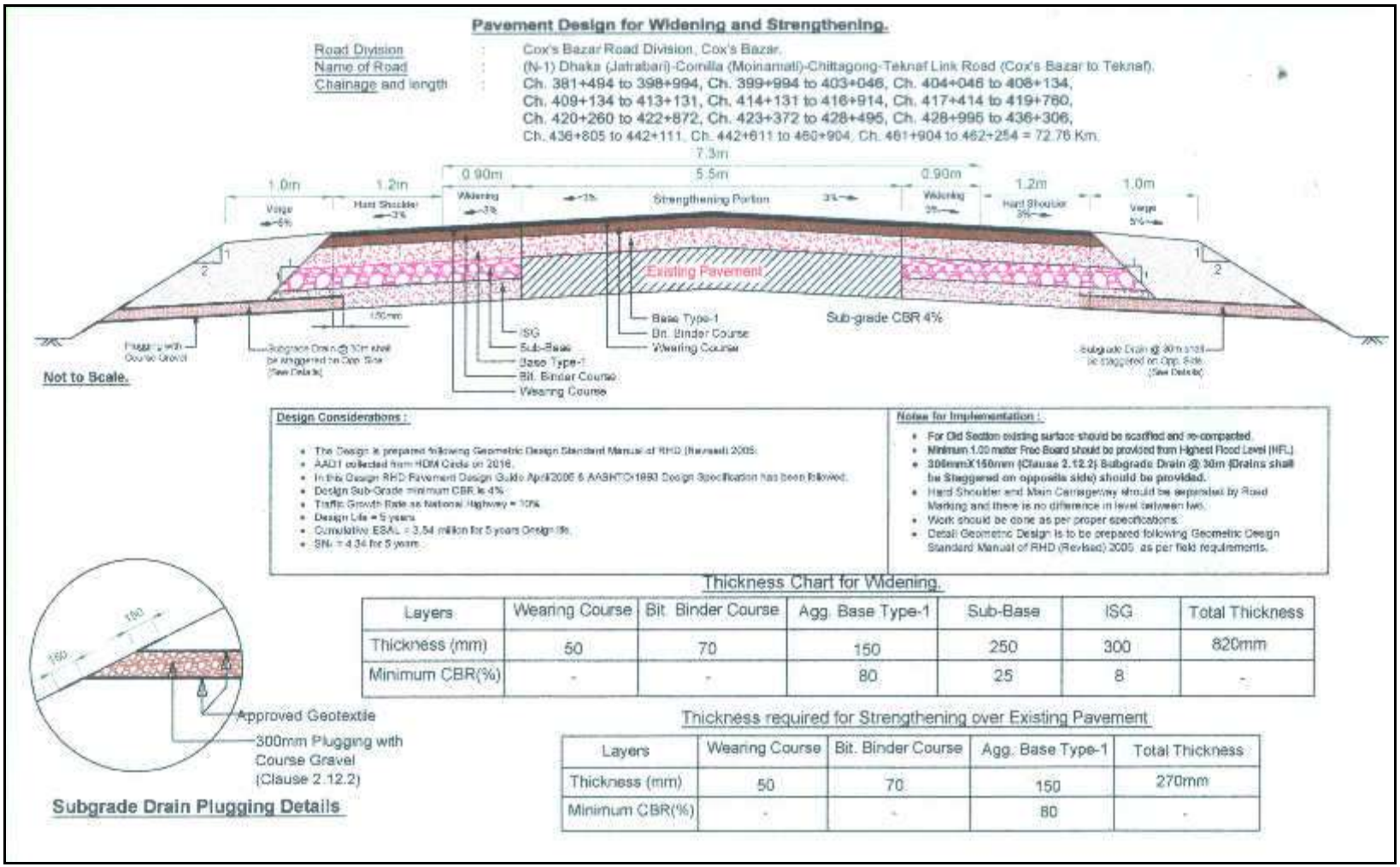
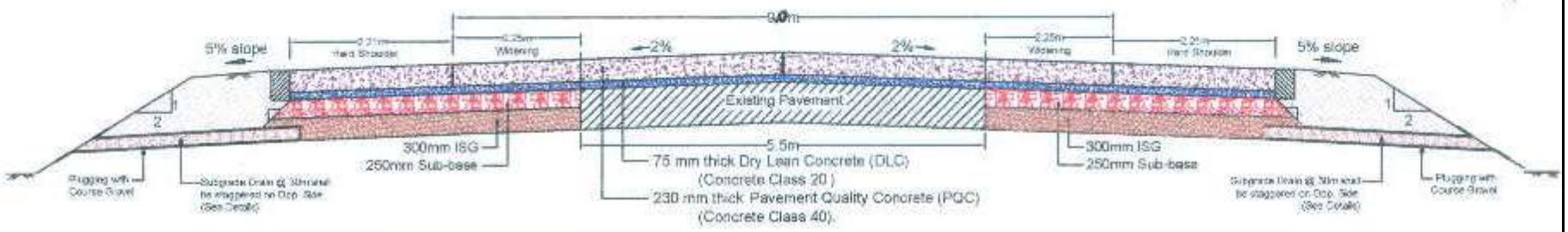


Figure III.2: Typical Cross Section of the Proposed Road Alignment

Rigid Pavement Design.

Road Division : Cox's Bazar Road Division, Cox's Bazar.
Name of Road : (N-1) Dhaka (Jatrabari)-Comilla (Moinamati)-Chittagong-Teknaf Link Road (Cox's Bazar to Teknaf)
Chainage and length : Ch. 398+994 to 399+994, Ch. 403+046 to 404+046, Ch. 408+134 to 409+134
Ch.413+131 to 414+131, Ch. 416+914 to Ch. 417+414, Ch. 419+760 to 420+260
Ch. 422+872 to 423+372, Ch. 428+495 to 428+995, Ch. 436+306 to 436+805,
Ch. 442+111 to 442+611, Ch. 460+904 to 461+904 = 8.00 Km.



Notes :

- For Old Section existing surface should be scarified and re-compacted.
- All Dimension are in millimeter unless otherwise mentioned.
- For PQC 28 days cylinder crushing strength of concrete f 'c = 40 mpa equivalent to 5800 psi.
- For DLC 28 days cylinder crushing strength of concrete f 'c = 20 mpa equivalent to 2900 psi.
- Yield strength of M.S Bar fy = 60000 psi.

Thickness Chart for Rigid Pavement.

Layers	Portion	PQC	DLC / LC	Sub-Base	ISG	Total Thickness
Thickness (mm)	Widening	230	75	250	300	855
Thickness (mm)	Existing	230	75	Existing Pavement		305
Concrete Class/ Minimum CBR(%)		C-40	C-20	25	8	-

Figure III.3: Typical Cross Section of the Rigid Pavement

Table III.4: Traffic Survey Result for the Project Road

Traffic Survey Result														
Date	Truck			Bus			Others							Total
	Heavy	Medium	Small	Large	Medium	Micro	Utility	Car	A/R	M/C	B/C	C/R	Cart	
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
24/06/2108	106	524	990	60	523	1277	833	46	5926	1230	45	176	0	11736
25/06/2018	108	575	962	55	534	1234	835	37	5626	1257	38	181	0	11442
26/06/2018	109	549	949	52	555	1285	911	38	6052	1237	41	176	0	11954
27/06/2018	132	608	1051	65	575	1313	1038	48	6080	1345	61	161	0	12477
28/06/2018	118	565	1025	61	585	1322	1046	54	6036	1338	57	157	0	12364
29/06/2018	105	473	915	61	504	1113	963	38	5203	1186	64	112	0	10737
30/06/2018	96	539	975	64	532	1268	1063	49	5686	1243	57	139	0	11711
Average	**111**	**548**	**981**	**60**	**544**	**1259**	**956**	**44**	**5801**	**1262**	**52**	**157**	**0**	**11774**

IV. DESCRIPTION OF THE BASELINE ENVIRONMENT

A. General

127. 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.

128. Data was collected mostly from secondary sources for the macro-environmental setting like climate (temperature, rainfall, humidity, and wind speed), physiography, geology etc. Firsthand information collection was limited during the feasibility study to record the micro environmental features within and adjacent to the project corridor. Collection of primary information includes extrapolating environmental features on proposed road design, tree inventories, location and measurement of socio-cultural features adjoining proposed road. Consultation was another source of information and to explain local environmental conditions, impacts, and suggestions, etc.

129. 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; and
- **Socio-economic Environment-** anthropological factors like demography, income, land use and infrastructure.

B. Physical Environment

1. Climate

130. Although less than half of Bangladesh lies within the tropics, the presence of the Himalayan 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 located in south-eastern climatic regions.

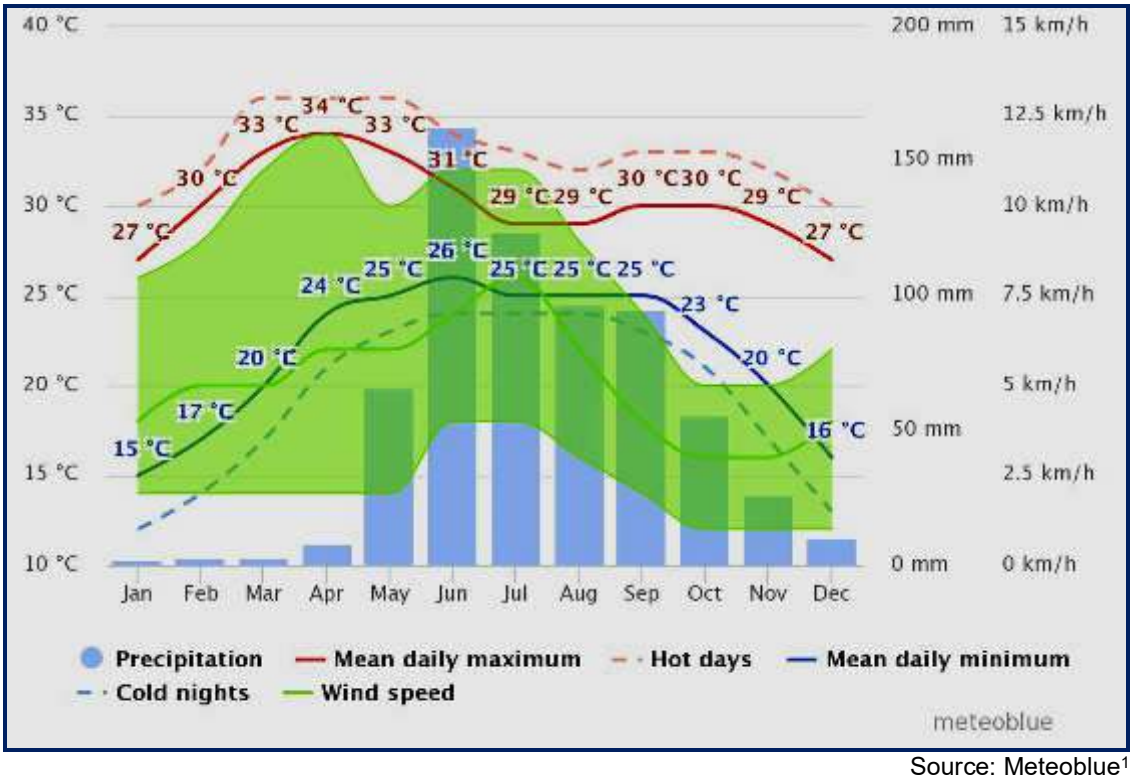
i. ***South-eastern zone:*** It comprises the Chittagong sub-region and a strip of land extending from southwest Sundarbans to the south of Comilla. The hills over 300m in height have north-eastern zone climate. The rest of the area has a small range of temperature, rarely goes over a mean of 32°C and below a mean of 13°C. Rainfall is heavy, usually over 2,540 mm. In winter dew fall is heavy.

131. The sea breezes in Chittagong and Chittagong-Teknaf coasts carry moisture to the land mass moving against the easterly circulations to create a convergence line. This causes nocturnal showers with thunderstorms riding over the easterly circulations throughout the year.

132. The climatic condition of the whole project area may be considered same as reported in Cox's Bazar meteorological station, since this station is closed to the project areas. The climate data are derived from the meteoblue. The meteoblue climate diagrams are based on 30 years of hourly weather model simulations. The weather models with historical data from 1985 onwards and generated a continuous 30-year global history with hourly weather data.

a) Temperature

133. Bangladesh has warm temperatures throughout the year, with relatively little variation from month to month. Figure IV:1 shows the mean daily maximum and minimum air temperature of 30 years of Cox's Bazar. As temperature record shows, April is the warmest month. Although in short spell, there exists a winter season in Bangladesh from November to February.



Source: Meteoblue[1]

Figure IV.1: Temperature and Rainfall in Cox's Bazar

134. The "mean daily maximum" (solid red line) shows the maximum temperature of an average day for every month. Likewise, "mean daily minimum" (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years. Monthly precipitations above 150mm are mostly wet, below 30mm mostly dry.

b) Rainfall

135. Heavy rainfall is characteristic of Bangladesh frequently causing flood across the country or at local scale. With the exception of the relatively dry western region of Rajshahi, where the annual rainfall is about 1,600 mm (63.0 in), most parts of the country receive at least 2,300 mm (90.6 in) of rainfall per year. About 80% of Bangladesh's rain falls during the monsoon season. Maximum rainfall occurs during May to September and the lowest rainfall occurs in November to February during winter season. Figure IV:1 shows the average monthly precipitation of 30 years of Cox's Bazar. The number of sunny, partly cloudy and nos. of rainy day is given in Figure IV:2 below.

[1] https://www.meteoblue.com/en/weather/forecast/modelclimate/cox%e2%80%99s-b%c4%81z%c4%81r_bangladesh_1336134

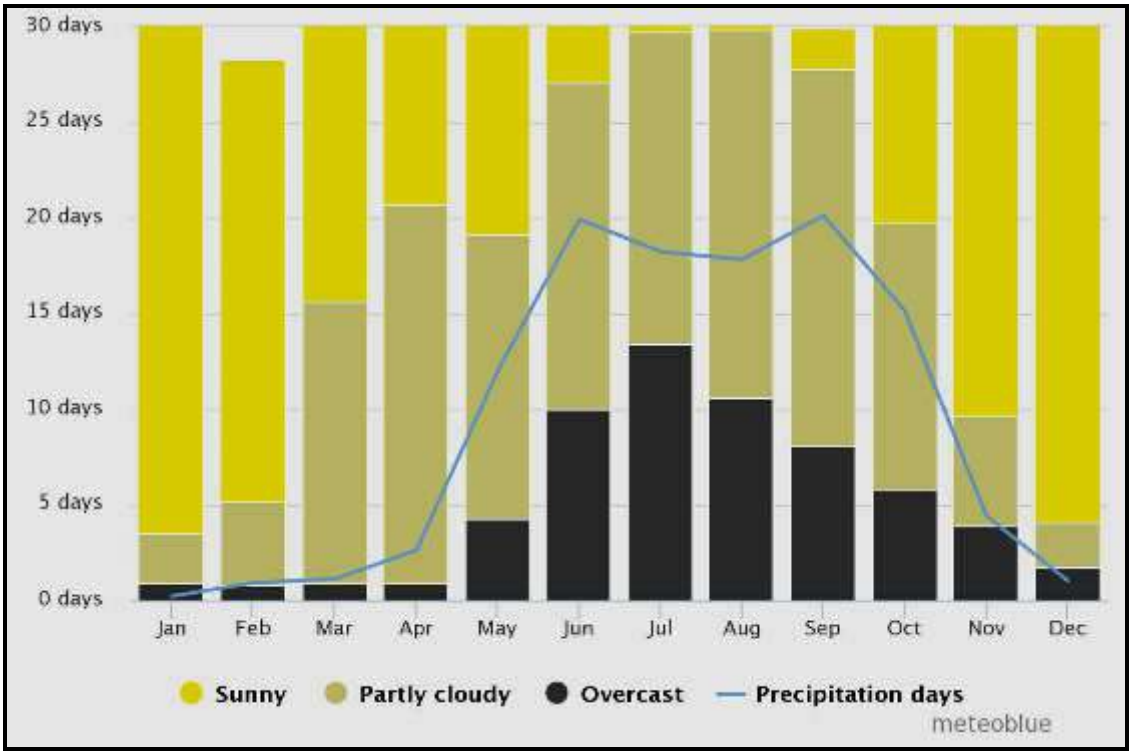


Figure IV.2: Number of Sunny, Rainfall and Cloud Coverage Days in Cox's Bazar

136. The graph shows the monthly number of sunny, partly cloudy, overcast and precipitation days. Days with less than 20% cloud cover are considered as sunny, with 20-80% cloud cover as partly cloudy and with more than 80% as overcast.

c) Wind Speed and Direction

137. Wind could be the biggest and most influential weather fact. So it is extremely important to know the direction and velocity. The Wind Rose model is used to understand wind factors. The wind rose (Figure IV:3) provides an overview of prevailing wind conditions within the project area.

138. The wind rose shows how many hours per year the wind blows from the indicated direction. From all the wind rose diagrams it can be said that the region is predominantly characterized by North-east, East-Southeast, South-East, and West wind flow. The average wind speed ranges from 5 to 19 km/h during maximum period in a year.

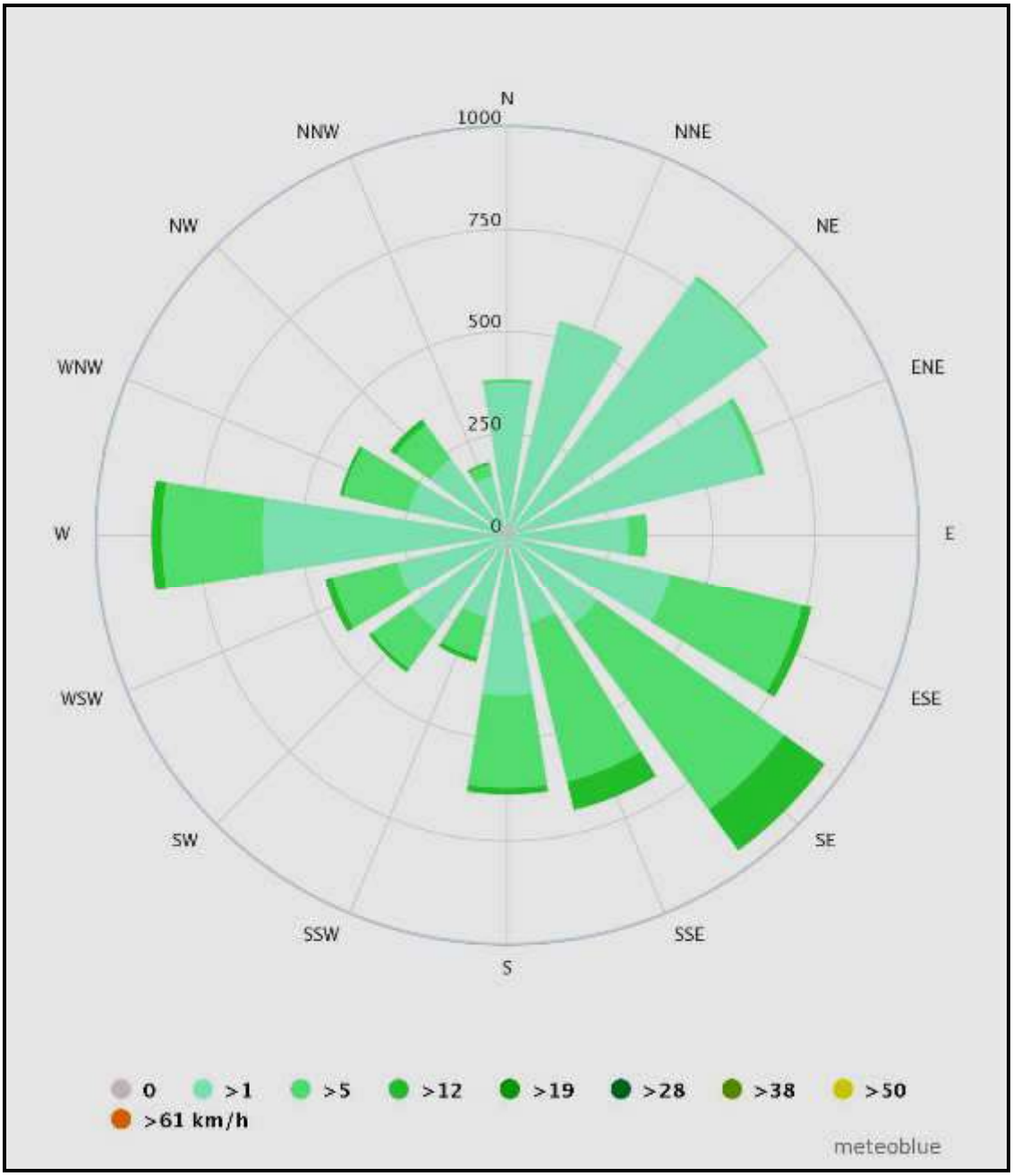


Figure IV.3: Wind rose Diagram in Chittagong

2. Topography

139. Nearly 12.5 percent area of Bangladesh in north northeast and south southeast regions is hilly, 8.5 percent in the north centre and North West is flood free terrace land and 79 percent area is level land prone to seasonal inundation to variable depths. Topography of the eastern hill region is steeply dissected uplands with valleys between the hills that slope towards the west. The relief of the valley area has changed with time due to gully erosion and due to human interventions e.g. clearing of vegetation for agriculture, land filling settlements, development of commercial, socio-cultural structures, digging of ponds for storing water, and finally due to urbanization.

140. The rivers and creeks that drain the eastern hill region shed water through the project area. Impact of shifting cultivation on hill slopes can cause gully erosion, the erosion products ultimately get deposited in rivers and channel bottoms affecting depth and duration of flood in coastal plains and valleys.

3. Physiographic Features

141. The physiography is the form of the earth's surface. In Bangladesh this may be classified into three distinct physiographic regions (a) floodplains, (b) terraces, and (c) hills. Each physiographic region has unique distinguishing characteristics. The three main physiographic regions can be further subdivided into 24 sub-regions and 54 sub-units.

142. The Project area occurs primarily within one physiographic unit, being the "Chittagong coastal plain". The plain along the coast extends from the Feni River to the mouth of the Matamuhuri delta, a distance of 121 km. It comprises gently sloping piedmont plains near the hills, river floodplains alongside the Feni, Karnafuli, Halda and other rivers, tidal floodplains along the lower courses of these rivers, a small area of a young estuarine floodplain in the north, adjoining sub-regional young Meghna estuarine floodplain, and sandy beach ridges adjoining the coast in the south. Sediments near the hills are mainly silty, locally sandy, with clays more extensive in floodplain basins. The whole of the mainland area is subjected to flash floods. Flooding is mainly shallow and fluctuates in depth with the tide (except where this is prevented by river or coastal embankments). The average daily rise in the tide is about two metres. Some soils on tidal and estuarine floodplains become saline in the dry season.

4. Geology and Soil

143. Bangladesh is situated to the east of the Indian sub-continental plate. Nearly 85% of Bangladesh is underlain by deltaic and alluvial deposits of the Ganges, Brahmaputra, and Meghna river systems. Geologically Bangladesh sediments belong to the Recent (floodplains), Plio-Plaistocene (terraces) and Mio-Pliocene (hills) periods (Wadia 1957 and Morgan and McIntire 1959). The dissected hills in the south eastern region (project area) belong to the Mio-Pliocene while the coastal and inter-tidal zone belongs to the recent periods.

144. The general soil types of the project road area predominantly include the Brown Hill Soils. This type of soils Occupy gentle to very steep slopes of northern and eastern hills. These soils have been developed over consolidated or unconsolidated rocks, which are imperfectly to excessively drained. In most of the cases, they have Cambic or Argillic B-horizon. But some of them are very shallow soils overlying rock or iron pan at less than 25 cm depth. Generally the subsoils are yellow to strong brown, friable, porous, sandy loam to sandy or silty clay loam, very strongly to extremely acidic. In shallow soils there are rock fragments or soft-bedded structure. The majority of these soils are Dystric Cambisols and Haplic and Ferric Alisols.

5. Water Resources and Hydrology

145. Bangladesh and the western portion of the Indian State of Bengal are located within the 'Bengal Basin'. According to Rahman et al (2003), this basin includes the world's largest river delta, which is 140,000 square kilometers (the Ganges-Padma, Jumna-Brahmaputra-Tista and Meghna rivers and numerous tributary complexes) and the world's largest submarine fan complex (the Bengal Fan). These river systems carry a combined annual sediment load of 1.5 to 2.4 billion metric tons.

146. The headwaters of both the Ganges-Padma and Brahmaputra-Jumuna-Tista river systems are situated in the Himalayas ranges. Water in the Meghna River, originates from

the Shillong Plateau. It drains one of the heaviest rainfall areas of the world. As a result of these extensive catchments, flooding is an annual occurrence in Bangladesh and occurs mainly during the rainy season between May to October when the rainfall in the catchments is at its maximum intensity.

147. Bangladesh has an average annual surface flow of approximately 1,073 million acre feet (MAF), of which about 870 MAF (93%) are received from India as inflow and the remaining 203 MAF (7%) as rainfall. This water is enough to cover the entire country to a depth of 9.14m. About 132 MAF (65% of rainfall and 12% of total) is lost to evaporation each year (114.30 cm), the remainder flows out to the Bay of Bengal.

148. Bangladesh is located over a subsiding basin of tectonic origin with a great thickness of sedimentary strata. This forms an unconsolidated alluvial deposit of recent age, overlaying marine sediments. The near surface Quaternary alluvium contains good groundwater aquifer characteristics (transmission and storage coefficients). The typical groundwater storage reservoirs in Bangladesh have three divisions: upper clay and silt layer, a middle composite aquifer (fine to very fine sand) and a main deep aquifer consisting of medium to coarse sand.

149. Average annual rainfall in the country varies from greater than five meters in the northwest to less than 1.5 meters in the west. The majority of Bangladesh receives between 1.5 and 2.5 meters of precipitation annually (Reimann, 1993) and the Project area is located in a relatively high rainfall area. Under natural conditions a large proportion of the precipitation enters surface water as runoff and a large proportion infiltrates through the soils to groundwater aquifers. Most rivers in Bangladesh lose water to groundwater aquifers during the wet season and gain water from February through April (Pitman, 1993). The rate of water transfer depends on the extent which the river is incised into permeable aquifer materials.

150. Groundwater levels in most of Bangladesh are within two meters of the ground surface during July through October. Groundwater levels during the dry season vary across the country depending upon the proximity to surface water, depth and type of aquifer, extent of irrigation, and many other factors.

a) Surface Water

151. The water bodies in EHR largely occur beyond the project affected site but the inter-tidal zone along sea coast is tidally inundated and there are ponds at village sites and in valleys. The Karnaphuli, Sangu, Matamuhuri and Bakkhali rivers and the innumerable seasonal chharas (channels) drain the on rushing run-off from the eastern uplands. The localized problem of salinity intrusion in shallow ground table caused due to over exploitation in coastal plain and in urbanized sites is required to be mitigated before the situation gets worse but this is not directly related to the project.

152. The wetland areas in Bangladesh and at project site have shrunk due to land use conflicts, watershed degradation in catchments. Pollution of open water bodies due to discharge of industrial effluent, solid wastes and fish culture affected aquatic bio-diversity and wetland environment. Additionally, there are very minimum numbers of water bodies along the project road which might be affected due to road construction.

153. The key issues related to surface water quality at EHR particularly along the project road are (i) collection, storage and disposal of household solid wastes, (ii) use of surface water for domestic, agricultural and industrial uses instead of exhausting the groundwater, (iii) control of gully erosion will reduce wetland shrinkage due to sedimentation and (iv)

development of storm water drainage system in urban areas to reduce public inconvenience. A river network map in the project area is given in Figure IV.4 below.

Figure IV.4: River Network in the Project Area

b) Groundwater

154. Bangladesh including the project site is rich in groundwater (GW) reserve and annual recharge rate is also high. Groundwater both deep and shallow is subject to over exploitation during dry season for domestic, agricultural and industrial uses. GW in coastal plain, settlements and in urban areas show downward trend during dry season with consequent salinity intrusion in shallow aquifer due to over exploitation. Recharge of GW in coastal plain zone is between 100-200 mm annually. Recharge in GW is constrained due to poor permeability, presence of compact clay layer at variable depths and slope gradient.

155. The Shallow Groundwater Table (SGWT) at highway site occurs within 50 meter deep during dry season while the Deep Groundwater Table (DGWT) occurs below 100-150 meter deep in coastal plain and over 300 meter deep on hills. The GW both deep and shallow is arsenic free but contains soluble iron and aluminum. Salinity intrusion in shallow tube wells in coastal plain is already evident (WARPO 2000).

6. Seismicity

156. Bangladesh is situated in one of the most tectonically active regions in the world. Here is where three major plates meet (the Indian Plate, the Tibet Sub-Plate, and the Burmese Sub-Plate). The project area is located over the Indian Plate, which is moving north. However due to the location of relevant plates, fault lines and hinge zones, Bangladesh itself is divided into three seismic zones, based on the ranges of the seismic coefficient (*note: the seismic coefficient is a measure of how strong an earthquake has the potential to be based on a combination of the mass of the plate and the seismic forces acting on it, as well as how frequently these quakes are likely to occur*). Zone 3 is in the most seismically active area with a seismic coefficient on 0.25, and Zone 1 is the least active with a significantly lower seismic coefficient of 0.075 (Zahiruddin, 1993). As per the seismic zone classifications, project road falls in zone II means medium seismic intensity (Figure IV.5). Some major earthquake near and around the project area since 1548 are listed below:

Table IV.1: Chronology of Important Earthquake near the Project Area from 1548

Year	Description of Event
1548	The first recorded earthquake was a terrible one. Sylhet and Chittagong were violently shaken; the earth opened in many places and threw up water and mud of a sulphurous smell.
1762	The great earthquake of April 2, which raised the coast of Foul island by 2.74m and the northwest coast of Chedua island by 6.71m above sea level and also caused a permanent submergence of 155.40 sq km near Chittagong. The earthquake proved very violent in Dhaka and along the eastern bank of the meghna as far as Chittagong. In Dhaka 500 persons lost their lives, the rivers and jheels were agitated and rose high above their usual levels and when they receded their banks were strewn with dead fish. A large river dried up, a tract of land sank and 200 people with all their cattle were lost. Two volcanoes were said to have opened in the Sitakunda hills.
1865	Terrible shock was felt, during the second earthquake occurred in the winter of 1865, although no serious damage occurred.
1997	Occurred on 22 November in Chittagong with a magnitude of 6.0. It caused minor damage around Chittagong town.
1999	Occurred on 22 July at Maheshkhali Island with the epicentre in the same place, a magnitude of 5.2. Severely felt around Maheshkhali island and the adjoining sea. Houses cracked and in some cases collapsed.
2003	Occurred on 27 July at Kolabunia union of Barkalupazila, Rangamati district with magnitude 5 1. The time was at 05:17:26.8 hours.

(Source: National Encyclopedia of Bangladesh, Banglapedia, CDEditionFebruary2006)

Figure IV.5: Seismic Zones of Bangladesh

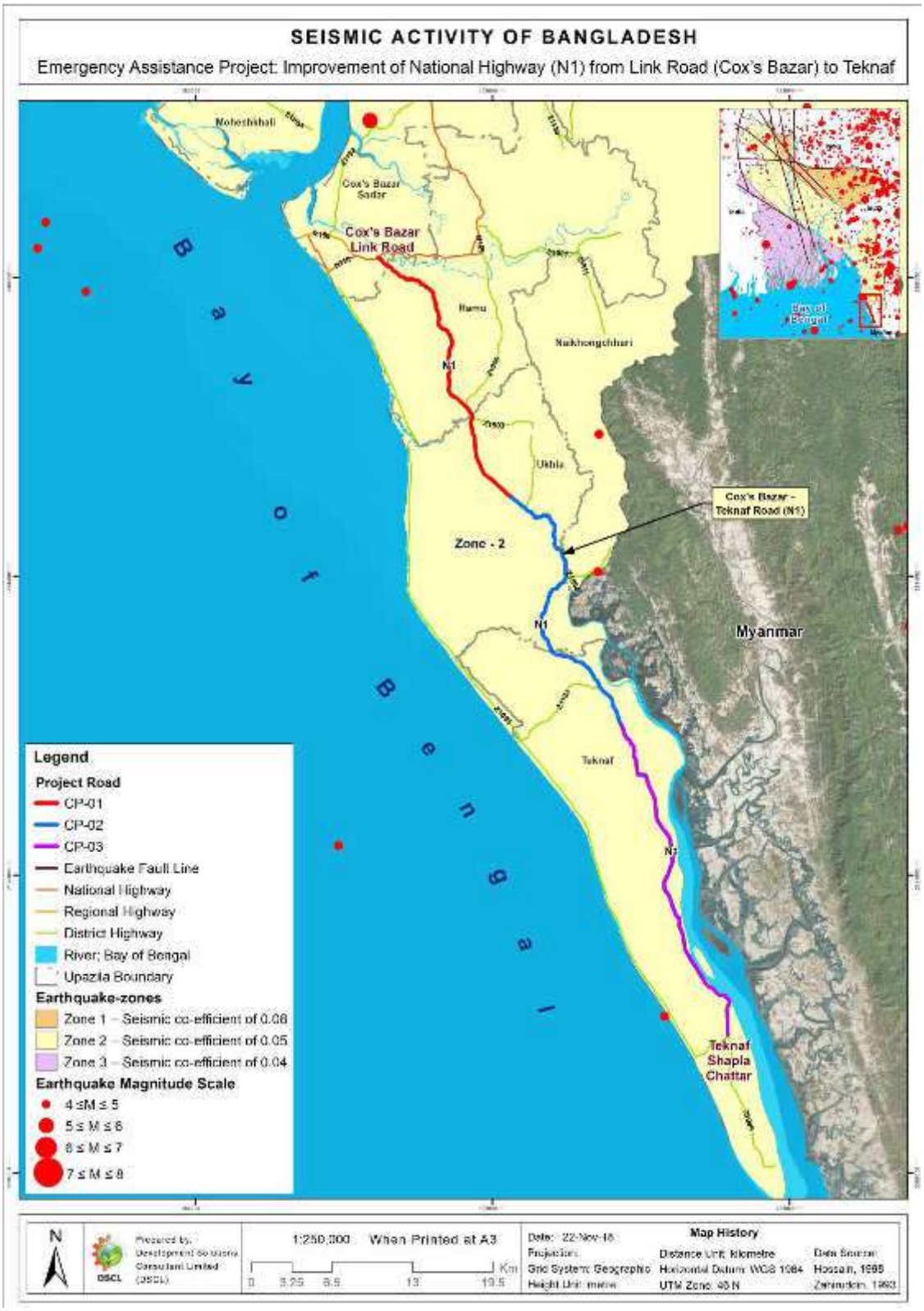


Figure IV.6: Seismic Activity in the Project Area

157. In July 1999 the Moheshkhali Island and its adjoining sea were affected by around 5.2 magnitude earthquake. During the design of the project structure the historical

information of earthquake should be taken care of. A recent historical earthquake statistics are shown in Table IV.2 (Source: Bangladesh Meteorological Department).

Table IV.2: Historical Earthquake around Bangladesh

Sl No.	Date (D/M/Y)	Lat (°N)	Long (°E)	Magnitude (Richter Scale)	Location of Epicenter
1	10-01-1869	24.79	93.17	7.5	Kachar, Assam, India
2	14-07-1885	24.70	89.55	7.0	Eastern Province, Nepal
3	12-06-1897	25.84	90.38	8.8	Shilang, Meghalaya, India
4	08-07-1918	24.16	91.75	7.6	Dauki, Meghalaya, India
5	02-07-1930	25.95	90.04	7.1	Dhubri, Assam, India
6	15-01-1934	26.60	86.8	8.3	Bihar-Nepal Border
7	23-10-1943	26.80	94.00	7.2	Assam, India
8	15-08-1950	28.79	95.62	8.6	Tibet, China
9	21-03-1954	25.86	94.00	7.2	Assam, India
10	08-07-1975	25.58	92.60	6.5	Assam, Sillon
11	06-08-1988	25.13	95.15	6.6	Manipur-Myanmar Border
12	21-11-1997	22.07	92.75	8.5	Arakan, Myanmar
13	11-08-2009	15.01	92.30	7.8	Andaman Islands

(Source: National Encyclopedia of Bangladesh, Banglapedia, CD EditionFebruary2006)

7. Natural Hazards

158. In Bangladesh, due to its unique geographic location, suffers from devastating tropical cyclones frequently. The funnel-shaped northern portion of the Bay of Bengal causes tidal when cyclones make landfall due to which thousands of people living in the coastal areas are affected. Some of the most devastating natural disasters in recorded history with high casualties were tropical cyclones that hit the region now forming Bangladesh (Wikipedia, 2015). The project area falls under high to low risk zone of cyclone in its different sections (Figure IV.7). Due to its topography the project area is free from flooding (Figure IV.8).

Figure IV.7: Cyclone Map of Bangladesh

Figure IV.8: Flood Map of Bangladesh

C. Biological Environment

1. Bio-ecological Zones

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

160. Each of the ecosystems has many sub-units with distinct characteristics as well. IUCN Bangladesh in 2002 classified the country into twenty five bio-ecological zones. The project road alignment falls in the "Chittagong Hills and the CHTs" bio-ecological zone. The south-eastern hill range of the country is composed of tropical evergreen and semi evergreen forest, which are important watershed areas of the country. The majority of the species in the lower canopy are evergreen, and the upper canopy of the forest is deciduous type. Tropical evergreen forest is found in the valleys of this zone. Knowledge on the diversity of reptiles and amphibians of this zone is rather rudimentary, as few surveys of these animals have been made. This zone possess richest avifauna population of the country mostly marine and shore birds (IUCN, 2002f).

2. Diversity of Terrestrial and Aquatic Flora

Terrestrial Flora

161. The terrestrial ecosystem at EHR includes hilly lands, settlements, road side plantation and locally block plantation. Dominant forest species are segun (Tectona grandis), garjan (Dipterocarps spp.), telsur (Hopea orodata), civet (Switonia floriband), dhaki jam (Syzygium grande), Koroi (Albazia spp), gamar (Gamelina arborea), Chapalish (Artocarpus chaplasa), etc. Dominant tree species on road sides are rain tree (Samanea saman), mahogany (Swietonia spp), raj koroi (Albizia richardiana), babla (Albizia nilotica), segun (Tectona grandis), eucalyptus (Eucalyptus camaldulensis), jack fruit (Artocurpus heterophylus), mango (Manifera indica), neen (Azdirecta indica) etc. Settlement trees are mango (Mangifera indica), black berry (Syzygium cumini), jack fruit (Artocarpus heterophyllus), neem (Azdirecta indica), coconut (Cocos nucifera), betel nut (Areca catechu), chakunda (Cassia tora), hijal (Baringtonia acutangula), mandar (Erithrina indica), Bamboo, and several fuel wood species. A survey of roadside located near the present carriageway has been carried out by the Consultant team during the environmental assessment. A detailed list of terrestrial floral species found in the project area is shown in Table IV.3. the listed trees found at the roadside during the

Table IV.3: List of Plants in the Project Area

Sl. No.	Local Name	*Scientific Name*	*IUCN Redbook status***
1	Mango	*Magnifera Indict*	DD
2	Kathal	*Artocarpus Heterophyllus*	DD
3	Jam	*Syzygium cumini*	NE
4	Lichi	*Litchi chinensis*	LC
5	Piyara	*Psidiun guajava*	DD
6	Amra	*Spondias mombin*	LC
7	Papaya	*Carica papaya*	DD

Sl. No.	Local Name	*Scientific Name*	*IUCN Redbook status***
8	Akashmoni	*Acacia auriculiformis*	LC
9	Koroi	*Albizia procera*	NE
10	Akonddo	*Calotropis gigantean*	DD
12	Rain tree	*Samanea saman*	DD
13	Palm Tree	*Dypsis lutescens*	NT
12	Golpata	*Nypa fruticans*	LC
13	Debdaru	*Polyalthia longifolia*	NE
14	Jhau	*Tamarix aphylla*	-
15	Mahogany	*Swietenia mahagoni*	EN
16	Chakunda	*Senna obtusifolia*	LC
18	Eucalyptus	*Eucalyptus sp.*	LC
19	Dhaincha	*Sesbania bispinosa*	LC
20	Babbla	*Acacia nilotica*	DD
21	Bahera	*Terminalia bellirica*	DD
22	Bot	*Ficus benghalensis*	DD
23	Dhundul	*Luffa cylindrical*	DD
24	Dumur	*Ficus racemosa*	LC
25	Gamari	*Gmelina arborea*	DD
26	Haritaki	*Terminalia chebula*	DD
27	Jambura	*Citrus maxima*	DD
28	Jamrul	*Syzygium samarangense*	DD
29	Jarul	*Lagerstroemia speciosa*	DD
30	Segun	*Tectona grandis*	-
31	Gorjon	*Rhizophora apiculata*	LC
32	Pithraj	*Aphanamixis polystachya*	LC
33	Jolpai	*Elaeocarpus floribundus*	DD
34	Chalta	*Dillenia indica*	-
35	Arjun	*Terminalia arjuna*	DD
36	Epil Epil	*Leucaena leucocephala*	NE
37	Joba	*Hibiscus rosa-sinensis*	CR
38	Jolpai	*Elaeocarpus floribundus*	DD
39	Lebu	*Citrus sp.*	DD
40	Mandar	*Erythrina indica*	LC
41	Bash	*Bambusa nutans*	CR
42	Boroi	*Ziziphus jujube*	LC
43	Kamrangga	*Averrhoa carambola*	LC
44	Kola	*Musa acuminate*	DD
45	Borak Bash	*Bambusa vulgaris*	-
46	Tolla Bash	*Banbusa nutans*	-
47	Soyaben	*Glycine max*	-
48	Narikal	*Cocos nucifera*	DD
49	Nageswar	*Mesua ferrea*	DD
50	Nim	*Azadirachta indica*	DD
51	Nimbhut	*Murraya koenigii*	DD
52	Shupari	*Areca catechu*	DD
53	Shimul	*Bombaxceiba L.*	LC

Sl. No.	Local Name	*Scientific Name*	*IUCN Redbook status***
54	Sojina	*Moringa oleifera*	DD
55	Ata	*Anonna reticulata*	-
56	Bel	*Agele mermelos*	-
57	Tal	*Borassus madagascariensis*	EN
58	Tatul	*Tamarindus indica*	LC
59	Chapalis	*Artocarpus chama*	-
60	Krishnachura	*Delonix regia*	LC
61	Kodom	*Neolamarckia cadamba*	DD
62	Khajur	*Phoenix rupicola*	NT
63	Gajari	*Sohera robusta*	LC
64	Sishu	*Dalbergia sissoo*	-
65	Kamranga	*Averrhoa carambola*	LC
66	Bokul	*Mimusops elengi*	-
67	Almond	*Terminlia catappa*	DD
68	Alu	*Dioscorea alata*	-
69	Radhachura	*Peltophorum pterocarpum*	DD
70	Teli Garjan	*Dipterocarpus turbinatus*	CR
71	Telsur	*Hopea odorata*	CR
72	Deua	*Artocarpus Lacucha*	-
73	Madar	*Erithrina fuska*	-
74	Bet	*Calamus tenuis*	LC
75	Jatneem	*Azadirachta indica*	LC
76	Rabar	*Heva brasiliensis*	-
77	Jika	*Lannea coromandelica*	-
78	Bilombi	*Averrhoa bilimbi*	-
79	Keura	*Sonneratica apetala*	LC
80	Gab	*Diospyros blancoi*	-
81	Komola	*Citrus reticulata*	-
82	Shabu	*Metronylon sagu*	-
83	Tun	*Toona cilialta*	LC
84	Chatim	*Alstonia scholaris*	LC
85	Shotomuli	*Asparagus racemosus*	-
86	Methi	*Trigonella foenumgraecum*	-
87	Kumbi	*Careya arborea Roxb.*	-
88	Khalshi	*Aegiceras carniculatum*	LC
89	Hijlibadam	*Anacardium occidentale*	LC
90	Kokra	*Aporusa aurea Hook. F.*	-
91	Latka	*Baccaurea ramiflora Laur*	-

**There is no IUCN Red List for flora developed in Bangladesh. The status is given based on the global status and may vary with the national context.
Abbreviations: EXTINCT (EX), EXTINCT IN THE WILD (EW), CRITICALLY ENDANGERED (CR), ENDANGERED (EN), VULNERABLE (VU), NEAR THREATENED (NT), LEAST CONCERN (LC), DATA DEFICIENT (DD), NOT EVALUATED (NE)

162. The roadside trees along the project corridor are primarily planted under the social forestation programme of Forest Department (FD). The number of trees planted by the RHD is comparatively lower.

Figure IV.9: Roadside Vegetation along the Project Corridor

Aquatic Flora

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

3. Diversity of Terrestrial and Aquatic Fauna

Terrestrial Fauna

164. The diversified habitat and ecosystem in the project area support various types of animals. Primary and secondary mode was adopted for identification of fauna. The terrestrial mammals at EHR are jackal, mainland serow, mongoose, Asiatic wild dog, civet cats, jungle cat, otter, squirrel, porcupine, fishing cat, leopard, bear, hare, scaly ant eater, monkey, capped monkey, macaque, slow loris, Asiatic elephant, etc. Reptile and lizard species include common vine snake, cobra, wall gecko, black monitor, golden monitor and giant monitor. Other vertebrate species are toad, bull frog, green frog, cricket frog, rodents and others.

165. The project area particularly the forest area is the habitat of the Asian elephant (*Elephas maximus*), the largest animal living on land in Asia. This elephant is listed as endangered under the IUCN red list. Their population is under rapid decline due to habitat loss, degradation and fragmentation.

166. Asian elephants are migratory species. It can move more considerable distances even with a short period. In the wild, elephant herds follow well-defined seasonal migration routes. The survival of this species largely depends on corridors and routes because it allow elephants to safely migrate, access food sources and establish crucial genetic links between herds. It is the chore of the eldest elephant to remember and follow the traditional migration routes. The presence of traffic on the road, construction of steep retaining walls and the presence of human population along the entire corridor and routes can limit the migration of elephants.

167. The avifaunal species are dove, pigeon, parakeets, fly catcher, hawk cuckoo, koel, crow pheasant, owl, drongo, black drongo, common myna, talking bird (black myna), house

crow, red vented bulbul, house sparrow, jungle babler, grey tailored bird, magpie robin, black headed munia, pond heron, little egret, cattle egret, water hen, crane, duck, etc.

168. The Teknaf Animal Sanctuary provides some degree of protection to most of the species mentioned above. There is some evidence of Elephant activity outside the Teknaf Game Reserve; Warning road signs and anecdotal evidence of Elephants passing through forested areas near the road. There are no Elephant migration routes across the Naff River to Myanmar.

169. Of the significant wildlife species found in the project area, it is mainly the Asian elephant, *Elephas maximus* that needs attention from the perspective of project impacts, since the project road traverses the elephant crossing routes at a number of locations.

170. Lack of available food in the forests has led the elephants to enter into the crop fields and people's households. On one hand, people's livelihoods are dependent on crops and they always try to protect it. On the other hand, elephants need food and this conflicting interest creates severe human-elephant conflict. Moreover, present investigation shows that human settlements, agricultural lands, roads and highways, brick fields, army cantonments, village markets etc. were constructed within or near the elephant movement routes and corridors. This further created human-elephant conflicts and resulted in human casualties, elephant deaths, human injuries, damages to crops and so on. As elephants always follow their fixed routes and corridors during movement, construction of infrastructures have largely affected their mobility.

Aquatic Fauna

171. Fish is the most important aquatic fauna of the project areas, along with other groups. The aquatic fauna includes Prawns (Macrobrachium spp.), crabs, snails (Pila, Vivipara, Lymna etc.), freshwater mussels (Lamellidens sp.) etc. invertebrates and several species of fish. Kolabang (Rana tigrina); Guishap (Varanusbengalensis) and Matia sap (Enhydrisenhydris) are common. The aquatic birds are Pancowri (Phalacrocoraxcarto), Kanibok (Ardeolagrayii), Sadabok (Egrettagarzetta), Borobok (Egrettaalba), Machranga (Halcyon pileata), Dahuk (Gallicrexcinerea), and winter migratory birds – Balihash (Dendrocygnajavanica) and Chakha (Tadornaferruginea). In addition to fish cultivation people in this area mostly catch the fishes in the sea.

4. Environmental Protected Areas

172. The Bio-ecological zones defined by IUCN (2000) for Bangladesh are the protected landscapes considering their ecological importance. The eco-resources of the country depleted chronologically due to demographic pressure, natural calamities, poor enforcement, poor management and land use conflicts. Hence, GoB considered several of the sites as environmentally sensitive and declared as protected areas through gazette notifications. Amongst the notified 29 ecologically sensitive landscapes the estuarine land, wetland, mangrove forest and virgin hill forests are also included. Three sites in the Sundarbans, one Hakaluki Haor in Sylhet and one in Tanguar Haor at Sunamganj and Char kukri mukri at Bhola district have been notified as Ramsar Convention Sites. The historical site and structures, cultural structures, archaeological sites and national monuments are also the declared protected sites. The MoEF and other Ministries also declared some sites as protected through notification.

173. Based on information obtained to date there are two designated Forestry areas that the road passes through (Figure IV.10). Data has been obtained from various websites and Forest Department (FD) on Himchari National Park and Teknaf Game Reserve Table IV.4.

Table IV.4: Notified Protected Areas along the Project Road

Name	Type	Wildlife importance	Total area (hectare)	Location	Notification Year
Himchhari National Park	National Park	Birds, Gibbon, Rhesus Macaque, Leopard Cat, Fishing Cat, Tiger, Sloth Bear, Wild Boar, Dhole	1729	Cox's Bazar	1980
Teknaf Wildlife Sanctuary	Game Reserve	Elephant, deer, wild boar, other animals, but no data at present	11615	Teknaf	1983

Source: Forest Department 2005

174. The Himchari National Park is comprised of lush tropical rain forest, grasslands and trees, and features a number of waterfalls. To protect the area from encroaching developments, Himchari National Park was established in 1980 by the Bangladeshi government as a conservation area for research, education and recreation. At one time the stomping grounds of herds of Asian elephant, Himchari is still home to a limited number of these majestic animals. Other mammals that visitors may see when exploring the park include Gibbon, Rhesus Macaque, Leopard Cat, Fishing Cat, Tiger, Sloth Bear, Wild Boar, Dhole (also known as the Asiatic Wild Dog) and Indian Muntjac. Additionally the Himchari National Park is home to around 56 species of reptiles and 13 amphibian species. There are well over 100 species of trees, shrubs, grasses, canes, palms, ferns and herbs in the park, while beautiful orchids break the innumerable shades of green with splashes of color. Many of the herbs found in Himchari National Park have therapeutic properties that the local people understand and can make use of. This wide variety of plant life provides suitable habitats for the more than 286 species of birds that call the park home, including the Barn Swallow (*Hirundo rustica*), Asian Palm Swift (*Cypsiurus balasiensis*) and *Acridotheres fuscus*.

175. The Teknaf Game Reserve lies on the west side of Cox's Bazaar- Teknaf highway has been declared protected for conservation of both floral and faunal species particularly for conservation of Asiatic elephant species presently native to Bangladesh. The declaration of protected areas by MoEF is intended for conservation hill forest species, the ecosystem and biodiversity for consideration of ecological, educational and recreational values.

176. Despite degradation, Teknaf WS is still home to a small population of endangered Asian Elephants which comes into regular conflict with local people. The fauna of the WS has been only partially studied, but the wider Teknaf peninsula is home to a diverse fauna: some 260 species of birds including the impressive and globally vulnerable Great Slaty Woodpecker and Grey Peacock Pheasant, and mammals such as Rhesus Macaque and Hog Badger, and is home to the last population of Long-tailed Macaque in Bangladesh.

177. Though these are designated Forestry and National Park many of the areas close to the existing road have already been settled, cultivated and impacted by human development and can longer be classified as environmentally critical areas. The areas close to the road

have been significantly denuded and in many instances there is little clear evidence of primary forest and in some areas secondary forest near the road alignment.

178. There is extensive Forest Department land within the area; the majority of land is within their control. Most is defined as Shrub and Grass with some plantation land. No land is defined as Natural Forest. The road alignment passes through the forest areas illustrated in Figure IV.11.

Figure IV.10: Environmental Protected Areas along the Project Road

Figure IV.11: Forest Areas along the Project Corridor

D. Socio-economic Environment

1. General

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

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

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

2. Administrative Structures

181. Bangladesh is divided into eight administrative Divisions. Each Division is divided into Districts/Zilas; there are 64 Districts within Bangladesh. Districts/ Zila's are subdivided into Upazilas (there are 483 Upazilas in Bangladesh), which consist of a number of Union Parishads. Union Parishads of which there are 4486 in Bangladesh are the locally elected governments at the village level.

182. The Project area is located in Cox's Bazar district within Chittagong Division. The project alignment passes through Cox's Bazar Sadar, Ramu, Ukhiya and Teknaf upazila.

3. Demography

183. Bangladesh population increased from 106.31 million in 1991, 124.35 million in 2001 and 142.32 million in 2011 with an average annual growth rate 1.58% in 1991-2001 and 1.34% in 2001-2011 (Population & Housing Census 2011, Preliminary result, BBS July 2011).Presently 28.4 million people live in six cities while the urban population is 38.6 million (BBS 2005,2008). The total population of Cox's Bazaar district is 1.77 million while over 52,000 live at Cox's Bazaar town.

184. There are significant refugee populations of Rohingya people from Myanmar who have been migrating over the last 30-40 years with significant numbers in recent years. UNCHR manage the refugee camp sites and monitor ongoing refugee migration. Kutupalang and Noyapara are the two largest camps in the vicinity of the road. A map showing all the refugee camps along the project road is given in Figure IV.12.

Figure IV.12: Location of Rohingya Refugee Camps along the Road

185. Indigenous people belonging to the Indo-Burmese, Mongolian and Dravidian origins live in Bangladesh. Indigenous people in Cox's Bazaar district is 25,000 (BBS 2008). The ethnic minorities are either naturalized within the main stream population or have moved deep inside hill forests, hence will not be specifically affected by the Cox's Bazaar-Teknaf road improvement activities.

4. Land Use Patterns

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

187. The land use pattern along the alignment like other areas has traditionally been devised based on soil condition, relief, climate, hydrology and flood conditions, availability of resources, etc. The road alignment would impact the local land uses positively due to establishment of fast, safe and convenient road linkages between the project command areas and small markets of semi-urban/rural areas. In the project area land use calculation are shows in Figure IV.13. The details of the land use maps are given in Appendix 3.

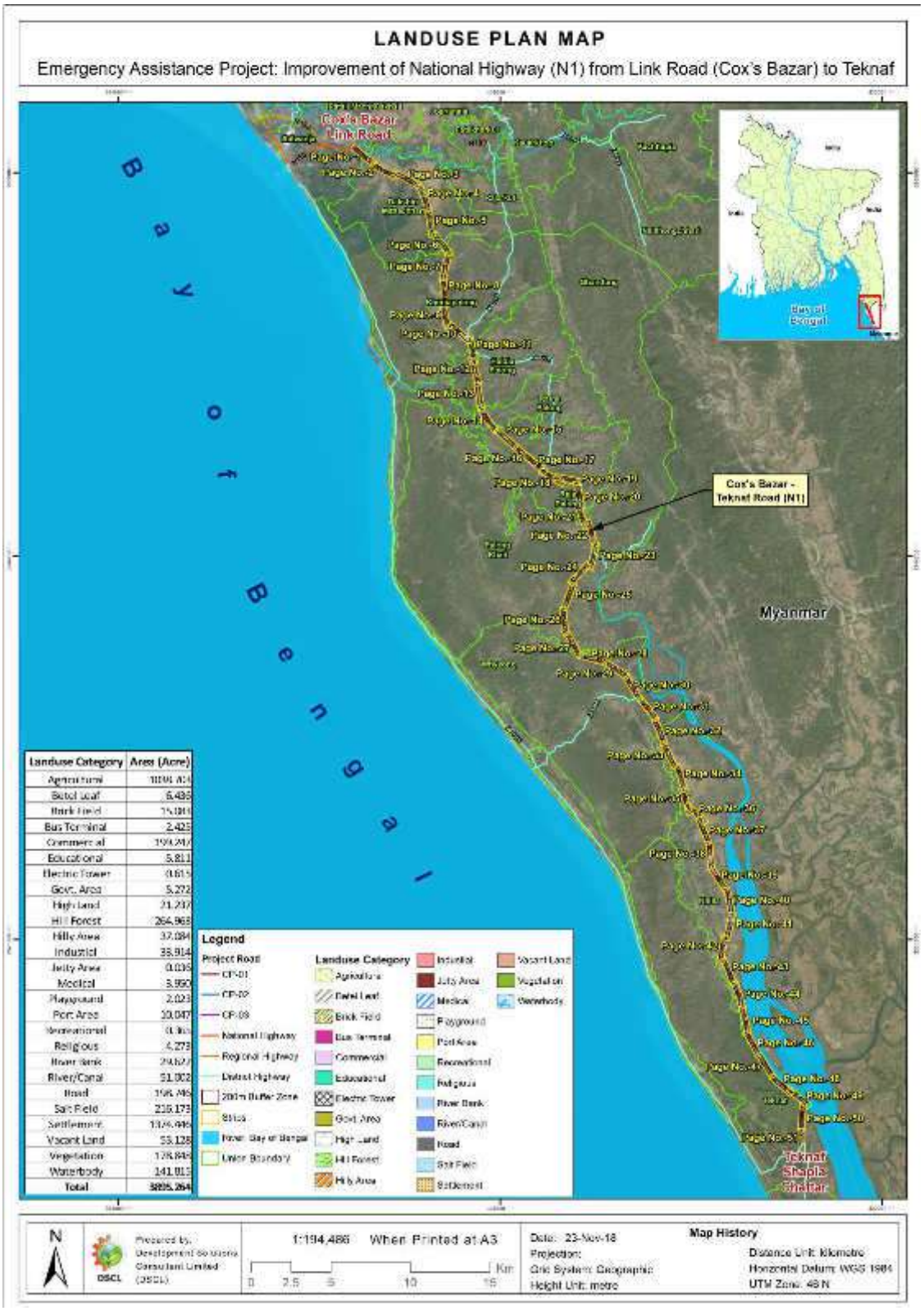


Figure IV.13: Land Use Pattern along the Project Corridor

5. Agricultural Environment

188. Along the project road different type of crop cultivation practice has been observed though the practices are very few. Farmers at this region mostly cultivate rice and vegetables. The land suitable for agriculture at EHR is limited but not prone to seasonal flooding like floodplains lands elsewhere in Bangladesh. Intensive agriculture, growth of industry and urbanization process proceeds within the EHR at an accelerated rate. Population in the region increased consequently in search of employment mainly due to migration. The region presently has limited potential for agriculture growth mainly due to lack of land availability, limited availability of irrigation water, flash floods, occasional cyclonic storms, and shortage of agriculture labour. The local people prefer working in forest, marine fishing and in trading farms rather than as agriculture laborers. In recent years the trend continued and many are working in industries, transport industry and in other sort of jobs.

6. Tourism

189. The project area is one of the famous tourism places in Bangladesh where tourists visit round the year. The Pagodas at Cox's Bazaar and Teknaf are rich in Buddhist architectures and indigenous cultures of eleven different indigenous tribes living in Chittagong and Chittagong Hill Tracts. The eroding indigenous cultures, traditional attires and artifacts have good potential to attract the local and expatriate tourists provided these are conserved and developed properly and facilities developed. The beach at Inani, Teknaf and Cox's Bazaar already developed some facilities for tourists and remain crowded for large part of the year. Thousands of tourists visit the St. Martin, Sonadia and Moheshkhali off-shore islands every year particularly during the dry seasons. Development of improved land communication, safe and clean accommodation and local transport facilities will attract more and more tourists in the region.

190. The designated Forestry areas referred to above attract small numbers of domestic and international tourist and there is potential for significant growth in the future. Teknaf Game Reserve however appears to be used primarily as a picnic spot and there is limited interest in the wildlife and nature trails

7. Cultural and Common Property Resources

191. Cultural Property means those have a regional and or national cultural heritage, e.g., ancient mosque, historic buildings, works of art, archaeological sites, libraries and museums and Common Property Resources mean the property usually used by the local communities, e.g., educational institutes, religious institutes, Eidgah, Crematory etc. These properties require to be protected as they contribute to local culture and will remain in the Project area during operational period of the Project. Along the project road there are several numbers of mosques, temples, church, schools, colleges, madrashas, bazars, etc. these cultural property resources are the sensitive receptors along the alignment which might be impacted due to the pollution from road construction. The lists of these sensitive receptors are given in the Figure IV.14, 15, and 16 for the each contract package respectively. There is no historical archeological site within the project influenced area of the alignment.

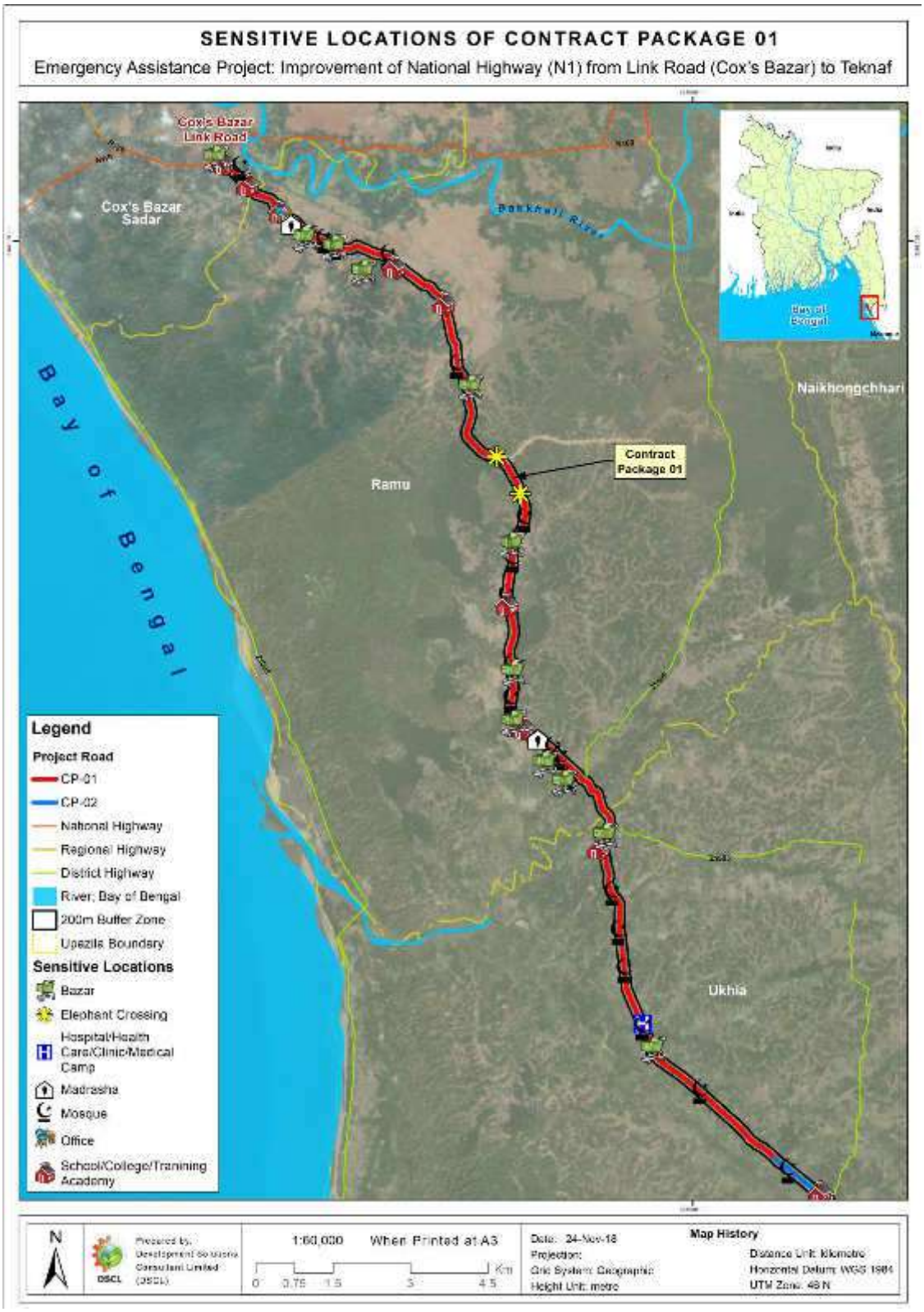


Figure IV.14: Sensitive Locations along Contract Package 01

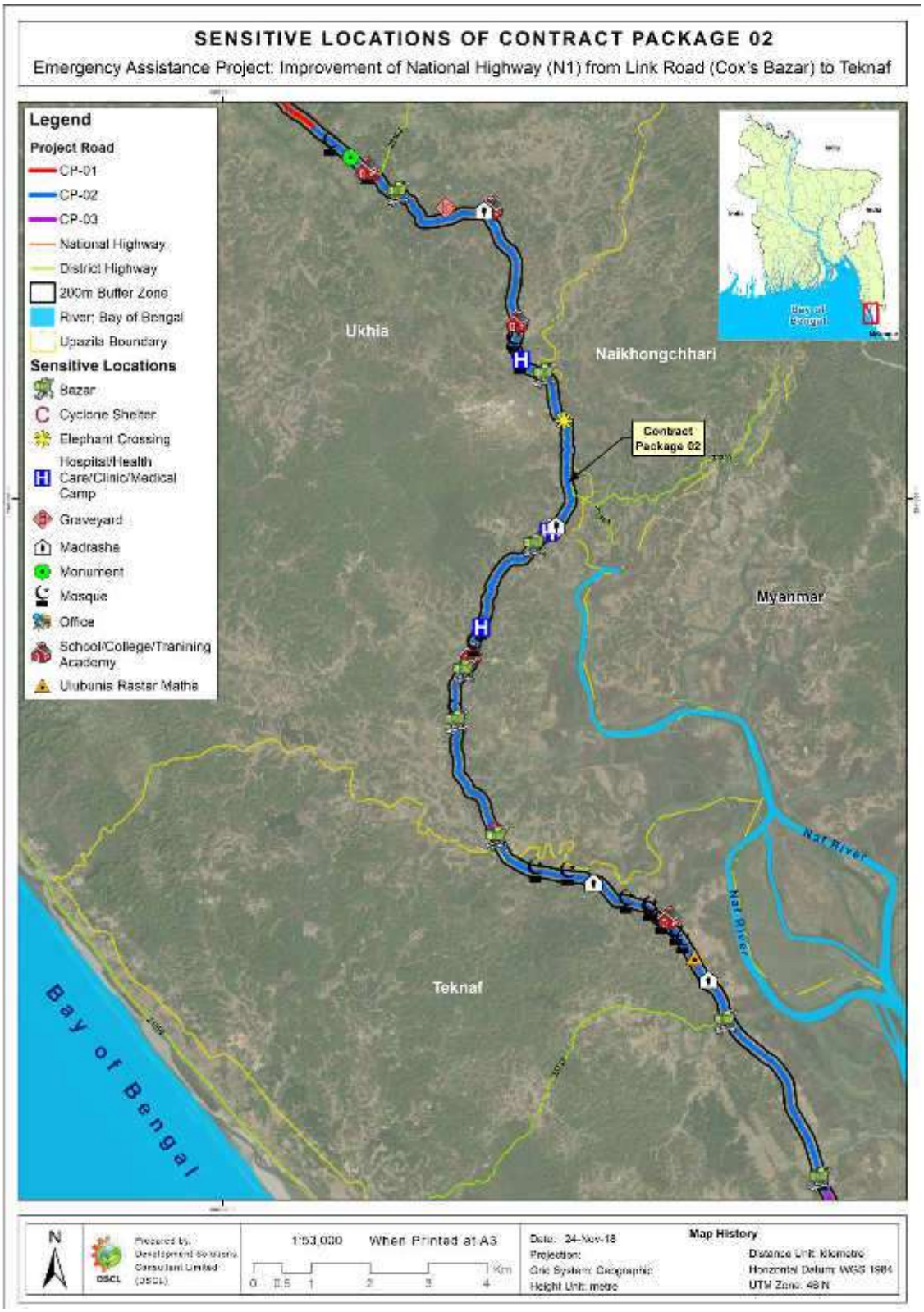


Figure IV.15: Sensitive Locations along Contract Package 02

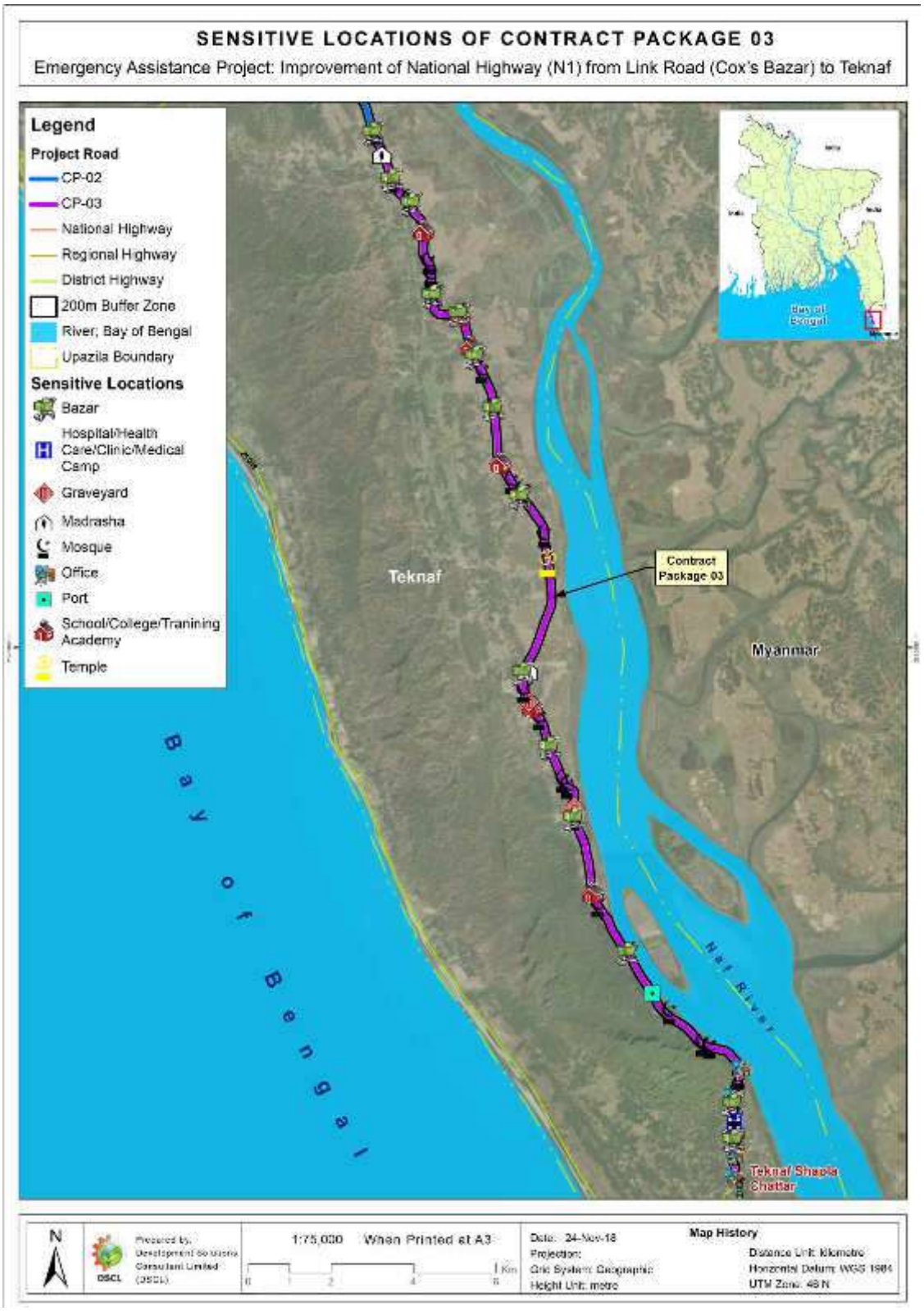


Figure IV.16: Sensitive Locations along Contract Package 03

E. Environmental Quality

192. The existing environmental quality in the project influence area serves as the basis for identification, prediction and evaluation of potential environmental impacts of the proposed project interventions. The baseline environmental quality has been assessed through field studies during 16th to 19th November, 2018 within the impact zone and analysis the information for various components of the environment, viz. air and noise, water, and soil. The sampling locations were in the following Figure IV.17.

Figure IV.17: Locations of Samples Collection in the Project Area

1. Ambient Air Quality

193. The actual contribution that individual developments, actions or sources of air pollutants make to the local air quality is extremely difficult to categorically specify. This is because air, by its nature is very mobile, mixes quickly and is difficult to predict because it is greatly affected by ambient conditions such as the weather and microclimatic conditions.

194. The activities, which generate modify atmospheric air quality, are transportation (i.e., motor vehicle emissions); industry; domestic and construction. The principal sources of air pollution due to road projects are hot mix plants and machinery used during construction phase and the vehicles that ply over it during the operation phase. The major pollutants of significance to roadside air quality, on account of vehicular emissions, are particulate matters (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), nitrogen oxides (NOx), hydrocarbons (HC), carbon-monoxide (CO), and total volatile organic carbon (TVOC).

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

196. Along the project area there is no major commercial or industrial activities and the area is mostly covered with natural vegetation; therefore, air pollution is comparatively lower than other areas of Bangladesh. However, air pollution in the project area is observed from road dust, black smoke from diesel engines, construction dust, domestic heating and cooking, transportations and brick kilns.

197. Ambient Air quality measurements carried out during 16th to 19th November, 2018 in three locations along the Project road and the monitoring results are given in Table IV.5. The sampling locations were selected mostly at bazar area where many people visit all day long and maximum number of people will be the receptor of air pollution during the road construction. Bangladesh national standards for ambient air quality are followed for the ambient air quality analysis. The key air quality parameters (particulate matter- PM_{10} and $PM_{2.5}$, oxides of sulfur - SOx, oxides of nitrogen – NOx, carbon monoxide- CO) were analyzed from samples collected at each sampling sites. The measurement results showed achievement of all air quality standards. Based on the ambient air quality standard of DOE, air quality in the project areas can be stated as in good condition. Particulate matters PM_{10} and $PM_{2.5}$ showed concentrations of which are far below the DoE standard.

Figure IV.18: Ambient Air Quality Sampling in the Project Area

Table IV.5: Test Result of Ambient Air Quality Analysis

Parameter	Unit	Concentration Present			Bangladesh Standard**	Duration (hours)	Method of Analysis
		AAQ_01	AAQ_02	AAQ_03			
		21°25.543'N 92°01.452'E	24°14.716'N 92°08.287'E	20°52.516'N 92°17.881'E			
PM_{10}	µg/m^3	18.21	13.87	20.39	150	24	Gravimetric
$PM_{2.5}$	µg/m^3	5.22	7.46	8.76	65	24	Gravimetric
SO_2	µg/m^3	4.35	5.22	7.10	365	24	West- Geake
NOx	µg/m^3	10.20	8.13	11.82	100	Annual	Jacob and Hochheiser
CO*	ppm	<1	<1	<1	9	8	CO-Meter
Weather Condition	-	Sunny	Sunny	Sunny	-	-	-

Source: Sampling and Lab Analysis, DSCL, 2018

Table IV.6: Monitoring Results of Weather Data

Sample ID	Location	GPS Location	Humidity (%)	Temperature ^{0} C	Wind Speed Knots	Wind Direction
AAQ_01	Link Road Bazar, Cox,s Bazar	21°25.543'N 92°01.452'E	52.31	36.1	1.37	North-West
AAQ_02	Ukhiya Bazar, Ukhiya, Cox,s Bazar	21°14.716'N 92°08.287'E	59.10	34.4	1.56	East-South
AAQ_03	In front of Hospital Gate, Teknaf, Cox,s Bazar	20°52.516'N 92°17.881'E	61.52	36.3	1.89	South-West

Source: DSCL, 2018

2. Noise Level

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

199. Two primary sources of noise have been identified in the project area:

- **Road Traffic:** Road traffic is one of the major noise sources in the project area. The project road is the only route of transportation the largest sea port of Bangladesh. This highway carries a relatively high volume of both motorized and non-motorized vehicles, resulting in road traffic noise impacts along the road corridors.
- **Commercial Areas:** There are some commercial or refreshment areas where always significant number of people gather and makes chaos continuously. This is another source of noise pollution along the road.

200. The noise level of the surroundings of the project area is insignificant. However, there is negligible sound pollution from the traffic movement on the nearby road. Noise level has been monitored at six locations along the project road during day and night time (Figure IV.19). Two noise sampling was conducted for each contract package; one sampling was at bazar location and another was conducted at silent area for better understanding. Results of the noise level monitored along with details of the sampling locations have been showed in

Table IV.7. The results show that time weighted average value of the sound monitored at six different locations of the project influence area did not exceed the standard fixed except at Ukhiya bazar for both day and night time.

Figure IV.19: Noise Level Measurement in the Project Area

Table IV.7: Results of Noise Level Measurement

Sample ID	Sample Location	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)	
				Day	Night	Day	Night
NM_01	Link Road Bazar, Cox's Bazar	21°25.527'N, 92°01.472'E	Commercial	10:34am	23:16pm	63.72	51.75
NM_02	Paner Chara, Ramu, Cox's Bazar	21°23.318'N, 92°04.159'E	Mixed Area	11:11am	22:59pm	52.21	43.56
NM_03	Ukhiya Bazar, Ukhiya, Cox's Bazar	21°14.720'N, 92°08.283'E	Commercial	12:34pm	22:09pm	67.23	58.79
NM_04	Chakmarkul Area, Hoyankong Union, Teknaf, Cox's Bazar	21°08.390'N, 92°09.668'E	Mixed Area	14:34pm	21:04pm	51.56	39.76
NM_05	Domdomia Ferry Ghat, Teknaf, Cox's Bazar	20°55.204'N, 92°16.087'E	Mixed Area	16:20pm	20:13pm	55.17	47.89
NM_06	In front of Hospital Gate, Teknaf, Cox's Bazar	20°51.950'N, 92°17.906'E	Commercial	16:57pm	20:38pm	63.33	52.98

Notes:

- *Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)*
- *Shaded cell indicate noise levels in excess of Noise Pollution Control Rules ambient noise limits for a given land use area*
- *The sound level standards for mixed area is 60, commercial area 65 dBA at day time and mixed area 50, commercial area 55 dBA at night time.*
- *Noise Level is the average noise recorded over the duration of the monitoring period*

Source: DSCL, 2018

3. Groundwater Quality

201. Water for human consumption should be undergone regular physico-chemical tests. Physico-chemical properties are high priorities in determining acceptability, although they may have little bearing on whether the water is safe to drink or not. Generally, the standards

used to evaluate the suitability of water for drinking and domestic purposes are more restrictive than those that would be applied to water for other purposes.

202. The groundwater quality parameters, measured in the project area during the field survey (Figure IV.20), were found to comply with the drinking water quality standards set by DOE. The groundwater samples were collected near from possible camp locations where several numbers of worker will be deployed. The reason of the selection was to compare the existing water quality with national standard and to ensure good potable water for the workers during construction period. The collected samples were submitted to Department of Public Health and Engineering (DPHE) for further parameters analysis. The groundwater quality of the area is presented in Table IV.8.

Figure IV.20: Sampling and Onsite Test of Groundwater Quality in the Project Area

Table IV.8: Test Results of Groundwater Analysis

Parameters	Unit	Concentration Present			Standards for Groundwater**	Analysis Method
		GW_01 Kuniapalong Stack Yard, Ukhiya	GW_02 Balukhali Stack Yard, Ukhiya	GW_03 Nila Stack Yard, Nila		
Temperature*	°C	26.8	26.2	27.8	20-30	Multimeter
pH*	-	7.21	7.64	7.36	6.5-8.5	Multimeter
Salinity*	ppm	177	103	225	-%0	Multimeter
ORP*	-	5.7	-11.2	-57.9	NYS	Multimeter
Total Dissolved Solids (TDS)*	mg/L	231	154	297	1000	Multimeter
Electrical Conductivity (EC)*	µs/cm	315	217	449	NYS	Multimeter
Dissolved Oxygen (DO)*	mg/L	1.4	1.79	0.9	6.0	DO Meter
Arsenic (AS)	mg/L	0.001	0.003	0.004	0.05	AAS
Chloride	mg/L	37	14	42	150-600	Trimetric
Coliform (Faecal)	N/100ml	0	0	0	0	MFM
Coliform (Total)	N/100ml	0	0	0	0	MFM

Parameters	Unit	Concentration Present			Standards for Groundwater**	Analysis Method
		GW_01 Kuniapalong Stack Yard, Ukhiya	GW_02 Balukhali Stack Yard, Ukhiya	GW_03 Nila Stack Yard, Nila		
Color	Hazen	2	19.5	0.90	15	UVS
Hardness	mg/L	190	165	230	200-500	Trimetric
Iron (Fe)	mg/L	1.26	1.84	0.24	0.3-1	AAS
Manganese (Mn)	mg/L	0.03	0.18	0.07	0.1	AAS
Turbidity	NTU	3.5	4.7	2.2	10	Turbidity Meter

Note:
Source: DSCL & DPHE, 2018
**On-site Test Result*
***Standards for Groundwater is followed Environmental Conservation Rule (ECR)'97*
NYS- Not Yet Standardized

4. Surface Water Quality

203. The surface water quality assessment in the project influence area has been carried out for the most important parameters. The sampling were undertaken from the road side waterbodies during the field survey and the detailed analyses are incorporated with the standard values set by the DoE are shown in Table IV.9. The surface water samples were collected and submitted to Department of Public Health and Engineering (DPHE) for further parameters analysis.

Figure IV.21: Sampling and Onsite Test of Surface Water Quality in the Project Area

Table IV.9: Test Results of Surface Water Analysis

Parameters	Unit	Concentration Present			Standards for Inland Surface Water**	Analysis Method
		SW_01 Setoli Bottoli; Holodia; Ukhiya	SW_02 Kutupalong Rohingya Camp; Kutupalong, Teknaf	SW_03 Kanjarpara, Hoyankong, Teknaf		
Temperature*	°C	29.3	29.8	29.2	NYS	Multimeter
pH*	-	7.70	8.92	9.5	6.5-8.5	Multimeter

Parameters	Unit	Concentration Present			Standards for Inland Surface Water**	Analysis Method
		SW_01 Setoli Bottoli; Holodia; Ukhiya	SW_02 Kutupalong Rohingya Camp; Kutupalong, Teknaf	SW_03 Kanjarpara, Hoyankong, Teknaf		
Salinity*	ppm	77.2	49.8	95.3	NYS	Multimeter
ORP*	-	-99.5	91.6	-18.3	NYS	Multimeter
Total Dissolved Solids (TDS)*	mg/L	1667.4	1498.5	1295.3	NYS	Multimeter
Electrical Conductivity (EC)*	µs/cm	158.4	101.7	182.5	NYS	Multimeter
Dissolved Oxygen (DO)*	mg/L	2.3	3.0	3.3	5 or more	DO Meter
Total Suspended Solids (TSS)	mg/L	17	20	16	NYS	Gravimetric Method
Turbidity	NTU	12.7	12.6	16.3	NYS	Turbidity Meter

Note: Source: DSCL & DPHE, 2018

**On-site Test Result*

***Standards for Inland Surface Water is followed Environmental Conservation Rule (ECR)'97*

NYS- Not Yet Standardized

204. The surface water quality standard is yet not developed in the ECR 1997 except for few parameters. Among the tested parameters the pH value at Kutupalong Rohingya Camp and Kanjarpara was exceeded the national standard. Additionally, the DO values for all the tested locations were below the standard value set by ECR 1997.

5. Soil Quality

205. The quality of the local soil was identified to characterize the baseline status. During the survey period, soil samples were collected from three possible camp site locations. The samples were sent to the laboratory of Dhaka University. The results of the test are shown in Table IV.10.

Figure IV.22: Soil Sampling from the Project Area

Table IV.10: Test Results of Soil Analysis

Sl. No.	Test parameters	Unit	Test results		
			SL_01	SL_02	SL_03
01	pH	-	7.18	7.20	7.15
02	Lead (Pb)	mg/kg	0.65	0.50	BDL
03	Iron (Fe)	%	2.36	1.78	1.38
04	Sulphate as SO_4^{2-} (Extractable)	mg/kg	18.50	21.41	18.08
05	Organic Matter	%	0.84	1.08	0.77

Source: DU Laboratory, 2018

206. There is no Bangladesh regulation/standard for soil. In the absence of local country standards, it is the environment consultant's practice to use globally recognized 'Dutch Ministry of Public Housing, Land-use and Environmental Guidelines - Soil and Groundwater Standards' to assess soil quality and to determine the need, if any, for remedial action. Parameters analyzed in baseline quality of soil was observed to be well below the threshold limits for Intervention as per the Dutch Standards.

V. ANALYSIS OF ALTERNATIVE

A. Background

207. Analysis of alternatives involves the examination of optional solutions, e.g., road improvement, or air service, instead of rail, and alternative alignments and/or technologies to be applied, such as electric versus diesel locomotives. Optional solutions have been assessed by RHD during the early stages of the Project planning with ADB. Location of Project alignment is being identified during project preparation by analysis of various possible alignments through technical, economic, social and environmental considerations.

B. Alternatives to the Project

208. The road alignment is predominantly rural for most of its length though there are some semi-urban uses and development at the township. Some disturbance to adjacent uses will be inevitable. It is assumed that the right of way is adequate for the proposed development, but this needs to be confirmed.

209. In order to widen the carriageway some displacement of the encroachers to the RHD land will be relocated and this will need to be strictly managed during the construction phase. This is an existing road and there is likely to be clearing of several small grown roadside vegetation. In addition the social/resettlement issues are likely to be substantial in many areas where there are villages and markets adjacent to the road. Since the RoW is probably wide enough proposed improvement, there is no land acquisition resettlement problems at the market locations also. There are a number of sensitive uses near to the project road such as schools, graveyards and other sensitive structures alongside the alignment. Some localized problems may occur and special management will be necessary during the construction phase.

1. The Without-Project Alternative

210. From a purely physical and environmental point of view, the 'do-nothing' approach is preferable to any project implementation since it would avoid creation of any of the adverse impacts associated with a new road. The without project alternative is not acceptable since this will strongly reduce the potential for socio-economic development of the country. Despite having great potential, the industrial and commercial growth is retarded mainly due to absence of safe and reliable transportation facility. Further, as a common route for the tourists to travel to St. Martin Island this road does not yet have the required transportation infrastructure to provide a safe journey for the tourists. Additionally, carrying the goods and foods for the Rohingya Refugees an improved road is essential to ensure the humanitarian supports smoothly.

211. Therefore the 'no-build' alternative is unacceptable, and the potential socio-economic benefits of implementation of such Project far outweigh the adverse impacts, all of which can be controlled and minimised to an acceptable level.

C. The Alternatives Alignments

212. Two alternative option alignments (Figure V.1) has been assessed for the proposed road improvement. The Option-1 is the present alignment that follows the national highway and the Option-2 is the newly constructed Marine Drive Road runs through the Cox's Bazar-Teknaf Sandy Beach.

Figure V.1: Alternative Options Alignments of the Project Road

1. Option-1: National Highway (N1) From Link Road (Cox's Bazar) To Teknaf

213. The alignment runs through the National Highway (N1) along the several forest areas semi-urban settlements and village areas as discussed in the Baseline Environment (Chapter IV). Due to the nature of the proposed road improvement there is no land acquisition or resettlement and mostly the activities will be conducted within the RHD land. Though there are several trees and vegetation along the road edges and embankment but no tree will be cut due to the improvement. The selection of this road improvement will ensure the minimum disturbance to the local environment and no land acquisition or resettlement.

2. Option-2: Marine Drive Road From Cox's Bazar To Teknaf

214. This road is newly constructed which also travels to Teknaf along the Cox's Bazar-Teknaf sea beach. This road also runs through the Himchari National Park the Teknaf Wildlife Sanctuary. Additionally, the sea side along the road is breeding ground of several sea turtles. The Government of Bangladesh also declared the Cox's Bazar-Teknaf sea coast as Environmental Critical Area (ECA). This road is also a tourist place where many people visits due to its landscape. Moreover, this road is prohibited for heavy vehicles and can only carry small transportations. If the road will be considered for improvement and permission to heavy vehicles will be given then the scenic beauty will be decreased. Additional transport and people will also damage the present habitations. Thus improvement of this road will create more problems to the ecosystem of this area in addition to the present road from Link Road (Cox's Bazar) To Teknaf.

D. Conclusions

215. The preferred alignment (Option-1), taking into consideration not just environmental and social considerations, but also financial, economic and engineering requirements.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. General

216. This section identifies the overall impacts on the physical, biological and socio-economic environment of the project area. 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. Environmental assessment was carried out considering present environmental setting of the project area, and nature and extent of the proposed activities. Potential environmental impacts associated with the proposed project activities of both the project are classified as:

I. impacts during pre-construction/design phase;
II. impacts during construction phase; and
III. impacts during operation phase.

B. Project Corridor

217. The Project corridor is delineated according to two criteria: right of way (RoW); which the RHD is legally entitled to, and Corridor of Impact (CoI), i.e. the width of the corridor that will be impacted, directly or indirectly, by the proposed project during the construction and operational phases.

1. Project Right of Way (RoW)

218. The proposed project corridor will have a well-defined RoW that will be approximately 7.3m for the entire length of the highway and additional bus bays at bazar locations. Major construction works will generally remain confined within the RoW.

2. Corridor of Impact (CoI)

219. The corridor of the proposed Impact (CoI) was delineated as the extent, which has direct or indirect impact of project. Direct impacts of the project are relocation of temporary shops, and air and noise pollution impact. All direct impacts are constrained within the RoW. Indirect impacts, caused by noise, dust emissions, camp sites and borrow sites could be beyond the RoW.

220. According to the type of impacts the project area is divided into two sections. One, those related to the project which is 7.3m for the project. Another section is those related to the background environmental features of the project site. This should cover not only the project site in proper, but generally an area that might have project influence. However, due to the nature of the project, the direct or indirect impact will not go beyond 200m from the RoW of the road alignment. In this project 200m from the RoW have been considered as core impact zone. However, as per the DoE guideline this assessment will consider up to 5 km as buffer zone for better understanding.

C. Methodology

221. This section identifies the potential impacts that the various elements of the proposed Project may have on aspects of the physical, biological and socio-economic environment. The identification of the potential impacts will be considered for the three distinctive Project stages (pre-construction, construction and operation). The activities undertaken during each of these Project stages form the basis for potential impact identification and analysis.

222. Assessment of potential impacts requires a multi-disciplinary approach in which a wide range of issues are taken into consideration to identify and determine which potential Project impacts may be significant and therefore require the application of reasonable and effective management and/or mitigation. Most projects result in positive and negative potential impacts on the environment, society and economy, all of which are identified and assessed in this section.

223. Certain impacts identified in this section have the potential to be significant. The determination of whether a given potential impact is significant depends on several factors:

- The potential for on-site and off-site impacts;
- The potential for direct and indirect impacts;
- The frequency and duration of a potential impact;
- The geographic area affected by a potential impact
- The period of time affected by any potential impact;
- The sensitivity of the receiving environment; and
- The degree of confidence with which the potential impacts of the action/activity are known and understood.

224. Measures of potential impact significance as part of the Project planning and assessment phase presented in this IEE have been determined using a risk based model. The risk based model is a two dimensional matrix of 'magnitude of impact' and 'likelihood'. Both are assigned score between 1 and 5 based on severity or probability and multiplied to obtain the 'risk band'.

225. The 'magnitude of impact' is a 5 point based scale set by expert's judgement. The scale and its explanation is given in Table VI.1.

Table VI.1: Explanation and Assignment of Scores to 'Magnitude of Impact'

Colour Band	Incidental	Minor	Moderate	Major	Severe/ catastrophic
Score	Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
Explanation	Impacts such as localized or short-term effects on habitat, species or environment al media.	Localized, long term degradation of sensitive habitat or widespread, short-term impacts to habitat, species or environmental media	Impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species or environmental media	Widespread and persistent changes in habitat, species or environmental media	Persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.

226. The 'likelihood' is also a 5 point based scale set by expert's judgement. The scale and its explanation is given in Table VI.2.

Table VI.2: Explanation and assignment of scores to 'likelihood'

Colour Band	Rare	Unlikely	Seldom	Occasional	Likely
Score	Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
Explanation	Rare or unheard of	Reasonable to expect that the consequence	Exceptional conditions may allow	Conditions may allow the consequence to	Consequence can reasonably be expected to

		will not occur during this project though has occurred several times in industry	consequences to occur within the project lifetime	occur during the project lifetime, or the event has occurred within similar projects	occur in life the project

227. Therefore, "Risk" factor is derived from the following equation:

Risk = Magnitude x likelihood (1)

228. The score of 'Risk' ranges from 1 to 25. The score is classified in 3 classes. The explanation is given in Table 9. The score matrix for risk assessment has been used to identify the priority environmental impact and their mitigation plan.

Table VI.3: Two Dimensional Risk Assessment Matrix

			MAGNITUDE OF IMPACT				
			Incidental	Minor	Moderate	Major	Severe/cats.
			Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
LIKELIHOOD	Rare	Score: 1	1	2	3	4	5
	Unlikely	Score: 2	2	4	6	8	10
	Seldom	Score: 3	3	6	9	12	15
	Occasional	Score: 4	4	8	12	16	20
	likely	Score: 5	5	10	15	20	25

D. Anticipated Adverse Impacts and Mitigation Measures

1. Design/Pre-construction Stage

229. Following is a brief description of impacts envisaged during the Preconstruction/ Design Phase:

a) Landscape/Topography

Impact

230. Adverse impacts on the topography /landscape of the project area may occur. Since the project road mostly passes through flat terrain with minor changes of height at hilly areas, impacts on topography is likely to be minimal and no special design requirements are needed.

231. The topography in the project area will change to some extent because of construction of the proposed project related structures such as embankments, culverts, bus bays etc. Visual changes to the topography would be permanent and minor negative in nature.

Mitigation

232. During the pre-construction phase, harmonization with the surrounding natural scenery was taken into consideration when designing the road improvement activities and structures. Visual changes to the topography will be of permanent but slightly adverse in nature and need no mitigation measures except that the project design should consider aesthetic concerns.

b) Natural Calamities

Impact

233. The proposed road has highest threat to cyclone and tidal surge. In Bangladesh, due to its unique geographic location, suffers from devastating tropical cyclones frequently. The project area is mostly lies in high risk zone due to its close location to Bay of Bengal.

234. According to the BWDB, in 1991 a storm surge as high 6.1 metres occurred with landfall centred from Kumira in the Chittagong area to Cox's Bazar. The maximum height of a storm surge can be 12 metres in the Bay of Bengal. In the report "Chittagong City Outer Ring Road Project: Design Report" dated April 2012 by SMEC (SMEC, 2012), an exceedance analysis was undertaken of the storm surge estimates at gauges near Chittagong. This resulted in a 50 year ARI storm surge level of around 8.5 m MSL.

Mitigation

235. The engineering design of the road should assure an adequate flood release capacity by providing sufficient culverts and bridges along the road alignment. The rationale of the cross structures should secure sufficient drainage capacity during after flood in order to reduce adverse effects to agricultural products and local habitants.

236. In cyclone prone areas wind speed of 310 km/hr. should be considered under climate change scenario (predicting a 20% increase in wind speed by 2100).

c) Loss of Commercial Activities

Impact

237. The improvement of the road embankment will require removal of 80 numbers of temporary shops/commercial units located within the ROW. As a result, these temporary shops will be essential to relocate. Resettlement of these temporary shops will cause financial loss of the shopkeepers as well as their families.

Mitigation

238. Proper compensation must be provided at first as per the national legal frameworks and ADB's SPS. It should be kept in mind that consultation with the affected people has to be made before relocating any business unit.

d) Tree Cutting and Wildlife

Impact

239. Widening of the project road will not require felling the existing planted roadside trees and homestead trees outside the ROW since the existing land is adequate for the improvement. Most of the trees and vegetation, now present in the stretches are far from the proposed ROW and will be avoided for clearing.

240. However, any loss of trees will impact on other flora and may affect wildlife, particularly birds and mammals that rely on trees their food source. In addition the loss of tree may increase soil erosion from rain cut. Apart from trees and undergrowth other

vegetation affected will be bamboo bush and other native vegetation. Excavation of borrow pits will add to the destruction of flora.

Mitigation

241. Mitigation measures will include:

- No trees shall be felled unless they are directly in the path of the project road and clearly defined, or unless they created a safety hazard to the future operation of road;
- Upon completion of embankment works turfing and planting should be done on embankment and slopes. Dense and well rooted growth of permanent grasses should be planted to eliminate dust and erosion;
- Replanting along the roadway, should consist of a multi-species mix of local vegetation including fruit trees, fast growing (fuel) trees and timber trees;
- RHD will be responsible for the enhancement tree planting program as suggested in the management plan by forming an "Environmental and Social Team" in coordination with the Forest Department (FD). The tree cutting programme will not start until RHD will get permission from Forest Department. The trees will be planted primarily along the road within the RoW;
- Permission from the Forest Department will be sought for cutting trees (if unavoidable) from the roadside if these fall within the RoW. Planting will be done as soon as the construction of the road is completed. Maintenance is the key to the establishment of the plantation and therefore regular monitoring of plantation will be carried out by the executing agency;
- Forestation programmes should be initiated, covering the road ROW, any embankments, and land near bridges and culverts to compensate for the loss of vegetation, to reduce the risk of erosion of the banks, and finally as a noise reducing wall.

2. Construction Stage

a) Landscape/Topography

Impact

242. As a result of construction, topography of the Project Area will be changed. Since the project construction activities scale is very minimum so the changes of existing landscape will not be changed in large scale. Moreover, no tree clearing and infrastructure demolishing will be placed during the construction period.

Mitigation

243. Mitigation measure for this impact is proper landscaping. Construction camps should be constructed at suitable place to minimize this impact. Vegetation (only small grown trees and bushes) clearing has to be at minimum level as possible. After completion of road construction, trees shall be planted along sections of road near the populous residential areas to mitigate impact of traffic noise to residents living along the road, and to improve landscape along the road.

b) Loss Top Soil

Impact

244. The potential impacts on top soil are:

- Loss of top soil by wind and water erosion;
- Removal of top soil for construction from outside the RoW;
- Compaction of top soil;

- Covering of top soil by project works.

Mitigation

245. Mitigation measures will include:

- The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil.
- Locate topsoil stockpiles in areas outside drainage lines and protect from erosion.
- Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil.
- Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites.
- Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bonding of the soil layers, water penetration and revegetation.
- Limit equipment and vehicular movements to within the approved construction zone.
- Remove unwanted materials from top soil like grass, roots of trees and similar others.

c) Dredging and Dredged Materials

Impact

246. Dredging will be required to source borrow material for the construction of road embankments. It is estimated that about 406542.84m^3 of embankment materials (mostly dredged sand) will be required due to the construction of road embankments. Since hill cutting and collection of soil from agricultural land is prohibited as per the government regulations thus these amounts of embankment materials will be collected from river/sea bed during the construction period after having required permission from relevant authorities and supervision engineers. Disposal of the dredged materials on the land for stockpiled and filling up of the project sites will generate a huge outflow from wet dredged materials that contain high turbidity and potentially impact of the soil quality of nearby agricultural lands, crops and other vegetation. Dredging of riverbed materials has physical and ecological impacts on the river. Dredging may cause increased river bank erosion and flood at downstream of the particular river. The quality of the surface water will be degraded because of dredging and spilling/seepage of oil and lubricants from the dredging machines.

Mitigation

247. Mitigative measures defined for this activity are (i) obtaining permits for extraction sites and quantities from appropriate authorities and adhering to the prescribed extraction volume limits per site, and (ii) conducting a survey at each dredging site to establish water quality conditions while the dredging is on-going. Prior to start dredging and disposal of dredged materials on land, the contractor should prepare site wise method statement (MS) in which environmental issue and its mitigation will be included. However, dredging must not be carried out when the fish are likely to be breeding in the affected surface water bodies, or in the period normally from April to August between spawning and the subsequent emergence of juvenile fish. To the end, water samples will be collected upstream and downstream of the dredger while in full operation and tested for nutrient, sediment loads, heavy metals as well as oil and grease concentrations, and river bed dredged materials of the selected rivers need to be tested by the contractor.

d) Soil Erosion and Siltation

Impact

248. Rainfall is often considered to be one of the triggering elements for soil erosion at gravity which include water erosion, collapse and landslide. As the project is located in an

area with adequate rainfall which often concentrates in a certain period, proper measures such as well construction and improvement of drainage system might considerably reduce the soil erosion that would occur due to land disturbance by road construction.

249. Erosion will be taken place at the slope of the proposed road embankment if slope protection measures are not taken immediately. Erosion can be happened at the culvert construction sites. The silt from erosion if run into the nearby surface water streams, the aquatic life living in the water body and the water body itself will be affected. The accumulation of suspended particulate matters will increase the turbidity of the water. In the highly turbid aquatic ecosystem normal photosynthesis is disrupted. Moreover, if eroded materials run into the agricultural land then crop production will be hampered.

250. Slopes of soil may fail commonly due to increased stress placed on them (loading), vibration, undercutting and the removal of vegetation which may alter the soil profile and it can have a direct effect on existing or potential land use and an indirect effect through siltation on water quality, fishing and land use downstream water bodies.

Mitigation

251. The following mitigation measures are proposed to alleviate or avoid the impacts:

- The road embankments and road cuttings shall be vegetated with a fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. Use of stone pitching or riprap shall be made at appropriate places especially around culverts.
- The erosion tendency increases at water logged areas as well. Adequate drain and slope protection measures shall be applied at such locations specially as identified above.
- Spraying of water over the road bed from time to time and use of geo-grids on a layer by layer basis for better bonding in the pavement structure must be carried out to resist erosion.
- Provide temporary protection along the embankment at possible bank failure places due to vehicle movement and rain water flows.
- The portion of the highway that is in contact with river, channel and canal will be provided with slope protection measures.

e) Soil Contamination

Impact

252. Due to construction of the proposed project, soil contamination may take place around borrow pits, road cuttings, embankments, construction camps, workshop areas, equipment washing yards, asphalt plants, batching plants, fuel and chemical storage areas, etc. Soil contamination may affect the road stability in worst cases may reduce the economic productivity of land and biodiversity in the project area.

253. During transportation of machine and materials, the cultivable lands beyond the proposed ROW may get compacted due to movement of vehicle and construction equipment, setting up construction camps, resulting in reduction in agriculture yield. Dumping of construction debris on fields adjoining the project construction related areas, may lead to impairment of soil for agriculture, especially when the nearby areas to the alignment is largely agriculture. Parking of vehicles by the side of roads also leads to soil compaction and may spoil the soil characteristics necessary for cultivation. Soil in the project area may also get contaminated particularly from the bituminous wastes, spillage of oil and grease, mixing with construction materials, at the construction sites. The impacts of soil contamination would be temporary and moderate negative.

Mitigation

254. The movement of construction vehicles, machinery and equipment will be restricted to the corridor or identified route. The unusable, non-saleable, non-hazardous construction waste shall be dispose of in the properly delineated places. The compacted land is restored for agricultural use.

255. All efforts shall be made to prevent soil contaminations. Following measures shall be taken to prevent the same:

- The construction vehicle shall be fueled or repaired/serviced at the designated place with proper arrangement of waste collection and disposal. The arrangement shall include, cemented floor with dyke around for fuel storage and filling as well repairing of construction equipment.
- Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain of the total volume of stored fuels and chemicals.
- The disposal of waste asphalt shall be made in approved locations such as borrow pits or natural depressions and shall not be within the RoW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water percolating through the waste materials and leaching toxic chemicals into the surrounding soils. On completion of disposal at the site, the area shall be capped with a compacted thickness of impermeable soil covered and with the top soil and shall be finally landscaped.

f) Air Pollution and Dust

Impact

256. During construction phase, there are two main sources of air emissions i.e. mobile sources and fixed sources. Mobile sources are mostly vehicles involved in construction activities while emissions are from fixed sources that include diesel generator sets, construction equipment (e.g. compressors) and excavation/ grading activities. Certain amount of dust and gaseous emissions will be generated during the construction phase from road construction machineries. Pollutants of primary concern include Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM). However, suspended dust particles are coarse and settle within a short distance of construction area. Therefore, impact in nearby inhabited area will be direct but temporary and restricted within the closed vicinity of the construction activities only.

257. Localised emissions are also anticipated from hot mix plants and batching plants. These emissions would be in the form of coarse particulate matter and will settle down in close vicinity of construction site. Further, this will be a temporary phase. Hence, no significant impact is expected during the construction phase. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. Construction work involves breaking up, digging, crushing, transporting, and dumping large quantities of dry material. During construction, the continuous operation of machinery and movement of heavy trucks and vehicles may generate gaseous emissions. It will inevitably lead to an increase in suspended particulate matter (SPM) in and around the construction zones. Emissions from crushers and quarry sites can cause health impacts, i.e. coughing, flue, difficulty in inhaling, irritation in eyes and reduction in visibility. This impact is temporary and major negative in nature.

Mitigation

258. Mitigation measures will include:

- The stockpiles of construction material shall be sprinkled with water. Water should be sprayed at asphalt mixing site and temporary service and access roads. After compacting, water should be sprayed on the earthwork regularly to prevent dust. Construction equipment will be maintained to a good standard and idling of engines discouraged. Machinery causing excessive pollution (e.g. visible clouds of smoke) will be banned from construction sites;
- The Contractor(s) will submit a dust suppression program to RHD prior to construction. The plan will detail action to be taken to minimize dust generation (e.g. spraying of roads with water), and will identify equipment to be used.
- Road pavement design should be such that tyre friction due to vehicle movement will be reduced. Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce dust pollution on existing road.
- Dust control by equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions;
- Hot mix plants should be located at least 500 m away from the populated areas and be fitted with high stack (30m) to allow adequate dispersion of emissions. Further, the hot mix plants must be sited at least 1 km in the downwind direction from the nearest human settlement. Regular maintenance of machinery and equipment shall be carried out. Diesel Generating (DG) sets shall be fitted with stacks of adequate height. Low sulphur diesel will be used in DG sets as well as machineries. Dust mask will be provided to the workers. Proper dust collection system should be ensured at crushers and continuous sprinkling of water;
- Air pollution monitoring shall be carried out as per monitoring plan and corrective action shall be taken in case of deviation.

g) Noise and Vibration

Impact

259. During construction, noise is likely to be generated form site clearing, excavation, concrete mixing, and crushers. The general noise levels during construction phase such as due to working of heavy earth moving equipment and machineries installation may sometimes go up to 100 dB(A) or more at the work sites[2]. Under the worst case scenario, it is assumed that all these equipment generate noise from a common point. The increase in noise levels due to operation of various construction equipment is expected to increase the noise level from 100 dB (A) at a distance of 1 m to 52.1 dB (A) at a distance of 250 m from the sources. The vehicular increase during construction is likely to be limited and may not have any significant contributions to increase in ambient noise level.

260. Vibrations caused by movements of heavy construction equipment, operation of crushing, ballasting and aggregating plants will disturb the local residents unless operation times are fixed by discussing with local representatives. The vibration caused by some of the construction activities such as the roller compaction of the embankment, movement of heavy material transport vehicles, driving of piles and erection of bridges may be detrimental to the neighbouring structures.

Mitigation

[2] The noise level from various construction equipment /machinery is (all levels are in dB(A)): Dozers (95-100), front Loaders (72-84), Backhoes (72-93), Tractors (76-96), Toppers/Trucks (82-94), Concrete mixers (75-83), Concrete pumps (75-83), Concrete pumps (81-83), Cranes (movable) (75-86), Vehicular Traffic (construction material & plant & Machinery) (85-98), Dg Set (90-95), Pumps (69-71), Compressors (74-86), Pneumatic Wrenches (83-88), Jack Hammer and rock drills (81-98), Pile Drivers (peak) (95-105).

261. All mitigation measures mentioned below should be taken in order to minimize the impacts of noise in the project area. These measures include, but are not limited to the following:

- Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices.
- All powered mechanical equipment and machinery shall be fitted with noise abating gear such as mufflers for effective sound reducing, in full compliance with the DoE regulations.
- Vehicles and equipment should be fitted with silencer and maintained well.
- The noisiest operations should be performed during daytime. Proper equipment maintenance and restricted operation between 0700 to 1800 hours will reduce noise.
- The construction equipment/machinery (stationary) shall be placed away from inhabited areas. Provision of temporary noise barrier shall be made near sensitive locations like schools, religious places and hospitals. If temporary noise barriers are not feasible then regulate construction activity and timing so as the impact intensity is minimized.
- The workers should be provided with personal protection devices as earplugs and earmuffs.
- In areas, where there are structures likely to be affected by vibrations because of the construction activities, precaution will be taken to minimize the vibration and the resulting impact.
- Noise and vibration monitoring shall be carried out as per the suggested monitoring plan.

h) Surface Water Quality

Impact

262. The number of ponds and borrow pits along the project corridor are very minimum and the available water bodies are currently being used for fishing likely to be affected. The project road also crosses several canals. Most of the water bodies are seasonal in nature. Construction activities may have localised impact in terms increase TSS level in waterways. Since this will be a temporary phenomenon, no significant adverse impact is anticipated during this phase.

263. Surface water might get contaminated due to the disposal of construction waste generated from the project activity. Uncontrolled dumping of wastes, sewage, dredge materials, and accidental spillage of fuels and chemicals into the water bodies may greatly pollute them. Disposal of sewage and wastes from the construction camps to surface water bodies without treatment will deteriorate the water quality. The seasonal ditches and ponds are unlikely to be affected from construction activities. This contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement. The impact on these water bodies will be only for the period of construction and will vanish as the construction work is over.

Mitigation

264. The Contractor shall undertake at all times to prevent water pollution as a result of his activities, and shall implement the measures to control water pollution that shall include, but not be limited to the followings:

- The Contractor shall comply with the national legislation and other regulations currently applied in Bangladesh as they relate to water pollution control.

- Protection of the water environment shall be recognized as a key constraint for any construction work. The Contractor shall devise and arrange methods of working to minimize water quality impacts to the satisfaction of the CSC.
- The Contractor shall at all times ensure that all existing water courses and drains within, and adjacent to, the site are kept safe and free from any debris and any excavated materials arising from the works.
- The earthwork sites where exposed land surface is vulnerable to runoff, etc. shall be consolidated and/or covered;
- The Contractor shall ensure that rain run-off from the construction sites is not deposited directly into any watercourse.
- All drainage facilities and erosion and sediment control structures shall be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms.
- Wastewater shall be collected, re-used and/or disposed of off-site after oil/grease removal and settlement of suspended solids. Sediment tanks of sufficient capacity, constructed from pre-formed individual cells of approximately 6-8m^3 capacities shall be used at all sites for settling waste-waters prior to disposal.
- Construction wastes shall be collected and re-used wherever possible. Otherwise should be disposed in the small deposit area invulnerable to surface run-off, along with soil erosion prevention measures.
- The material stockpile sites shall be located far away from water bodies and areas prone to surface run-off. If some must be placed near bridge construction sites, the stockpiles should be surrounded by interception ditches or retaining structures to prevent the erosion and materials into the water bodies. The loose materials should be bagged and covered.
- The fuel storage and equipment maintenance yard should have weather/rain protection and should be on concrete pads to prevent dripping and leaking oils from entering the water bodies via surface runoff. All spoil soil disposal sites should only be allowed in the dedicated areas where will be erosion control measures and landscaping plan following the disposal operations.
- For construction for culverts, there should be strict waste control plan to restrict discharge or dumping of any directly discharge of wastewater, slurry, waste, fuels and waste oil into the water. All these materials should be collected and disposed at the banks. The slurry and sediment should be pumped to the banks for disposal and should not be allowed to discharge to the rivers directly.
- Drainage from vehicle maintenance areas, plant servicing areas and vehicle wash bays shall be passed via a petrol interceptor prior to discharge.
- The Contractor shall ensure that no tools or machinery are washed in any water source or areas that drain into an existing watercourse.
- The Contractor shall weekly check all equipment for prevention of oil and or lubrication leaks and ensure that all equipment oil and lubrication replacements are performed only in bounded maintenance and repair areas.

i) Groundwater Quality

Impact

265. Increased demand of groundwater is anticipated during the construction phase for construction activities and domestic purposes. Uncontrolled extraction of water may also affect availability of waters to locals. In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.

Mitigation

266. Mitigation measures will include

- Pumping of groundwater should be from deep aquifers of more than 300 m to supply arsenic free water. Safe and sustainable discharges are to be ascertained prior to selection of pumps.
- Tube wells will be installed with due regard for the surface environment, protection of groundwater from surface contaminants, and protection of aquifer cross contamination.
- All tube wells, test holes, monitoring wells that are no longer in use or needed shall be properly decommissioned.
- Install monitoring wells both upstream and downstream areas near construction yards and construction camps to regularly monitor the water quality and water levels.
- Protect groundwater supplies of adjacent lands.

j) Drainage Congestion

Impact

267. Run off from storage of construction material near water bodies, or uncontrolled disposal may cause temporary drainage congestion, especially near the locations of culverts, service areas, and construction sites. Project design has made provisions of reconstruction of the existing culverts with larger water openings. Hence, no significant impact is anticipated on these water bodies during this phase. Stockpiling of fill materials dredged from the riverbeds for construction of the embankment may result erosion and subsequent deposition in the adjacent crop fields. The hydrological impacts of the project are primarily limited due to faster post monsoon drainage caused due to faster fall of water level in the drainage channels following the monsoon season. Additionally, the project area is not prone to flood and there is no water logging impacts due to flood hazards.

Mitigation

268. Construction shall be so planned that there is no drainage congestion. Wastes should not be disposed near any water body. All waste depending on its characteristics, should be disposed off in a controlled manner. Adequate cross drainage structure shall be provided to easily drain off water to canals and other lowland areas. Drainage works can also be designed with the provision of lower volume of water to drain in other low-lying areas.

k) Clearing of Vegetation

Impact

269. The project implementation activities will not involve clearing of any trees and vegetation due to its nature and scale of improvement. However, if unavoidable then removal of trees will affect the local ecosystem, habitat of local birds, animals and wildlife. Particularly, the wildlife that is living by the affected trees will permanently lose the ecological services from those trees. Therefore, removal of mature trees will cause ecological loss to the environment.

Mitigation

270. Public and FD will be consulted before cutting of the trees if its felling is absolutely unavoidable due to technical consideration. Additionally, an enhancement measure with the tree plantation has been proposed at the management plan which should be followed strictly.

l) Terrestrial Fauna

Impact

271. The vibration of equipment, noise, wastewater and exhausts gas are often considered to be disturbances to animals. These could drive animals away from their current habitats. However, impacts caused by construction works to terrestrial animals are considered manageable, due to the fact that the amphibians found along the project road inhabit mainly in the deep forest areas.

272. During the construction phase, illegal hunting may also occur and pose the threat to wild animals particularly in the forest areas along the project road. Ditching and construction of temporary construction sites and access roads may lead to damage and deterioration of local ecosystems. It is likely that the development of the road will generate significant quantities of spoil materials which will be required to be removed off-site and either disposed-of or contained in stable storage and dumping areas.

273. This will include temporary and permanent dumping areas, which will need to be managed with respect to landslide stability, embankment stability, drainage control, erosion protection (wind and water) and sediment. Spoil stockpiling in small valleys or river banks will directly affect the habitat of animals. However, these animals may find alternate habitats in the areas around the project road, and return to their previous habitat when the vegetation is recovered after the completion of construction.

274. During construction phase, air pollution, wastewater, and solid waste generated by the construction works may also deteriorate the animals' habitat, and may force them to evacuate to other habitat. As an example, the construction of culverts may cause degradation of water quality, loss of habitat, loss of food sources for reptiles, amphibians, fishes, etc.

Mitigation

275. In total of 69 and 38 species of wildlife are included in the Schedule 1 and 2 respectively under Wildlife (Conservation and Security) Act, 2012. Therefore, conservation activities need to be included without causing harm to the species. Almost all protected species are widely distributed and are less common to common within the area. Therefore, the species will not be at further risk due to much localized intervention. However, contractor shall

- Setting up and implementation code of conducts to workers, including no catching or hunting fish and wildlife, and no consumption of wildlife products.
- Provision of environmental training with information on the importance of biological diversity, and its relationships with sustainable development.
- Limit the construction works within the designated sites allocated to the contractors.
- Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds.
- Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.

m) Impacts on Elephant

Impact

276. Habitat conversion and fragmentation has been identified to be the most serious problem for the wild Asian elephant population which often results in elephant being restricted in isolated habitats or habitat islands. In Asia this has been caused by large scale conversion of forests to monoculture plantations, croplands, and settlement areas. This has resulted in compression of elephant herds inside protected areas and the elephants are often forced to pass through settlement areas when moving between their fragmented habitat islands. This is exactly the case for the elephants of the Project area.

277. Discussions with the local people in the project area revealed that the elephants pass through the project road at Ramu and Ukhiya forest areas throughout the year. The usual elephant movement time was observed at night. During that time, a group of elephants regularly cross the road. The herd is also known to sometimes split into smaller groups especially when passing through villages. It is also during these times when human-elephant conflict incidents occur the most.

278. Elephant behavior studies have indicated that any disturbance like road construction and traffic near the feeding ground will distract their movement. Most of the herd will avoid such spots, even at the cost of traveling longer distances to forage elsewhere.

279. Based on the information in the paras above it is highly likely that the elephants will cross the road during the construction period. The usual elephant movement time has been observed at night, during which no construction activities will take place. So the chances of direct interference of the construction activities with the elephant movement across the road are low. However, one cannot rule out the possibility of day time movement. If there is any elephant movement while construction activities are going on during the day, the elephants may get distracted by the noise and vibration and become aggressive or not be able move across the road. This may pose a danger for the construction workers and given the human-elephant conflict history could result in injuries and destruction of construction equipment and road works.

Mitigation

280. If any elephants come near the road construction site while construction activities are going on during the day, construction activities must be stopped immediately and the construction workers must be taken away to a safe distance from the elephants. This must be done to allow passage of the elephants through the area with minimal disturbance and also to prevent any injuries to the workers due to attacks from the elephants. Construction activities may resume only after the elephants have passed through or moved away from the construction site.

281. While no construction activities will be allowed during the night time, the newly constructed road will sometimes need to be kept clear of any animal or elephant movement. To discourage the elephants from crossing the road at these times, the road will be lit up during the night. While potential damages to the newly constructed road can be saved, this measure can also prevent potential injuries to the elephants by soft road layering (for instance asphalt), or from other containers, equipment and materials which may need to be kept on site.

n) Pollution from Wastes

Impact

282. The construction process will take at least 1.5 years and as a result, the construction camps will take a semi-permanent appearance. The majority of waste generated will include construction wastes (solid wastes: piece of rods, woods, bricks, stones, containers, electric wire, pipes 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 camps, construction activities and materials used for construction. If inadequate arrangements exist for the disposal of above mentioned 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 including invasive species, etc.

Mitigation

283. Mitigation measures will include

- Develop waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to RHD for approval.
- Prepare spill control procedures and submit the plan for RHD approval.
- Train the relevant construction personnel in handling of fuels and spill control procedures.
- Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses.
- Refueling shall occur only within bunded areas.
- Make available MSDS for chemicals and dangerous goods on-site.
- Place a high emphasis on good housekeeping practices.
- Store hazardous materials above flood plain level.
- Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill.
- Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak.
- Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution.

o) Asphalt Hot Mix Plant, Rock Crushing, and Bitumen Supply

Impact

284. Rock crushing activities will generate noise and dust, and asphalt hot-mix plant and pavement works will generate gas and odour while compaction of the pavement will also generate noise and dust. Notwithstanding those emissions from powered mechanical equipment that supply crushed rock and asphalt will be rapidly dispersed, they will need to be sited carefully to avoid complaints. It is also possible that soil may be contaminated by oils and chemicals at asphalt/bitumen plant sites, workshop areas, and equipment washing yards. The contamination may limit the future use of the land for agricultural purposes.

Mitigation

285. Although emissions from powered mechanical equipment that supply crushed rock and asphalt will be rapidly dispersed, they will need to be sited carefully to avoid complaint. In order to maintain the existing air quality of the project area in a condition acceptable to the local population, compliance with the following mitigation measures will be needed:

- Cement batching and aggregate mixing plant will be located as far as possible (at least 500 m from settlements and habitation near the project corridor, or as required by environmental regulations;
- All conditions of DoE permits and local guidelines will be observed;
- Dust suppression equipment will be installed at cement and aggregate mix plants;
- Areas of construction, as well as the haul road, will be kept damp by watering. The construction area where local roads are used for hauling, they shall be kept in serviceable condition, and any damage will be repaired promptly without interference to local travel routes;
- All hot-mix plants, crushers, and batching plants will be located in agreement with the local district or municipality, and installed in a sealed area only after receiving approval from the relevant local authority and DoE.

p) Construction Waste Disposal

Impact

286. Due to construction activities waste will be generated at construction and contractors camp site. The construction waste will include wastewater, oil spillage from machinery, hazardous waste and solid waste etc. This will result in unhygienic conditions, health risk to work force and general public at the camp site. Following are the types and sources of construction waste:

- Oil, grease etc. from construction machinery;
- Hazardous and solid waste from waste construction material and food;
- Waste water from washing and sprinkling; and
- Sanitary waste from staff toilets.

Mitigation

287. Mitigation measures will include

- 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 environmental impact.
- Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by DOE. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route
- Train and instruct all personnel in waste disposal practices and procedures as a component of the environmental induction process.
- Provide absorbent and containment material (e.g., absorbent matting) where hazardous material are used and stored and personnel trained in the correct use.
- Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use.
- Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur.
- 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.
- Provide reuse containers at each worksite.
- Request suppliers to minimize packaging where practicable.
- Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.
- 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.

q) Construction Yard

Impact

288. The precise locations of construction camps and other facilities such as workshops, equipment washing yards, construction material storage areas, haul routes and disposal sites for construction waste will be finally decided by CSC and RHD in consultation with Contractors. However, the siting of these facilities may cause a number of issues such as loss of plantation and vegetation, permanent physical and visual impact on the area, siltation and pollution risks if construction materials are extracted from the river bed. The construction

process will take several years, with the result that the camps will take on a semi-permanent appearance. The people and the changes they bring can have significant impacts on the local communities and social structures. Substantial numbers of workers will inhabit the area in temporary camps loading local infrastructure and causing ambient social influence. Most important aspects are: pollution risk of soil and surface water due to sanitation of the labour camps and wastes from the camps.

Mitigation

289. The Contractor shall

- Locate the construction camps at areas which are acceptable from environmental, cultural or social point of view.
- Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities.
- Submit to the PIU for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps.
- Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.
- Adequate housing, safe and reliable water supply for all workers.
- Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons.
- Paved internal roads. Ensure with grass/vegetation coverage to be made of the use of top soil that there is no dust generation from the loose/exposed sandy surface. Pave the internal roads of at least haring-bond bricks to suppress dusts and to work against possible muddy surface during monsoon.
- Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
- Ensure proper collection and disposal of solid wastes within the construction camps.
- Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at household level.
- Locate the garbage pit/waste disposal site min 500 m away from the residence so that peoples are not disturbed with the odour 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 to enter and play with.
- Provide adequate health care facilities and first aid facility round the clock within construction sites. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse.
- Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work.
- Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during monsoon.
- Provide appropriate security personnel (police/home guard or private security guards) and enclosures to prevent unauthorized entry in to the camp area.

- Maintain register to keep a track on a head count of persons present in the camp at any given time.
- Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed
- Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site by RHD.
- Handover the construction camps with all built facilities as it is if agreement between both parties (contactor and land-owner) has been made so.
- Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner.

r) Occupational Health and Safety (OHS)

Impact

290. Construction workers are more likely to face occupational health hazards such as minor or major injuries due to lack of general safety requirements and precautions applicable while working at construction sites, and handling with machines and equipment, use of equipment and driving vehicles and so on. Poorly designed temporary labour camp and sanitation facilities may pose a health threat and nuisance to the workers. Uncontrolled vending of food and drinking water at the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhoea, Malaria, and Dengue in particular. Construction workers will be required to handle hazardous materials such as cement, bitumen, chemicals, fuels, and so on which will increase health risks of the workers if personal protective equipment are not used. Although presently total ratio of the affected people in Bangladesh by HIV/AIDS is far less than 0.1%, however this percentage is slowly being increased due to injection drug users and overseas migrant workers returned to Bangladesh.

Mitigation

291. Mitigation measures will include:

- Obligatory insurance against accidents for laborers/workers;
- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- Layout plan for camp site, indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents;
- Protection devices (ear muffs) will be provided to the workers doing job in the vicinity of high noise generating machines;
- Provision of adequate sanitation, washing, cooking and dormitory facilities including light up to satisfaction;
- Provision of protective clothing for laborers handling hazardous materials, e.g. helmet, adequate footwear for bituminous pavement works, protective goggles, gloves etc.;
- Adequate signage, lightning devices, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads.

s) Community Health and Safety

Impact

292. The construction activities and vehicular movement at construction sites and access service roads may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. This is a temporary and minor negative

impact. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents etc. The labour works with different transmittable diseases may cause spread out of those diseases in the local residents. The borrow pit areas located near the residential, settlements, may cause accident for the people moving near to those areas.

Mitigation

293. Mitigation measures will include:

- There should be proper control on construction activities and oil spillage leakage of vehicles.
- The labour works with different transmittable diseases should be restricted within the construction site.
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Provision of proper safety and diversion signage, particularly at urban areas and at sensitive/accident-prone spots.
- Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease;
- During construction work, pedestrian and vehicular passages should be provided for crossing near settlement
- Culverts and other structures have to be structurally stable enough to bear maximum ground acceleration recorded for the area in past.
- Use of water should not disturb public water availability. Source of water should be selected carefully.

t) Traffic Congestion/ Road Accidents

Impact

294. The existing national highway is very busy due to additional transportation for the humanitarian supports to the refugee people than the past experience. The influx of heavy construction vehicles used for the construction work may cause road accident if they are not moved following traffic rules. The construction work beside the existing highway road will impede regular movement of the vehicles. The construction workers, pedestrians and onlookers are also prone to accidents. Road accident may also occur at road crossing during construction work.

295. Due to construction activities, traffic management may be a problem in the Project area. This may result in traffic jams and cause inconvenience to the people passing through the road crossings at proposed interchanges due to movement of vehicles carrying construction materials. The construction vehicles will add more traffic and as a result, traffic congestion and road accidents will be increased.

Mitigation

296. The Contractor shall

- Prepare and submit a traffic management plan to the RHD for approval at least 15 days before commencing work on any project component involved in traffic diversion and management.
- Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours,

temporary road, temporary culverts, temporary diversions, 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 Traffic Regulations.
- Restrict truck deliveries, where practicable, to day time working hours.
- Restrict the transport of oversize loads.
- Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions.
- Enforce on-site speed limit
- Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the project information in both Bangla and English.

u) Income/Employment

Impact

297. Normal living of the local people will be affected for a certain period. Income loss in a lower scale will be happened due to the disturbance at bazar locations for construction activities. Some local roads will be disturbed being located on the road alignment during developing the road embankment.

298. During construction activities, local unemployed people will get employment and increased income. The immediate benefits to the poorest residents in the project impact areas include employment in construction activities; and subsistence allowances and other benefits under resettlement, and increased income from petty business during construction. It is also expected that during the construction phase several other employment opportunities with contractor's office would be available for local people.

Mitigation

299. In order to minimize the income loss, contractors as far as practicable will recruit construction workers from amongst the locals where possible, and shall maintain gender equity while employing the locals. Priority shall always be given to people from amongst the PAPs and from those unemployed and belong to the lower income group. Additional benefits will be derived by setting aside-areas within contractor camps/labour shed for local people to sell their products or to provide additional services to the workers. Replacement on a suitable location in a better form will be done with the help and consent of the affected local community.

300. Project authorities shall take necessary actions as per the recommendation of Resettlement Plan (RP).

v) Tree Plantation

Impact

301. During the construction work of the road tree plantation will be conducted as an enhancement measures which will provide positive impact on the natural environment. Inappropriate selection of tree species and plantation location may not ensure the inherent objective of the tree plantation plan. Moreover, lack of proper care (e.g. watering, securing with fence) by the respective authority will also hinder the process of proper growth of the planted trees.

Mitigation

302. Different species can be planted at the road shoulder (whereas possible), to substitute the ecological loss occurred because of the road construction. Moreover,

Contractor will be responsible to take measures of protecting the planted seedlings until the seedlings grow enough to survive independently. Scope of natural rehabilitation of the local wildlife to the habitat will be created in result of the tree plantation and growth of the vegetation. If possible shifted homesteads may be compensated through providing seedlings. Especial care should be taken for biodiversity rich areas during construction.

3. Operation Stage

a) Landscape/Topography

Impact

303. New infrastructure (e.g. residential and commercial building, shop, market etc.) are expected to be established beside the project road. The settlements in the immediate vicinity of the road will be directly affected which would be minor negative impact.

Mitigation

304. This can be mitigated by tree plantation along the corridor. It would also serve as physical barrier between the road and the existing settlements as well as future developments. On the other hand, aesthetic beauty plays an important role. The construction of culverts as well as new improved road with side plantation will improve the aesthetics view of the project area.

b) Air Quality

Impact

305. The bad road conditions, the idling of vehicles and congestions are the main causes of the air and noise pollution at present. The improved road conditions will change this scenario, which will result in the improved ambient air quality. However, in the longer run, increased traffic levels and congestion will lead to PM_{10} and $PM_{2.5}$ pollution levels above the national/international standards, which may result in causing public health risks, nuisance and other impacts on bio-physical environment.

306. These conditions will result in the rise of vehicular emissions (CO, NOx, SOx, PM_{10}, $PM_{2.5}$) associated with the adverse effects on the environment and human. This impact is permanent and positive, in case of improvement of road conditions and minor negative, when traffic volume is increased.

Mitigation

307. Mitigation measures will include:

- It is proposed to maintain the road conditions especially the shoulders and embankment turfing.
- Setting up of a system to monitor air quality along project area in accordance with the applicable standards/limits;
- Roadside tree plantations as applicable and feasible under harsh climatic conditions; plants should be selected in accordance to their ability to absorb emissions;
- Densely populated trees shall be planted close to school, and religious places.
- Provision of slip road shall be made in urban and congested areas as feasible to separate slow moving and localised traffic.
- Regular road maintenance to ensure good surface condition;
- Regular vehicle check to control/ensure compliance with air quality standards;
- Best traffic management practices shall also be adopted to regulate the traffic. Enforcement and penalties against traffic rules violators.

c) Noise and Vibration

Impact

308. During the operational phase, the noise levels are anticipated to increase due to traffic related noise pollution; vibrations from engines and tires and mainly use of pressure horns. The main source of noise during the operation phase is the traffic. It can be estimated that ambient noise level will increase due to the increased traffic. However, the better road condition and less congestion on roads will reduce the net noise levels at market and other crowded places. The Noise levels are likely to reach the acceptable levels at a distance of 500 m from the road. Some sensitive locations within 500m of the road may be affected due to higher noise levels than the stipulated 45 dB(A). Overall, impact on noise environment is considered moderate during the operation phase.

Mitigation

309. This impact is permanent and moderate negative in nature. Mitigation measures will include:

- It is suggested that suitable engineering measures such as noise barriers, road pavement design, underpasses/foot over bridges at market areas as feasible should be adopted to minimize the noise generation.
- According to monitoring results, additional sound barriers in form of trees and hedges will be discussed with the affected people and planted if agreed;
- It is also suggested that surface roughness of the roads are maintained as per the design characteristics and honking should be discouraged through signboard displays.
- Signs for sensitive zones (health centres / educational institutions etc.) to disallow the use of pressure horns;
- Enforcement and penalties against traffic rules violators; and
- Noise monitoring shall be carried out as per the suggested monitoring plan.

d) Water Pollution (Surface and Groundwater)

Impact

310. The surface water bodies may get flooded and polluted due to uncontrolled release of contaminated storm-water/road runoff from road surfaces. The pollutants associated with the road-runoff include, hydrocarbons, heavy, corrosive products and suspended solids including insoluble heavy metals as colloidal materials from traffic. The worst contamination generally takes place during the first flush of runoff from roads after a spell of dry weather. The level of pollution is directly related to the traffic volume. The pollution risk from accidental spillage may increase moderately. In the long run, the increased traffic volume and faster traffic speeds would increase the risk of accidental spillage, which could have medium adverse impact on surface water quality. The natural drainage of road runoff across embankments or discharge of runoff into water bodies from large area of carriageway may have medium adverse impacts on ponding and the flood risk to downstream locations.

311. Groundwater may get polluted due to contaminated road runoff on earthen shoulders and embankments planted with grasses. Additionally, the project may lead to faster urbanization near the bazar area where improvement with additional facilities have been proposed. This will exert stress on the availability of groundwater in the project area.

Mitigation

312. The following mitigation measures are proposed to attenuate water quality related impacts:

- In order to discharge rapid removal of storm-water/road runoff, cross slopes and longitudinal drainage will be provided in the design. Well-designed cross drainage structures limit ponding across embankments;
- Proper drainage system with sedimentation ponds and oil separators will be provided to avoid contamination by run-off and oil spills, especially drainage will be provided for oil spills near water channels to prevent any contamination;
- Retention basins with reedbeds provided in the design will improve the quality of polluted storm-water/road runoff;
- Drainage and collection structures on the road project, particularly in areas near the river and irrigation canals, shall be designed such that spills of hazardous materials shall not result to contamination of these watercourses

e) Cultural/Sensitive Structure

Impact

313. Cultural/sensitive structures (mosque, grave yards, temple, college, school, and madrasa) adjacent up to the ROW boundary will be affected due to the noise and dust pollution.

Mitigation

314. Noise barrier through plantation on the boundary of the affected cultural sites may reduce the magnitude of noise level.

f) Road Accident/Road Safety

Impact

315. The increased vehicular movement and speed may result in road safety issues like traffic accidents. The accidents may also be due to tiredness. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move.

Mitigation

316. Mitigation measure will include strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic) and enforcement of penalties for the violators. Traffic signs will be provided to facilitate road users about rest areas, eating establishments etc. All the lanes, median, sharp bends will be reflectorized to facilitate travelers in the night time. Proper lighting arrangement on the RoW will be done at required places.

g) Income/Job Opportunities

Impact

317. The operation of the improved road would lead to opening up new markets to rural economic activities by reducing the production and transportation cost thereby stimulating agricultural production. The proposed Project will promote better business opportunities such as new petrol pumps and hotels. Due to increase of traffics, more people will be involved to operate the additional traffics.

Mitigation

318. As a regulatory authority RHD will monitor of the road. Illegal infrastructure development and encroachment along the road have to be checked and controlled by RHD. No infrastructure should be built just adjacent to the road.

4. Assessment of Potential Cumulative Impacts

319. The main purpose of the proposed project is to provide better road connectivity between Cox's Bazar and Teknaf to ensure continuous humanitarian support to the Rohingya Refugee people. Therefore, a sudden increase in traffic after the completion of road upgrading is not expected during normal condition. Existing conditions on the proposed road are poor making travel difficult and time consuming. Therefore in the quest to enhance connectivity between Cox's Bazar and Teknaf, communities along the proposed road will also benefit.

320. Indirect, induced and cumulative impacts will be mainly positive. The full scale of positive indirect impacts will be achieved once the project is implemented. These positive impacts are already discussed in previous section of this IEE, including:

- Improved and safe road connectivity to ensure continuous humanitarian support to the Rohingya refugee people;
- Improved access to social services and connectivity;
- Contribution to poverty reduction through economic development; and
- Improved health and health and safety of the road users.

a) Potential Negative Induced and Cumulative Impacts - Construction

321. Given the remote nature of the project area and that no other major projects are foreseen or planned in the area, cumulative impacts during construction are not anticipated to be significant**.** Should this situation change during the life of the construction project, a robust GRM which has been formulated will assist in mitigating potential cumulative impacts.

b) Potential Negative Induced and Cumulative Impacts – Operation

322. When the improved road is operational, the National Highway (N1) will be considered a success if it encourages economic development and trade in the region. However, this may also have a number of potentially negative impacts:

Tourism:

323. Tourists can bring extra income to the region since this place is already considered as one of the major tourism places of Bangladesh. Additionally, the government is planning to develop the Sabrang Tourism Park at Teknaf. However if tourism grows without appropriate control and regulation and before the infrastructure is prepared, then it can become problematic. After implementation of this project the tourism will grow faster in the region as current tourism activities is very limited due to poor connectivity.

Resource Exploitation:

324. There are natural resources (particularly resources within the forest areas) in the area which are currently being exploited. It is possible that with improved road access to the area, further depletion will be occurred. This may have environmental consequences which would need careful management and monitoring by the relevant authorities.

Human-Wildlife Collision

325. The project road crosses several forest areas in its different sections. However, all the sections are falling in the buffer zone of the forest areas but have serious issues of human – wildlife conflict. Particularly, the conflict between vehicle and elephant along the road might be serious problem in its operation period. It is expected that the use of proper and adequate sign will prevent the conflict and prohibit cutting of trees and hunting of wildlife.

Induced Traffic and Vehicle Emissions

326. The project is likely to induce additional vehicle ownership and related emissions. This is inevitable with a road designed to improve the economic situation of the region, and therefore its use is a measure of its success. Given the remote nature of the road, and lack of industrial development in the region, the additional vehicle emissions induced by the project are not considered to be locally significant, however, they will contribute to global emissions.

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Purpose of Public Participation

327. The development and construction of any project will impact on the surrounding human and physical environment and will have beneficial or adverse effects. It is therefore essential that the community can fully understand the project, have the opportunity to express their views and to become directly involved in the project's overall decision-making process.

328. Public authority developers must take account of the community's views and include any useful suggestions to improve the project. This may include suggestions to help further develop environmental protection measures thereby reducing environmental pollution, reducing the loss of environmental resources and improve the project's environmental and social benefits, thus helping achieve more sustainable development.

329. In accordance with the requirements of the ADB as defined in the SPS 2009 Appendix 1, the ''borrower will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation'' The following activities have therefore been carried out in his project in accordance with the ADB requirements.

B. Consultation and Participation during Feasibility Stage

330. During the environmental assessment the level of consultation and participation has been limited to the Focus Group Discussions (FGD) with the local people:

1. Focus Group Discussions (FGDs)

331. A focus group is a group of individuals were selected and assembled by the environmental survey team to discuss and comment on, from personal experience. Central to successful group discussion was to capture a wide range of opinions about the impact and mitigation because of the road project. The groups were consisted of more than 10 people and they were discussed for approximately one hour to gather information and opinion they have. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. The participants were the villagers, local residents, government officials, shop owners, and general public. The FGDs were conducted at three locations along the project corridor at certain intervals or at bazaar areas to confirm more participants. The details of the consultations is given in the below Table VII.1.

Table VII.1: Details of Consultations with Local People

Sl. No.	Location	Date	Time	Comments/Suggestions
01	Tola Bagan Bazar, Ramu, Cox's Bazar	16.11.2018	11.00am to 12.00pm	▪ Improved road is essential and we welcome the road. ▪ After coming the Rohingya people this road become very busy due to the movement of relief goods and people for the support to refugees. ▪ Due to movement of additional vehicle the road condition become very poor and traffic congestion is common. ▪ The living expense of the local people is very high after coming the huge refugees. If the
02	Teknaf Bazar Road, Teknaf, Cox's Bazar	17.11.2018	2.00pm to 3.00pm	
03	Kot Bazar, Ratna Palong, Ukhiya, Cox's Bazar	19.11.2018	2.00pm to 3.00pm	

Sl. No.	Location	Date	Time	Comments/Suggestions
				road will be improved we will travel to the town easily for seeking better job. ▪ Local people will be benefited economically due to more employment opportunities. ▪ Water should be sprayed 2-3 times in a day to reduce the dust pollution. ▪ Since the road side trees will not be cut so the local environment will not degrade much. However, road safety should be ensured since the road will be very close to the trees. ▪ Commuting will be faster which will help improve business environment.

Figure VII.1: Consultations with Local People

C. Conclusion

332. It will be essential to continue this consultation process to ensure that the community remains supportive and that they are fully informed of progress particularly before and during the construction period. It will be essential that the community is given information on the grievance redress mechanism and that regular meetings with the community are held in the future. Once the project has been approved and a construction program has been defined, the first of a number of community meetings must be held to provide details of the

construction program and to give information on the grievance redress mechanism. A website should be set up including all this information, however, many of the community may not have access to the internet, therefore face to face meetings and hard copy handouts must be provided to the whole community.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. General

333. Environmental mitigation measures and environmental monitoring requirements will be implemented through an Environmental Management Plan (EMP). The EMP provides details of the environmental impacts, environmental mitigation measures, environment monitoring requirements, and environmental supervision responsibilities.

334. This section provides an approach for managing and monitoring environment related issues for environmental management and resource allocations to be carried out by the Roads and Highways Department (RHD) for mitigating negative impacts of the proposed Project.

B. Objectives of the Environmental Management Plan

335. Environmental management plan (EMP) is prepared for all the identified environmental impacts (as illustrated in Chapter VI) during pre-construction, construction and operation stages due to implementation of various Project activities and associated development. The EMP includes mitigation plan, monitoring plan and environmental cost.

336. The aim of the EMP is to ensure implementation of the recommended mitigation measures effectively. The mitigation measures are designed either to prevent impacts or by mitigating those to reduce the effect to an acceptable level that complies with the environmental guidelines of DOE and with the guidelines of the ADB's SPS (2009) by adopting the most suitable techno-economic options. The EMP also ensures that the positive impacts are conserved and enhanced. The main objectives of the EMP for the construction of the Chittagong Port Access Road project are:

- Define the responsibilities of the project proponents in accordance with the three project phases (design, construction and operation);
- Facilitate the implementation of the mitigation measures by providing the technical details of each project impact, and proposing an implementation schedule of the proposed mitigation measures;
- Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
- Identify training requirements at various levels and provide a plan for the implementation of training sessions;
- Identify the resources required to implement the EMP and outline corresponding financing arrangements; and
- Providing a cost estimate for all proposed EMP actions.

C. Environmental Mitigation Plan

337. Mitigation measures for each of the impacts listed in the Table VIII.1, Table VIII.2 and Table VIII.3 for Contract Package-01, Contract Package-02, and Contract Package-03 respectively in accordance with the chapter VI. Responsible institutions/departments for the implementation and supervision of each of the environmental issues have also been illustrated. Mitigation measures have been suggested based on the knowledge of the Environmental Specialist, suggestions of the stakeholders collected during public consultation, and opinions from other relevant specialists.

338. The mitigation measures will be considered successful when comply with the Environmental Quality Standards (EQS), policies, legal requirements set by DOE and other

relevant GOB organizations. In absence of DOE's own EQS, other relevant international or other recognized organization's quality standard will have to be followed.

339. Though the "Anticipated Environmental Impacts and Mitigation Measures" Chapter describes all the relevant issues and the Contractors and other relevant authorities have to ensure the implementation of the issues during different stages of this Project. The below tables for mitigation and monitoring of several environmental issues covers only those have potential impacts during the pre-construction, construction and operation stages of the project.

Table VIII.1: Environmental Management Plan-Mitigative Measures for CP-01

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
Pre-construction Phase							
1.1	Trees and Landscape	No tree cutting is expected due to the improvement of the road. However, some saplings within the RoW of proposed alignment, and workers camp setting areas will be felled and removed during pre-construction period resulting in very minimal ecological and economic loss.	▪ RHD will ensure that no tree is felled due to road improvement. ▪ If unavoidable at least two trees will be planted for every tree cut. ▪ Plantation of 500 trees as enhancement measures. ▪ As each section of the construction work is completed, trees and understory vegetation must be planted, in order to help the cleared areas in an effort to attract some wildlife such as birds.	Along the road	Tree felling may take place throughout the pre-construction period and replanting immediately after each section of road construction is completed.	RHD	RHD, FD, DoE
1.2	Employment and Livelihood	With the extension of road around 30 shops and 141 numbers of people will lose their income, employment and livelihood.	Direct and indirect loss of income will be compensated as prescribed in the ARP and must be implemented prior to construction taking place.	Along the alignment	During implementation stage	RHD	RHD
1.3	Capacity Building of Implementation Agency, RHD, PIU and Contractor	Together with the RHD's SEC a better understanding of environmental safeguards and how they are to implemented is needed. RHD needs to provide this briefing to the implementing agency as well as the contractor	Daylong workshop and briefing on use and application of IEE and EMP documentation	Project Office	Prior to start of construction	RHD, SEC, PIU, Construction Supervision Consultant (CSC) and Contractor	CSC
Construction Phase							
2.1	Topography and Landscape Changes	▪ Visual intrusion will be due to large piles of embankment materials obstructing views. ▪ Excavation along the edge of the alignment will leave large unsafe holes.	▪ Trees as well as fast growing native grasses will be planted along embankment sites to promote natural vegetation. ▪ Material stockpiles will be removed as soon as work is complete and the area re-landscaped.	Embankment areas of the alignment.	Throughout the construction period.	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
2.2	Air Quality	▪ Dust resulting from construction work ▪ Exhaust gas from construction machinery and vehicles used for mobilization of equipment	▪ Watering access road, especially in the dry season Using cover sheets on trucks for the transportation of soil ▪ Periodic maintenance and management of all the construction machinery and vehicles	Construction area	During construction phase	Contractor	CSC
2.3	Hydrology and Surface Water Quality	▪ Earthwork activities during construction of embankment may result in drainage congestion and pollution in paddy field; ▪ The surface water at workers' camp and project site areas may be polluted due to faecal, organic and other contamination. ▪ Disposed wastes and effluents from the construction sites may cause further degradation of surface water.	▪ Ensure all earthworks are done according to design and specifications; ▪ Wastes, effluents and other contaminant materials at camp/work sites to be stored, handled, transported and disposed in planned manners; ▪ Garbage disposal service to be provided, Concrete refuse reused or disposed of without habitat loss; ▪ All other effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out. ▪ Install silt protection curtain ▪ Monitoring water quality in the water bodies regularly	Inspection throughout alignment earthworks	Inspect weekly to ensure that drainage is properly maintained at earthworks	Contractor	CSC
2.4	Groundwater	The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer).	▪ Workforce camps will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags, and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from entering well and groundwater recharge areas. ▪ Wells used for drinking will be tested quarterly to ensure potability.	Throughout the alignment, especially where any new wells were dug.	During construction phase	Contractor	CSC
2.5	Waste	▪ Construction waste from	▪ Update the 'Waste Management Plan' in	Construction	During construction	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
		construction work ▪ Domestic waste from workers ▪ Hazardous waste	Appendix 10 and get approval from CSC. ▪ Conduct separate waste collection and promote recycling and reuse. ▪ Appropriate disposal of non-recyclable waste according to rules ▪ Hazardous waste should be treated under the related regulation	area	phase		
2.6	Noise and Vibration	▪ Noise and vibration caused by construction machinery ▪ Noise caused by vehicles used for mobilization of equipment and workers	▪ Construction machinery Optimizing construction schedule ▪ Performing construction work during daytime, especially piling work. Using low-noise/ low vibration equipment, as much as possible ▪ Transportation of material and equipment for construction by shipping Determine a traffic control plan including route-setting ▪ Limit truck speed, especially around residential areas	Construction area	During construction phase	Contractor	CSC
2.7	Soil	▪ Leakages of oil and chemical materials from construction activity ▪ Inappropriate disposal of waste ▪ Exhaust gas and dust from vehicles	▪ Storage of oil and chemical materials in an appropriate storage site and method to prevent permeation into the ground. ▪ Prohibit illegal dumping ▪ Groundwater monitoring	Construction area	During construction phase	Contractor	CSC
2.8	Erosion	Clearing topsoil in proposed embankment areas can lead to erosion and dust from unprotected storage sites. The erosion risk will also be there at embankment slopes.	Topsoil storage areas must be protected during the dry season wind erosion by covering. Rapid revegetation and use of hydro-seeding and jute erosion protection mats will be applied in areas where erosion is noted during the regular monthly inspections.	Construction area	During construction phase	Contractor	CSC
2.9	Wildlife and	▪ Impact to local ecosystems and species, particularly endangered	▪ Hunting the birds and other animals by construction workers should be banned at	Himchari	During construction	Contractor, CSC,	CSC, RHD

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
	Endangered Species	species and their continued health and sustainability ▪ Disturbance during the construction stage, ▪ Potential opening up of the areas at some distance from the road during construction and operation to greater public access which could lead to intentional and unintentional destruction of any remaining habitats and ecosystems.	the construction sites ▪ No access for any construction activities allowed into forest areas and officially designated areas ▪ No disposal of construction and other waste allowed into forest areas and officially designated areas ▪ No construction of labor camps will be allowed within 5 kilometer of the boundary of any designated area.	National Park, Reserved Forest at Panerchora and Protected Forest at Ukhia	phase	RHD	
2.10	Elephant Pass Path	▪ Elephant and construction equipment collision. ▪ Disturbance to elephant movement by the construction workers. ▪ Obstruction to elephant pass due to temporary construction related structures.	▪ Contractor needs to be fully aware when working in vicinity of elephant travel routes, ▪ Taking care not to block this with equipment of temporary storage, ▪ No construction related camp, equipment and material storage at the crossing site.	Panerchora reserved forest at Ramu	During construction phase	Contractor, CSC, RHD	CSC, Forest Department, DoE
2.11	Losses of Employment and Means of Livelihood	Decrease in employment and business opportunities at the bazaar areas along the road alignment.	Employment of local residents as much as possible.	Bazaar areas along the road	During construction phase	Contractor	CSC
2.12	Disturbance to Existing Social Infrastructure and Services	▪ Increased road traffic may disturb the residents ▪ Traffic jams caused by increased vehicles during construction	▪ Consulting with related authorities on schedule of vessels ▪ Determining a water route after consultation with related authorities ▪ Proper signage around construction area for navigation safety - Reducing the number of vehicles by using buses consulting with related authorities on schedules	Roads near the construction area	During construction phase	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			- Informing vehicle schedules to the surrounding villages determining a traffic control plan ▪ Training for safe operation of vehicles				
2.13	Infectious Diseases such as HIV/AIDS	Temporary influx of migrant labor during construction may increase risk of infection	▪ Implementation of periodic medical check-ups by temporary medical team ▪ Education and training for health care of workers	Construction area	During construction phase	Contractor	CSC
2.14	Work Conditions (Including Work Safety)	▪ Labor accidents ▪ Diseases caused by air pollutants, water pollutants, and noise by construction work	The following generic measures needs to be implemented: ▪ Comply with requirements of Government of Bangladesh Labour Law of 2006 (amended in 2013) and all applicable laws and standards on workers' health and safety (H&S). ▪ Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. ▪ Produce and implement a site H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&S training for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. ▪ Arrange for readily available first aid unit	Construction area	During construction phase	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			including an adequate supply of sterilized dressing materials and appliances ▪ Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. ▪ Provide medical insurance coverage for workers; ▪ Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back-up alarms; ▪ Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be				

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and - Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.				
2.15	Accidents	Traffic accidents	▪ Observation of traffic regulations, installation of traffic signs, and education on safe driving ▪ Training safe operation of vehicles. ▪ Optimization of vehicle schedule. ▪ Reducing the number of vehicles by using buses ▪ Consulting with related authorities on schedules ▪ Informing vehicle schedules to the surrounding villages	Construction area	During construction phase	Contractor	CSC
Operational Phase							
3.1	Air Quality	▪ Exhaust gas from vehicles used for mobilization of equipment and workers ▪ Dust from road	▪ Monitoring the ambient air quality along the road	Along the road	During the operation of the road	RHD	RHD
3.2	Surface Water Quality	▪ Surface water runoff to paddy fields ▪ Ponds along the road	▪ Surface water runoff to paddy fields ▪ Monitoring water quality in the water bodies	Surface water runoff to paddy fields	During the operation of the road	RHD	RHD
3.3	Noise and Vibration	Noise caused by vehicles moving along the road carrying passengers and goods.	▪ Monitoring the noise and vibration levels ▪ Determine a traffic control plan including route-setting ▪ Limit truck speed, especially around residential areas	Along the road	During the operation of the road	RHD	RHD

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
3.4	Elephant Pass Path	▪ Accidents due to more traffic movement. ▪ Changes of the landscape in the crossing area.	▪ Provide proper and adequate signage at elephant crossing section ▪ Ensure the landscape is similar as it was before the road improvement.	Panerchora reserved forest area.	During the operation of the road	RHD	RHD, FD, DoE
3.5	Disturbance to the Existing Social Infrastructure and Services	▪ Traffic jams caused by increased vehicles ▪ Improved roads	▪ Minimizing traffic volume by using buses for local people ▪ Access to social services	Villages near the site	During the operation of the road	RHD	RHD
3.6	Accidents	Traffic accidents	▪ Observation of traffic regulations, installation of traffic signs, and education on safe driving ▪ Reducing the number of vehicles by scheduling buses ▪ Consulting with related authorities on schedules Informing vehicle schedules to the surrounding villages	Villages along the road	During the operation of the road	RHD	RHD

Table VIII.2: Environmental Management Plan-Mitigative Measures for CP-02

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
Pre-construction Phase							
1.1	Trees and Landscape	No tree cutting is expected due to the improvement of the road. However, some saplings within the RoW of proposed alignment, and workers camp setting areas will be felled and removed during pre-construction period resulting in very minimal ecological and economic loss.	▪ RHD will ensure that no tree is felled due to road improvement. ▪ If unavoidable at least two trees will be planted for every tree cut. ▪ Plantation of 500 trees as enhancement measures. ▪ As each section of the construction work is completed, trees and understory vegetation must be planted, in order to help the cleared areas in an effort to	Along the road	Tree felling may take place throughout the pre-construction period and replanting immediately after each section of road construction is completed.	RHD	RHD, FD, DoE

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			attract some wildlife such as birds.				
1.2	Employment and Livelihood	With the extension of road around 43 shops and 189 numbers of people will lose their income, employment and livelihood.	Direct and indirect loss of income will be compensated as prescribed in the ARP and must be implemented prior to construction taking place.	Along the alignment	During implementation stage	- Local NGOs - RHD	RHD and Local NGOs
1.3	Capacity Building of Implementation Agency, RHD, PIU and Contractor	Together with the RHD's SEC a better understanding of environmental safeguards and how they are to implemented is needed. RHD needs to provide this briefing to the implementing agency as well as the contractor	Daylong workshop and briefing on use and application of IEE and EMP documentation	Project Office	Prior to start of construction	RHD, SEC, PIU, Construction Supervision Consultant (CSC) and Contractor	CSC
Construction Phase							
2.1	Topography and Landscape Changes	▪ Visual intrusion will be due to large piles of embankment materials obstructing views. ▪ Excavation along the edge of the alignment will leave large unsafe holes.	▪ Trees as well as fast growing native grasses will be planted along embankment sites to promote natural vegetation. ▪ Material stockpiles will be removed as soon as work is complete and the area re-landscaped.	Embankment areas of the alignment.	Throughout the construction period.	Contractor	CSC
2.2	Air Quality	▪ Dust resulting from construction work ▪ Exhaust gas from construction machinery and vehicles used for mobilization of equipment	▪ Watering access road, especially in the dry season Using cover sheets on trucks for the transportation of soil ▪ Periodic maintenance and management of all the construction machinery and vehicles	Construction area	During construction phase	Contractor	CSC
2.3	Hydrology and Surface Water Quality	▪ Earthwork activities during construction of embankment may result in drainage congestion and pollution in paddy field;	▪ Ensure all earthworks are done according to design and specifications; ▪ Wastes, effluents and other contaminant materials at camp/work sites to be stored,	Inspection throughout alignment earthworks	Inspect weekly to ensure that drainage is properly maintained at	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
		▪ The surface water at workers' camp and project site areas may be polluted due to faecal, organic and other contamination. ▪ Disposed wastes and effluents from the construction sites may cause further degradation of surface water.	handled, transported and disposed in planned manners; ▪ Garbage disposal service to be provided, Concrete refuse reused or disposed of without habitat loss; ▪ All other effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out. ▪ Install silt protection curtain ▪ Monitoring water quality in the water bodies regularly		earthworks		
2.4	Groundwater	The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer).	▪ Workforce camps will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags, and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from entering well and groundwater recharge areas. ▪ Wells used for drinking will be tested quarterly to ensure potability.	Throughout the alignment, especially where any new wells were dug.	During construction phase	Contractor	CSC
2.5	Waste	▪ Construction waste from construction work ▪ Domestic waste from workers ▪ Hazardous waste	▪ Update the 'Waste Management Plan' in Appendix 10 and get approval from CSC. ▪ Conduct separate waste collection and promote recycling and reuse. ▪ Appropriate disposal of non-recyclable waste according to rules ▪ Hazardous waste should be treated under the related regulation	Construction area	During construction phase	Contractor	CSC
2.6	Noise and Vibration	▪ Noise and vibration caused by construction machinery ▪ Noise caused by vehicles used for	▪ Construction machinery Optimizing construction schedule ▪ Performing construction work during	Construction area	During construction phase	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
		mobilization of equipment and workers	daytime, especially piling work. Using low-noise/ low vibration equipment, as much as possible ▪ Transportation of material and equipment for construction by shipping Determine a traffic control plan including route-setting ▪ Limit truck speed, especially around residential areas				
2.7	Soil	▪ Leakages of oil and chemical materials from construction activity ▪ Inappropriate disposal of waste ▪ Exhaust gas and dust from vehicles	▪ Storage of oil and chemical materials in an appropriate storage site and method to prevent permeation into the ground. ▪ Prohibit illegal dumping ▪ Groundwater monitoring	Construction area	During construction phase	Contractor	CSC
2.8	Erosion	Clearing topsoil in proposed embankment areas can lead to erosion and dust from unprotected storage sites. The erosion risk will also be there at embankment slopes.	Topsoil storage areas must be protected during the dry season wind erosion by covering. Rapid revegetation and use of hydro-seeding and jute erosion protection mats will be applied in areas where erosion is noted during the regular monthly inspections.	Construction area	During construction phase	Contractor	CSC
2.9	Wildlife and Endangered Species	▪ Impact to local ecosystems and species, particularly endangered species and their continued health and sustainability ▪ Disturbance during the construction stage, ▪ Potential opening up of the areas at some distance from the road during construction and operation to greater public access which could lead to intentional and unintentional	▪ Hunting the birds and other animals by construction workers should be banned at the construction sites ▪ No access for any construction activities allowed into forest areas and officially designated areas ▪ No disposal of construction and other waste allowed into forest areas and officially designated areas ▪ No construction of labor camps will be allowed within 5 kilometer of the boundary of any designated area.	Construction area and Protected Forest at Ukhia and other small patches of forest	During construction phase	Contractor, CSC, RHD	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
		destruction of any remaining habitats and ecosystems.					
2.10	Elephant Pass Path	▪ Elephant and construction equipment collision. ▪ Disturbance to elephant movement by the construction workers. ▪ Obstruction to elephant pass due to temporary construction related structures.	▪ Contractor needs to be fully aware when working in vicinity of elephant travel routes, ▪ Taking care not to block this with equipment of temporary storage, ▪ No construction related camp, equipment and material storage at the crossing site.	Protected forest at Ukhiya	During construction phase	Contractor, CSC, RHD	CSC, Forest Department, DoE
2.11	Losses of Employment and Means of Livelihood	Decrease in employment and business opportunities at the bazaar areas along the road alignment.	Employment of local residents as much as possible.	Bazaar areas along the road	During construction phase	Contractor	CSC
2.12	Disturbance to Existing Social Infrastructure and Services	▪ Increased road traffic may disturb the residents ▪ Traffic jams caused by increased vehicles during construction	▪ Consulting with related authorities on schedule of vessels ▪ Determining a water route after consultation with related authorities ▪ Proper signage around construction area for navigation safety - Reducing the number of vehicles by using buses consulting with related authorities on schedules - Informing vehicle schedules to the surrounding villages determining a traffic control plan ▪ Training for safe operation of vehicles	Roads near the construction area	During construction phase	Contractor	CSC
2.13	Infectious Diseases such as HIV/AIDS	Temporary influx of migrant labor during construction may increase risk of infection	▪ Implementation of periodic medical check-ups by temporary medical team ▪ Education and training for health care of workers	Construction area	During construction phase	Contractor	CSC
2.14	Work Conditions (Including Work	▪ Labor accidents ▪ Diseases caused by air pollutants,	The following generic measures needs to be implemented:	Construction area	During construction phase	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
	Safety)	water pollutants, and noise by construction work	▪ Comply with requirements of Government of Bangladesh Labour Law of 2006 (amended in 2013) and all applicable laws and standards on workers' health and safety (H&S). ▪ Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. ▪ Produce and implement a site H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&S training for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. ▪ Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances ▪ Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all				

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			times. ▪ Provide medical insurance coverage for workers; ▪ Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back-up alarms; ▪ Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and - Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.				
2.15	Accidents	Traffic accidents	▪ Observation of traffic regulations,	Construction	During construction	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			installation of traffic signs, and education on safe driving ▪ Training safe operation of vehicles. ▪ Optimization of vehicle schedule. ▪ Reducing the number of vehicles by using buses ▪ Consulting with related authorities on schedules ▪ Informing vehicle schedules to the surrounding villages	area	phase		
Operational Phase							
3.1	Air Quality	▪ Exhaust gas from vehicles used for mobilization of equipment and workers ▪ Dust from road	▪ Monitoring the ambient air quality along the road	Along the road	During the operation of the road	RHD	RHD
3.2	Surface Water Quality	▪ Surface water runoff to paddy fields ▪ Ponds along the road	▪ Surface water runoff to paddy fields ▪ Monitoring water quality in the water bodies	Surface water runoff to paddy fields	During the operation of the road	RHD	RHD
3.3	Noise and Vibration	Noise caused by vehicles moving along the road carrying passengers and goods.	▪ Monitoring the noise and vibration levels ▪ Determine a traffic control plan including route-setting ▪ Limit truck speed, especially around residential areas	Along the road	During the operation of the road	RHD	RHD
3.4	Elephant Pass Path	▪ Accidents due to more traffic movement. ▪ Changes of the landscape in the crossing area.	▪ Provide proper and adequate signage at elephant crossing section ▪ Ensure the landscape is similar as it was before the road improvement.	Protected forest at Ukhiya.	During the operation of the road	RHD	RHD, FD, DoE
3.5	Disturbance to the Existing Social Infrastructure and Services	▪ Traffic jams caused by increased vehicles ▪ Improved roads	▪ Minimizing traffic volume by using buses for local people ▪ Access to social services	Villages near the site	During the operation of the road	RHD	RHD

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
3.6	Accidents	Traffic accidents	▪ Observation of traffic regulations, installation of traffic signs, and education on safe driving ▪ Reducing the number of vehicles by scheduling buses ▪ Consulting with related authorities on schedules Informing vehicle schedules to the surrounding villages	Villages along the road	During the operation of the road	RHD	RHD

Table VIII.3: Environmental Management Plan-Mitigative Measures for CP-03

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
Pre-construction Phase							
1.1	Trees and Landscape	No tree cutting is expected due to the improvement of the road. However, some saplings within the RoW of proposed alignment, and workers camp setting areas will be felled and removed during pre-construction period resulting in very minimal ecological and economic loss.	▪ RHD will ensure that no tree is felled due to road improvement. ▪ If unavoidable at least two trees will be planted for every tree cut. ▪ Plantation of 500 trees as enhancement measures. ▪ As each section of the construction work is completed, trees and understory vegetation must be planted, in order to help the cleared areas in an effort to attract some wildlife such as birds.	Along the road	Tree felling may take place throughout the pre-construction period and replanting immediately after each section of road construction is completed.	RHD	RHD, FD, DoE
1.2	Employment and Livelihood	With the extension of road around 43 shops and 189 numbers of people will lose their income, employment and livelihood.	Direct and indirect loss of income will be compensated as prescribed in the ARP and must be implemented prior to construction taking place.	Along the alignment	During implementation stage	- Local NGOs - RHD	RHD and Local NGOs
1.3	Capacity Building of	Together with the RHD's SEC a better understanding of	Daylong workshop and briefing on use and application of IEE and EMP documentation	Project Office	Prior to start of construction	RHD, SEC, PIU, Construction	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
	Implementation Agency, RHD, PIU and Contractor	environmental safeguards and how they are to implemented is needed. RHD needs to provide this briefing to the implementing agency as well as the contractor				Supervision Consultant (CSC) and Contractor	
Construction Phase							
2.1	Topography and Landscape Changes	▪ Visual intrusion will be due to large piles of embankment materials obstructing views. ▪ Excavation along the edge of the alignment will leave large unsafe holes.	▪ Trees as well as fast growing native grasses will be planted along embankment sites to promote natural vegetation. ▪ Material stockpiles will be removed as soon as work is complete and the area re-landscaped.	Embankment areas of the alignment.	Throughout the construction period.	Contractor	CSC
2.2	Air Quality	▪ Dust resulting from construction work ▪ Exhaust gas from construction machinery and vehicles used for mobilization of equipment	▪ Watering access road, especially in the dry season Using cover sheets on trucks for the transportation of soil ▪ Periodic maintenance and management of all the construction machinery and vehicles	Construction area	During construction phase	Contractor	CSC
2.3	Hydrology and Surface Water Quality	▪ Earthwork activities during construction of embankment may result in drainage congestion and pollution in paddy field; ▪ The surface water at workers' camp and project site areas may be polluted due to faecal, organic and other contamination. ▪ Disposed wastes and effluents from the construction sites may cause further degradation of surface water.	▪ Ensure all earthworks are done according to design and specifications; ▪ Wastes, effluents and other contaminant materials at camp/work sites to be stored, handled, transported and disposed in planned manners; ▪ Garbage disposal service to be provided, Concrete refuse reused or disposed of without habitat loss; ▪ All other effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out. ▪ Install silt protection curtain	Inspection throughout alignment earthworks	Inspect weekly to ensure that drainage is properly maintained at earthworks	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			▪ Monitoring water quality in the water bodies regularly				
2.4	Groundwater	The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer).	▪ Workforce camps will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags, and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from entering well and groundwater recharge areas. ▪ Wells used for drinking will be tested quarterly to ensure potability.	Throughout the alignment, especially where any new wells were dug.	During construction phase	Contractor	CSC
2.5	Waste	▪ Construction waste from construction work ▪ Domestic waste from workers ▪ Hazardous waste	▪ Update the 'Waste Management Plan' in Appendix 10 and get approval from CSC. ▪ Conduct separate waste collection and promote recycling and reuse. ▪ Appropriate disposal of non-recyclable waste according to rules ▪ Hazardous waste should be treated under the related regulation	Construction area	During construction phase	Contractor	CSC
2.6	Noise and Vibration	▪ Noise and vibration caused by construction machinery ▪ Noise caused by vehicles used for mobilization of equipment and workers	▪ Construction machinery Optimizing construction schedule ▪ Performing construction work during daytime, especially piling work. Using low-noise/ low vibration equipment, as much as possible ▪ Transportation of material and equipment for construction by shipping Determine a traffic control plan including route-setting ▪ Limit truck speed, especially around residential areas	Construction area	During construction phase	Contractor	CSC
2.7	Soil	▪ Leakages of oil and chemical materials from construction	▪ Storage of oil and chemical materials in an appropriate storage site and method to	Construction	During construction	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
		activity ▪ Inappropriate disposal of waste ▪ Exhaust gas and dust from vehicles	prevent permeation into the ground. ▪ Prohibit illegal dumping ▪ Groundwater monitoring	area	phase		
2.8	Erosion	Clearing topsoil in proposed embankment areas can lead to erosion and dust from unprotected storage sites. The erosion risk will also be there at embankment slopes.	Topsoil storage areas must be protected during the dry season wind erosion by covering. Rapid revegetation and use of hydro-seeding and jute erosion protection mats will be applied in areas where erosion is noted during the regular monthly inspections.	Construction area	During construction phase	Contractor	CSC
2.9	Wildlife and Endangered Species	▪ Impact to local ecosystems and species, particularly endangered species and their continued health and sustainability ▪ Disturbance during the construction stage, ▪ Potential opening up of the areas at some distance from the road during construction and operation to greater public access which could lead to intentional and unintentional destruction of any remaining habitats and ecosystems.	▪ Hunting the birds and other animals by construction workers should be banned at the construction sites ▪ No access for any construction activities allowed into forest areas and officially designated areas ▪ No disposal of construction and other waste allowed into forest areas and officially designated areas ▪ No construction of labor camps will be allowed within 5 kilometer of the boundary of any designated area.	Construction area and Teknaf Wildlife Sanctuary	During construction phase	Contractor, CSC, RHD	CSC, Forest Department
2.10	Losses of Employment and Means of Livelihood	Decrease in employment and business opportunities at the bazaar areas along the road alignment.	Employment of local residents as much as possible.	Bazaar areas along the road	During construction phase	Contractor	CSC
2.11	Disturbance to Existing Social Infrastructure	▪ Increased road traffic may disturb the residents ▪ Traffic jams caused by increased	▪ Consulting with related authorities on schedule of vessels ▪ Determining a water route after	construction area	During construction phase	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
	and Services	vehicles during construction	consultation with related authorities ▪ Proper signage around construction area for navigation safety - Reducing the number of vehicles by using buses consulting with related authorities on schedules - Informing vehicle schedules to the surrounding villages determining a traffic control plan ▪ Training for safe operation of vehicles				
2.12	Infectious Diseases such as HIV/AIDS	Temporary influx of migrant labor during construction may increase risk of infection	▪ Implementation of periodic medical check-ups by temporary medical team ▪ Education and training for health care of workers	Construction area	During construction phase	Contractor	CSC
2.13	Work Conditions (Including Work Safety)	▪ Labor accidents ▪ Diseases caused by air pollutants, water pollutants, and noise by construction work	The following generic measures needs to be implemented: ▪ Comply with requirements of Government of Bangladesh Labour Law of 2006 (amended in 2013) and all applicable laws and standards on workers' health and safety (H&S). ▪ Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. ▪ Produce and implement a site H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves,	Construction area	During construction phase	Contractor	CSC

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			goggles and masks) at all times; (iii) providing H&S training for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. ▪ Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances ▪ Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. ▪ Provide medical insurance coverage for workers; ▪ Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; ▪ Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted				

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
			with audible back-up alarms; ▪ Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and - Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.				
2.14	Accidents	Traffic accidents	▪ Observation of traffic regulations, installation of traffic signs, and education on safe driving ▪ Training safe operation of vehicles. ▪ Optimization of vehicle schedule. ▪ Reducing the number of vehicles by using buses ▪ Consulting with related authorities on schedules ▪ Informing vehicle schedules to the surrounding villages	Construction area	During construction phase	Contractor	CSC
Operational Phase							
3.1	Air Quality	▪ Exhaust gas from vehicles used for mobilization of equipment and workers ▪ Dust from road	▪ Monitoring the ambient air quality along the road	Along the road	During the operation of the road	RHD	RHD
3.2	Surface Water Quality	▪ Surface water runoff to paddy fields ▪ Ponds along the road	▪ Surface water runoff to paddy fields ▪ Monitoring water quality in the water bodies	Surface water runoff to	During the operation of the road	RHD	RHD

No	Environmental Issues	Potential Impact	Mitigation Measures	Location	Duration	Responsible Institution	
						Implementation	Supervision
				paddy fields			
3.3	Noise and Vibration	Noise caused by vehicles moving along the road carrying passengers and goods.	▪ Monitoring the noise and vibration levels ▪ Determine a traffic control plan including route-setting ▪ Limit truck speed, especially around residential areas	Along the road	During the operation of the road	RHD	RHD
3.4	Disturbance to the Existing Social Infrastructure and Services	▪ Traffic jams caused by increased vehicles ▪ Improved roads	▪ Minimizing traffic volume by using buses for local people ▪ Access to social services	Villages near the site	During the operation of the road	RHD	RHD
3.5	Accidents	Traffic accidents	▪ Observation of traffic regulations, installation of traffic signs, and education on safe driving ▪ Reducing the number of vehicles by scheduling buses ▪ Consulting with related authorities on schedules Informing vehicle schedules to the surrounding villages	Villages along the road	During the operation of the road	RHD	RHD

D. Environmental Monitoring Plan

340. Environmental monitoring is an essential tool for environmental management as it provides the basic information for rational management decisions. The purpose of the monitoring program is to ensure that the envisaged purposes of the project are achieved and result in desired benefits to the target population. To ensure the effective implementation of the mitigation measures, it is essential that an effective monitoring program be designed and carried out. Compliance monitoring will be conducted in accordance with the environmental mitigation measures and monitoring plan provided with this report (Table VIII.4, Table VIII.5, and Table VIII.6).

1. Objectives

341. The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. The main objectives of the pre-construction, construction and operation phase monitoring plans will be to:

i. Monitor the actual impact of the works on physical, biological and socioeconomic receptors within the project corridor for indicating the adequacy of the EIA;
ii. Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the EIA;
iii. Ensure compliance with legal and community obligations including safety on construction sites;
iv. Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMP;
v. Ensure the safe disposal of excess construction materials.
vi. Appraise the adequacy of the IEE with respect to the project's predicted long-term impacts on the corridor's physical, biological and socio-economic environment;
vii. Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
viii. Compile periodic accident data to support analyses that will help minimize future risks; and
ix. Monitor the survival rate of avenue plantations.

Table VIII.4: Environmental Monitoring Plan for Contract Package-01

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
Pre-Construction Phase								
1.1	Trees and Landscape	No tree cutting is expected due to the improvement of the road. However, some saplings within the RoW of proposed alignment, and workers camp setting areas will be felled and removed during pre-construction period resulting in very minimal ecological and economic loss.	▪ Confirm that a tree cutting and replanting programme is fully ready to implement during the preconstruction period ▪ Plantation of 500 trees as enhancement measures. ▪ Confirm that this planting plan is following during the construction period also.	Tree replanting plan and record of compensation	Along the alignment	During the pre-construction period	RHD	RHD
1.2	Employment and Livelihood	With the extension of road around 30 shops and 141 numbers of people will lose their income, employment and livelihood.	Confirm that this issue is addressed in RAP	Record of RAP review on file	Along the alignment	During the pre-construction period	RHD	RHD
1.3	Capacity Building of Implementation Agency, RHD and PIU	Together with the RHD's SEC a better understanding of environmental safeguards and how they are to implemented is needed. RHD needs to provide	Implementation of EMP	Obtain record of presentation	At RHD Office	Prior to contractor mobilization	RHD/SEC/PIU	

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		this briefing to the implementing agency as well as the contractor						
Construction Phase								
2.1	Topography and Landscape Changes	▪ Visual intrusion will be due to large piles of embankment materials obstructing views. ▪ Excavation along the edge of the alignment will leave large unsafe holes.	▪ Restoration of changes due to construction activities ▪ Visual amenity	Inspection/ consultation with adjacent households and RHD authority to get opinion on work being completed	Along the alignment	Construction stage/ Weekly inspection	Contractor	CSC & RHD
2.2	Air Quality	▪ Dust resulting from construction work ▪ Exhaust gas from construction machinery and vehicles used for mobilization of equipment	Evaluation of effect of the mitigation measure towards air pollution	Collecting samples and analyzing at the lab. (PM10, PM2.5, SOx, NOx, CO, Temperature, Humidity, Wind Speed and Wind Direction)	2 Sampling Stations ▪ sensitive location near construction site ▪ Near forest area	Once every three month	Contractor	CSC & RHD
2.3	Hydrology and Surface Water Quality	▪ Earthwork activities during construction of embankment may result in drainage congestion and pollution in paddy field; ▪ The surface water at workers' camp and project site areas may be polluted due to faecal, organic and other contamination.	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples and analyzing at the lab. (pH, Temperature, Turbidity, Conductivity, Total Phosphate (PO4),	1 Sampling Station ▪ Pond near the construction site	Once every three month	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		▪ Disposed wastes and effluents from the construction sites may cause further degradation of surface water.		Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Sulphate (SO4) and Dissolved Oxygen (DO))				
2.4	Groundwater Quality	Contamination by the seepage of wastes from workers' camps through the soil profile into the GW aquifer.	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples and analyzing at the Lab. (pH, Color, Temperature, Turbidity, Manganese (Mn), Arsenic (As), Iron (Fe), Chloride (Cl), Salinity, Total Hardness, Total Coliform (TC) and Faecal Coliform (FC))	2 locations ▪ Existing tubewell along the road ▪ Campsite	Quarterly	Contractor	CSC & RHD
2.5	Wastes	▪ Construction waste from construction work ▪ Domestic waste from workers ▪ Hazardous waste such as dry batteries, etc.	Evaluation of effect of the mitigation measure for waste	Record of kinds and quantity of waste, and the disposal method	▪ Along the road ▪ Workers camp	Continuous Record	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
2.6	Noise and Vibration	▪ Noise and vibration caused by construction machinery ▪ Noise caused by vehicles used for mobilization of equipment and workers	Evaluation of effect of the mitigation measure towards noise level	Measurement using noise level meter	4 points (day & night) ▪ Along the road near sensitive location ▪ Forest area ▪ Campsite	Once every three month	Contractor	CSC & RHD
2.7	Soil	▪ Leakages of oil and chemical materials from construction activity ▪ Inappropriate disposal of waste	Prevent soil pollution	Inspect storage areas and record state of storage areas with photos.	▪ Workers' camp ▪ Construction sites	As part of regular construction inspection, likely weekly	Contractor	CSC & RHD
2.8	Erosion	Clearing topsoil in proposed embankment areas can lead to erosion and dust from unprotected storage sites. The erosion risk will also be there at embankment slopes.	Prevent water pollution	▪ Inspect storage areas and record state of storage areas with photos, and then report level of erosion and onsite dust. ▪ Inspect embankment construction areas for erosion and repair	Embankment construction sites	As part of regular construction inspection, likely weekly	Contractor	CSC & RHD
2.9	Wildlife and Endangered Species	▪ Impact to local ecosystems and species, particularly endangered species and their continued	Restoration of local ecosystem	Observation	▪ Along the road alignment	Daily/weekly throughout the construction	Contractor, CSC	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		health and sustainability ▪ Disturbance during the construction stage, ▪ Potential opening up of the areas at some distance from the road during construction and operation to greater public access which could lead to intentional and unintentional destruction of any remaining habitats and ecosystems.			▪ Himchari National Park ▪ Panerchora Reserved Forest ▪ Protected forest at Ukhiya	period		
2.10	Elephant Pass Path	▪ Elephant and construction equipment collision. ▪ Disturbance to elephant movement by the construction workers. ▪ Obstruction to elephant pass due to temporary construction related structures.	Removal the obstruction of elephant pass	Observation	▪ Panerchora Reserved Forest	weekly throughout the construction period	Contractor, CSC, RHD	CSC, FD & RHD
2.11	Losses of Employment and Means of Livelihood	Decrease in employment and business opportunities at the bazaar areas along the road alignment.	▪ Improvement of the local economy ▪ Improvement of living standards of local residents ▪ Consideration to local residents' emotions	▪ Hearings from the related institutions ▪ Interviewing residents	▪ Bazar locations	weekly throughout the construction period	Contractor	CSC & RHD
2.12	Disturbance to Existing Social	▪ Increased road traffic may disturb the local residents	Evaluation of effect of construction schedule	Record of numbers construction vehicles	Project site	Continuous Record	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
	Infrastructure and Services	▪ Traffic jams caused by increased vehicles during construction						
2.13	Infectious Diseases such as HIV/AIDS	Temporary influx of migrant labor during construction may increase risk of infection	Evaluation of sanitation for labor	Labor health record	Related institutions	Twice a year	Contractor	CSC & RHD
2.14	Work condition (including work safety)	Labor accidents .	Evaluation of effect of the work safety plan	Record of accidents	Contractor's office	Continuous Record	Contractor	CSC & RHD
2.15	Accidents	Traffic accidents	Evaluation of effect of traffic schedule	Record of accidents	Contractor's office	Continuous Record	Contractor	CSC & RHD
Operation Phase								
3.1	Air Quality	▪ Exhaust gas from vehicles used for mobilization of equipment and workers ▪ Dust from road	Evaluation of effect of the mitigation measure towards air pollution	Collecting samples at the site, analyzing at the lab.	1point ▪ Residential area around the road	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD
3.2	Surface Water Quality	▪ Surface water runoff to paddy fields ▪ Ponds along the road	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples at the site, analyzing at the lab Continuous measurement using a sensor	1 point ▪ Pond near the road	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD
3.3	Noise and vibration	Noise caused by vehicles moving along the road carrying passengers and goods.	Evaluation of effect of the mitigation measure towards	Measurement using noise level meter	2 points (day & night) ▪ Along the	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
			noise level		road ▪ Forest area			
3.4	Elephant Pass Path	▪ Accidents due to more traffic movement. ▪ Changes of the landscape in the crossing area.	▪ Evaluation of the effect of traffic sign ▪ Evaluation of the effect of awareness	Record of numbers of human-elephant collision	Panerchora Reserved Forest	Continuous Record	RHD	RHD, FD
3.5	Disturbance to the Existing Social Infrastructure and Services	▪ Traffic jams caused by increased vehicles ▪ Improved roads	Evaluation of effect of traffic schedule	Record of numbers of vehicles	along the road	Continuous Record	RHD	RHD
3.6	Accidents	Traffic accidents	Evaluation of effect of the work safety plan	Record of accidents and fire	Along the road	Continuous Record	RHD	RHD

Table VIII.5: Environmental Monitoring Plan for Contract Package-02

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
Pre-Construction Phase								
1.1	Trees and Landscape	No tree cutting is expected due to the improvement of the road. However, some saplings within the RoW of proposed alignment, and workers camp setting areas will be felled and removed during	▪ Confirm that a tree cutting and replanting programme is fully ready to implement during the preconstruction period	Tree replanting plan and record of compensation	Along the alignment	During the pre-construction period	RHD	RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		pre-construction period resulting in very minimal ecological and economic loss.	▪ Plantation of 500 trees as enhancement measures. ▪ Confirm that this planting plan is following during the construction period also.					
1.2	Employment and Livelihood	With the extension of road around 43 shops and 189 numbers of people will lose their income, employment and livelihood.	Confirm that this issue is addressed in RAP	Record of RAP review on file	Along the alignment	During the pre-construction period	RHD	RHD
1.3	Capacity Building of Implementation Agency, RHD and PIU	Together with the RHD's SEC a better understanding of environmental safeguards and how they are to implemented is needed. RHD needs to provide this briefing to the implementing agency as well as the contractor	Implementation of EMP	Obtain record of presentation	At RHD Office	Prior to contractor mobilization	RHD/SEC/PIU	
Construction Phase								
2.1	Topography and Landscape Changes	▪ Visual intrusion will be due to large piles of embankment materials obstructing views. ▪ Excavation along the edge of the alignment will leave large unsafe holes.	▪ Restoration of changes due to construction activities ▪ Visual amenity	Inspection/ consultation with adjacent households and RHD authority to get opinion on work	Along the alignment	Construction stage/ Weekly inspection	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
				being completed				
2.2	Air Quality	▪ Dust resulting from construction work ▪ Exhaust gas from construction machinery and vehicles used for mobilization of equipment	Evaluation of effect of the mitigation measure towards air pollution	Collecting samples and analyzing at the lab. (PM10, PM2.5, SOx, NOx, CO, Temperature, Humidity, Wind Speed and Wind Direction)	2 Sampling Stations ▪ sensitive location near construction site ▪ Near forest area	Once every three month	Contractor	CSC & RHD
2.3	Hydrology and Surface Water Quality	▪ Earthwork activities during construction of embankment may result in drainage congestion and pollution in paddy field; ▪ The surface water at workers' camp and project site areas may be polluted due to faecal, organic and other contamination. ▪ Disposed wastes and effluents from the construction sites may cause further degradation of surface water.	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples and analyzing at the lab. (pH, Temperature, Turbidity, Conductivity, Total Phosphate (PO4), Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Sulphate (SO4) and Dissolved Oxygen (DO))	1 Sampling Station ▪ Pond near the construction site	Once every three month	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
2.4	Groundwater Quality	Contamination by the seepage of wastes from workers' camps through the soil profile into the GW aquifer.	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples and analyzing at the Lab. (pH, Color, Temperature, Turbidity, Manganese (Mn), Arsenic (As), Iron (Fe), Chloride (Cl), Salinity, Total Hardness, Total Coliform (TC) and Faecal Coliform (FC))	2 locations ▪ Existing tubewell along the road ▪ Campsite	Quarterly	Contractor	CSC & RHD
2.5	Wastes	▪ Construction waste from construction work ▪ Domestic waste from workers ▪ Hazardous waste such as dry batteries, etc.	Evaluation of effect of the mitigation measure for waste	Record of kinds and quantity of waste, and the disposal method	▪ Along the road ▪ Workers camp	Continuous Record	Contractor	CSC & RHD
2.6	Noise and Vibration	▪ Noise and vibration caused by construction machinery ▪ Noise caused by vehicles used for mobilization of equipment and workers	Evaluation of effect of the mitigation measure towards noise level	Measurement using noise level meter	4 points (day & night) ▪ Along the road near sensitive location ▪ Forest area ▪ Campsite	Once every three month	Contractor	CSC & RHD
2.7	Soil	▪ Leakages of oil and chemical	Prevent soil pollution	Inspect storage areas	▪ Workers'	As part of regular	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		materials from construction activity ▪ Inappropriate disposal of waste		and record state of storage areas with photos.	camp ▪ Construction sites	construction inspection, likely weekly		
2.8	Erosion	Clearing topsoil in proposed embankment areas can lead to erosion and dust from unprotected storage sites. The erosion risk will also be there at embankment slopes.	Prevent water pollution	▪ Inspect storage areas and record state of storage areas with photos, and then report level of erosion and onsite dust. ▪ Inspect embankment construction areas for erosion and repair	Embankment construction sites	As part of regular construction inspection, likely weekly	Contractor	CSC & RHD
2.9	Wildlife and Endangered Species	▪ Impact to local ecosystems and species, particularly endangered species and their continued health and sustainability ▪ Disturbance during the construction stage, ▪ Potential opening up of the areas at some distance from the road during construction and operation to greater public access which could lead to intentional and unintentional destruction of any remaining	Restoration of local ecosystem	Observation	▪ Along the road alignment ▪ Protected forest at Ukhiya ▪ Other small patches of forest	Daily/weekly throughout the construction period	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		habitats and ecosystems.						
2.10	Elephant Pass Path	▪ Elephant and construction equipment collision. ▪ Disturbance to elephant movement by the construction workers. ▪ Obstruction to elephant pass due to temporary construction related structures.	Removal the obstruction of elephant pass	Observation	▪ Protected forest at Ukhiya	weekly throughout the construction period	Contractor	CSC & RHD
2.11	Losses of Employment and Means of Livelihood	Decrease in employment and business opportunities at the bazaar areas along the road alignment.	▪ Improvementof the local economy ▪ Improvement of living standards of local residents ▪ Consideration to local residents' emotions	▪ Hearings from the related institutions ▪ Interviewing residents	▪ Bazar locations	weekly throughout the construction period	Contractor	CSC & RHD
2.12	Disturbance to Existing Social Infrastructure and Services	▪ Increased road traffic may disturb the local residents ▪ Traffic jams caused by increased vehicles during construction	Evaluation of effect of construction schedule	Record of numbers construction vehicles	Project site	Continuous Record	Contractor	CSC & RHD
2.13	Infectious Diseases such as HIV/AIDS	Temporary influx of migrant labor during construction may increase risk of infection	Evaluation of sanitation for labor	Labor health record	Related institutions	Twice a year	Contractor	CSC & RHD
2.14	Work condition (including work	Labor accidents .	Evaluation of effect of the work safety plan	Record of accidents	Contractor's office	Continuous Record	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
	safety)							
2.15	Accidents	Traffic accidents	Evaluation of effect of traffic schedule	Record of accidents	Contractor's office	Continuous Record	Contractor	CSC & RHD
Operation Phase								
3.1	Air Quality	▪ Exhaust gas from vehicles used for mobilization of equipment and workers ▪ Dust from road	Evaluation of effect of the mitigation measure towards air pollution	Collecting samples at the site, analyzing at the lab.	1point ▪ Residential area around the road	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD
3.2	Surface Water Quality	▪ Surface water runoff to paddy fields ▪ Ponds along the road	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples at the site, analyzing at the lab Continuous measurement using a sensor	1 point ▪ Pond near the road	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD
3.3	Noise and vibration	Noise caused by vehicles moving along the road carrying passengers and goods.	Evaluation of effect of the mitigation measure towards noise level	Measurement using noise level meter	2 points (day & night) ▪ Along the road ▪ Forest area	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD
3.4	Elephant Pass Path	▪ Accidents due to more traffic movement. ▪ Changes of the landscape in the crossing area.	▪ Evaluation of the effect of traffic sign ▪ Evaluation of the effect of awareness	Record of numbers of human-elephant collision	Protected forest at Ukhiya	Continuous Record	RHD	RHD, FD
3.5	Disturbance to the Existing Social	▪ Traffic jams caused by increased vehicles ▪ Improved roads	Evaluation of effect of traffic schedule	Record of numbers of vehicles	along the road	Continuous Record	RHD	RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
	Infrastructure and Services							
3.6	Accidents	Traffic accidents	Evaluation of effect of the work safety plan	Record of accidents and fire	Along the road	Continuous Record	RHD	RHD

Table VIII.6: Environmental Monitoring Plan for Contract Package-03

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
Pre-Construction Phase								
1.1	Trees and Landscape	No tree cutting is expected due to the improvement of the road. However, some saplings within the RoW of proposed alignment, and workers camp setting areas will be felled and removed during pre-construction period resulting in very minimal ecological and economic loss.	▪ Confirm that a tree cutting and replanting programme is fully ready to implement during the preconstruction period ▪ Plantation of 500 trees as enhancement measures. ▪ Confirm that this planting plan is following during the construction period also.	Tree replanting plan and record of compensation	Along the alignment	During the pre-construction period	RHD	RHD
1.2	Employment	With the extension of road	Confirm that this issue	Record of RAP review	Along the	During the pre-	RHD	RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
	and Livelihood	around 43 shops and 189 numbers of people will lose their income, employment and livelihood.	is addressed in RAP	on file	alignment	construction period		
1.3	Capacity Building of Implementation Agency, RHD and PIU	Together with the RHD's SEC a better understanding of environmental safeguards and how they are to implemented is needed. RHD needs to provide this briefing to the implementing agency as well as the contractor	Implementation of EMP	Obtain record of presentation	At RHD Office	Prior to contractor mobilization	RHD/SEC/PIU	
Construction Phase								
2.1	Topography and Landscape Changes	▪ Visual intrusion will be due to large piles of embankment materials obstructing views. ▪ Excavation along the edge of the alignment will leave large unsafe holes.	▪ Restoration of changes due to construction activities ▪ Visual amenity	Inspection/ consultation with adjacent households and RHD authority to get opinion on work being completed	Along the alignment	Construction stage/ Weekly inspection	Contractor	CSC & RHD
2.2	Air Quality	▪ Dust resulting from construction work ▪ Exhaust gas from construction machinery and vehicles used for mobilization of equipment	Evaluation of effect of the mitigation measure towards air pollution	Collecting samples and analyzing at the lab. (PM10, PM2.5, SOx, NOx, CO, Temperature, Humidity, Wind	2 Sampling Stations ▪ sensitive location near construction site ▪ Near forest area	Once every three month	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
				Speed and Wind Direction)				
2.3	Hydrology and Surface Water Quality	▪ Earthwork activities during construction of embankment may result in drainage congestion and pollution in paddy field; ▪ The surface water at workers' camp and project site areas may be polluted due to faecal, organic and other contamination. ▪ Disposed wastes and effluents from the construction sites may cause further degradation of surface water.	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples and analyzing at the lab. (pH, Temperature, Turbidity, Conductivity, Total Phosphate (PO4), Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Sulphate (SO4) and Dissolved Oxygen (DO))	1 Sampling Station ▪ Pond near the construction site	Once every three month	Contractor	CSC & RHD
2.4	Groundwater Quality	Contamination by the seepage of wastes from workers' camps through the soil profile into the GW aquifer.	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples and analyzing at the Lab. (pH, Color, Temperature, Turbidity, Manganese (Mn), Arsenic (As), Iron	2 locations ▪ Existing tubewell along the road ▪ Campsite	Quarterly	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
				(Fe), Chloride (Cl), Salinity, Total Hardness, Total Coliform (TC) and Faecal Coliform (FC))				
2.5	Wastes	▪ Construction waste from construction work ▪ Domestic waste from workers ▪ Hazardous waste such as dry batteries, etc.	Evaluation of effect of the mitigation measure for waste	Record of kinds and quantity of waste, and the disposal method	▪ Along the road ▪ Workers camp	Continuous Record	Contractor	CSC & RHD
2.6	Noise and Vibration	▪ Noise and vibration caused by construction machinery ▪ Noise caused by vehicles used for mobilization of equipment and workers	Evaluation of effect of the mitigation measure towards noise level	Measurement using noise level meter	4 points (day & night) ▪ Along the road near sensitive location ▪ Forest area ▪ Campsite	Once every three month	Contractor	CSC & RHD
2.7	Soil	▪ Leakages of oil and chemical materials from construction activity ▪ Inappropriate disposal of waste	Prevent soil pollution	Inspect storage areas and record state of storage areas with photos.	▪ Workers' camp ▪ Construction sites	As part of regular construction inspection, likely weekly	Contractor	CSC & RHD
2.8	Erosion	Clearing topsoil in proposed embankment areas can lead to erosion and dust from unprotected storage sites. The	Prevent water pollution	▪ Inspect storage areas and record state of storage areas with photos,	Embankment construction sites	As part of regular construction inspection, likely weekly	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		erosion risk will also be there at embankment slopes.		and then report level of erosion and onsite dust. ▪ Inspect embankment construction areas for erosion and repair				
2.9	Wildlife and Endangered Species	▪ Impact to local ecosystems and species, particularly endangered species and their continued health and sustainability ▪ Disturbance during the construction stage, ▪ Potential opening up of the areas at some distance from the road during construction and operation to greater public access which could lead to intentional and unintentional destruction of any remaining habitats and ecosystems.	Restoration of local ecosystem	Observation	▪ Along the road alignment ▪ Teknaf Wildlife Sanctuary ▪ Other small patches of forest	Daily/weekly throughout the construction period	Contractor	CSC & RHD
2.10	Losses of Employment and Means of Livelihood	Decrease in employment and business opportunities at the bazaar areas along the road alignment.	▪ Improvement of the local economy ▪ Improvement of living standards of local residents ▪ Consideration to local residents'	▪ Hearings from the related institutions ▪ Interviewing residents	▪ Bazar locations	weekly throughout the construction period	Contractor	CSC & RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
			emotions					
2.11	Disturbance to Existing Social Infrastructure and Services	▪ Increased road traffic may disturb the local residents ▪ Traffic jams caused by increased vehicles during construction	Evaluation of effect of construction schedule	Record of numbers construction vehicles	Project site	Continuous Record	Contractor	CSC & RHD
2.12	Infectious Diseases such as HIV/AIDS	Temporary influx of migrant labor during construction may increase risk of infection	Evaluation of sanitation for labor	Labor health record	Related institutions	Twice a year	Contractor	CSC & RHD
2.13	Work condition (including work safety)	Labor accidents .	Evaluation of effect of the work safety plan	Record of accidents	Contractor's office	Continuous Record	Contractor	CSC & RHD
2.14	Accidents	Traffic accidents	Evaluation of effect of traffic schedule	Record of accidents	Contractor's office	Continuous Record	Contractor	CSC & RHD
Operation Phase								
3.1	Air Quality	▪ Exhaust gas from vehicles used for mobilization of equipment and workers ▪ Dust from road	Evaluation of effect of the mitigation measure towards air pollution	Collecting samples at the site, analyzing at the lab.	1point ▪ Residential area around the road	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD
3.2	Surface Water Quality	▪ Surface water runoff to paddy fields ▪ Ponds along the road	Evaluation of effect of the mitigation measure towards water pollution	Collecting samples at the site, analyzing at the lab Continuous measurement using a sensor	1 point ▪ Pond near the road	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsible Organization	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
3.3	Noise and vibration	Noise caused by vehicles moving along the road carrying passengers and goods.	Evaluation of effect of the mitigation measure towards noise level	Measurement using noise level meter	2 points (day & night) ▪ Along the road ▪ Forest area	Once every year for years 1, and 3	RHD / Environmental Consultant	RHD
3.4	Disturbance to the Existing Social Infrastructure and Services	▪ Traffic jams caused by increased vehicles ▪ Improved roads	Evaluation of effect of traffic schedule	Record of numbers of vehicles	along the road	Continuous Record	RHD	RHD
3.5	Accidents	Traffic accidents	Evaluation of effect of the work safety plan	Record of accidents and fire	Along the road	Continuous Record	RHD	RHD

E. Environmental Monitoring Cost Estimation

342. Most of the mitigation measures require the contractors/project authority to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance.

343. Mitigation that is the responsibility of RHD and contractor's will be provided as part of their management of the project. The cost estimation for Environmental Mitigation Measures and Monitoring is given in the following Table VIII.7 (it as indicative table and will be applicable for each contract package independently). The total mitigation and monitoring cost for each contract package is calculated as BDT 22,37,550 (BDT 67,12,650 for the total project) including the remuneration of Contractor's Environment, Health and Safety Officer (EHSO). The total duration of the engagement of EHSO will be decided as per the requirement of the project after getting approval from the CSC.

Table VIII.7: Cost Estimation for Environmental Mitigation Measures and Monitoring

EMP Task No.	Mitigation and Monitoring Items	Unit	Cost/Unit	Total Unit	Total Cost
1.0	**Pre-construction Period**				
1.1	Trees and Landscape	No.	0	0	0
1.2	Employment and Livelihood	Costed in resettlement plan			
1.3	Capacity Building Workshop of Implementation Agency, RHD, PIU, Contractor	No.	10000	1	10000
2.0	**Construction Period (1.5 Yrs.)**				
2.1	Topography and Landscape Changes	Monitoring by EHSO			0
2.2	Air Quality (including dust suppression)	No.	25000	12	300000
2.3	Hydrology and Surface Water Quality	No.	15000	6	90000
2.4	Groundwater	No.	10000	12	120000
2.5	Waste	Month	6000	18	108000
2.6	Noise and Vibration	No.	3500	24	84000
2.7	Soil	No.	13000	3	39000
2.8	Erosion Protection	Monitoring by EHSO			0
2.9	Wildlife and Endangered Species	Monitoring by EHSO			0
2.10	Elephant Pass Path	Monitoring by EHSO			0
2.11	Losses of Employment and Means of Livelihood	Monitoring by EHSO			0
2.12	Disturbance to Existing Social Infrastructure and Services	Monitoring by EHSO			0
2.13	Infectious Diseases such as HIV/AIDS	Lump-sum			50000
2.14	Work Conditions (Including Work Safety)	Month	4000	18	72000
2.15	Accidents (Safety Sign)	Month	4000	18	72000
	Other Expenses during Construction Period				
	Tree Plantation Programme	No.	5000	100	500000
	Transportation (for Environmental Monitoring)	Month	10000	18	180000
	Communication	Month	2000	18	36000
	Workshop costs: At least one at start of Construction	Lump-sum			10000
	Reporting and Report Production	No.	2000	18	36000
	Remuneration of EHSO	Month	20000	18	360000
3.0	**Operating Period (Yrs. 1 and 3)**				
3.1	Air Quality Monitoring	No.	15000	2	30000
3.2	Surface Water Quality	No.	5000	2	10000
3.3	Noise and Vibration	No.	3000	8	24000
3.4	Elephant Pass Path	Monitoring by RHD			0
3.5	Disturbance to the Existing Social Infrastructure and Services	Monitoring by RHD			0
3.6	Acidents	Monitoring by RHD			0
	MITIGATION AND MONITORING				
	Pre Construction Period	**10000**			
	Construction (1.5 years)	**2057000**			
	Operating Period (Yrs. 1 and 3)	**64000**			
	Total	**2131000**			
	Contingency Costs @ 5% of total	**106550**			
	Grand Total:	**2237550**			

F. Institutional Arrangements

344. Environmental management of the project requires a multidisciplinary approach with consolidated and coordinated efforts from a number of agencies. Various institutions will be involved during implementation of the Project. While contractor is responsible for implementation of EMP during construction works, Construction Supervision Consultant (CSC) is primarily responsible for supervision of monitoring of the implementation of the EMP and also reporting the progress to RHD. Ministry of Road Transport and Bridges (MoRTB) is the Executing Agency (EA). The RHD will be involved in the implementation and management of the works for which they are responsible by establishing a Project Implementation Unit (PIU). The Key organizations and people involved in environmental management of the project are as presented in Figure VIII-1.

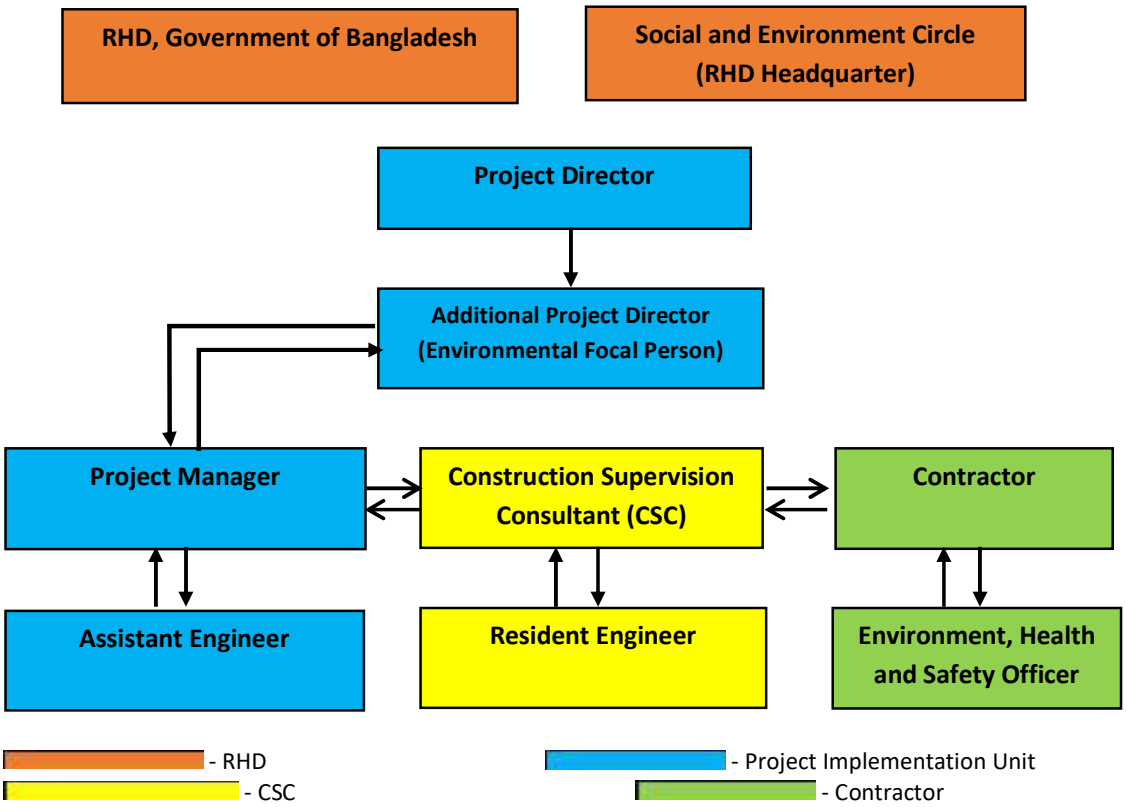


Figure VIII.1: Proposed Institutional Framework for EMP Implementation

G. Institutional Responsibilities

345. A number of institutions will be involved during construction and operation phase of the Project in order to achieve environmental compliance goal set by EMP. A proposed institutional framework for EMP implementation has been showed in Figure VIII-1. These institutions will carry out following distinct but interrelated responsibilities:

1. Ministry of Road Transport and Bridges (MoRTB)

346. MoRTB as the Executing Agency of the Project will have the overall responsibility of ensuring that the environmental safeguard requirements of the project are fulfilled through the Road and Highways Department. The main responsibilities of the MoRTB are to:

- Ensure that the project, regardless of financing source, complies with the provisions of the EMP and ADB Safeguard Policy Statement 2009 (SPS);
- Ensure that project implementation complies with government environmental policies and regulations;
- Ensure that project environmental management is implemented and reported to the Steering Committee and the financing agency as required.

2. Roads and Highways Department

347. The Roads and Highways Department (RHD), as the main project implementing agency, is responsible for the effective execution of the environmental safeguards. Although not directly involved in the day to day monitoring activities, RHD will have oversight on the monitoring activities carried out by the CSC and contractor through PIU and will report to MoRTB.

3. The Social and Environmental Circle

348. The Social and Environmental Circle of the RHD is headed by a Superintending Engineer (Resettlement and Environment). There is an Environmental Division under this circle staffed by one Executive Engineer, one Sub divisional Engineer, two Assistant Engineers and three Sub Assistant Engineers. The Environmental Division under the Social and Environmental circle will provide guidance to PIU staff for developing mechanisms for effective project supervision throughout the project construction and even in operation phase. They will also assist CSC and contractors in conducting subsequent monitoring and reporting and in undertaking corrective options and establishment and implementation of an environmental management system.

4. Project Implementation Unit

349. The Project Implementation Unit will be established under the RHD will include an environmental unit (EU). The EU will consist of one Executive engineer, one sub-divisional engineer and two assistant engineers to monitor environmental compliance. The EU will be responsible for overseeing of the monitoring activities conducted by the CSC on its behalf. It will also be responsible for overseeing the activities of contractor through PIU. The main activities of the EU with regard to environmental safeguards are:

- Planning and implementation of EMP
- Ensuring that environmental protection and mitigation measures in the EMP are incorporated in the Construction Environmental Management Plan (CEMP);
- Ensuring that the CSC commits and retains dedicated staff as environment and safety managers to oversee CEMP implementation
- Supervision and monitoring of the progress of activities of the consultants and contractors for implementation of different components of EMP
- Provide guidance to PIU, CSC and contractors in conducting subsequent monitoring and reporting and in undertaking corrective options
- Responsible for modifications of the EMP when there were adaptation/changes during implementation.
- Ensure submission of periodical environmental management and monitoring reports to steering committee and co-financers through RHD;
- Submit semi-annual monitoring reports on EMP implementation for co-financers review through RHD;
- Ensure establishment and implementation of an environmental management system;

- Implementation of environmental monitoring measures (such as environmental quality monitoring, tree plantation, landscaping, wild life monitoring) during O/M stage of the Project.
- Promote improved social and environment performance through the effective use of management systems;
- External communications with other government, semi-government and non-government organizations, universities, research institutes in the country on the matters of mutual interest related to environmental management and filming of activities to be carried out under the project development.

5. Construction Supervision Consultant (CSC)

350. The CSC functioning under the RHD will be directly responsible for contract administration and day-to-day project supervision including environmental management. The CSC will consist of an environmental unit with one national environmental expert. The CSC will advise the RHD and the PIUs on EMP implementation, and monitor the work of the contractors in the field. The consultants will also help the PIUs prepare quarterly progress reports to be submitted to the RHD, who will submit semi-annual reports to co-financier for review. The CSC will, inter alia, be responsible for the following:

- Engage environment specialist to ensure proper implementation of EMP provisions;
- Undertake regular monitoring of the contractor's environmental performance, as scheduled in the EMP;
- Conduct periodical environmental audits;
- Prior to construction, review and approve CEMPs/method statements prepared by the contractors;
- Supervise site environmental management system of the contractors, and provide corrective instructions;
- Monitor the implementation of the CEMP and review the environmental management and monitoring reports prepared by the contractor;
- Review and report on CEMP implementation by the contractor.

351. Overall, CSC is responsible for ensuring proper and timely implementation of all their tasks specified in the EMP.

6. Contractor

352. The contractor will be primarily responsible for preparing an implementing the CEMP. Each contractor will be recommended to have one Environmental, Health and Safety Officer, who will be working in close coordination with the environmental staff of CSC and PIU. The main functions of the contractor with regard to environmental management and monitoring are to:

- Prior to start of construction, prepare the CEMP and other method statements and management plans according to requirements of EMP and get them approved by CSC.
- Recruit qualified environmental and safety officers (ESO) to ensure compliance with environmental statutory and contractual obligations and proper implementation of CEMP;
- Provide sufficient funding and human resources for proper implementation of CEMP;
- Prepare monthly reports on environmental management and monitoring for review and verification by the CSC;
- Prepare and implement an Environmental Management system according to requirement specified in EIA/ ISO 14001.

IX. GRIEVANCE REDRESS MECHANISM

A. Requirements of the ADB

353. As a partner in the delivery of this project, the ADB's environmental safeguard requirements were carefully considered during the preparation of this EIA. The description of a grievance redress mechanism (GRM) is not required under the GoB environmental legislation but is mandatory for any ADB-funded project. To that end, a step-by-step process is defined in this chapter.

354. Grievance redress refers to the set of actions available to anyone negatively impacted by the project and not properly dealt with, ignored or overlooked the implementation of mitigative and monitoring measures defined in the EIA. The overriding principle of any GRM is that it must be non-threatening, easily accessible, quick, and impartial; delivering decisions to the complainant in an unbiased a-political manner. GRM's have been developed for many past donor-funded projects and have been accepted by the GoB and been reasonably successful in doing what they are supposed to do. The GRM described in this chapter (Figure X-1) builds on that success.

B. Grievance Redress Mechanism

355. 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.

356. 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.

357. First level of GRM: The first level and most accessible and immediate contact for the fastest resolve of grievances are the contractors, with assistance from DSC on site. Prior to construction of any works, the PIU will ensure local community meetings are held to notify residents and businesses of any temporary disturbances, and to inform them of the Project and the GRM. If any complaints arise, the contractors, with assistance from DSC can immediately resolve the complaint on site. The contractor's and DSC's office phone number will be posted in public areas within the subproject areas and construction sites. Any person with a grievance related to the project works can contact the project to file a complaint. The contractor may seek the assistance of the DSC safeguards specialists (the environmental specialist or social safeguards specialist) to resolve the issue. The DSC safeguards (environment and resettlement) focal person will immediately address and resolve the issue with the contractor within 1-2 days, if the complaint remains unresolved at the field level. The DIU safeguards focal person will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location, and (v) how the complaint was resolved.

358. Second level of GRM: Should the grievance remain unresolved; the contractor with assistance from DSC will forward the complaint to the PIU safeguards focal person. The

person filing the grievance will be notified by DSC safeguards focal person that the grievance was forwarded to the PIU safeguards focal person. The PIU will address the grievance. Grievances will be resolved through continuous interactions with affected persons, and the PIU will answer queries and resolve grievances regarding various issues including environmental or social impacts. Corrective measures will be undertaken at the field level by the PIU safeguards focal person within 7 days. He/she will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location and (v) how the complaint was resolved.

359. Third level of GRM: Should the grievance remain unresolved, the PIU's project director will activate the third level of the GRM by referring the issue (with written documentation) to a Grievance Redress Committee (GRC), which will, based on review of the grievances, address them in consultation with the PIU, contractor, DSC, and affected persons. The GRC will consist of Refugee Relief and Repatriation Commission (RRRC), as chairperson, EA/IA representative, camp-in-charge, and other relevant stakeholders. A meeting will be called with the GRC, if necessary, where the affected person can present his/her concern and issues. The process will promote conflict resolution through mediation. The GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The functions of the GRC are as follows: (i) to provide support to affected persons on problems arising from environmental or social disruption, asset acquisition (where required), and eligibility for entitlements, compensation, and assistance; (ii) to record grievances of affected persons, categorize and prioritize them, and provide solutions within 15 days; and (iii) to report to the aggrieved parties' developments regarding their grievances and decisions of the GRC. The EA/IA safeguards focal person will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued, and the decisions carried out.

360. Safeguard monitoring reports will include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third levels), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as affected person, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e. open, closed, pending).

361. Where an affected person is not satisfied with the outcomes of the 3 levels of the Project GRM, the affected person should make good faith efforts to resolve issues working with the South Asia Regional Department through ADB's Bangladesh Resident Mission. As a last resort, the affected person can access ADB's Accountability Mechanism (ADB's Office of Special Project Facility or Office of Compliance Review).[3] ADB's Accountability Mechanism, including information on how to file a complaint, will also be explained to affected households.

[3]Contact information on ADB's Bangladesh Mission is in https://www.adb.org/countries/bangladesh/main. Information on ADB's Accountability Mechanism is in www.adb.org/site/accountability-mechanism/main.

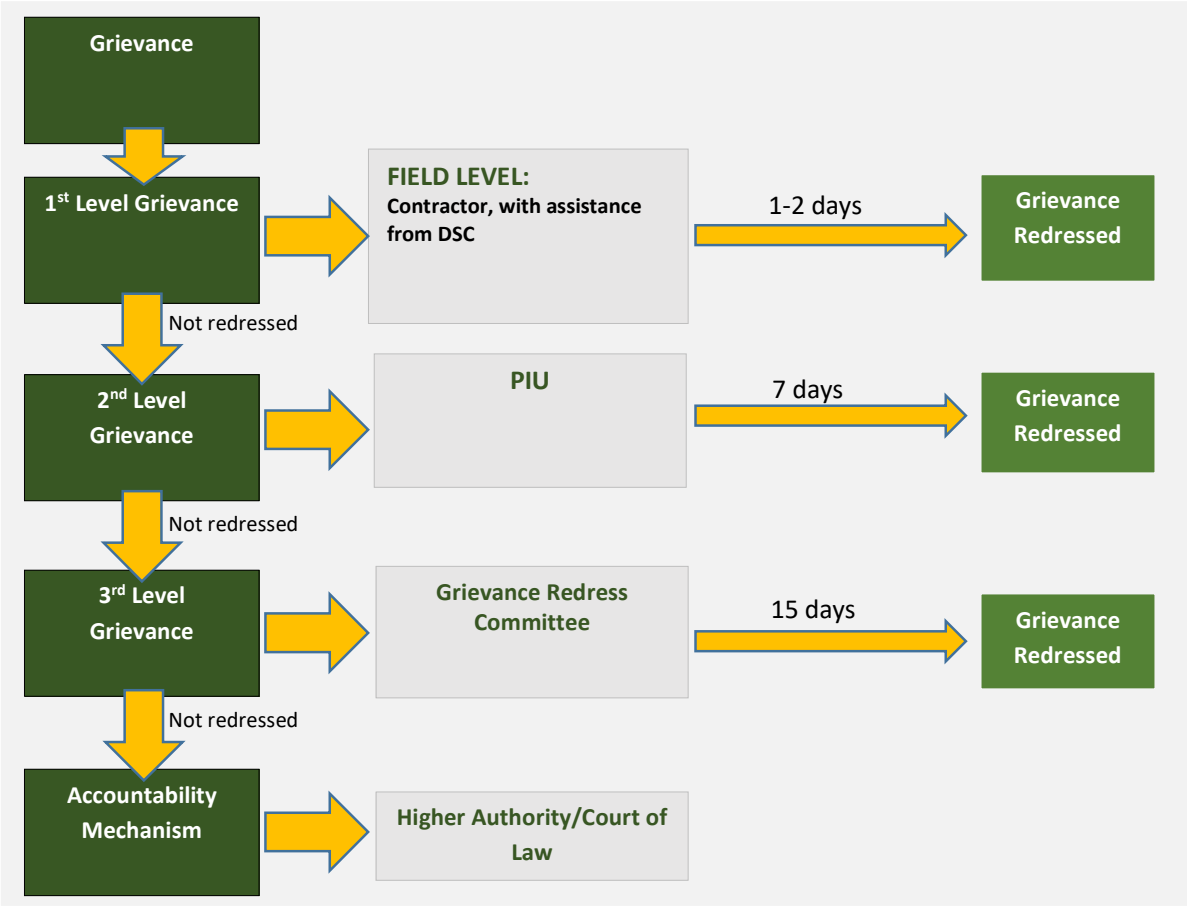


Figure IX.1: Grievance Redress Mechanism of the Project

1. Construction Workers Grievance

362. At construction sites, work camps and on-the-job, labourers and other unskilled hired employees of the contractor have little recourse when either their living conditions are badly degraded, they are not paid according to agreement, or basics, such as potable water, are not supplied. Under this contract, as part of the written agreement with each hire, the contract or letter of assignment with the work will include the name and contact information of a RHD and/or the CSC's employee for the worker to contact. The letter/agreement will contain a second statement indicating that the contractor will not penalize the worker for reporting a complaint and if that occurs, the contract will be levied a fine equal to the employees contract duration from the time of the incident to the end of the contract period. That amount will be paid to the complainant.

363. The contractor will provide a compliant box, sealed by the CSC and collected by the CSC, thus allowing the construction worker to file complaints by going directly to the CSC.

X. CONCLUSIONS AND RECOMMENDATIONS

364. The project will have a number of environmental impacts during the construction and operation periods. Assuming effective implementation of the mitigation measures and monitoring requirements as outlined in the Environmental Management Plan, the Project is not expected to have significant adverse environmental impacts. It should also be pointed out that the environmental benefits are likely to be important; an all-weather transport route will link between Cox's bazar and Teknaf. The potential for congestion will be reduced which will reduce vehicle emissions due to increased and more regular speeds and air quality adjacent to the road should improve.

365. In the EMP, RHD identified several mitigative actions needing to be addressed during the pre-construction, construction, and during the operating period of the road. To track the mitigation work, an air, noise, and surface water quality monitoring programme will be started during the construction period. There is little chance that impacts will extend much beyond the 50 m or 100 m wide corridor of impact centred over the road, given that all work will be strictly confined to the road's existing right of way.

366. RHD concludes that this IEE is complete and addresses all relevant likely impacts and proposes a full set of time-bounded mitigative and monitoring actions, including the assignment of responsibilities. The application of the detailed EMP will ensure that the nature and socio-cultural environmental are not unduly affected by the work or the operation of the second line. Therefore, RHD recommends that an environmental approval be granted by DoE, and that no additional studies be required.

367. The EMP, its mitigation and monitoring programs, contained herewith shall be included within the Bidding documents for project works. 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 that 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.

368. 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. Additionally, the prepared CEMP will be submitted to ADB after reviewing by the Engineer for ADB's record and future inspection. 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.

369. 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.

APPENDICES

Appendix 1: Rapid Environmental Assessment (REA) Checklist

Rapid Environmental Assessment (REA) Checklist (Access Road)

Instructions:

(i) The PIU completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to ADB.

(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 tribes, minor races, ethnic sects and communities;[4] (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.

Subproject Title: BANGLADESH: Emergency Assistance Project - Improvement of National Highway from Link Road (Cox's Bazar) to Ukhia. Contract Package – 01

IA: Roads and Highways Department (RHD)

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		✓	The road passes through many villages, and market areas. Around the settlement areas there are few community resources like mosque, educational institutes, and graveyards near the roads. None of these cultural sites will be directly affected because of the widening of the existing road.

[4]Groups or population identified as Indigenous Peoples within the context of ADB's Safeguard Policy Statement will be referred to in this document as *tribes, minor races, ethnic sects and communities* (following the request of the Government of Bangladesh).

Screening Questions	Yes	No	Remarks
▪ Protected Area	✓		The project road goes through the buffer zone of Himchari National Park at Cox's Bazar Sadar, Reserved Forest from Panerchora to Dhoapalong, and Protected Forest near Ukhia. However, the road improvement will not cause encroachment to the protected areas since the work will remain the RoW of the existing road. Additionally, the small segment in national park area is already a built up area.
▪ Wetland		✓	There is no designated wetland but few small ponds and Chora along the project road. However none of them are protected or rich in biodiversity.
▪ Mangrove		✓	
▪ Estuarine		✓	
▪ Buffer zone of protected area	✓		The road passes through the Reserved Forest at Panerchora and Protected Forest near Ukhia.
▪ Special area for protecting biodiversity		✓	None. However, the reserved and protected forest is considered an area for protecting biodiversity.
B. Potential Environmental Impacts Will the project cause…			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		✓	No encroachment on historical and cultural areas is envisaged. The topography of project road is mainly flat but there are some hilly areas along the road section. However, minor impacts on landscape are unavoidable due to widening of road embankment.
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?			The project road does not pass through any National Park/Wildlife Sanctuary. Though there are very minor section fall in the buffer zone of Himchari National Park area but this section is already a built up area with several multistoried buildings and roadside shops and market. Additionally, the reserved and protected forests will not be disturbed due to the road improvement since the work will remain on the existing RoW. Moreover, some of the road sections at Panerchora are known as elephant crossing/movement locations at the reserved forest area. The elephant crossing location at Panerchora is already obstructed due to construction of boundary wall of Ramu Cantonment.

Screening Questions	Yes	No	Remarks
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		✓	There are some small bridges and culverts along the road. The culverts replacement may temporally increase the sedimentation level around the construction site during the rainy days when heavy water runs from the hills through the *Chora*. However this would be temporary and short term in nature. All measures shall be taken during construction stage so that watercourses are not affected and temporary soil and rock stockpiles will be designed so that runoff will not induce sedimentation of waterways.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	✓		Deterioration may occur at worker camps and construction site if proper mitigation measures (under the EMP) are not followed by contractor during construction stage of project.
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	✓		Local air pollution level is likely to be increased for short duration during construction period particularly due to earth work. Appropriate distance from settlement area and wind direction will be taken into account to locate air polluting facility like stone crushing unit etc. if required.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?	✓		Construction activities could cause accidents and health risks to workers. Occupational health and safety measures will be mandatory for the contractor.
▪ noise and vibration due to blasting and other civil works?	✓		Ambient noise level is expected to increase in the range of 80-90 dB(A) due to various construction activities, maintenance workshops, and earthmoving equipment for short durations. The impact due to noise during construction activities will be minimal to inhabitants since most of the built-up areas are located at safe distances from the road. However, there are few noise sensitive locations especially forests, schools, mosque, etc. close to the alignment that will be affected adversely. Impact due to noise to the workers and local community will be avoided/minimized through mitigation measures such as occupation health and safety gear, restriction of construction timing and others.
▪ dislocation or involuntary resettlement of people?		✓	There will be minimal resettlement impacts. Further details are provided in the Abbreviated Resettlement Plan.
▪ dislocation and compulsory resettlement of people living in right-of-way?		✓	

Screening Questions	Yes	No	Remarks
▪ disproportionate impacts on the poor, women and children, tribes, minor races, ethnic sects and communities or other vulnerable groups?	✓		Resettlement Action Plan should properly address impacts on the poor, women and children, Indigenous Peoples or other vulnerable people by the project with compensation entitlement matrix.
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		✓	No major impacts anticipated. However, efforts will be made to minimize air pollution through appropriate measures such was wet spraying, covering of trucks, location of hot mix plants and other stationary equipment's away from settlement areas and others.
▪ hazardous driving conditions where construction interferes with pre-existing roads?	✓		Proper safety measures such as barricades, flagman, sign boards etc. will be placed to prevent accidents.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	✓		Appropriate waste management shall be adopted in construction camps. Worker health checks and awareness raising will be implemented to educate workers on communicable diseases.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?	✓		Breeding habitats maybe created in labour camps, garbage disposal sites borrow pits and material storage yards. Appropriate sanitation requirements in labour camps and avoidance of stagnant water included in the EMP.
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	✓		Temporarily during construction Stage. Adequate measures will be provided to prevent them such as speed reduction, provision of crash barrier and proper traffic signage system at sensitive places will ensure smooth traffic flow which will reduce accidental risk
▪ increased noise and air pollution resulting from traffic volume?	✓		Due to improvement in road riding conditions the net effect on noise and air pollution will be negligible. However, the number of traffic will increase and the pollution will also increase consistently.
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		✓	Water bodies along the road section are very few in numbers that might be directly impacted. Additionally, EMP recommendations are designed to mitigate water pollution due to construction related activities.
▪ social conflicts if workers from other regions or countries are hired?	✓		Since, the refugees are already involved with several income generation works on daily basis with low payment so, recruitment of Rohiynga people for road construction may create tension among the local people. EMP suggests to hire most workers from the local area and to ensure gender equality.

Screening Questions	Yes	No	Remarks
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Most workers will be hired locally, hence this is not anticipated.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	✓		Transport, storage, use and disposal of fuel and chemicals will be required. Appropriate safety, storage and disposal measures recommended in the EMP.
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	▪		Safety and injury related risks will arise from the presence of equipment's and construction activities. Clear demarcation of restricted areas and prevention of open access to construction areas is included in the EMP.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: BANGLADESH: Emergency Assistance Project - Improvement of National Highway from Link Road (Cox's Bazar) to Ukhia. Contract Package – 01
Sector:
Subsector:
Division/Department:

Screening Questions		Score	Remarks[5]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	1	The project area is located in the coastal regions of Bangladesh where frequently cyclones hits and create heavy rainfalls around the region.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc.)?	0	Though it is located in the coastal region but the road sections along the hilly areas and comparatively high land topography.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	This is an emergency project for the support of Rohiynga people. The construction work will be confined within the RoW to improve the road construction so no additional design measures will be required.
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	1	Due to project location extreme weather events (such as heavy rainfall) are common. This may affect the

[5]If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

			maintenance of the project.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium

Other Comments: _____

Prepared by: Raisin Akhter Feroz (Environmental Specialist)

Instructions:

(i) The PIU completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to ADB.

(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 tribes, minor races, ethnic sects and communities;[6] (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.

Subproject Title: BANGLADESH: Emergency Assistance Project - Improvement of National Highway from Ukhia to Unchiprang. Contract Package – 02

IA: Roads and Highways Department (RHD)

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		✓	The road passes through many villages, and market areas. Around the settlement areas there are few community resources like mosque, educational institutes, and graveyards near the roads. None of these cultural sites will be directly affected because of the widening of the existing road.
▪ Protected Area	✓		The project road goes through the protected forest from Ukhia to Whykhong at Ulhia Upazila. However, the road improvement will not cause encroachment to the protected areas since the work will remain the RoW of the existing road. Additionally, the road segment along the forest area is already disturbed and degraded due to the Makeshift Shelter and Camps for the Rohiynga Refugees.
▪ Wetland		✓	There is no designated wetland but few small ponds and *Chora* along the project road. However none of them are protected or rich in biodiversity.

[6]Groups or population identified as Indigenous Peoples within the context of ADB's Safeguard Policy Statement will be referred to in this document as *tribes, minor races, ethnic sects and communities* (following the request of the Government of Bangladesh).

Screening Questions	Yes	No	Remarks
▪ Mangrove		✓	
▪ Estuarine		✓	
▪ Buffer zone of protected area	✓		The road passes through the Protected Forest near Ukhia but this area is already degraded due to the Rohiynga refugees and no sign of forest area is remained.
▪ Special area for protecting biodiversity		✓	None. However, the protected forest is considered an area for protecting biodiversity.
C. Potential Environmental Impacts Will the project cause…			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		✓	No encroachment on historical and cultural areas is envisaged. The topography of project road is mainly flat but there are some hilly areas along the road section. However, minor impacts on landscape are unavoidable due to widening of road embankment.
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?			The project road does not pass through any National Park/Wildlife Sanctuary. Though there are some sections along the protected forest from Ukhia to Whykhong but this section is already deteriorated because of the Rohiynga camps and shelters. Additionally, the remaining protected forests will not be disturbed due to the road improvement since the work will remain on the existing RoW. Moreover, some of the road sections at Ukhia are known as elephant crossing/movement locations. However, the elephant crossing is obstructed due to the settlement and construction of Makeshift Shelter and other facilities for Rohiynga Refugees.
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		✓	There are some small bridges and culverts along the road. The culverts replacement may temporally increase the sedimentation level around the construction site during the rainy days when heavy water runs from the hills through the *Chora*. However this would be temporary and short term in nature. All measures shall be taken during construction stage so that watercourses are not affected and temporary soil and rock stockpiles will be designed so that runoff will not induce sedimentation of waterways.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	✓		Deterioration may occur at worker camps and construction site if proper mitigation measures (under the EMP) are not followed by contractor during construction stage of project.

Screening Questions	Yes	No	Remarks
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	✓		Local air pollution level is likely to be increased for short duration during construction period particularly due to earth work. Appropriate distance from settlement area and wind direction will be taken into account to locate air polluting facility like stone crushing unit etc. if required.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?	✓		Construction activities could cause accidents and health risks to workers. Occupational health and safety measures will be mandatory for the contractor.
▪ noise and vibration due to blasting and other civil works?	✓		Ambient noise level is expected to increase in the range of 80-90 dB(A) due to various construction activities, maintenance workshops, and earthmoving equipment for short durations. The impact due to noise during construction activities will be minimal to inhabitants since most of the built-up areas are located at safe distances from the road. However, there are few noise sensitive locations especially forests, schools, mosque, etc. close to the alignment that will be affected adversely. Impact due to noise to the workers and local community will be avoided/minimized through mitigation measures such as occupation health and safety gear, restriction of construction timing and others.
▪ dislocation or involuntary resettlement of people?		✓	There will be minimal resettlement impacts. Further details are provided in the Abbreviated Resettlement Plan.
▪ dislocation and compulsory resettlement of people living in right-of-way?		✓	
▪ disproportionate impacts on the poor, women and children, tribes, minor races, ethnic sects and communities or other vulnerable groups?	✓		Resettlement Action Plan should properly address impacts on the poor, women and children, Indigenous Peoples or other vulnerable people by the project with compensation entitlement matrix.
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		✓	No major impacts anticipated. However, efforts will be made to minimize air pollution through appropriate measures such was wet spraying, covering of trucks, location of hot mix plants and other stationary equipment's away from settlement areas and others.
▪ hazardous driving conditions where construction interferes with pre-existing roads?	✓		Proper safety measures such as barricades, flagman, sign boards etc. will be placed to prevent accidents.

Screening Questions	Yes	No	Remarks
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	✓		Appropriate waste management shall be adopted in construction camps. Worker health checks and awareness raising will be implemented to educate workers on communicable diseases.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?	✓		Breeding habitats maybe created in labour camps, garbage disposal sites borrow pits and material storage yards. Appropriate sanitation requirements in labour camps and avoidance of stagnant water included in the EMP.
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	✓		Temporarily during construction Stage. Adequate measures will be provided to prevent them such as speed reduction, provision of crash barrier and proper traffic signage system at sensitive places will ensure smooth traffic flow which will reduce accidental risk
▪ increased noise and air pollution resulting from traffic volume?	✓		Due to improvement in road riding conditions the net effect on noise and air pollution will be negligible. However, the number of traffic will increase and the pollution will also increase consistently.
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		✓	Water bodies along the road section are very few in numbers that might be directly impacted. Additionally, EMP recommendations are designed to mitigate water pollution due to construction related activities.
▪ social conflicts if workers from other regions or countries are hired?	✓		Since, the refugees are already involved with several income generation works on daily basis with low payment so, recruitment of Rohiynga people for road construction may create tension among the local people. EMP suggests to hire most workers from the local area and to ensure gender equality.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Most workers will be hired locally, hence this is not anticipated.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	✓		Transport, storage, use and disposal of fuel and chemicals will be required. Appropriate safety, storage and disposal measures recommended in the EMP.
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	▪		Safety and injury related risks will arise from the presence of equipment's and construction activities. Clear demarcation of restricted areas and prevention of open access to construction areas is included in the EMP.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: BANGLADESH: Emergency Assistance Project - Improvement of National Highway from Ukhia to Unchiprang. Contract Package – 02
Sector:
Subsector:
Division/Department:

Screening Questions		Score	Remarks[7]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	1	The project area is located in the coastal regions of Bangladesh where frequently cyclones hits and create heavy rainfalls around the region.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc.)?	0	Though it is located in the coastal region but the road sections along the hilly areas and comparatively high land topography.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	This is an emergency project for the support of Rohiynga people. The construction work will be confined within the RoW to improve the road construction so no additional design measures will be required.
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	1	Due to project location extreme weather events (such as heavy rainfall) are common. This may affect the maintenance of the project.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk

[7]If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium

Other Comments:_____

Prepared by: Raisin Akhter Feroz (Environmental Specialist)

Instructions:

(i) The PIU completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to ADB.

(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 tribes, minor races, ethnic sects and communities;[8] (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.

Subproject Title: BANGLADESH: Emergency Assistance Project - Improvement of National Highway from Unchiprang to Teknaf. Contract Package – 03

IA: Roads and Highways Department (RHD)

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		✓	The road passes through many villages, and market areas. Around the settlement areas there are few community resources like mosque, educational institutes, and graveyards near the roads. None of these cultural sites will be directly affected because of the widening of the existing road.
▪ Protected Area	✓		The project road goes through the protected area of Teknaf Wildlife Sanctuary at Teknaf Upazila. However, the road improvement will not cause encroachment to the protected areas since the work will remain the RoW of the existing road. Additionally, the road segment along the forest area is already disturbed and degraded due to the Makeshift Shelter and Camps for the Rohiynga Refugees.

[8]Groups or population identified as Indigenous Peoples within the context of ADB's Safeguard Policy Statement will be referred to in this document as *tribes, minor races, ethnic sects and communities* (following the request of the Government of Bangladesh).

Screening Questions	Yes	No	Remarks
▪ Wetland		✓	There is no designated wetland but few small ponds and *Chora* along the project road. However none of them are protected or rich in biodiversity.
▪ Mangrove		✓	
▪ Estuarine		✓	
▪ Buffer zone of protected area	✓		The road passes through the Protected Area at Teknaf Wildlife Sanctuary.
▪ Special area for protecting biodiversity	✓		Yes, the Teknaf Wildlife Sanctuary.
D. Potential Environmental Impacts Will the project cause…			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		✓	No encroachment on historical and cultural areas is envisaged. The topography of project road is mainly flat but there are some hilly areas along the road section. However, minor impacts on landscape are unavoidable due to widening of road embankment.
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?	✓		The project road will pass through Teknaf Wildlife Sanctuary but no encroachment to the protected areas will be happened due to road improvement.
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		✓	There are some small bridges and culverts along the road. The culverts replacement may temporally increase the sedimentation level around the construction site during the rainy days when heavy water runs from the hills through the *Chora*. However this would be temporary and short term in nature. All measures shall be taken during construction stage so that watercourses are not affected and temporary soil and rock stockpiles will be designed so that runoff will not induce sedimentation of waterways.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	✓		Deterioration may occur at worker camps and construction site if proper mitigation measures (under the EMP) are not followed by contractor during construction stage of project.
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	✓		Local air pollution level is likely to be increased for short duration during construction period particularly due to earth work. Appropriate distance from settlement area and wind direction will be taken into account to locate air polluting facility like stone crushing unit etc. if required.

Screening Questions	Yes	No	Remarks
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?	✓		Construction activities could cause accidents and health risks to workers. Occupational health and safety measures will be mandatory for the contractor.
▪ noise and vibration due to blasting and other civil works?	✓		Ambient noise level is expected to increase in the range of 80-90 dB(A) due to various construction activities, maintenance workshops, and earthmoving equipment for short durations. The impact due to noise during construction activities will be minimal to inhabitants since most of the built-up areas are located at safe distances from the road. However, there are few noise sensitive locations especially forests, schools, mosque, etc. close to the alignment that will be affected adversely. Impact due to noise to the workers and local community will be avoided/minimized through mitigation measures such as occupation health and safety gear, restriction of construction timing and others.
▪ dislocation or involuntary resettlement of people?		✓	There will be minimal resettlement impacts. Further details are provided in the Abbreviated Resettlement Plan.
▪ dislocation and compulsory resettlement of people living in right-of-way?		✓	
▪ disproportionate impacts on the poor, women and children, tribes, minor races, ethnic sects and communities or other vulnerable groups?	✓		Resettlement Action Plan should properly address impacts on the poor, women and children, Indigenous Peoples or other vulnerable people by the project with compensation entitlement matrix.
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		✓	No major impacts anticipated. However, efforts will be made to minimize air pollution through appropriate measures such was wet spraying, covering of trucks, location of hot mix plants and other stationary equipment's away from settlement areas and others.
▪ hazardous driving conditions where construction interferes with pre-existing roads?	✓		Proper safety measures such as barricades, flagman, sign boards etc. will be placed to prevent accidents.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	✓		Appropriate waste management shall be adopted in construction camps. Worker health checks and awareness raising will be implemented to educate workers on communicable diseases.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?	✓		Breeding habitats maybe created in labour camps, garbage disposal sites borrow pits and material storage yards. Appropriate sanitation requirements in labour camps and avoidance of stagnant water included in the EMP.

Screening Questions	Yes	No	Remarks
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	✓		Temporarily during construction Stage. Adequate measures will be provided to prevent them such as speed reduction, provision of crash barrier and proper traffic signage system at sensitive places will ensure smooth traffic flow which will reduce accidental risk
▪ increased noise and air pollution resulting from traffic volume?	✓		Due to improvement in road riding conditions the net effect on noise and air pollution will be negligible. However, the number of traffic will increase and the pollution will also increase consistently.
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		✓	Water bodies along the road section are very few in numbers that might be directly impacted. Additionally, EMP recommendations are designed to mitigate water pollution due to construction related activities.
▪ social conflicts if workers from other regions or countries are hired?	✓		Since, the refugees are already involved with several income generation works on daily basis with low payment so, recruitment of Rohiynga people for road construction may create tension among the local people. EMP suggests to hire most workers from the local area and to ensure gender equality.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Most workers will be hired locally, hence this is not anticipated.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	✓		Transport, storage, use and disposal of fuel and chemicals will be required. Appropriate safety, storage and disposal measures recommended in the EMP.
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	▪		Safety and injury related risks will arise from the presence of equipment's and construction activities. Clear demarcation of restricted areas and prevention of open access to construction areas is included in the EMP.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: BANGLADESH: Emergency Assistance Project - Improvement of National Highway from Unchiprang to Teknaf. Contract Package – 03
Sector:
Subsector:
Division/Department:

Screening Questions		Score	Remarks[9]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	1	The project area is located in the coastal regions of Bangladesh where frequently cyclones hits and create heavy rainfalls around the region.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc.)?	0	Though it is located in the coastal region but the road sections along the hilly areas and comparatively high land topography.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	This is an emergency project for the support of Rohiynga people. The construction work will be confined within the RoW to improve the road construction so no additional design measures will be required.
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	1	Due to project location extreme weather events (such as heavy rainfall) are common. This may affect the maintenance of the project.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk

[9]If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

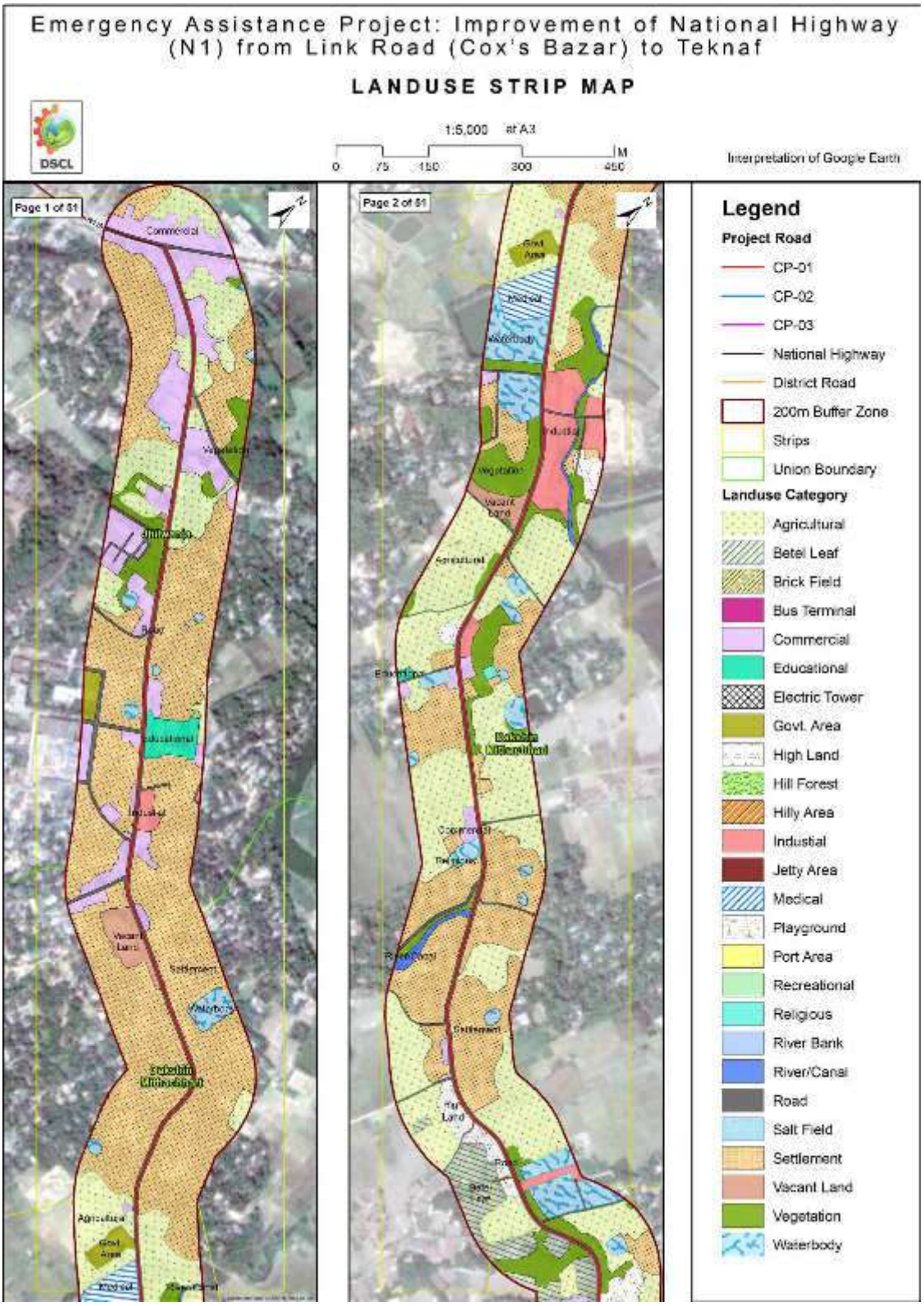
Result of Initial Screening (Low, Medium, High): Medium

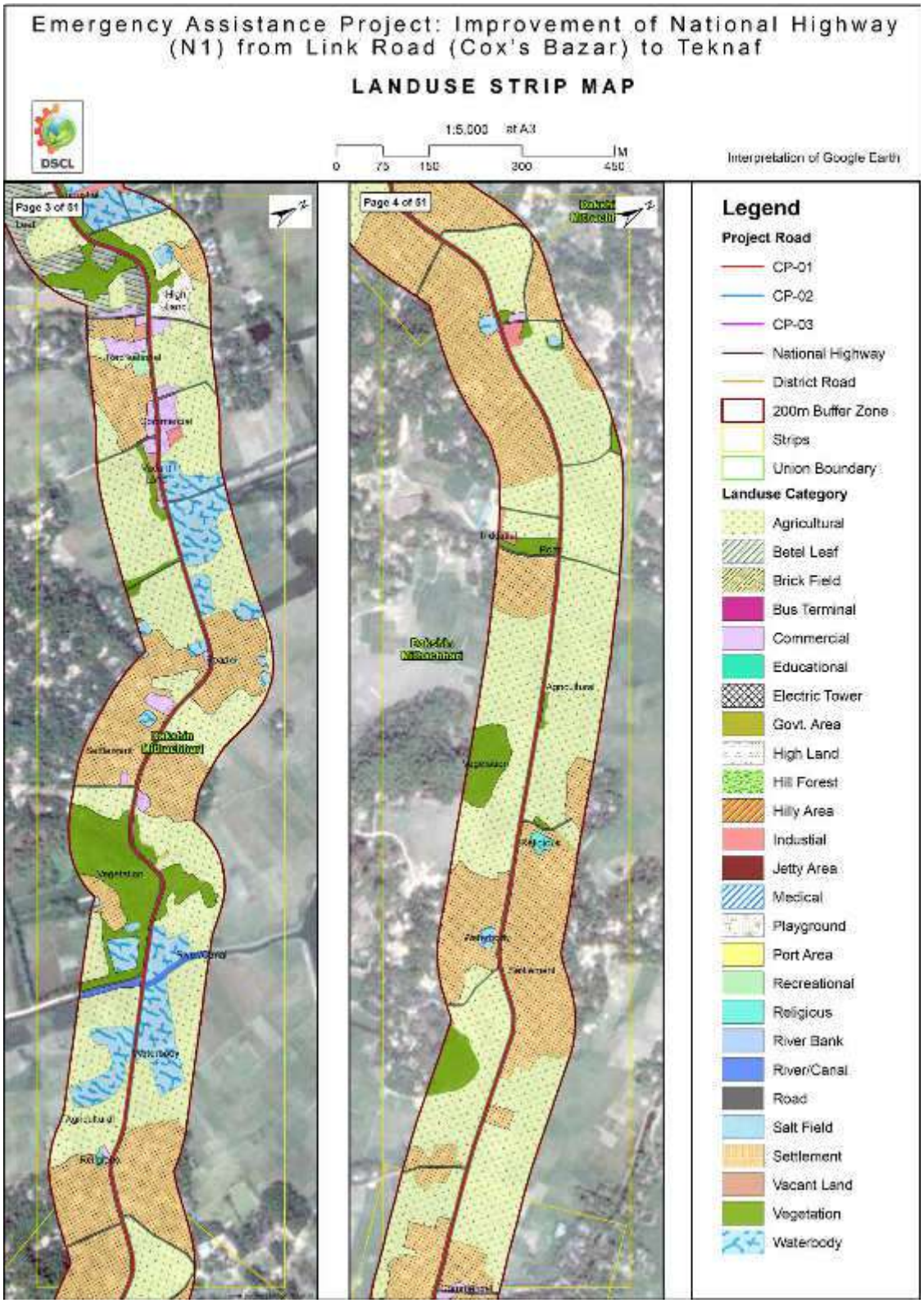
Other Comments:_____

Prepared by: Raisin Akhter Feroz (Environmental Specialist)

Appendix 2: DoE approved Terms of Reference (TOR) for Preparation of EIA

Appendix 3: Land Use Map along the Project Road Corridor




Emergency Assistance Project: Improvement of National Highway (N1) from Link Road (Cox's Bazar) to Teknaf
LANDUSE STRIP MAP
DSCL
1:5,000 at A3
0 75 150 300 450 M
Interpretation of Google Earth
Page 3 of 51
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Legend
Project Road
CP-01
CP-02
CP-03
National Highway
District Road
200m Buffer Zone
Strips
Union Boundary
Landuse Category
Agricultural
Betel Leaf
Brick Field
Bus Terminal
Commercial
Educational
Electric Tower
Govt. Area
High Land
Hill Forest
Hilly Area
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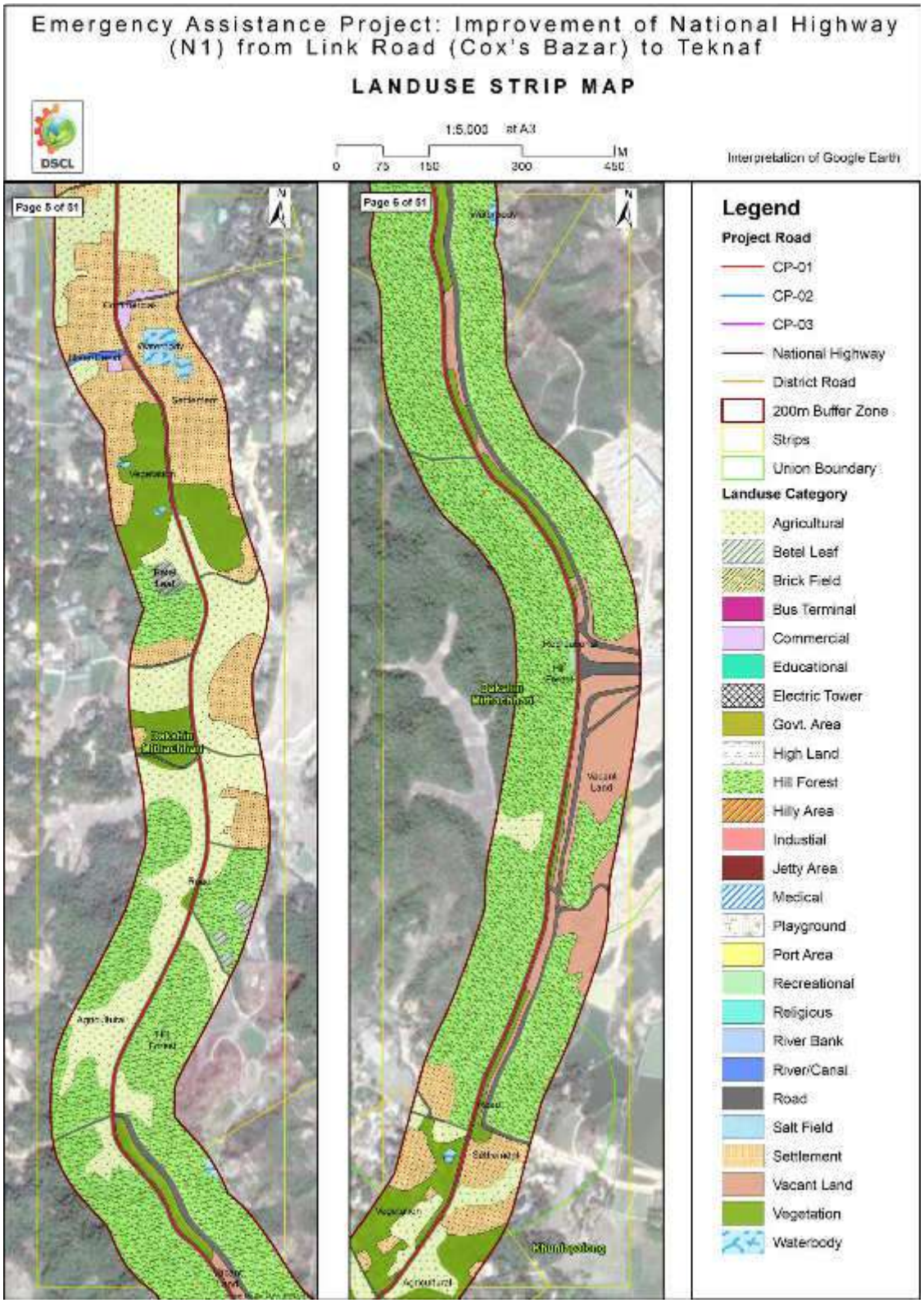
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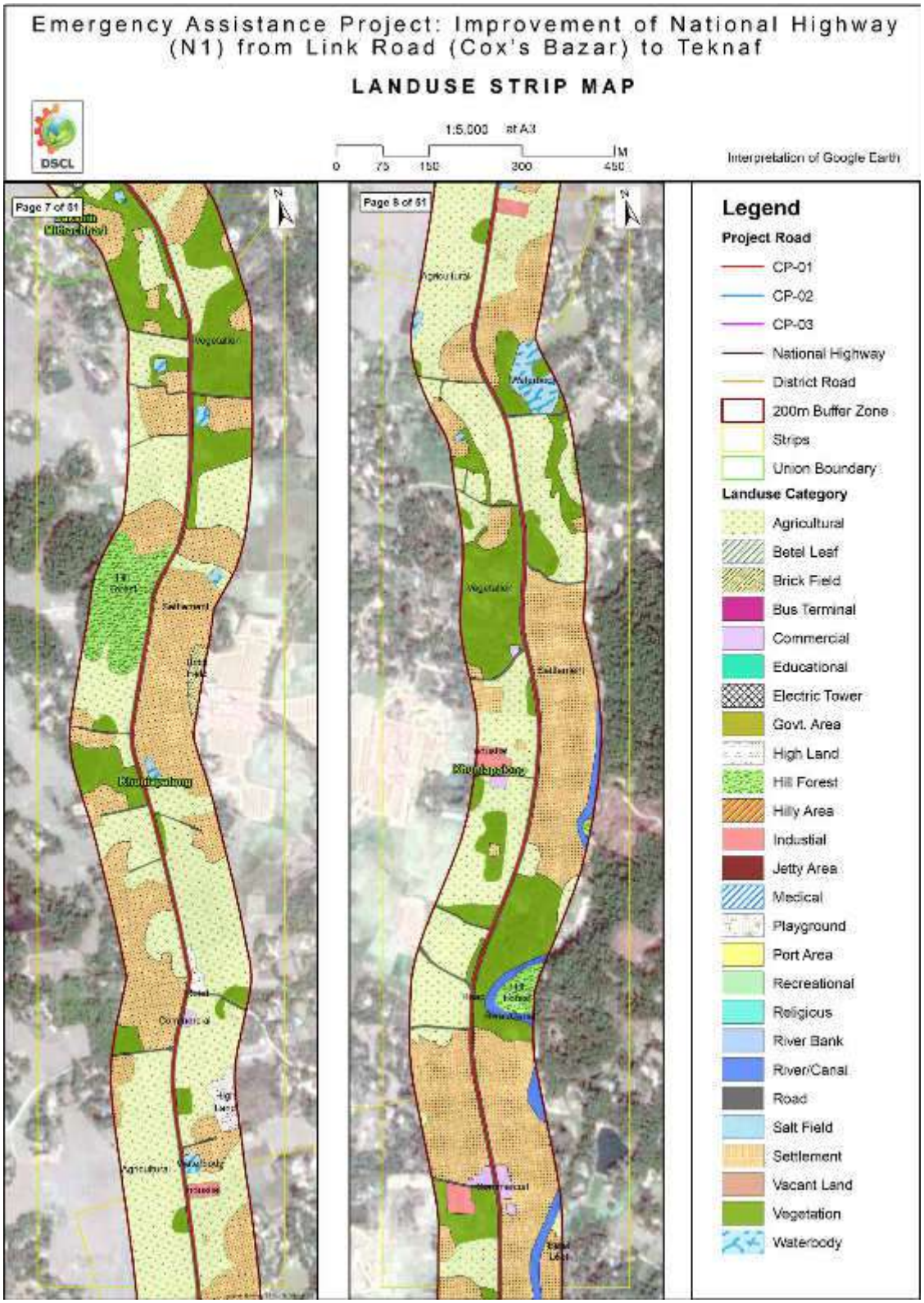
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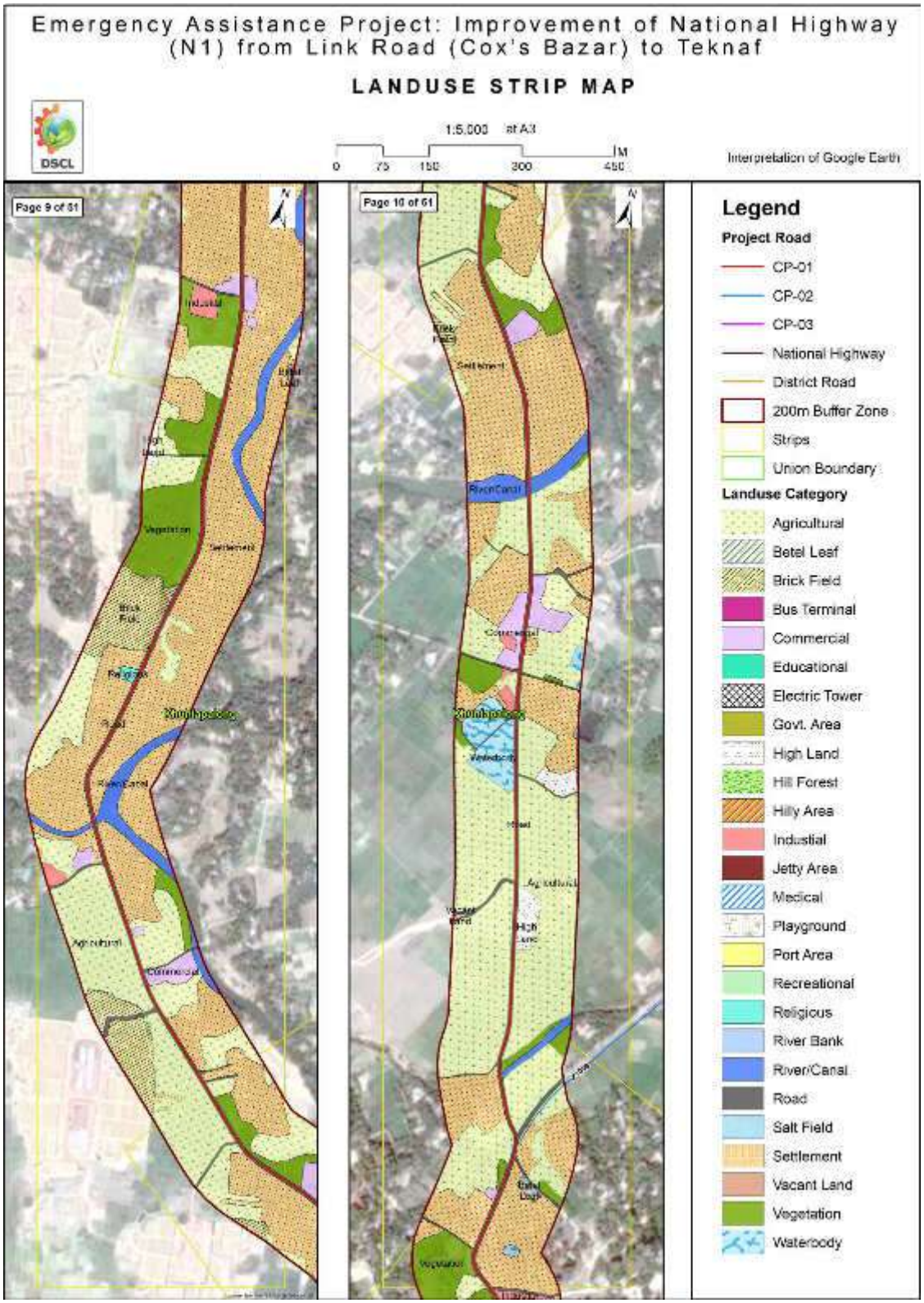
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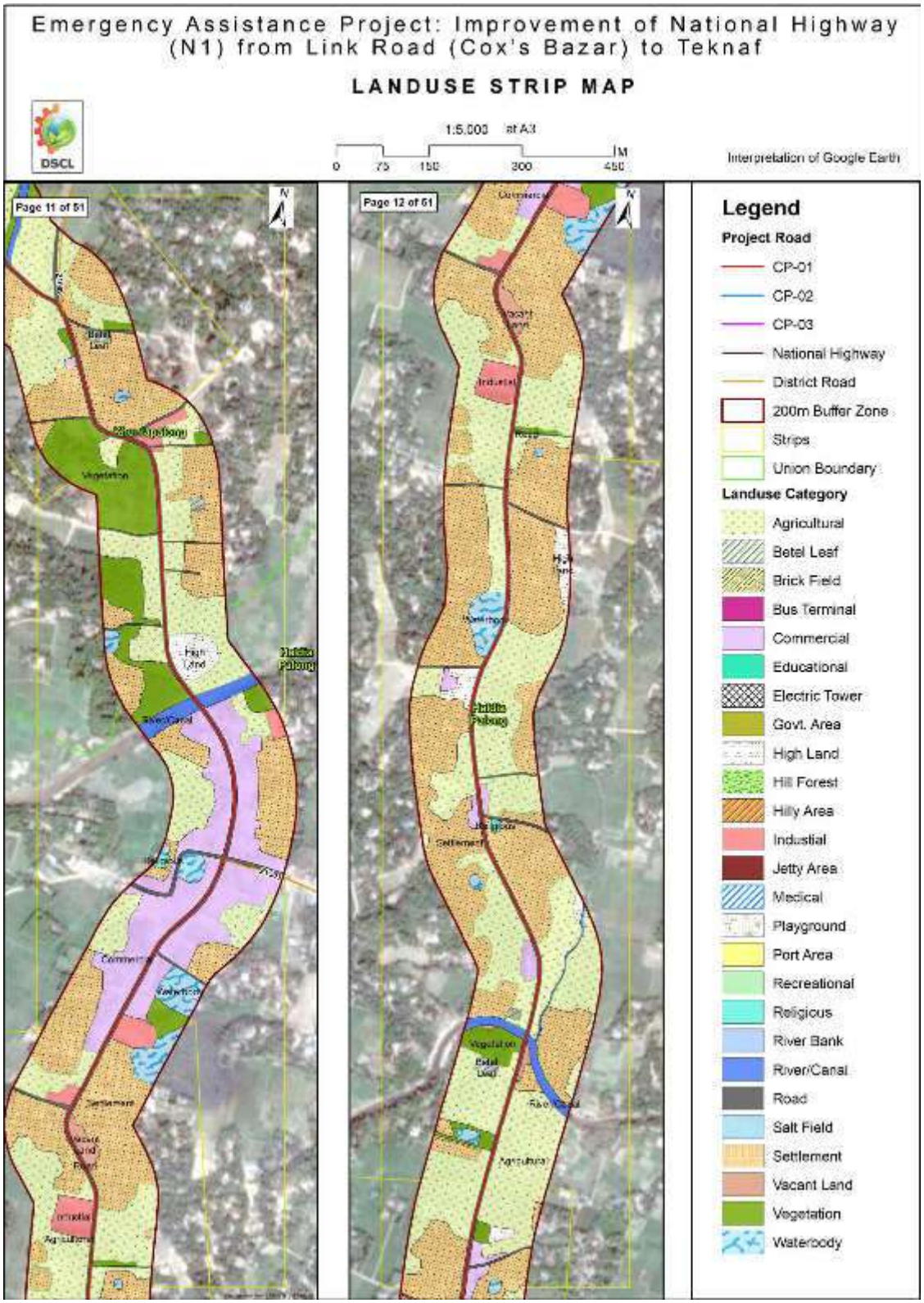
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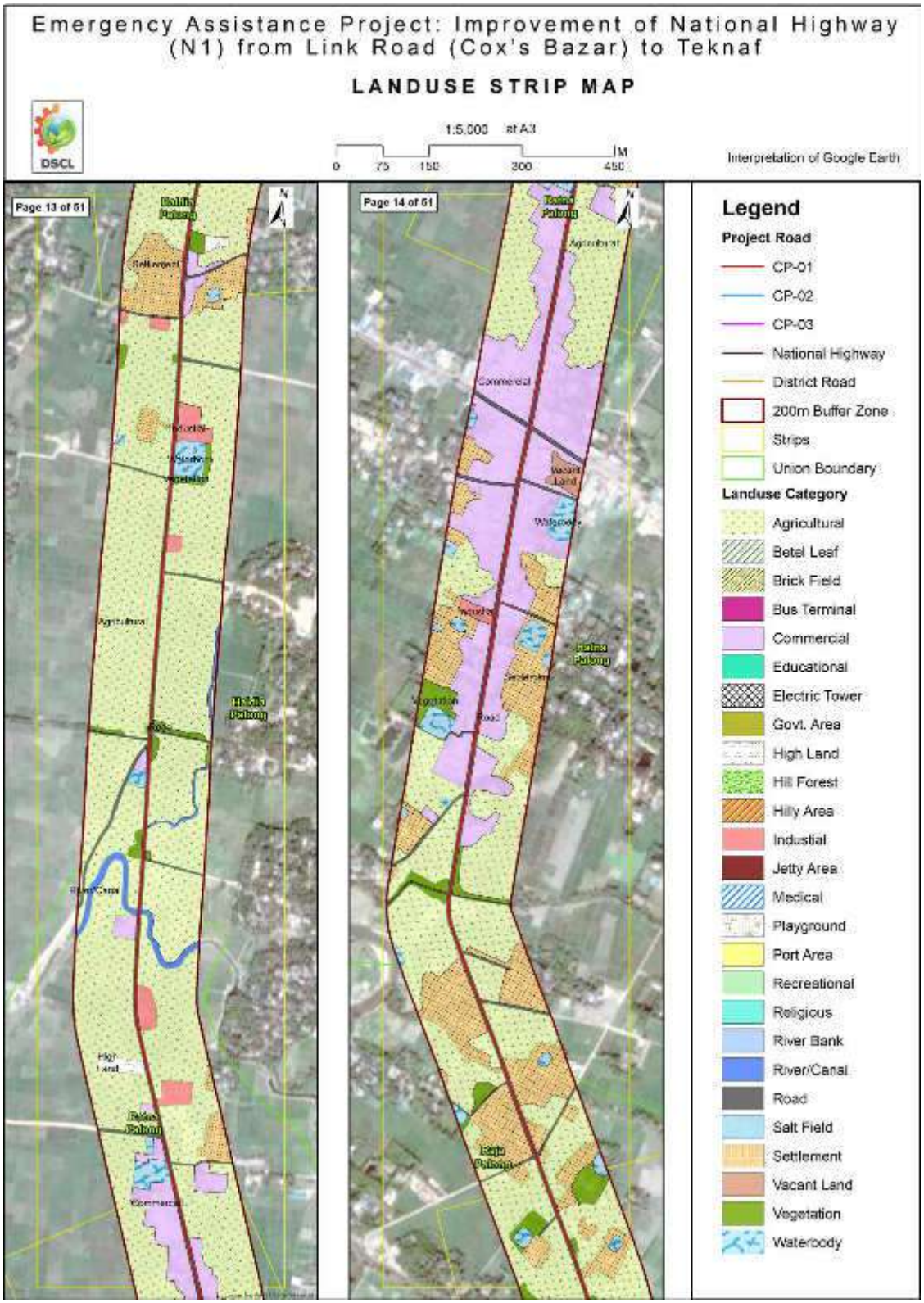
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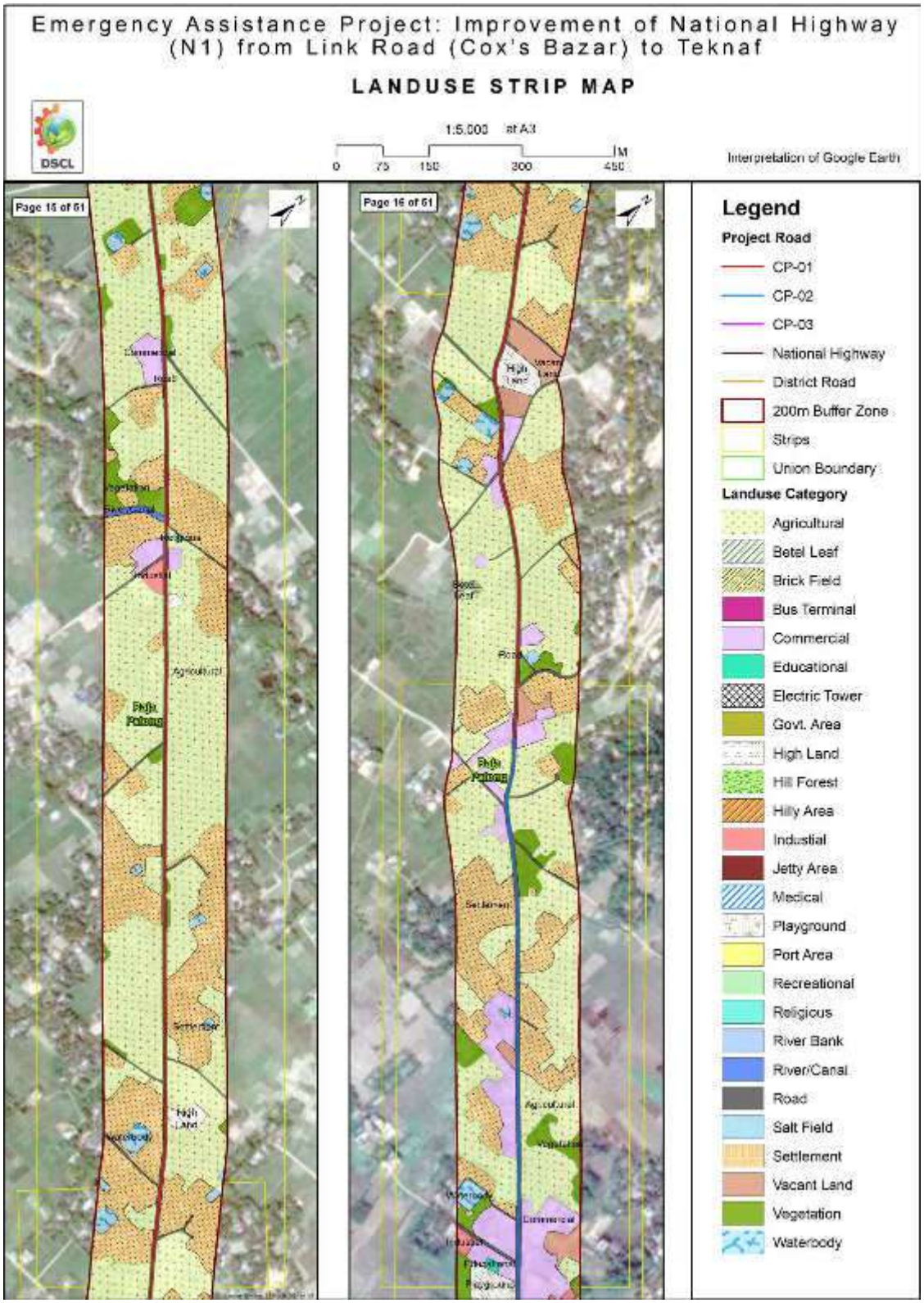
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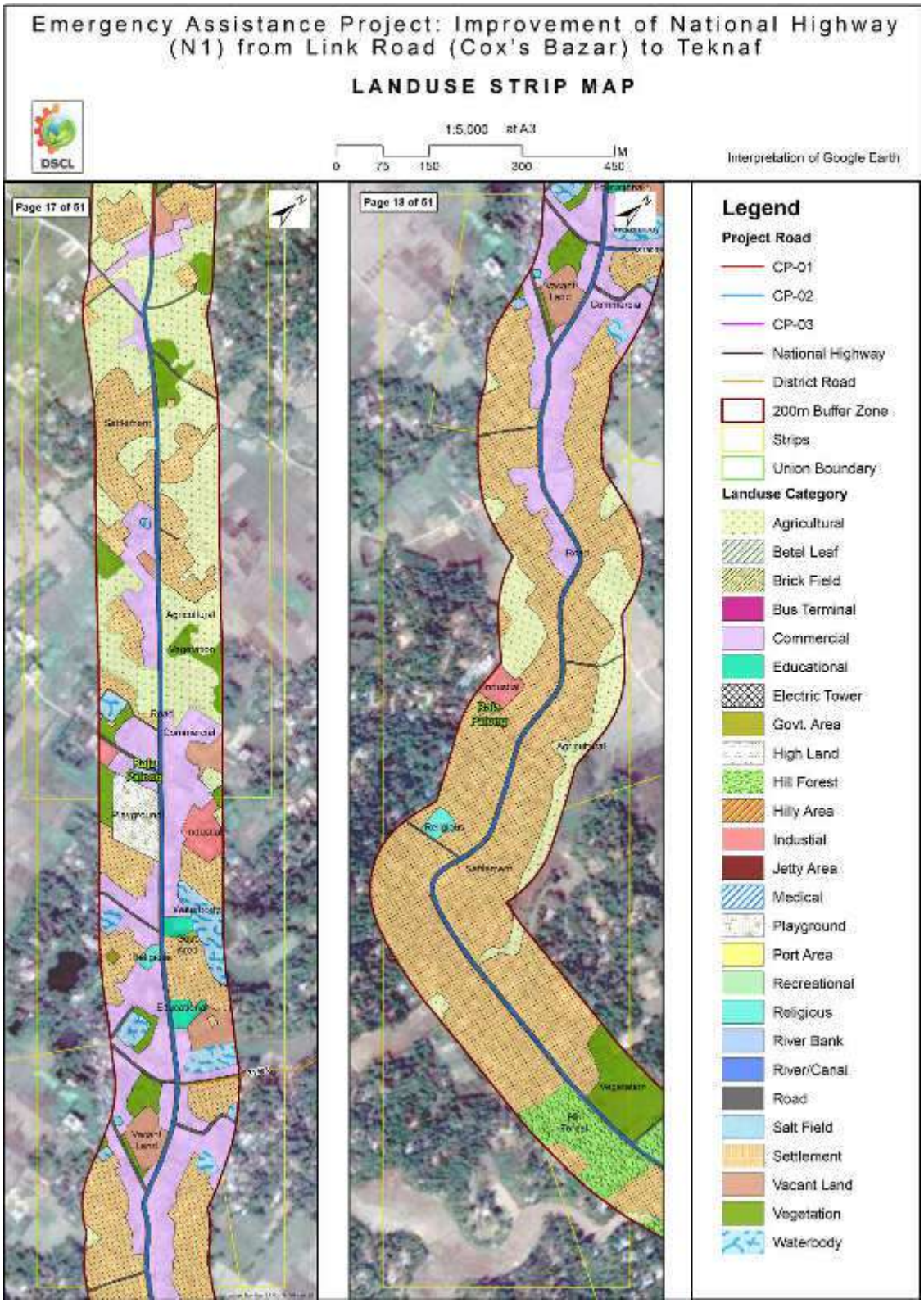
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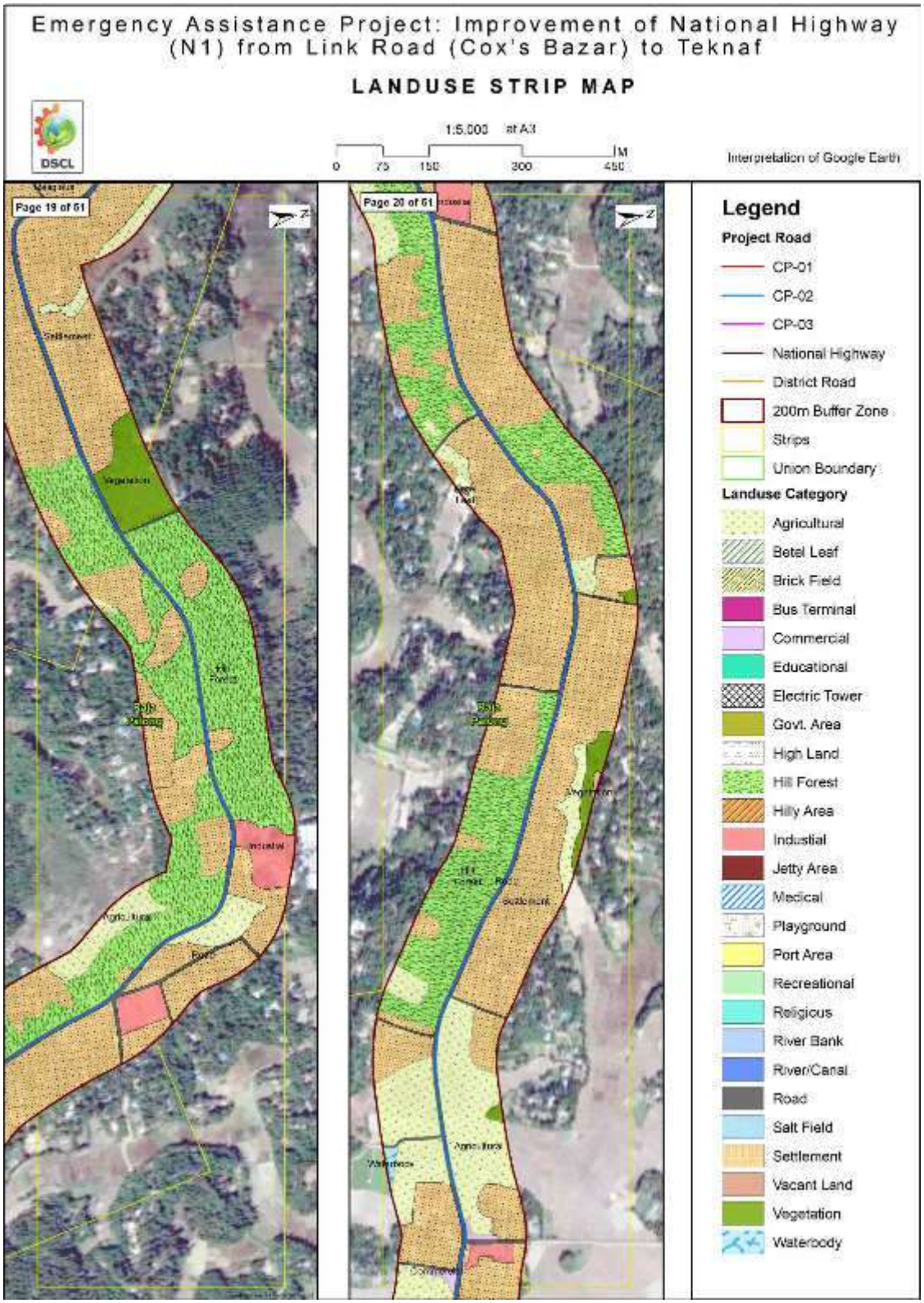
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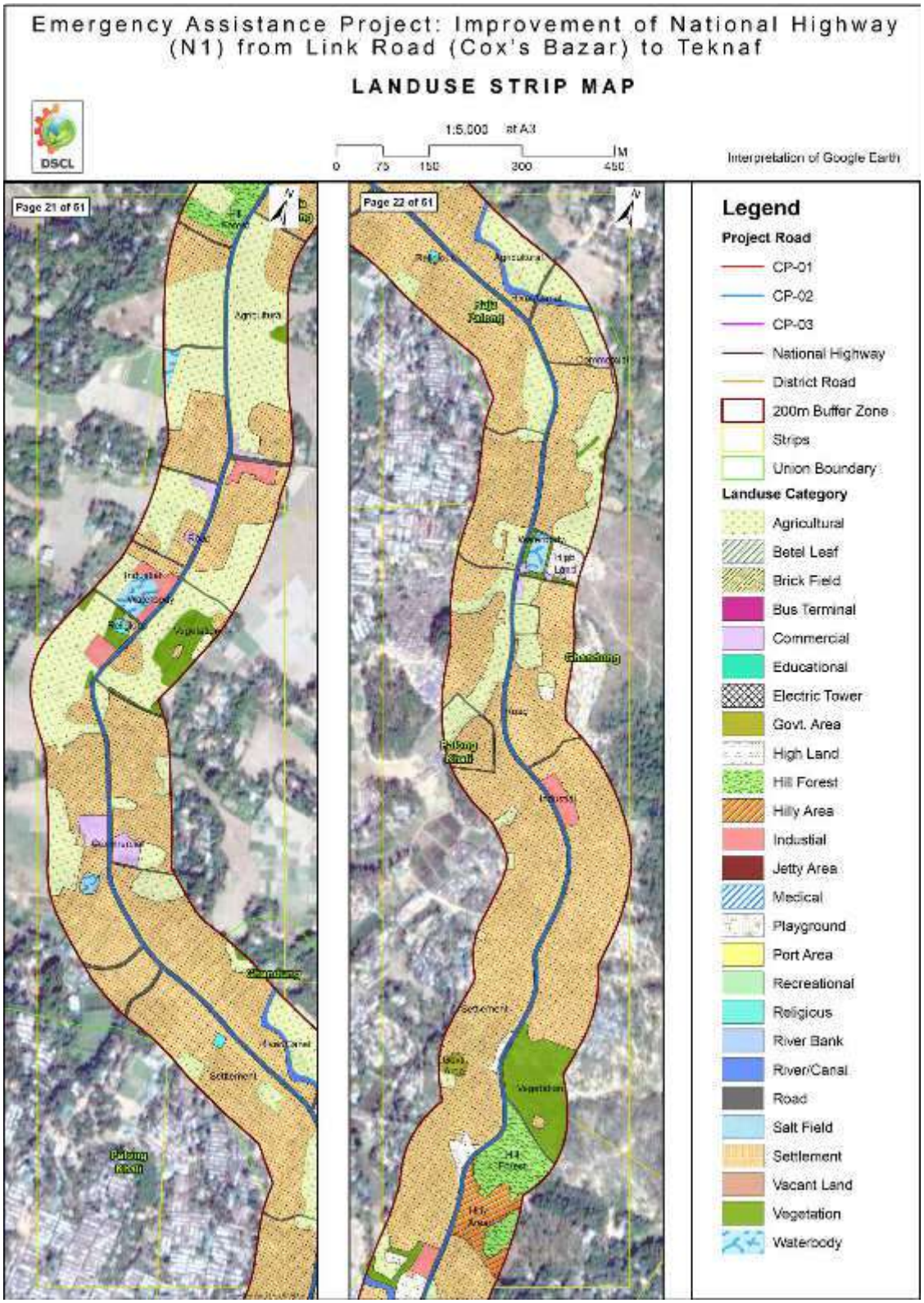
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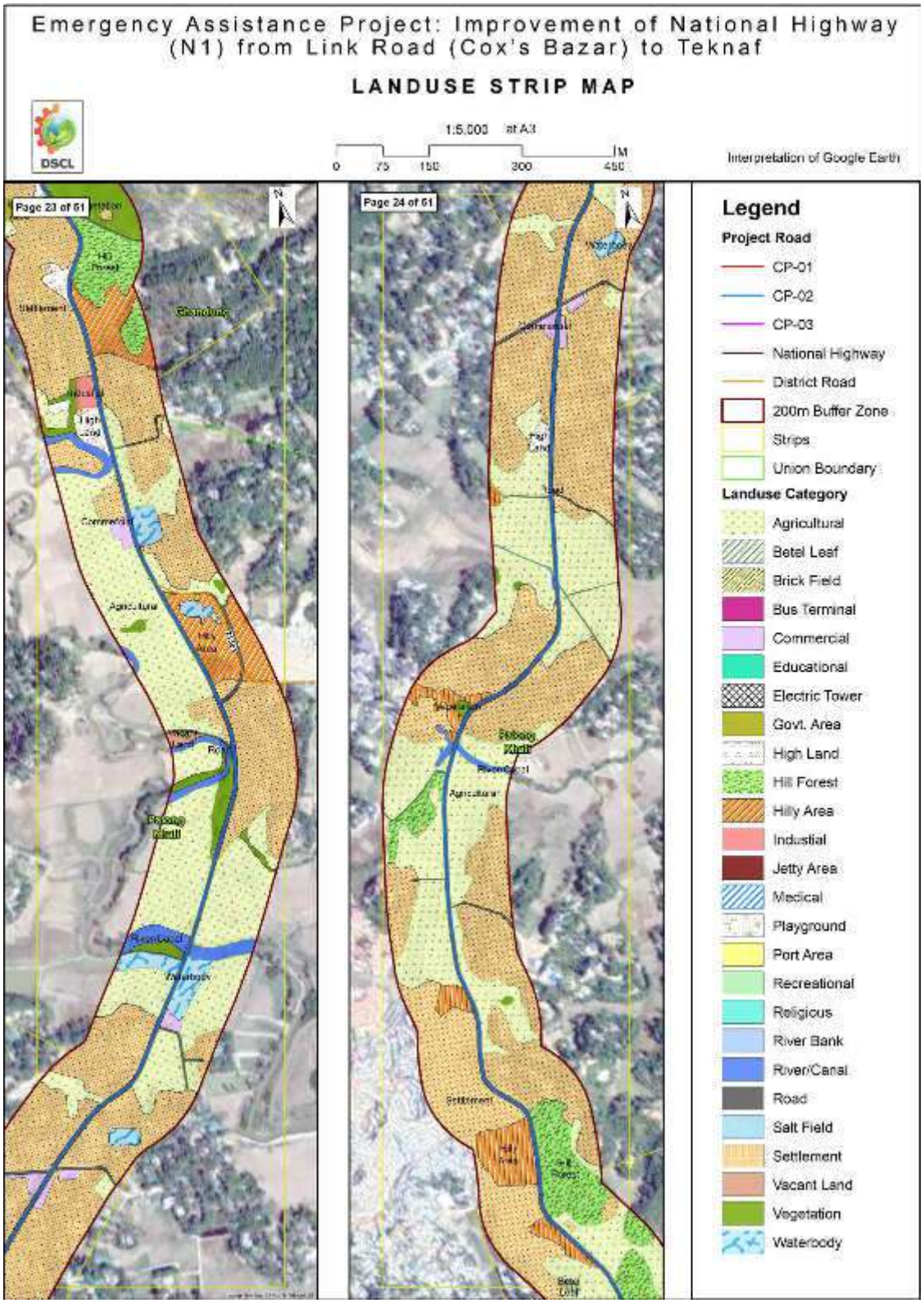
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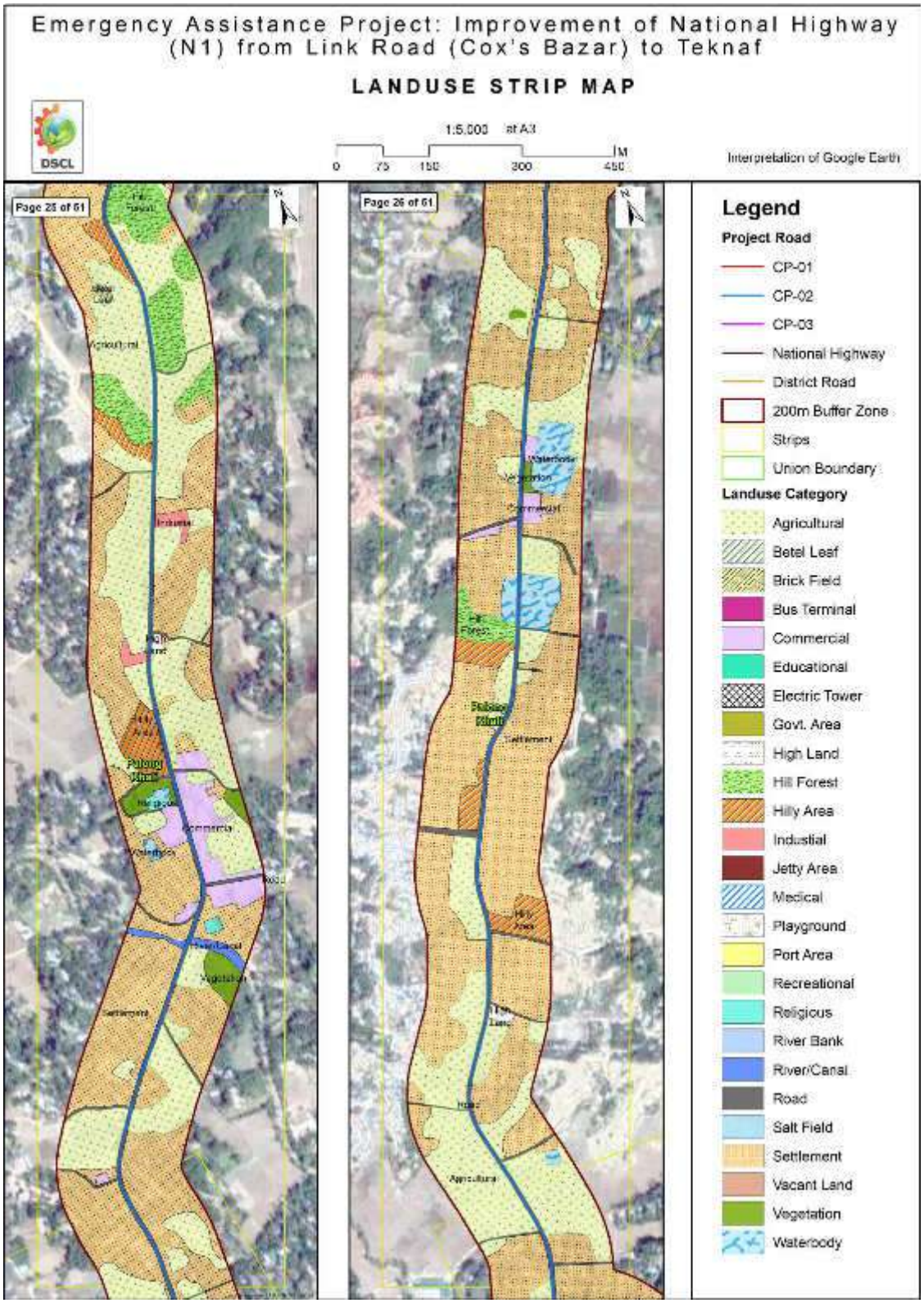
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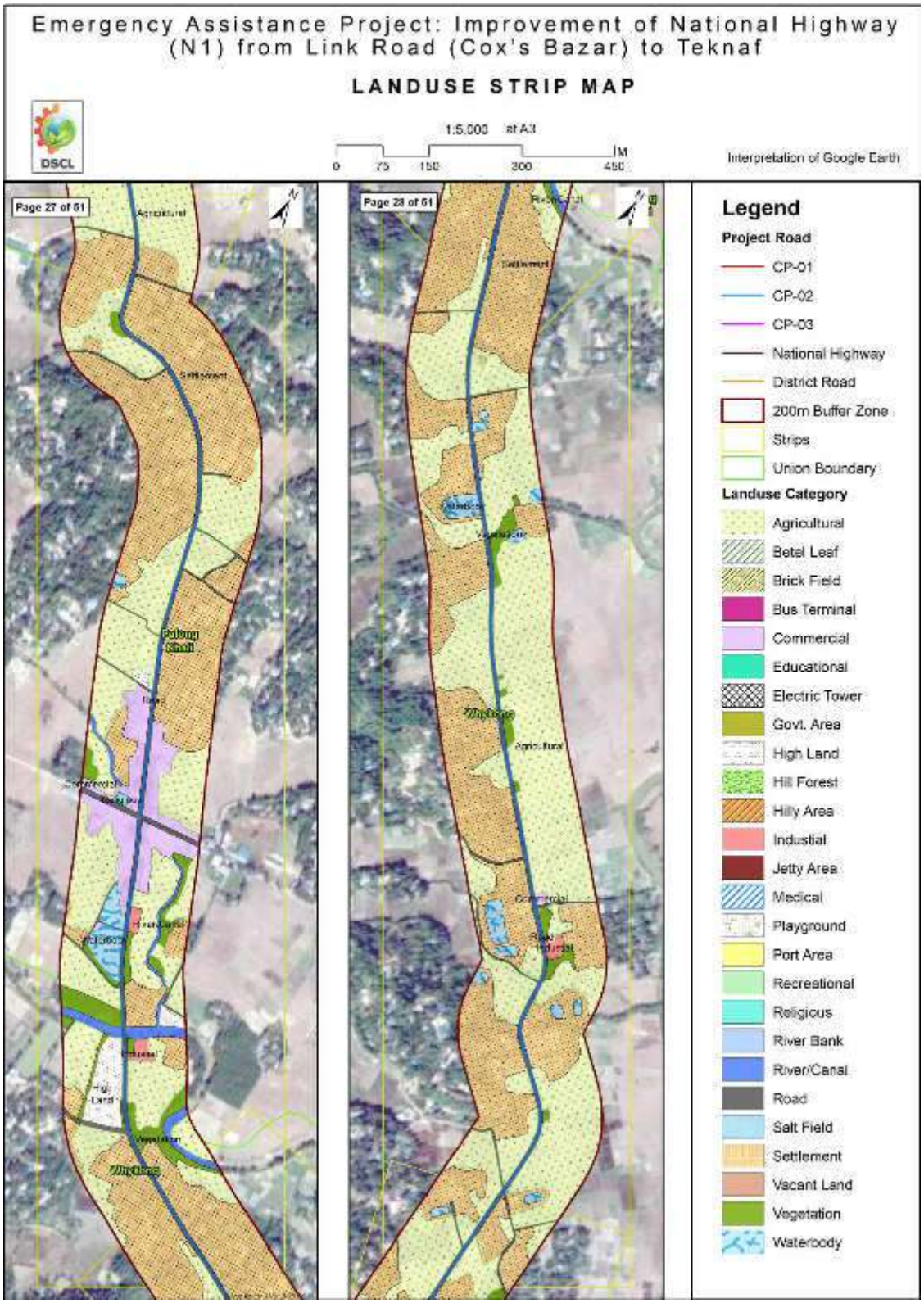
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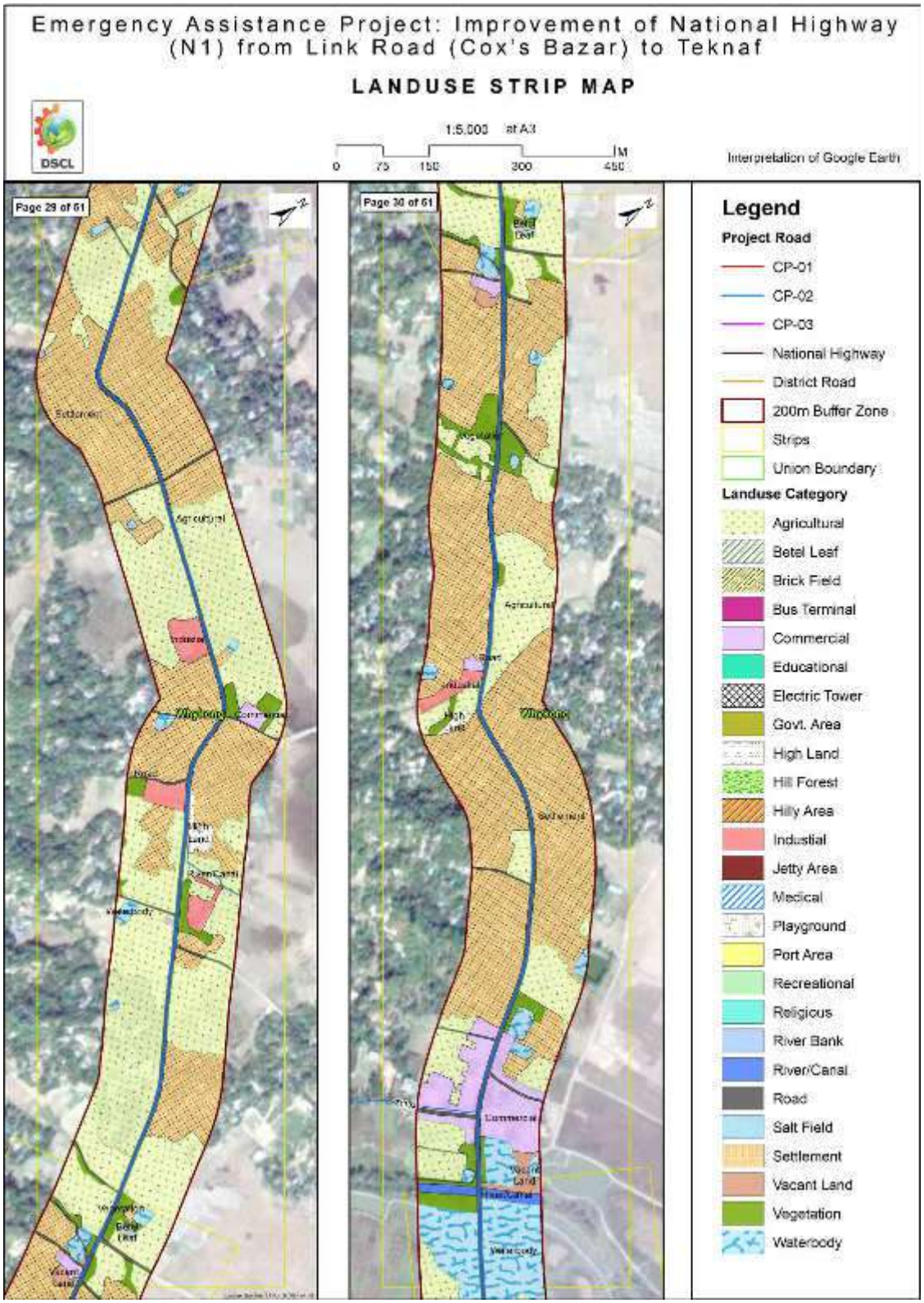
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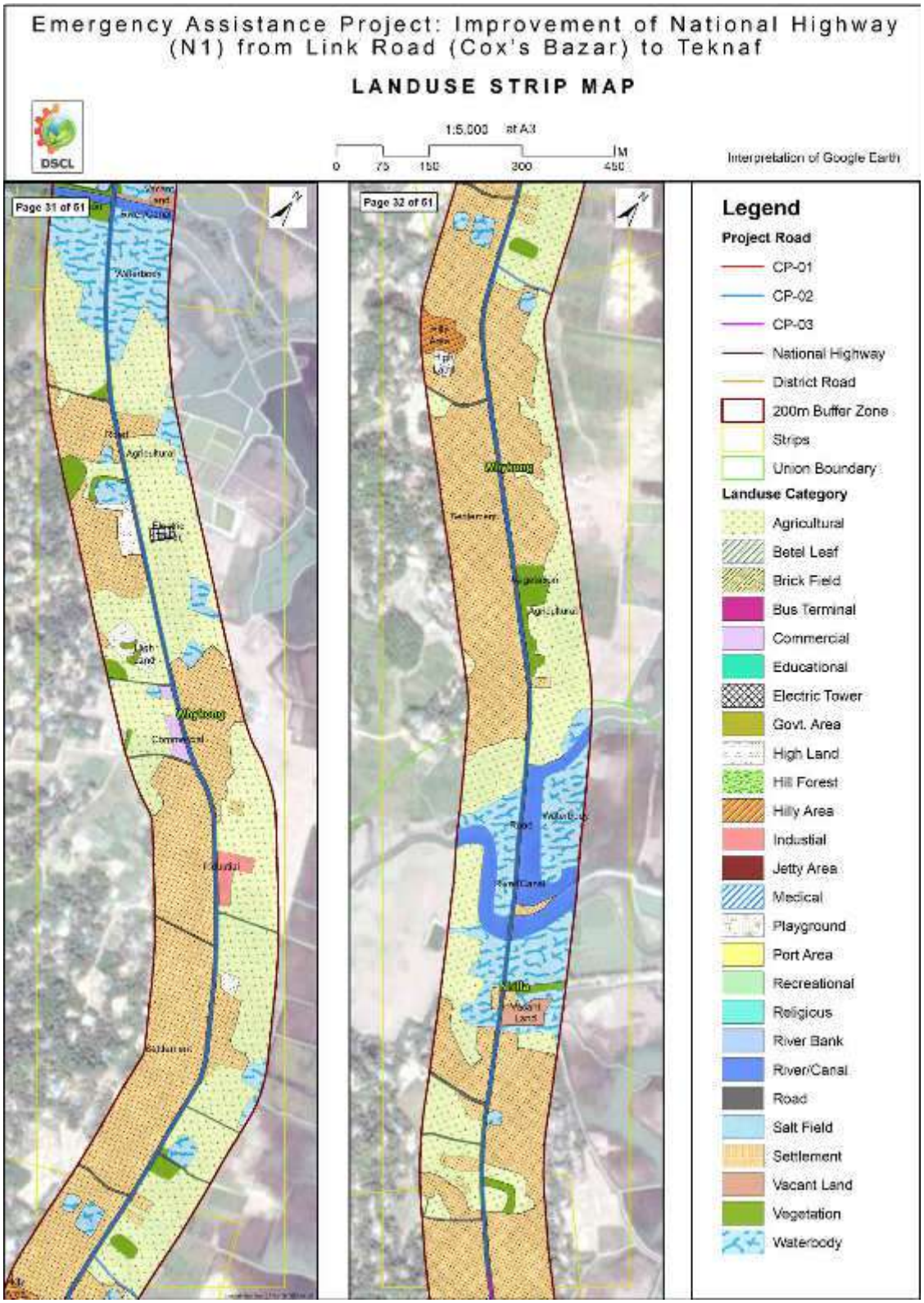
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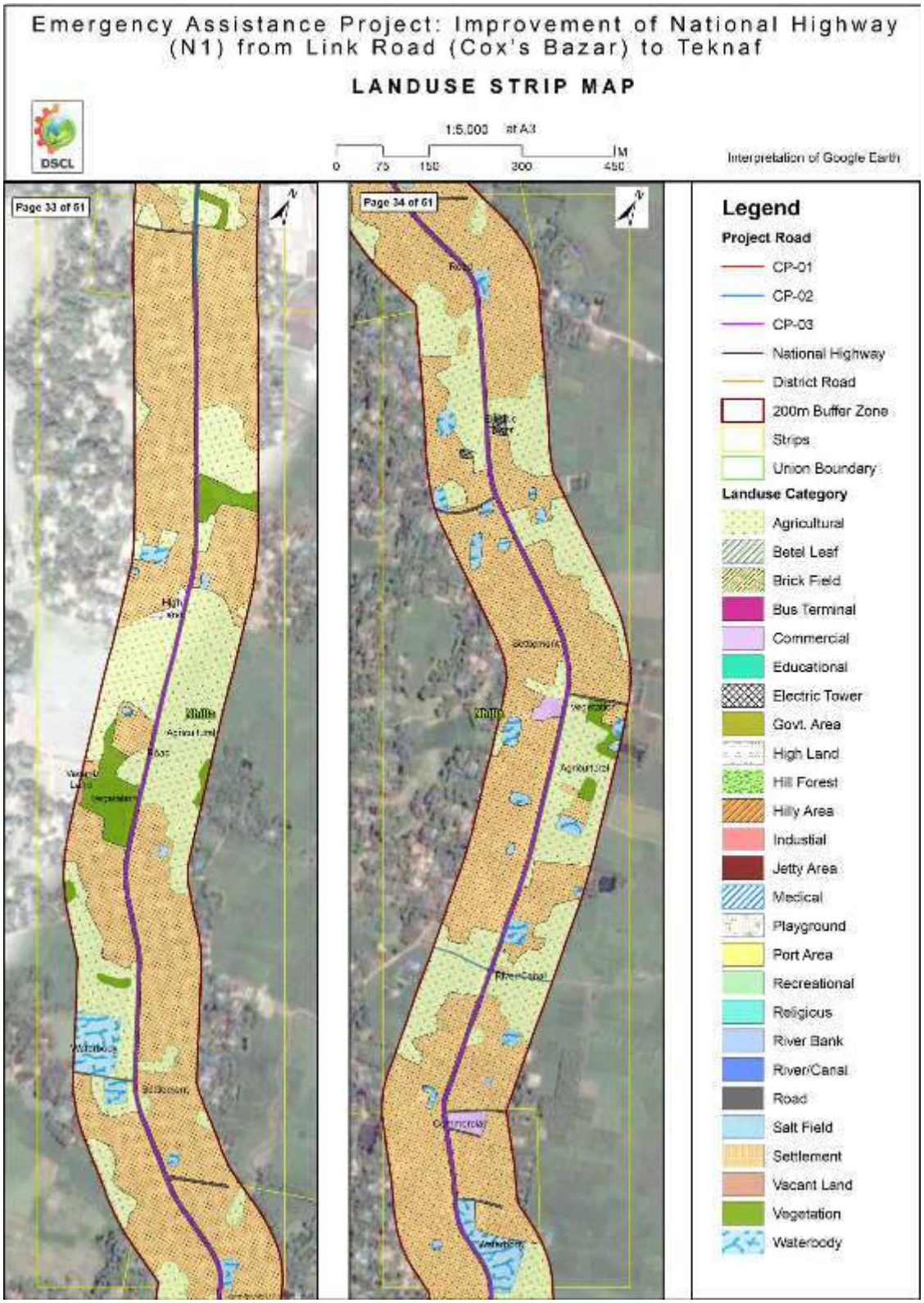
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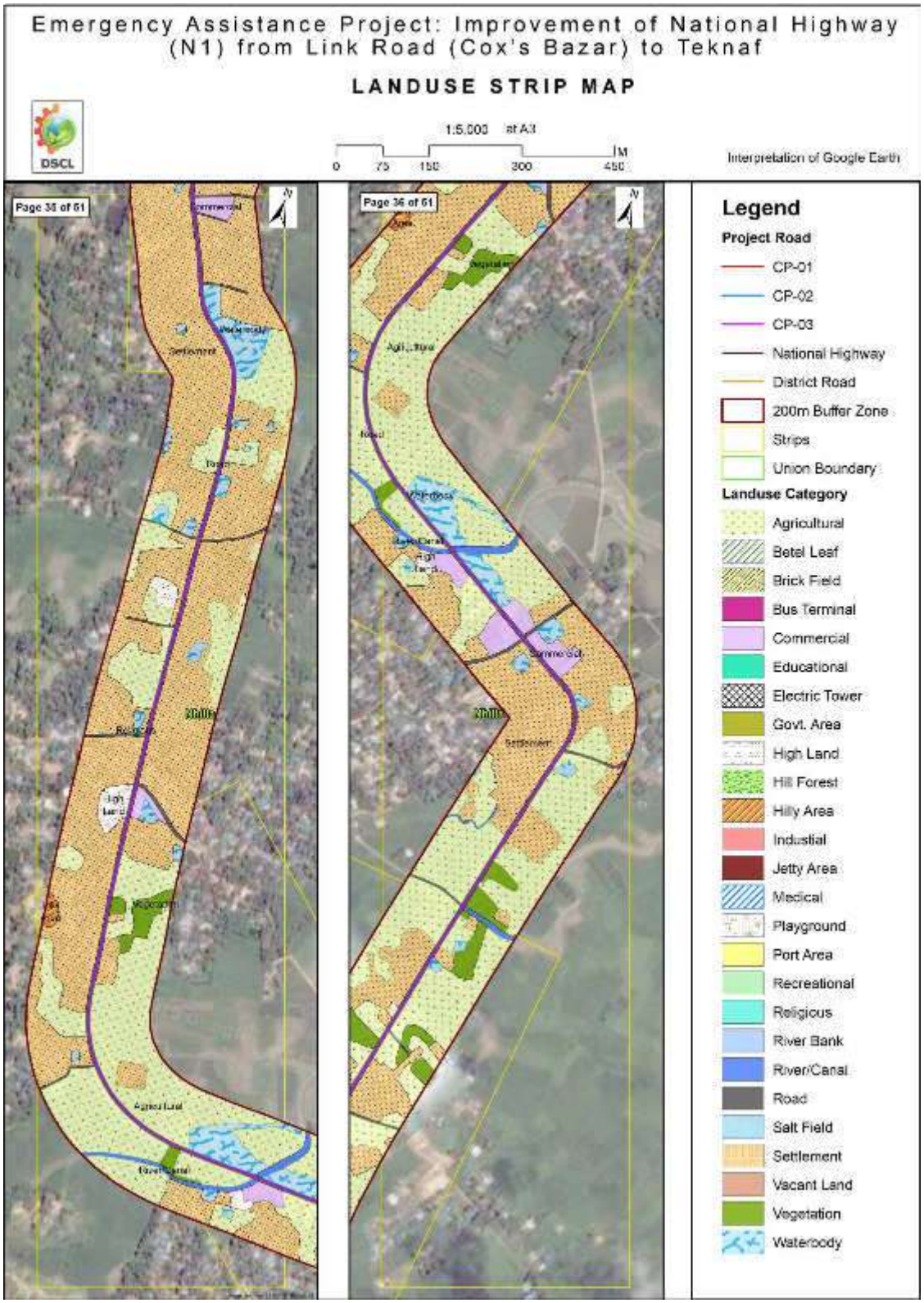
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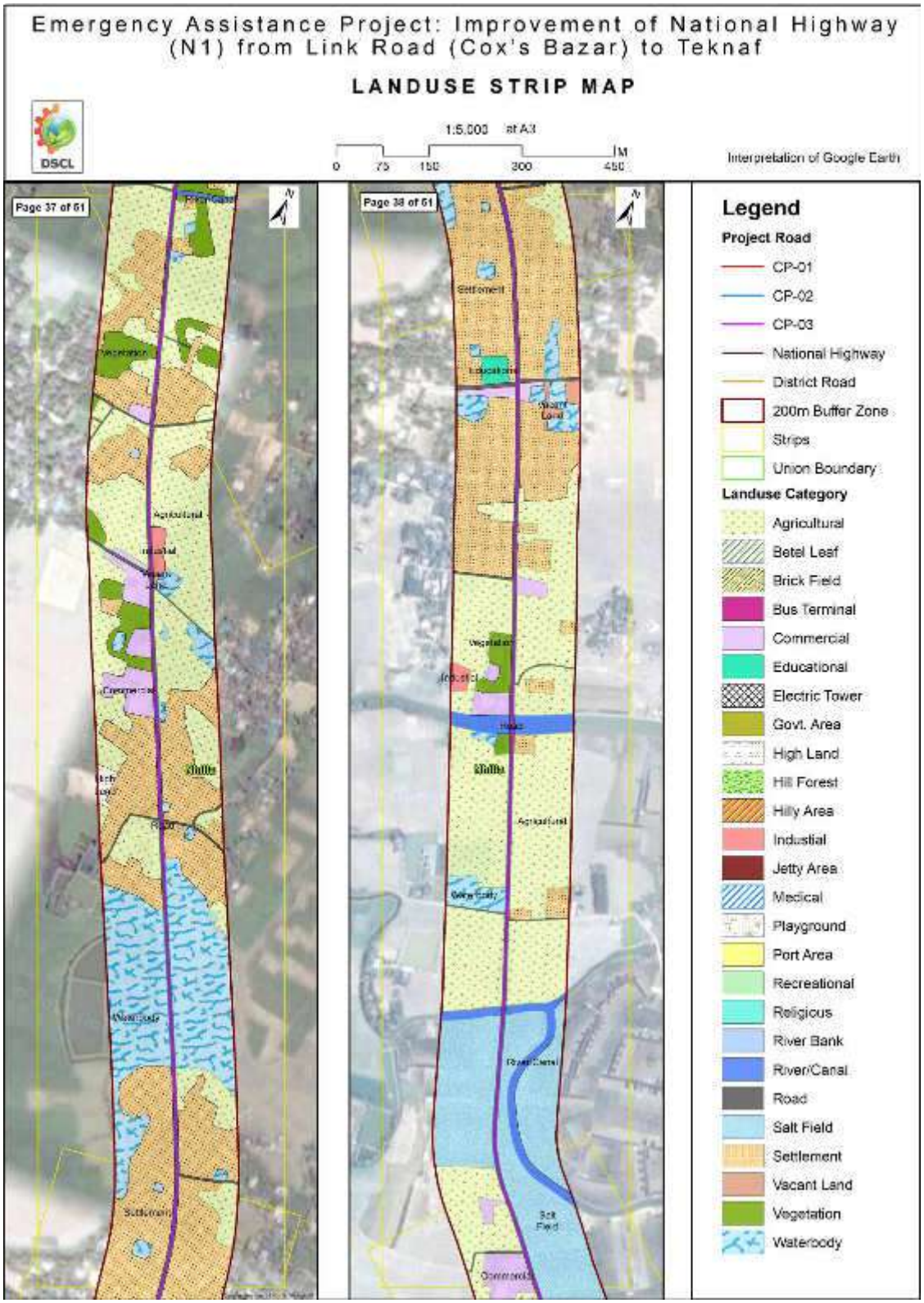
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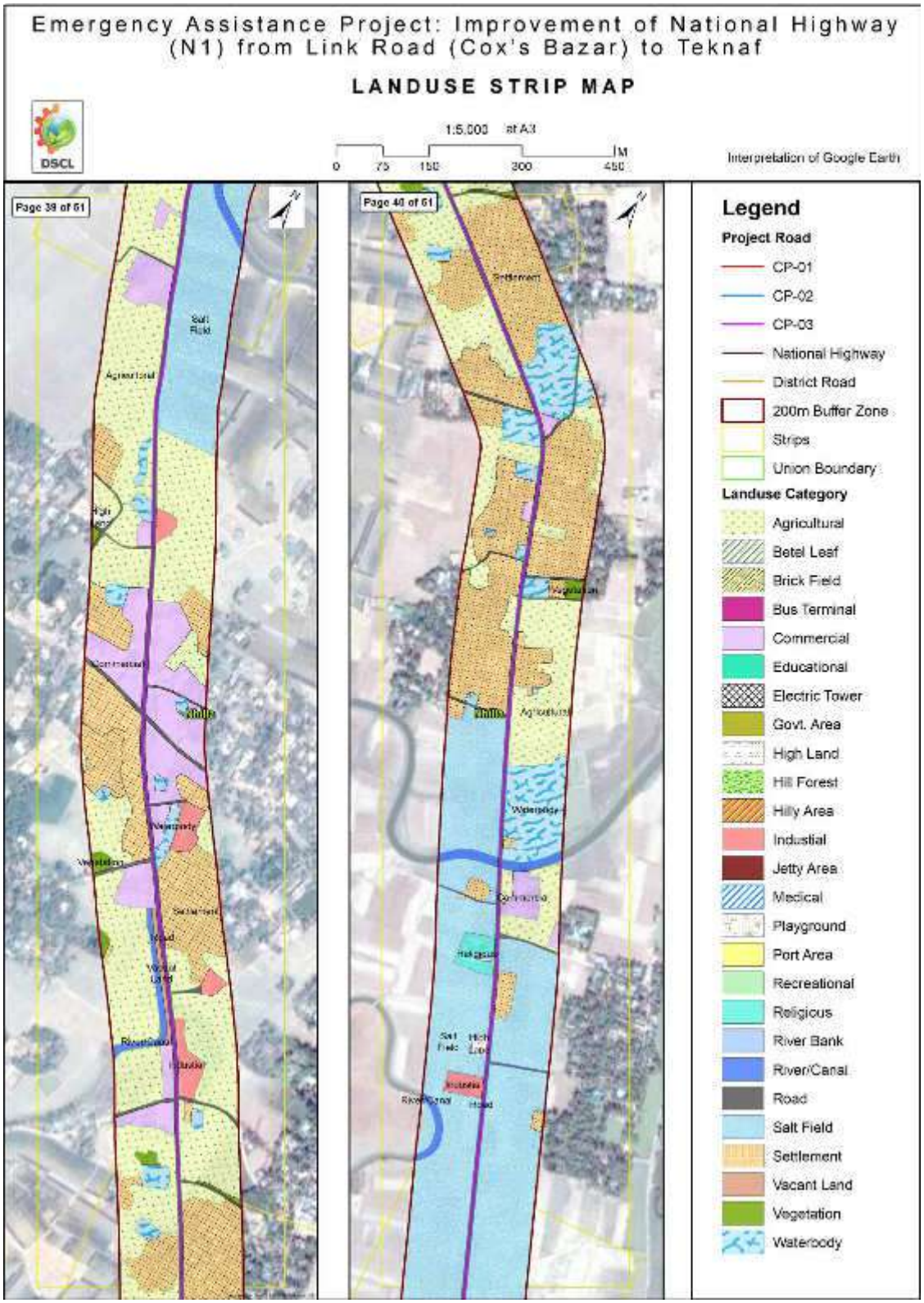
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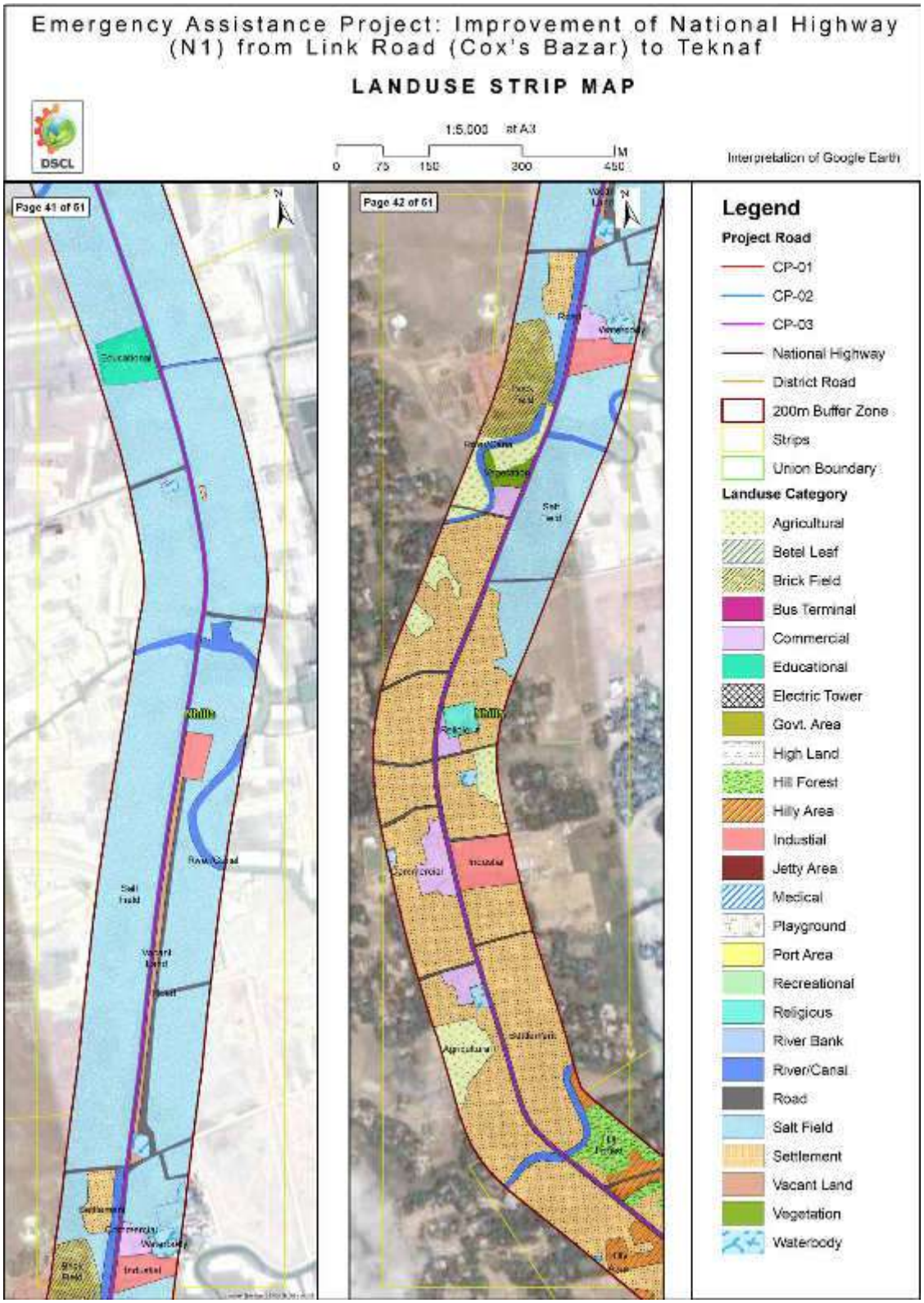
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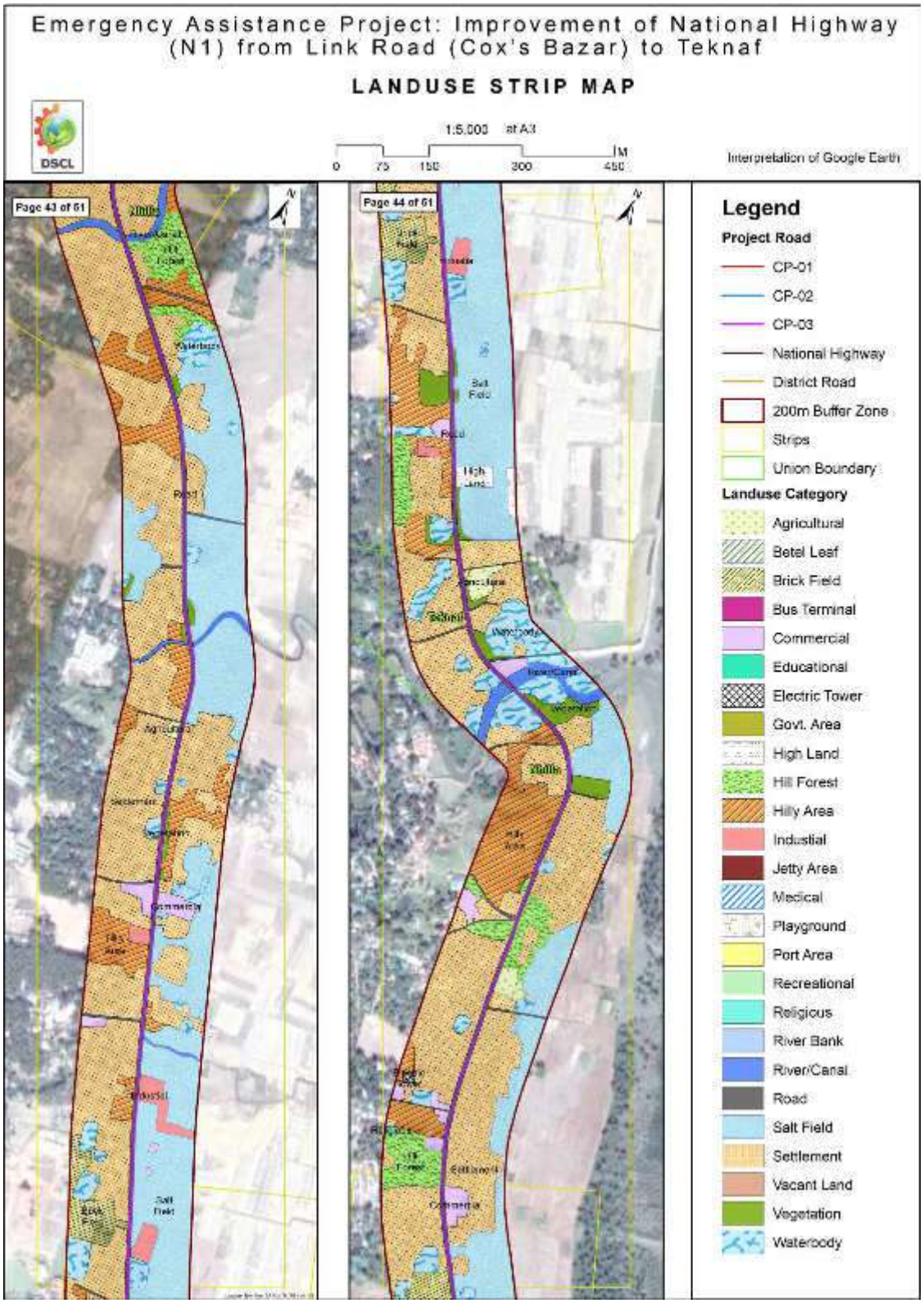
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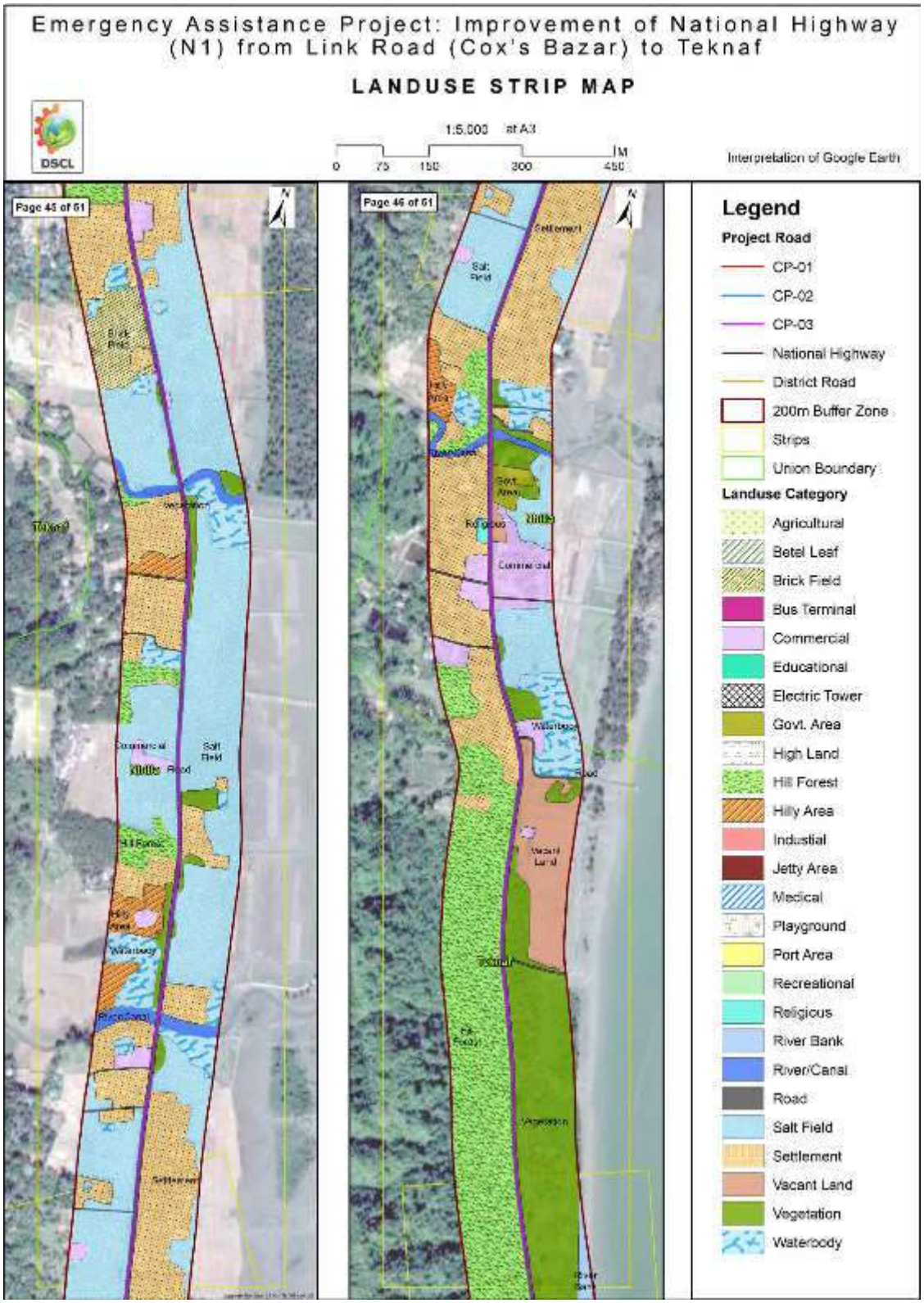
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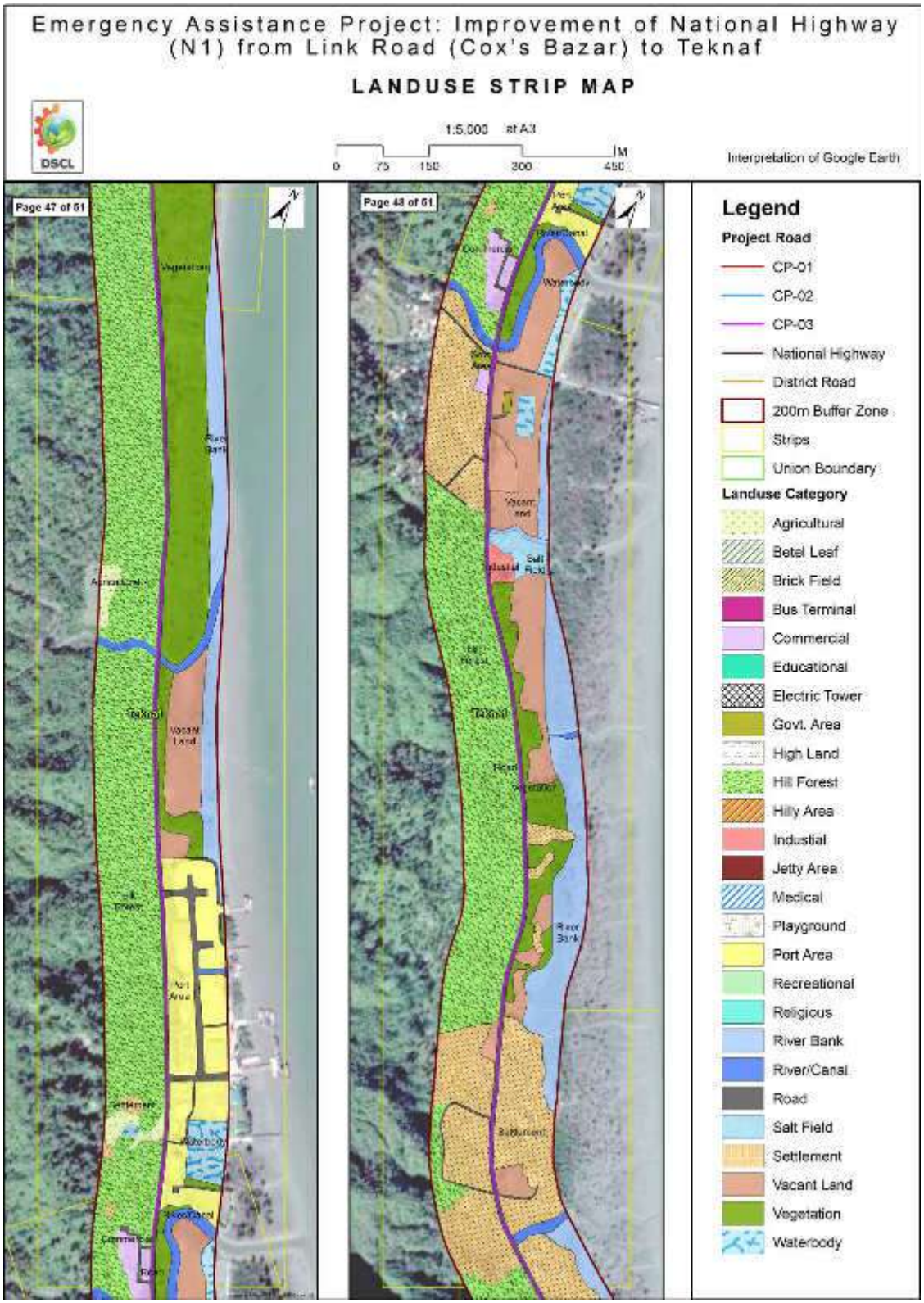
National Highway
District Road
200m Buffer Zone
Strips
Union Boundary
Landuse Category
Agricultural
Betel Leaf
Brick Field
Bus Terminal
Commercial
Educational
Electric Tower
Govt. Area
High Land
Hill Forest
Hilly Area
Industial
Jetty Area
Medical
Playground
Port Area
Recreational
Religious
River Bank
River/Canal
Road
Salt Field
Settlement
Vacant Land
Vegetation
Waterbody


Emergency Assistance Project: Improvement of National Highway (N1) from Link Road (Cox's Bazar) to Teknaf
LANDUSE STRIP MAP
DSCL
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Interpretation of Google Earth
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Legend
Project Road
CP-01
CP-02
CP-03
National Highway
District Road
200m Buffer Zone
Strips
Union Boundary
Landuse Category
Agricultural
Betel Leaf
Brick Field
Bus Terminal
Commercial
Educational
Electric Tower
Govt. Area
High Land
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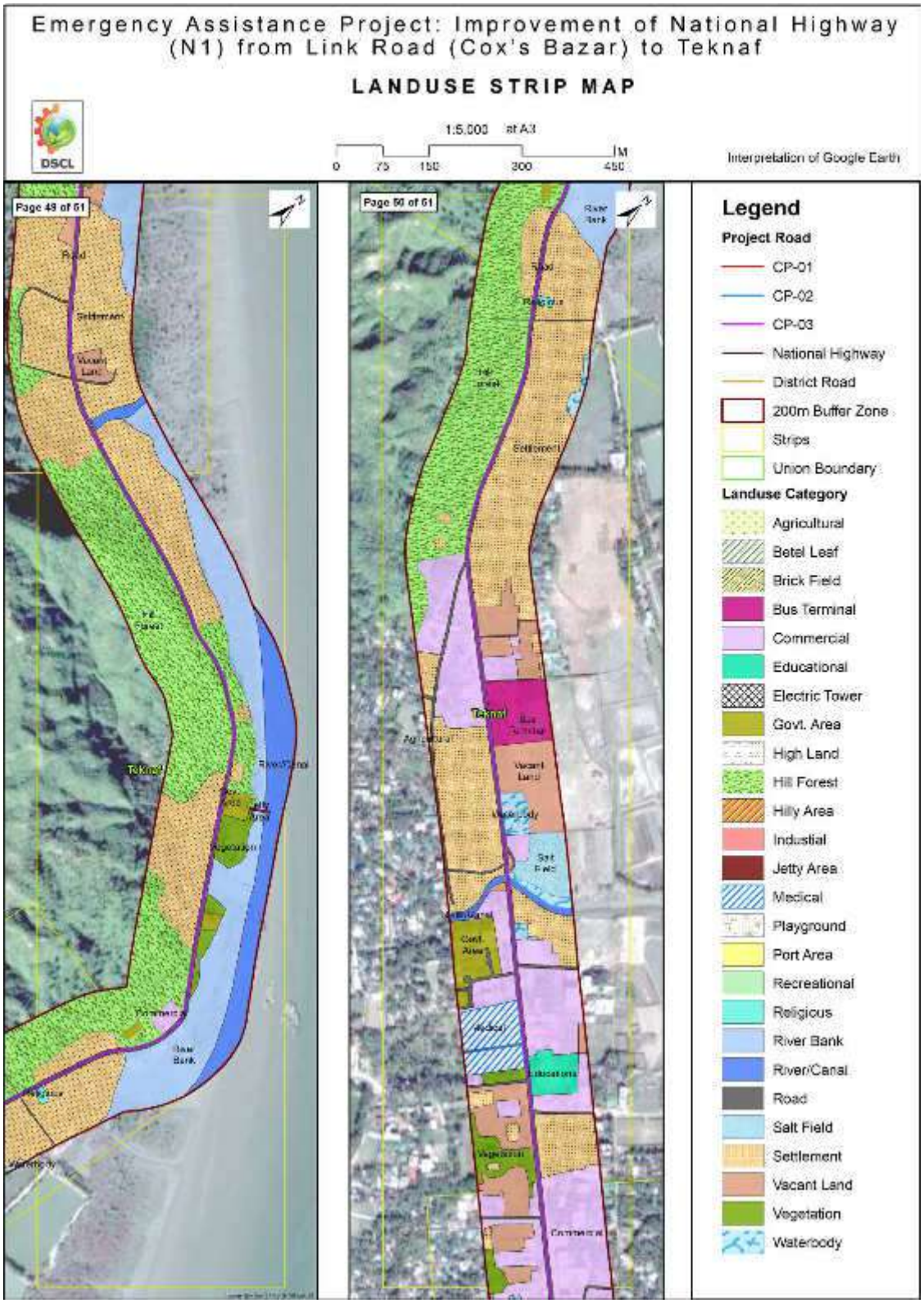
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LANDUSE STRIP MAP
DSCL
1:5,000 at A3
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Settlement
Vacant Land
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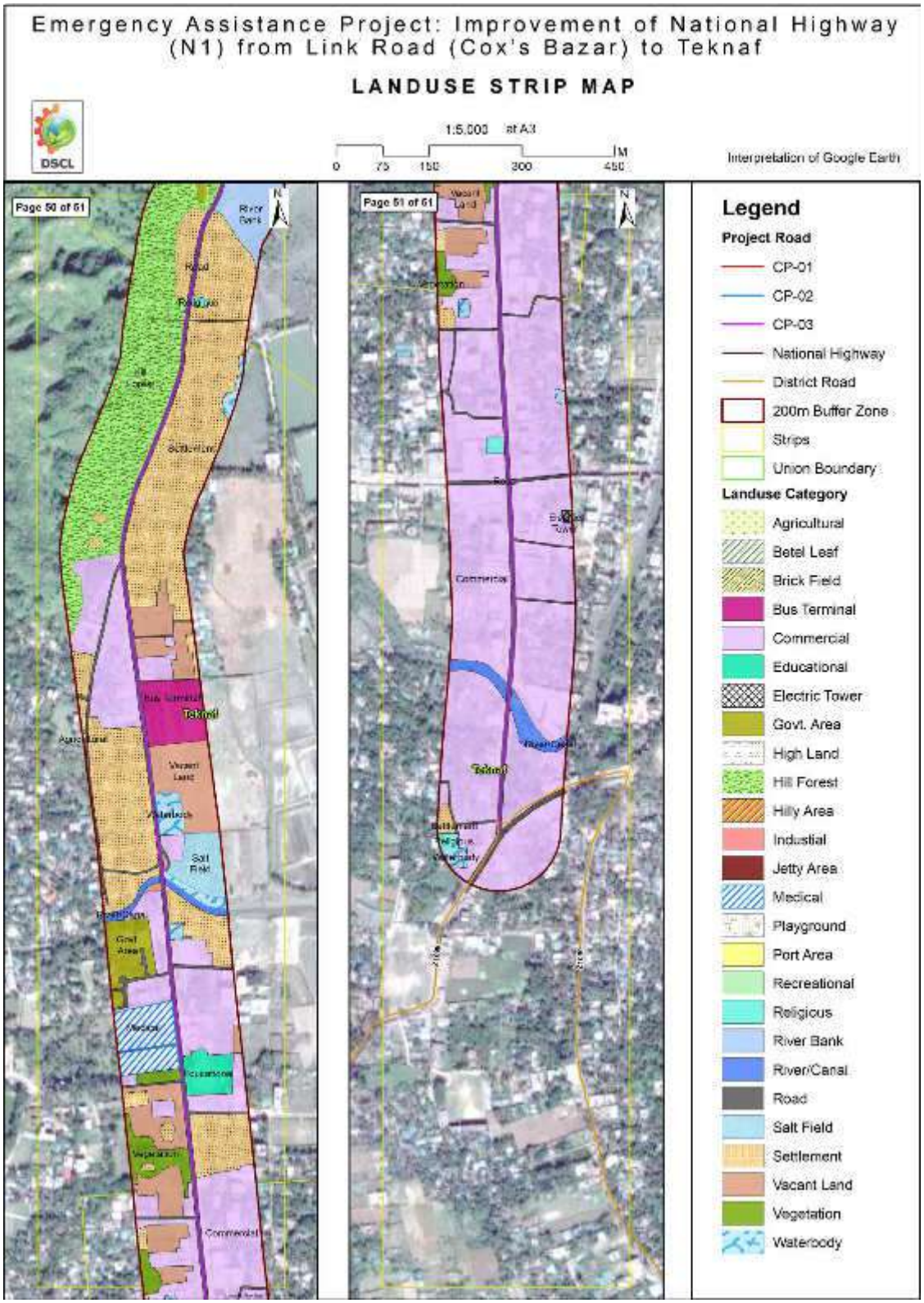
Waterbody


Emergency Assistance Project: Improvement of National Highway (N1) from Link Road (Cox's Bazar) to Teknaf
LANDUSE STRIP MAP
DSCL
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Teknaf
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Agricultural
Betel Leaf
Brick Field
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Hill Forest
Hilly Area
Industial
Jetty Area
Medical
Playground
Port Area
Recreational
Religious
River Bank
River/Canal
Road
Salt Field
Settlement
Vacant Land
Vegetation
Waterbody

Appendix 4: Test Results of Ambient Air Quality Measurement

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Name of the Project	Emergency Assistance Project: Improvement of National Highway (N1) for Link Road (Cox's Bazar) to Teknaf.
Description of Sample	Ambient Air Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	16th November 2018 to 18th November 2018

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Concentration Present			Bangladesh Standard**	Duration (hours)	Method of Analysis
		AAQ_01 21°25.543'N 92°01.452'E	AAQ_02 24°14.716'N 92°08.287'E	AAQ_03 20°52.516'N 92°17.881'E			
PM_{10}	µg/m³	20.39	13.87	18.21	150	24	Gravimetric
$PM_{2.5}$	µg/m³	8.76	7.46	5.22	65	24	Gravimetric
SO_2	µg/m³	7.10	5.22	4.35	365	24	West-Geake
NOx	µg/m³	11.82	8.13	10.20	100	Annual	Jacob and Hochheiser
CO*	ppm	<1	<1	<1	9	8	CO-Meter
Weather Condition	-	Sunny	Sunny	Sunny	-	-	-

Note:

** CO concentrations and standards are 8-hourly only.*
*** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.*
NYS: Not Yet Standardized

Monitoring Results of Weather Data

Sample ID	Location	GPS Location	Humidity (%)	Temperature °C	Wind Speed Knots	Wind Direction
AAQ_01	Link Road Bazar, Cox's Bazar	21°25.543'N 92°01.452'E	52.31	36.1	1.37	North-West
AAQ_02	Ukhiya Bazar, Ukhiya, Cox's Bazar	21°14.716'N 92°08.287'E	59.10	34.4	1.56	East-South
AAQ_03	In front of Hospital Gate, Teknaf, Cox's Bazar	20°52.516'N 92°17.881'E	61.52	36.3	1.89	South-West

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Location	Sample Site Description
AAQ_01	➢ High amount of dust particles were present in the area ➢ The weather was sunny. ➢ Traffic movement was high. ➢ People movement was high. ➢ Crowded Area.
AAQ_02	➢ Sampling location was busy with a lot of vehicles. ➢ Dust particles were present in the area due to Bazar location. ➢ Huge smoke was coming from vehicles ➢ The weather was sunny. ➢ People movement was high
AAQ_03	➢ Huge amount of dust particles were present in the area. ➢ The weather was sunny. ➢ People movement was high. ➢ Huge amount of traffic volume. ➢ Crowded Area.

Test Performed By:
Rashaduzzaman
Jr. Environmental Specialist

Development Solutions Consultant Limited DSCL

Checked By:
Tonmoy Pandit
Deputy Manager

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Appendix 5: Test Results of Noise Level Measurement

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Name of the Project	Emergency Assistance Project; Improvement of National Highway (N1) from Link Road (Cox's Bazar) to Teknaf.
Description of Sample	Noise Level Measurement
Sample Collector	Collected by DSCL Personnel
Sampling Date	16th November 2018- 17th November 2018

Noise Level Analysis

Sample ID	Sample Location	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)	
				Day	Night	Day	Night
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note:

- [illegible]
- [illegible]
- [illegible]
- *Noise Level is the average noise recorded over the duration of the monitoring period*

Abbreviation:
NM: Noise Measurement, dB: decibel

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Location	Sample Site Description
NM_01	➢ Moderate traffic movement. ➢ Birds Chinking. ➢ Construction near 50m distance from sampling site. ➢ Near the national highway.
NM_02	➢ Local Roadside. ➢ Mixed area because of simultaneously used for another purposes. ➢ Low people movement ➢ Near local residence.
NM_03	➢ Traffic volume was high. ➢ Crowd/conjunction happen at hour area. ➢ Commercial area, people movement was high.
NM_04	➢ Highway road traffic flow volume. ➢ Proper traffic movement. ➢ Low people movement. ➢ Mixed area.
NM_05	➢ Some residential area of main gate. ➢ [illegible] people movement. ➢ Moderate traffic and people movement. ➢ Mixed residential area.
NM_06	➢ Small town area. ➢ Moderate traffic volume and people movement. ➢ Commercial area. ➢ [illegible] from the national highway road.

Test Performed By:
Rashaduzzaman
Jr. Environmental Specialist

Development Solutions Consultant Limited * DSCL *

Checked By:
Tonmoy Pandit
Deputy Manager

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Appendix 6: Test Results of Groundwater Quality

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Name of the Project	Emergency Assistance Project; Improvement of National Highway (N1) for Link Road (Cox's Bazar) to Teknaf.
Description of Sample	Groundwater
Sample Collector	Collected by DSCL Personnel
Sampling Date	17th November, 2018

On-site Test Result of Groundwater

Parameters	Unit	Concentration Present			Standards for Groundwater*	Analysis Method
		GW_01	GW_02	GW_03		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Source:

1. [illegible] = [illegible], [illegible], [illegible]
2. [illegible] = [illegible], [illegible], [illegible]
3. GW_03 = Nila Stack Yard, Nila, Teknaf

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Location	Sample Site Description
GW_01	➢ The sample source was established in 2018. ➢ The boring was 70 feet. ➢ Owner of the source is Roads and Highway Department. ➢ Distance from nearest toilet was 10m. ➢ 20m away from the road.
GW_02	➢ The source was established in 2012. ➢ The depth was 150 feet. ➢ 50m away from the road side. ➢ Distance from nearest toilet was 150 feet.
GW_03	➢ The source was established in 2 years ago. ➢ The water is used from drinking purpose. ➢ 40m away from the road side.

Test Performed By:
Rashaduzzaman
Jr. Environmental Specialist

Development Solutions Consultant Limited DSCL

Checked By:
Tonmoy Pandit
Deputy Manager

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Lab Memo: 1198/ CC, DPHE, CL, Dhaka

Date: 25-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110125	Sample Receiving date: 19-11-2018
Ref. Memo No: DSCL /2018/NII & Dated: 19-11-2018	Sample Source: Ground Water
Sent by:Rashaduzzaman ,Jr. Environmental Specialist , DSCL Mirpur DOHS, Dhaka-1215.	Dist:Cox's Bazar; Upa:
Care Taken: DSCL (Sample :GW_01)	Union:, Vill:
Sample Collection date:	Date of Testing: 19/11/2018-25/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Chloride	150-600	37	mg/L	Titrimetic	-
3	Coliform (Faecal)	0	0	N/100ml	MFM	-
4	Coliform (Total)	0	0	N/100ml	MFM	-
5	Colour	15	2	Hazen	UVS	-
6	Hardness	200-500	190	mg/L	Titrimetic	-
7	Iron (Fe)	0.3-1	1.26	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
9	Turbidity	10	3.5	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	25-11-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	25.11.18 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
2.) Name: Taslima Akhter Designation: Sample Analyzer	25.11.18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka	2.) Name: Designation:	

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Lab Memo: 1198/ CC, DPHE, CL, Dhaka.

Date: 25-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110126	Sample Receiving date: 19-11-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 19-11-2018	Sample Source: Ground Water
Sent by:Rashaduzzaman ,Jr. Environmental Specialist , DSCL Mirpur DOHS, Dhaka-1216.	Dist:Cox's Bazar, Upa:
Care Taker: DSCL (Sample :GW_02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 19/11/2018-25/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Chloride	150-600	14	mg/L	Titrimetic	-
3	Coliform (Faecal)	0	0	N/100ml	MFM	-
4	Coliform (Total)	0	0	N/100ml	MFM	-
5	Colour	15	19.5	Hazen	UVS	-
6	Hardness	200-500	165	mg/L	Titrimetic	-
7	Iron (Fe)	0.3-1	1.84	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.18	mg/L	AAS	0.03
9	Turbidity	10	4.7	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B. AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	25-11-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	25.11.18 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
2.) Name: Taslima Akhter Designation: Sample Analyzer	25.11.18 Senior Chemist DPHE, Central Laboratory Mohakhali, Dhaka	2.) Name: Designation:	

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Lab Memo: 1196/ CC, DPHE, CL, Dhaka.

Date: 25-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110127	Sample Receiving date: 19-11-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 19-11-2018	Sample Source: Ground Water
Sent by:Rashaduzzaman ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Cox's Bazar, Upa:
Care Taker: DSCL (Sample :GW_03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 19/11/2018-25/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Chloride	150-600	42	mg/L	Titrimetic	-
3	Coliform (Faecal)	0	0	N/100ml	MFM	-
4	Coliform (Total)	0	0	N/100ml	MFM	-
5	Colour	15	0.90	Hazen	UVS	-
6	Hardness	200-500	230	mg/L	Titrimetic	-
7	Iron (Fe)	0.3-1	0.24	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.07	mg/L	AAS	0.03
9	Turbidity	10	2.2	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	25-11-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	25.11.18 Md. Biplab Hossain, Chief Chemist, Department of Public Health Engineering, Central Laboratory Mohakhali, Dhaka
2.) Name: Tasima Akhter Designation: Sample Analyzer	25.11.18 Sample Analyzer, DPHE, Central Laboratory, Mohakhali, Dhaka	2.) Name: Designation:	

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Appendix 7: Test Results of Surface Water Quality

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Name of the Project	Emergency Assistance Project; Improvement of National Highway (N1) for Link Road (Cox's Bazar) to Teknaf.
Description of Sample	Surface Water
Sample Collector	Collected by DSCL Personnel
Sampling Date	17th November, 2018

On-site Test Result of Surface Water

Parameters	Unit	Concentration Present			Standards for Inland Surface Water**	Analysis Method
		SW_01	SW_02	SW_03		
Temperature*	°C	29.3	29.8	29.2	NYS	Multimeter
pH*	-	7.70	8.92	9.5	6.5-8.5	Multimeter
Salinity*	ppm	77.2	49.8	95.3	NYS	Multimeter
ORP*	-	-99.5	91.6	-18.3	NYS	Multimeter
Total Dissolved Solids (TDS)*	mg/L	1667.4	1498.5	1295.3	NYS	Multimeter
Electrical Conductivity (EC)*	µs/cm	158.4	101.7	182.5	NYS	Multimeter
Dissolved Oxygen (DO)*	mg/L	2.3	3.0	3.3	5 or more	DO Meter

Note:
**On-site Test Result*
***Standards for Inland Surface Water is followed Environmental Conservation Rule (ECR) 97*
NYS- Not Yet Standardized

Source:

1. SW_01 = Setoli Bottoli; Holodia Union; Ukhiya Upazilla
2. SW_02 = Kutupalong Rohingya Camp; Kutupalong, Teknaf
3. SW_03 = Kanjarpara, Hoyankong Union, Teknaf Upazilla

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Location	Sample Site Description
SW_01	➢ The sample was collected from pond water. ➢ The pond is 10m away from the road side. ➢ Water remains in the pond all-round the year. ➢ Fish is cultured in the pond.
SW_02	➢ Rain Water drains in the pond. ➢ Waste from rohingya camp affects the water. ➢ Fish id cultured in the pond. ➢ Sampling location is near the Bazar Area.
SW_03	➢ The pond is near the national highway. ➢ Water remains all-round the year in the pond. ➢ Rain water washes in the pond. ➢ Fish is cultured in the pond.

Test Performed By:
Rashaduzzaman
Jr. Environmental Specialist

Development Solutions Consultant Limited * DSCL *

Checked By:
Tonmoy Pandit
Deputy Manager

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Lab Memo: 1196/ CC, DPHE, CL, Dhaka

Date: 25-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110128	Sample Receiving date: 19-11-2018
Ref. Memo No: DSCL/2018/Nil & Dated: 19-11-2018	Sample Source: Suface Water
Sent by:Rasheduzzaman ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216	Dist:Cox's Bazar, Upa:
Care Taker: DSCL (Sample :SW_01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 19/11/2018-25/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Total Suspended Solid (TSS)	10	17	mg/L	Gravimetric Method	-
2	Turbidity	10	12.7	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client
N.B: LOQ - Limit of Quantitation

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	25-11-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	25.11.18 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
2.) Name: Taslima Akhter Designation: Sample Analyzer	25.11.18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka	2.) Name: Designation:	

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Lab Memo: 1198/ CC, DPHE, CL, Dhaka.

Date: 25-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110129	Sample Receiving date: 19-11-2018
Ref. Memo No: DSCL/2018/Nil & Dated: 19-11-2018	Sample Source: Suface Water
Sent by:Rashaduzzaman ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216	Dist:Cox's Bazar, Upa:
Care Taker: DSCL (Sample :SW_02)	Union:, Vill:
Sample Collection date:	Date of Testing: 19/11/2018-25/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Total Suspended Solid (TSS)	10	20	mg/L	Gravimetric Method	-
2	Turbidity	10	12.6	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Mosin Designation: Sample Analyzer	25-11-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	25.11.18 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
2.) Name: Taslima Akhter Designation: Sample Analyzer	25-11-18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka	2.) Name: Designation:	

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Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com

Lab Memo: 1196/ CC, DPHE, CL, Dhaka

Date: 25-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110130	Sample Receiving date: 19-11-2018
Ref. Memo No: DSCL/2018/Nil & Dated: 19-11-2018	Sample Source: Suface Water
Sent by:Rashaduzzaman ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Cox's Bazar, Upa:
Care Taker: DSCL (Sample :SW_03)	Union: , Vill :
Sample Collection date:	Date of Testing: 19/11/2018-25/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Total Suspended Solid (TSS)	10	18	mg/L	Gravimetric Method	-
2	Turbidity	10	16.3	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	25-11-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	25.11.18
2.) Name: Taslima Akhter Designation: Sample Analyzer	25.11.18	2.) Name: Designation:	

Sample Analyzer
DPHE, Central Laboratory
Mohakhali, Dhaka

Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka

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Appendix 8: Test Results of Soil Quality Analysis

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা ১০০০
বাংলাদেশ

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Date: 22. 11. 2018

Report of Analysis

Sample supplied by
Mr. Rashaduzzaman
Junior Environmental Specialist
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Re.: Emergency Assistance Project for Improvement of National Highway (N1) from Link Road (Cox,s Bazar) to Teknaf

Sample Title : Soil Quality Test
Sample ID : SL_01, SL_02 and SL_03

Analytical Results:

Sl. No.	Test Parameters	Units	Test Results		
			SL_01	SL_02	SL_03
1	pH (1:2.5)	-	7.18	7.20	7.15
2	Lead (Pb)	(mg/kg)	0.65	0.50	BDL
3	Iron (Fe)	(%)	2.36	1.78	1.38
4	Sulphate as SO_4^{2-} (Extractable)	(mg/kg)	18.50	21.41	18.08
5	Organic Matter	(%)	0.84	1.08	0.77

BDL- below detection limit

Methods Used:

1. **pH** : pH meter
2. **Pb, Fe** : Aqua-regia digestion and AAS method
3. Sulphate : Turbidity method
4. Organic matter :Wet oxidation method

(Dr. Md. Didar-ul-Alam)
Professor & Chairman

Dr. Md. Didar-ul-Alam
Professor & Chairman
Dept. of Soil, Water & Environment
University of Dhaka
Dhaka-1000, Bangladesh

Telephone: 9661920-73/7470, Fax: (880-2) 8615583, e-mail: swed@du.ac.bd

Appendix 9: Consultation Details and List of Participants for FGDs

Consultation No- 1
Site: Tola Bagan Bazar; Union: Tola Bagan; Upazilla: Ramu, Dist: Cox's Bazar
GPS Coordination: 21°21.783'N, 92°04.862'E
Date: 16th November 2018.
Time: 11:00 PM TO 12:00 PM.

Outcome of the Consultation

A consultation meeting was held during 11:00 pm to 12:00 pm on 16th November 2018 at Tola Bagan Bazar, Tola Bagan Union, Ramu, Cox's Bazar adjacent to the proposed project site. All the participants were local people from several professions. Total 15 (Fifteen) people participated in the meeting. In consultation meeting; environmental and social issues were examined. The main focus was to dig out information on how indiscriminate use of natural resources causes social and environmental degradation or benefit by implementing the proposed project with using several natural resources. The issue on potential impact of construction works has also been raised.

Most of participants appreciated because of the benefit from the proposed project. They also discussed about noise, water and soil pollution issue that are evolving because of existing the future possibilities. They expect improved technology and good management practice to minimize the problem. Additionally, some of the participants informed that it would be better for local community if project proponent recruit up to 50% employment from local people.

Some Specific Question and Comments from the Stakeholder are given below-

Questions to the Groups	Participants opinion, comments and suggestions
Are you aware about the activities of the Emergency Assistance Project? If yes, how do you?	**Md. Akramul Haque (Service):** Yes, the project proponent has shared this information with us. The Govt. of Bangladesh will improve the highway from Link road, Cox's Bazar to Teknaf in order to improve the transport facilities.
How The project will impact on surrounding environment? Please mention both positive and negative sides	**Md. Akramul Haque (Service):** Due to construction of this proposed project, surrounding environment may be impacted but temporarily. Air pollution and noise pollution will influence on surrounding environment. Agricultural land will be impacted very minimum since very few land is remaining used for agriculture. The project proponent should take proper attention regarding to reduce these impacts. The waste materials should be maintained properly and it should not be kept at open place. This project will enhance our livelihood also.
Are you have facing any problem due to	**Md. Absar Mia (Business):**

Questions to the Groups	Participants opinion, comments and suggestions
Rohingya entrance in our community: If yes, Please Explain?	Yes, we have faced many problem due to Rohingya. The population has increased due to arrivals of Rohingya people. Previously our population was nearly 70,000 which has reached to 700, 000 due to arrival of Rohingya people. Moreover, these people are creating various illegal activities and in most cases the local people are victims.
Do you have any recommendation before the implementation of this project?	**Md. Hashem (Business):** We are very happy to know that a road improvement project for reducing traffic congestion and easy access is to be implemented in this area. Local Labors should be prioritized during construction work. The people of that community proposed drainage facilities bedside the road. Rehabilitation plan for the affected people. Foot over bridge for roads. Speed limit signboard on both sides of the proposed road.
This area is known as Elephant Crossing point; Do you have any suggestion and opinion?	**Md. Nurul Hakim (Farmer) & Md. Akramul Haque (Service):** Yes this area is known as Elephant Passing point. Elephant always pass this area after one/two weeks. In most time one-two elephant pass this area but sometimes more numbers of elephant also cross this area. Elephant usually cross this point at night time. Due to construction of army camp the elephants are using other corridor for their movement. Since the elephants usually move at night time so construction works should be conducted at day time only.

Emergency Assistant Project; Improvement of National Highway (N1) from Link Road (Cox,s Bazar) to Teknaf

List of Participants for FGD

FGD No. 01

Address Tola Bagan Bazar; Upazilla: Ramu; District: Cox,s Bazar

Date 16.11.2018 Time 11.00am - 12.00Pm

GPS Location 21°21.783'N; 092°04.862'E

SL No.	Participant's Name	Age	Occupation	Telephone No.	Signature
1	Md. Sayed Nur	63	Farmer	01625590633	Sayed Nour
2	Md. Shar Ali	55	"	01827656923	
3	Md. Nurul Hakim	35	Farmer	01950691556	
4	Md. Nurul Alam	52	"	01621793333	
5	Md. Abdul Bari	56	"	0193733009	
6	Mst Golser Banu	55	"	01794679289	
7	Md. Hasem	35	Busnis	01994193843	hashem
8	Md. Akramul Haque	33	Job	01878701341	
9	Md. Mokter Ali	31	Driver	01693360095	
10	Md. Rosid Ahamod	65	Farmer	01731437650	
11	Md. Absar Miea	40	Busnis	01721786643	
12	Md. Nur Alom	55	"	01840548282	
13	Md. Safail Miea	26	"	01718673136	
14	Md. Monsur Alom	25	"	01820256743	
15	Tonmoy Pandit	24	Job	01794679289	

Facilitated By Tonmoy Pandit

Signature

Consultation No- 2
Site: Teknaf Bazar Road; Union: Teknaf Sadar; Upazilla: Teknaf, Dist: Cox,s Bazar
GPS Coordination: 20°52.516'N, 92°17.881'E
Date: 17th November 2018.
Time: 2:00 PM TO 3:00 PM.

Outcome of the Consultation

A consultation meeting was held during 2.00 pm to 03:00 pm on 17th November 2018 at Teknaf Bazar Road, Teknaf Sadar Union, Teknaf, Cox's Bazar beside the project site. The consultation meeting was conducted with local people of the project site. Total 15 (Fifteen) people participated in the meeting. In consultation meeting; environmental and social issues were examined. The main focus was to dig out information on how indiscriminate use of natural resources causes social and environmental degradation or benefit by implementing the proposed project with using several natural resources. The issue on potential impact of construction works has also been raised.

During the consultation the participants appreciated the new project explaining their desires and expectations. The project will increase and improve the quality of their life. No major impact will take place due to the implementation of this project. Most of the people argued that they are willing to endure the negative impact to some extent for the sake of this project which they believe will improve their livelihood.

Some Specific Question and Comments from the Stakeholder are given below-

Questions to the Groups	Participants opinion, comments and suggestions
Do you have face any traffic congestion problem due to existing national highway road?	**Md. Mosif (Driver):** Traffic congestion is major problem. Most of the roads are narrow and broken. We need extra time to reach the destination because of excessive amount of check posts. Numbers of vehicles have increased compared to past due to extra pressure of Rohingya people. The frequency of loaded vehicles increased on road. Roads are also already broken and needs repairing. Before Rohingya people started to enter our country, we needed 2-2.5 Hours to reach Teknaf from Link Road. Now a days it requires almost 5-6 hour.
There are Environmental Protected Area (EPA) / Environmental Sensitive Area located nearby the project. Do you this it will be impacted due to the Project?	**Md. Zabed Ali (Service):** Yes, there are several forest areas along the road in order to conservation and breeding of wild animal. It should be ensured that there are no harmful effects in the projected area due to these project activities. The project work should be done in Environmentally Sustainable manner.
Are you facing any social and environmental problem due to Rohingya activities? If yes, Please	**Md. Absar Mia (Business):** Yes, we have faced many environmental and social problem due to rohingya activities. Illegal hill cutting due

Questions to the Groups	Participants opinion, comments and suggestions
Explain?	to their housing facilities which is creating serious environmental disruptions. Also their involvement in various illegal activities including drugs and prostitution need to be taken under scrutiny. Various GO and NGO activities to provide settlement and additional spaces for the Rohingya community is actually shrinking the spaces for local educational facilities (i.e., school building, cyclone shelters that are used as educational buildings etc.). This incident is impacting the local communities very badly.
Are you in favor of this project? Why?	**Asia Sultana (Housewife):** Yes, we appreciate the initiative. In the long run it will help to develop the economic and social condition in this area.

Emergency Assistant Project; Improvement of National Highway (N1) from Link Road (Cox,s Bazar) to Teknaf

List of Participants for FGD

FGD No. 02

Address Teknaf Bazar Road, Teknaf, Cox's Bazar

Date 17.11.2018 **Time** 2.00-3.00

GPS Location 20°52.536'N; 92°17.881'E

SL No.	Participant's Name	Age	Occupation	Telephone No.	Signature
1	Md. Habibur Rahman	60	Business	01786338902	Habibur
2	Md. Shahbuddin	42	Driver	01824426472	
3	Md. Mariful Islam	28	"	01811277532	
4	Md. Bochu Mia	48	"	01718154986	
5	Md. Mobarog	32	Business	01731497650	
6	Md. Masif	33	Driver	01819506055	
7	Md. Abdullah	30	"	01830177415	
8	Md. Robiul Hasan	24	"	01835379047	Robiul
9	Md. Joinal Abedin	30	Business	01733620000	
10	Md. Rashed	20	Business	01876977828	
11	Md. Ohasim Ali	43	Driver	01819179162	
12	Md. Zabed Ali	20	Job	01828424372	
13	Md. Jamal Mia	24	Job	01640459168	Jamal
14	Ronok Das	49	Business	01850092574	
15	Tonmoy Pandit	25	Job	01794679289	

Facilitated By Tonmoy Pandit

Signature

Consultation No- 3
Site: Coat Bazar; Union: Ratna Palong; Upazilla: Ukhiya, Dist: Cox's Bazar
GPS Coordination: 21°16.344'N, 92° 06.116'E
Date: 19th November 2018.
Time: 2:00 PM TO 3:00 PM.

Outcome of the Consultation

A consultation meeting was held during 2.00 pm to 03:00 pm on 19th November 2018 at Coat Bazar, Ratna Palong Union, Ukhiya, Cox's Bazar adjacent to the existing project site. The consultation meeting was conducted with local people and elite group community of the project site. Total 15 (Fifteen) people participated in the meeting. In consultation meeting; environmental and social issues were examined. The main focus was to dig out information on how indiscriminate use of natural resources causes social and environmental degradation or benefit by implementing the proposed project with using several natural resources. The issue on potential impact of construction works has also been raised.

Most of participants appreciated because of the benefit from the proposed project. They also discussed about noise, water and soil pollution issue that are evolving because of existing the future possibilities. They expect improved technology and good management practice to minimize the problem. Additionally, some of the participants informed that it would be better for local community if project proponent recruit up to 50% employment from local people.

Some Specific Question and Comments from the Stakeholder are given below-

Questions to the Groups	Participants opinion, comments and suggestions
Are you aware about the activities of the Emergency Project Activities? If yes, how do you?	**Md. Saddam Hossain (Business):** Yes, the project proponent has shared this information with us. We are very happy to know that a road improvement project for reducing traffic congestion and easy access is to be implemented in this area.
Any air pollution in the area due to the project during construction and operation? If yes, how to mitigate?	**Md. Apel Borua (Student):** The air quality will not anticipate significantly because of construction activities. Though more traffic will run to carry construction materials which will increase dust around the roadside but this would not be harmful to local people. Construction of building for workers shed and other facilities will decrease the local air quality temporarily. As the road is beside some residential dwellings so there is minor possibility of anticipated impact but proper care should be taken to minimize the anticipated impact. During the construction water spray is mandatory for reducing the dust.
Are you facing any problem due to Rohingya activities? If yes, Please Explain?	**Nurjahan Begum (Housewife):** Yes, we have faced many problem due to Rohingya activities. Rohingya people are causing chaos among the

Questions to the Groups	Participants opinion, comments and suggestions
	local people. Prostitution increasing among Rohingya people. Population has increased due to entering of Rohingya community in this country. Huge traffic Jam occurring here due to entrance of Rohingya. Arrivals of Rohigya communities has increased local population by at least 10 folds and increased competition in business. Some low income local business are struggling due to this problem. Unemployment problem due to arrivals Rohingya.
Any noise impact of the project during construction and operation at the locality? If yes how to mitigate?	**Topon Mistree (Business):** The noise level will increase because of running construction machineries and movement of workers. The effect will be temporary. After the construction the noise level will come back to the previous limit.
Will the project impact on your social and economic sector? If yes, how?	**Rahima Begum (Housewife):** Yes, by this project transportation facilities will be improved. Reduction of traffic congestion and road accidents due to this proposed project is expected. Local Labors should be prioritized during construction work. Employment opportunities for local people through this project.
Do you have any recommendation before the implementation of this project?	**Md. Abul Kalam (Service):** Fixed place is needed for Rohingya people movement (and for living) so that they cannot move all the places. Require foot over bridge. Speed limiting signboards are necessary. Propose drainage bedside the road. Propose passenger shed at bazar area along the road.

Asian Development Bank

Emergency Assistant Project; Improvement of National Highway (N1) from Link Road (Cox,s Bazar) to Teknaf

List of Participants for FGD

FGD No. 03

Address kot Bazar, uni Ratna palong. up: ukhia: Cox's Bazar

Date 19.11.18 **Time** 2:00 – 3:00

GPS Location N- 21°16.349" E 092°06.116"

SL No.	Participant's Name	Age	Occupation	Telephone No.	Signature
1	Md. Nojibul Alom	28	Job	01831968799	
2	Md. Samsul Alom	32	Driver	01834637016	
3	Md. Monir Alom	30	"	01815079960	
4	Md. Dil Mohammad	26	"		
5	Md. Jahagir Alom	23	"		
6	Bito borua	28	"		
7	Md. Saddam Hosson	25	Business	01813-553470	
8	Apel boruah	22	Student		
9	Topon mistree	36	Business	01825446079	
10	Md. Abu kalam	34	Job	01719823109	
11	Md. karimul	25	Job	01861283077	
12	Md. Abusaiyed	31	Busnis	01774178416	
13	Nurjahan Begum	37	Housewife	01640924254	
14	Asia Sultana	32	Business	01825328139	
15	Rahima Begum	39	Housewife	-	

Facilitated By Tonmoy Pandit

Signature

Appendix 10: Waste Management Plan (WMP)

1. GENERAL

Considerable quantities of wastes (general & construction) will be generated due to the 1.5 years construction of the project road. Two types of wastes will be generated during construction:

a. General Waste:

– Organic waste (foods, fruits, tree leaves etc.); and

– Inorganic (such as papers, plastic and glass bottles & containers, polythene etc.); and

b. Construction Waste:

– Construction wastes are: construction materials such as sand, piece of rocks, bricks, rods, geotextiles, remaining concrete & bentonite waste.

2. OBJECTIVES

The main objective of the WMP is to organize disposal of all wastes generated during construction in an environmentally acceptable manner specially consider the following:

- Health hazards of the project personnel as well as community people should not be occurred;
- Manage the wastes in such a way that environment (specially air, soil, water etc.,) will not be polluted;
- Odor means bad smell should not be generated;
- Always friendly environment at the construction sites and construction camps;
- Any waste should not be disposed into the river and any water bodies to avoid water pollution;
- Any waste should not be burnt; and
- Any waste should not be placed in earth holes/chambers.

3. POTENTIAL ENVIRONMENTAL IMPACTS

Major potential environmental impacts due to the lack of waste management are:

- All types of environmental pollutions such as air, soils, water (surface & ground) pollutions;
- Generation of odor;
- Increase of flies, mosquitoes, insects etc.,
- Health hazards; and
- Environmental nuisance at the project sites

4. STRATEGIES TO ADOPT

The following strategies need to be adopt for appropriate soil waste collection system to be functioned properly:

a. Setting waste collection bins (not permanent structure, movable high quality movable plastic bins; See Figure 1) in strategic points of the construction camp and work sites.

b. Introduce solid waste bins for organic and non-organic waste.

c. Coordinate with the municipalities waste collection system so that the waste can be collected at midnight when the road transports are minimum.

d. Wash liquids needs to be drained out though the functioning drains. The liquid waste needs to be treated with bleaching power every evening before draining so that the waste water cannot create nuisance and local pollution.

The other strategies that might be adopted are explained in later paragraphs.

Figure 1: High quality plastic bins for solid waste collection

5. METHOD OF DISPOSAL OF WASTES

The Contractor will collect the general wastes in separate waste bin at sources (means organic waste in one bin & inorganic waste in another bin) and dumped at the designated waste disposal site. The contractor will construct concrete waste disposal site; means concrete floor and wall and covered by shed to avoid, air, bad smell, soil and ground water pollutions. Based on the quantity of general waste (organic & inorganic waste), the following two chambers (rooms) of the concrete disposal site will be constructed by Contractor:

Just after filling one chamber (say after 6 months) by organic waste through pocket gate, it should be covered by earth (soils) properly & keeps it for about 6 months for converting organic fertilizer for the agricultural lands. After filling 1st chamber by organic waste, disposing of waste will be started for 2nd chamber.

The inorganic waste will be collected in the waste collection bins. Just after filling, these inorganic wastes can be given to the vender free of cost.

The Contractor will collect construction waste as mentioned above separately and dump in to the designated room at the construction camp. Just after filling the room, Contractor will sale these waste to the vender for re-cyclic.

The Contractor will maintain log book for the measurement of quantity of the wastes (especially hazardous wastes) disposed every day.

6. INSTITUTIONAL ARRANGEMENT

Contractor is mainly responsible for design, construction, maintenance as well as environmental monitoring for the disposal of waste. Environmental Specialist of the CSC is responsible for monitoring of the disposal. The PIU of the RHD will setup a 'Waste Management Committee' with the representatives of the CSC and contractor to effectively disposing the wastes and distribution of organic fertilizer to the farmers and inorganic wastes to the venders. The committee is also responsible for monitoring procedure for the collection and carrying of wastes without causing any environmental hazards