Initial Environmental Examination

July 2017

BAN: Third Urban Governance and Infrastructure Improvement (Sector) – Additional Financing – Drain Subprojects at Cox's Bazar *pourashava*

Prepared by Local Government Engineering Department – Government of Bangladesh for the Asian Development Bank. This is an initial draft available on http://www.adb.org/projects/39295-038/documents.

CURRENCY EQUIVALENTS

(as of 3 March 2017)

Currency Unit	=	BDT
BDT1.00	=	$0.01260
$1.00	=	BDT79.36

ABBREVIATIONS

ADB	-	Asian Development Bank
AM	-	Accountability Mechanism
AP	-	Affected Person
BBS	-	Bangladesh Bureau of Statistics
BSCIC	-	Bangladesh Small and Cottage Industries Corporation
BDT	-	Bangladesh Taka
BMD	-	Bangladesh Meteorological Department
BNBC	-	Bangladesh National Building Code
BOD	-	Biochemical Oxygen Demand
BOD_5	-	5-day Biochemical Oxygen Demand
CC	-	cement concrete
CCA	-	Climate Change Adaptation
COD	-	Chemical Oxygen Demand
CRO	-	Complaint Receiving Officer
dB	-	Decibel
DFR	-	Draft Final Report
DO	-	Dissolved Oxygen
DoE	-	Department of Environment
DPHE	-	Department of Public Heath Engineering
EA	-	Environmental Assessment
EARF	-	Environmental Assessment and Review Framework
ECA	-	Environmental Conservation Act
ECC	-	Environmental Clearance Certificate
ECR	-	Environment Conservation Rules
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
FGD	-	Focus Group Discussion
GHG	-	Green House Gas
GoB	-	Government of Bangladesh
GRC	-	Grievance Redress Committee
GRM	-	Grievance Redress Mechanism
H&S	-	Health and Safety
IEE	-	Initial Environmental Examination
IUCN	-	International Union for Conservation of Nature
LGD	-	Local Government Division
LGED	-	Local Government Engineering Department
MDSC	-	Management Design and Supervision Consultant
MLGRDC	-	Ministry of Local Government, Rural Development, and Cooperatives
NEMAP	-	National Environmental Management Action Plan
NGO	-	Nongovernment Organization
O&M	-	Operation and Maintenance
PIU	-	Project Implementation Unit

PM	-	Particulate Matter
PMU	-	Project Management Unit
RP	-	Resettlement Plan
RCC	-	Reinforced Cement Concrete
ROW	-	Right of Way
RUCCA	-	Rapid Urban and Climate Change Assessment reports
SPM	-	Suspended Particulate Matter
SPS	-	Safeguard Policy Statement
TDS	-	Total Dissolved Solids
TSS	-	Total Suspended Solids
USEPA	-	United States Environmental Protection Agency
WHO	-	World Health Organization
WLCC	-	Ward Level Coordination Committee

GLOSSARY OF BANGLADESHI TERMS

beel	Permanent water body
bosti	Slum
charra	Natural drainage channel
ghat	Boat landing station
khal	Drainage ditch/canal
katcha	Poor quality, poorly built
lakepar	Side of lake
mahalla	Community area
mouza	Government-recognized land area
parashad	Authority (*pourashava*)
pourashava	Municipality
pucca	Good quality, well built, solid
thana	Police station
upazila	Sub-district

UNITS

ha	-	hectare
km	-	kilometer
m	-	meter
mm	-	millimeter
km/h	-	kilometer per hour

NOTES

(i) The fiscal year of the Government of Bangladesh and its agencies ends on 30 June.
(ii) In this report, "$" refers to US dollars.

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7. Environmental Standards

EXECUTIVE SUMMARY

1. After the successful implementation of the first and second Urban Governance and Infrastructure Improvement (Sector) Project (UGIIP-1 and UGIIP-2)[1] in 78 *pourashavas* (municipalities), Local Government Engineering Department (LGED) with the financial assistance of Asian Development Bank (ADB) have been implementing UGIIP-3 in selected 30 *pourashavas* over a period of six years (2014 to 2020). The on-going UGIIP-3 (current project) supports strengthening of urban governance and improvement of urban infrastructure and service delivery in *pourashavas* by providing investment support to *pourashavas* based on their governance performance.[2] The additional financing will expand the current project and invest in (i) additional priority infrastructure and governance improvement in *pourashavas* under the current project, and (ii) infrastructure and governance improvement in five more *pourashavas*.[3] With additional financing the project implementation period is proposed to be extended for one year to 2021.

2. **Subproject scope.** The Cox's bazaar drainage subproject is one of the subprojects proposed under the additional financing UGIIP-3. The subproject includes construction and rehabilitation of 12 drains and small canals, 21 roadside drain and 11 cross-drains.

3. **Screening and Categorization.** An environmental assessment of the subproject is required per ADB's Safeguard Policy Statement (SPS, 2009). An environmental assessment using ADB's Rapid Environmental Assessment (REA) checklist for drainage and flood control (**Appendix 1**) was conducted and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus Cox's Bazaar drainage subproject is classified as environmental category B as per ADB SPS and an initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

4. This is the draft Initial Environmental Examination (IEE) based on the feasibility study and detail engineering designs prepared during project preparation. This IEE may be updated during implementation stage[4] to reflect any necessary changes in the designs.

5. As per Government of Bangladesh Environment Conservation Act, 1995 (ECA, 1995) and Environment Conservation Rules (ECR, 1997), Cox's Bazaar drainage subproject is categorized as "red" and location clearance certificate (LCC) and environmental clearance certificate (ECC) must be obtained from the DoE.

6. **Implementation arrangements.** LGED and Department of Public Health Engineering (DPHE), both under the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), are the executing agencies (EA). LGED is

[1] With limited but effective incentives for *pourashavas* to improve their governance, the first UGIIP introduced a performance-based fund allocation strategy through the urban governance improvement action plan (UGIAP) ensuring governance reforms while creating tangible development impacts in an integrated manner.

[2] Under UGIIP-3 the UGIAP covers the areas (i) citizen awareness and participation, (ii) urban planning, (iii) gender equality and social inclusion, (iv) local resource mobilization, (v) financial management and accountability, (vi) administrative transparency, and (vii) keeping essential *pourashava* services functional.

[3] P*ourashavas* to be included under additional financing are Cox's Bazar, Faridpur, Gopalganj, Kushtia, and Mymensingh.

[4] Updated IEE will be submitted to ADB for final review and disclosure prior to award of contract.

responsible for providing support and guidance to *pourashavas* concerning performance criteria and *pourashava* development planning. DPHE will provide support in water supply and sanitation schemes. Implementation activities will be overseen by a project management unit (PMU). Participating *pourashavas* are the implementing agencies (IA), with a project implementation unit (PIU) within the *pourashava* structure. Consultant teams, composed of Management Design and Supervision Consultants, and Governance Improvement and Capacity Development Consultants, are responsible for (i) detailed engineering design, contract documents preparation and safeguards facilitation; (ii) project management and administration support; (iii) assistance in supervising construction; (iii) strengthening of local governance, conducting required studies/surveys and (iv) awareness raising on behavioral change in water, sanitation and solid waste management activities.

7. **Description of the environment**. Subproject components are located in Cox's Bazaar urban area or in its immediate surroundings which were developed into urban land uses. The subproject sites are located in existing right of ways (ROWs) and government-owned land. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. There are no forest areas within or near Cox's Bazaar town.

8. **Environmental management.** An environmental management plan (EMP) is included as part of this IEE, which includes (i) mitigation measures for environmental impacts during implementation; (ii) an environmental monitoring program, and the responsible entities for mitigating, monitoring, and reporting; (iii) public consultation and information disclosure; and (iv) a grievance redress mechanism. A number of impacts and their significance were reduced through mitigation measures in the preliminary design stage. The EMP will form part of the civil work bidding and contract documents.

9. Locations and siting of the proposed infrastructures were considered to further reduce impacts. The concepts considered in design of the Cox's Bazaar drainage subproject are: (i) locating facilities on government-owned land to avoid the need for land acquisition and relocation of people; (ii) taking all possible measures in design and selection of alignment to avoid resettlement impacts; (iii) avoiding where possible locations that will result in destruction/disturbance to historical and cultural places/values; (iv) avoiding tree-cutting where possible; (v) ensuring all planning and design interventions and decisions are made in consultation with local communities and reflecting inputs from public consultation and disclosure for site selection.

10. During the construction phase, impacts mainly arise from (i) disturbance of residents, businesses, and traffic; (ii) need to manage excess construction materials and spoils; and (iii) community and workers health and safety. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation measures such as conducting work in lean season and minimizing inconvenience by best construction methods will be employed. Traffic management will be necessary during excavation works on busy roads. In the operational phase, all facilities and infrastructure will operate with routine maintenance, which should not affect the environment. Facilities will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be infrequent, affecting small areas only.

11. Mitigation measures have been developed to reduce all negative impacts to acceptable levels and will be assured through a program of environmental monitoring. The monitoring program will include observations on- and off-site, document checks, and interviews with

workers and beneficiaries. The PMU will submit semi-annual monitoring reports to ADB which will include a detailed review of EMP implementation, including corrective actions taken.

12. The expected climate change impacts on Cox's Bazar are mainly associated with tidal flooding, cyclone-related storm surges, rainfall-driven drainage congestion, and sea level rise. The by-products of these include temperature variations, monsoon-, flash- and tidal flooding, increased water logging and landslides. The area is also highly susceptible to earthquakes and related landslides. All these impacts are expected to increase as the *pourashava*'s low-lying topography between the hill range and the sea further exacerbates the challenges associated with water supply, drainage, urban and transport infrastructure, community health and energy supply. The IEE includes design considerations for mitigation, especially design material, method of construction should be taken appropriate to make the subproject climate-proof and disaster resilient.

13. **Consultation, disclosure and grievance redress.** The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations in the *pourashava* and will be disclosed to a wider audience via the ADB and LGED project websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

14. **Monitoring and reporting.** The PMU, PIU (Cox's Bazaar *pourashava*), and Management Design and Supervision Consultants (MDSC) will be responsible for safeguard monitoring. The MDSC will submit monthly monitoring reports to PMU, and the PMU will send semi-annual monitoring reports to ADB. ADB will post the semi-annual environmental monitoring reports on its website as part of its disclosure requirements.

15. **Conclusions and recommendations.** The citizens of Cox's Bazaar will be the major beneficiaries of this subproject. The proposed subproject is unlikely to cause significant adverse impacts and net environmental benefits to citizens of Cox's Bazaar will be positive. The potential impacts that are associated with design, construction and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

I. INTRODUCTION

1. After the successful implementation of the first and second Urban Governance and Infrastructure Improvement (Sector) Project (UGIIP-1 and UGIIP-2)[5] in 78 *pourashavas* (municipalities), Local Government Engineering Department (LGED) with the financial assistance of Asian Development Bank (ADB) have been implementing UGIIP-3 in selected 30 *pourashavas* over a period of six years (2014 to 2020). The on-going UGIIP-3 (current project) supports strengthening of urban governance and improvement of urban infrastructure and service delivery in *pourashavas* by providing investment support to *pourashavas* based on their governance performance.[6] The additional financing will expand the current project and invest in (i) additional priority infrastructure and governance improvement in *pourashavas* under the current project, and (ii) infrastructure and governance improvement in five more *pourashavas*.[7] With additional financing the project implementation period is proposed to be extended for one year to 2021.

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II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

6. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all ADB investments.

7. **Screening and categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

(i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
(ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
(iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
(iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

8. **Environmental management plan.** An EMP, which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks.

9. **Public disclosure.** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

(i) for environmental category A projects, draft EIA report at least 120 days before Board consideration;
(ii) final or updated EIA and/or IEE upon receipt; and
(iii) environmental monitoring reports submitted by the PMU during project implementation upon receipt.

10. **Pollution Prevention and Control Technologies.** During the design, construction, and

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operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of Bangladesh regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 1: Applicable WHO Ambient Air Quality Guidelines

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 2: World Bank Group's Noise Level Guidelines

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

B. National Laws

11. Implementation of all subprojects will be governed by the environmental acts, rules, policies, and regulations of the Government of Bangladesh. These regulations impose restrictions on the activities to minimize/mitigate likely impacts on the environment. Many of these are cross-sectoral and several of them are directly related to environmental issues. The most important of these are the Environment Conservation Act, 1995 (ECA, 1995), and the Environment Conservation Rules (ECR, 1997).

12. Table 3 presents specific requirements for the Cox's Bazaar drainage subproject. **Appendix 7** provides the environmental standards for air, surface water, drinking water, emissions, noise and vehicular exhaust.

Table 3: Applicable Government of Bangladesh Environmental Legislations

	Legislation	Requirements for the Project	Relevance
1.	Environmental Conservation Act of 1995 and amendments in 2000, 2002 and 2010[a]	• Restriction on operation and process, which can be continued or cannot be initiated in the ecologically critical areas • Regulation on vehicles emitting smoke harmful to the environment • Remedial measures for injuries to ecosystems • Standards for quality of air, water, noise and soil for different areas for various purposes and limits for discharging and emitting waste • Environmental guidelines	The provisions of the act apply to the entire subproject in the construction and operation and maintenance (O&M) phases.
2.	Environmental Conservation Rules of 1997 and amendments in 2002 and 2003	• Environmental clearances • Compliance to environmental quality standards	The subproject is categorized as red and requires locational clearance certificate (LCC) and environmental clearance certificate (ECC). All requisite clearances from DoE shall be obtained prior to commencement of civil works.
3.	Forest Act of 1927 and amendments (2000)	• Clearance for any felling, extraction, and transport of forest produce	Considered in subproject preparation and implementation.
4.	Bangladesh Climate Change Strategy and Action Plan of 2009	• Ensure existing assets is put in place to deal with the likely impacts of climate change. • Enhance the capacity government ministries, civil society and private sector to meet the challenge of climate change	Considered in subproject preparation and implementation.
5.	Bangladesh Labor Law of 2006	• Compliance to the provisions on employment standards, occupational safety and health, welfare and social protection, labor relations and social dialogue, and enforcement • Prohibition of employment of children and adolescent	Considered in the EMP.

[a] *ECA 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. *ECA Amendment 2002* elaborates 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. In *ECA Amendment 2010,* no individual or institution (government or semi-government/non-government/self-governing can cut any hill or hillock; fill-up or changed any remarked water body however in case of national interest; the mentioned activities can be done after getting clearance from respective the departments.

C. Government of Bangladesh Environmental Assessment Procedures

13. Under ECA, 1995 and ECR, 1997 industrial units and projects are classified into four categories according to "their site and impact on the environment" and investment size, and each category (Green, Orange-A, Orange-B and Red) requires a different level of environmental assessment as a prerequisite for the Department of Environment (DoE) in granting the

locational clearance certificate (LCC) and environmental clearance certificate (ECC) that allow the project to proceed.

14. As per Schedule 1 of ECA, 1995 Cox's Bazaar drainage subproject is likely to be classified as red category (Table 4). Thus LCC and ECC is required from the DoE prior to commencement of the subproject.

Table 4: Likely Government of Bangladesh Classification of Cox's Bazaar Drainage Subproject

	Subproject	Component	Equivalent in Schedule I of ECR 1997	DoE Classification
1.	Drainage and flood control	Primary network (includes domestic connections or primary drains)	Engineering works (Above 10 hundred thousand Taka capital)	Red
		Secondary network (includes secondary drains)		
		Tertiary network (includes main drains and drainage outfalls)		

15. Rule 7 of the ECR, 1997 indicates that the application for ECC must be made to the relevant DoE Divisional Officer, and the application for red category projects will include the following:

(i) Completed application for ECC, and the appropriate fee;
(ii) Report on the feasibility of the project;
(iii) Report on the IEE for the project, and terms of reference (TOR) for the EIA; or EIA report prepared on the basis of TOR previously approved by DoE;
(iv) Report on the environmental management plan (EMP);
(v) No-objection certificate from the local authority;
(vi) Emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution; and
(vii) Outline of the relocation and rehabilitation plan (where applicable).

16. DoE has 60 days to respond to receipt of the ECC application for a red category project.

17. This draft IEE will serve the basis for the ECC application and will be supplemented to fulfill any additional government requirements.

D. Relevant Occupational Health and Safety Laws and Rules

18. The implementation of the subproject shall comply with the relevant occupational health and safety Laws and Rules as shown in Table 5.

Table 5: Relevant Occupational Health and Safety Laws and Rules

Title of Laws and Rules	Descriptions
Social Security under the Act, 1923 and an amendment in 1980	According to the Act social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.
Bangladesh Labor Law of 2006	- Compliance to the provisions on employment standards, occupational safety and health, welfare and social protection, labor relations and social dialogue, and enforcement - Prohibition of employment of children and adolescent
The Employer's Liability Act,	The Act declares that the doctrine of common employment and of assumed

1938	risk shall not be raised as a defense in suits for damages in respect of employment injuries. Under the Maternity Benefit Act, 1939, the Maternity Benefit Act, 1950, the Mines Maternity Benefit Act, 1941, and finally the rules framed thereunder, female employees are entitled to various benefits for maternity, but in practice they enjoy leave of 6 weeks before and 6 weeks after delivery.
Public Health (Emergency Provisions) Ordinance, 1994	The ordinance calls for special provisions with regard to public health. Whereas an emergency has arisen, it is necessary to make special provision for preventing the spread of human disease, safeguarding public health and providing them adequate medical service and other services essential to the health of respective community and workers in particular during the construction related work.
The Employees State Insurance Act, 1948	It has to be noted that health, injury and sickness benefit should be paid to people, particularly respective workers at work place under the Act.
Bangladesh Factory Act, 1979	The Act requires every workplace including small or large scale construction where women are employed to have an arrangement of childcare services. Based on this Act and Labor Laws - medical facilities, first aid and accident and emergency arrangements are to be provided by the authority to the workers at workplaces.
Water Supply and Sewerage Authority Act, 1996	The Act specify WASA's responsibility to develop and manage water supply and sewerage systems for the public health and environmental conservation.

E. Conventions, Treaties and Protocols

19. Bangladesh has consented to be bound by the terms of some 21 of the 44 principal international conventions, treaties and protocols relating to the environment (Islam, 1996). Those with partial and indirect relevance to industrial projects are the Paris convention of 1972 concerning the protection of the World cultural and natural Heritage, Convention concerning safety in the use of chemicals at work, Geneva 1990, Biodiversity convention, Rio-de-Janeiro, 1992, Convention concerning occupational health services, Geneva 1985 etc.

III. DESCRIPTION OF THE PROJECT

A. The Study Area

20. Cox's Bazar is surrounded by the Bakkhali River to the north and east; the Bay of Bengal to the west and by the Cox's Bazar hill range to the north and south. The height of the hill range varies from 50 m to 82 m above sea level and it terminates abruptly against the beach, creating vertical sections. The *pourashava* covers an area of 32.9 sq.km (BBS, 2011). It consists of 12 wards. In 2011 the population of the *pourashava* was 167,477 (BBS, 2014); the population density is 5090 persons per km^2. The major part of the *pourashava* area is low-lying. Due to its location between steep hills and the sea, and along a river, the low slope gradients and high groundwater table exacerbate chronic flooding and water logging in the low-lying areas. Flash floods due to huge hill runoff during heavy rainfall are very common. These are accompanied with huge sediment load and solid wastes result frequent drainage clogging and create environmental nuisance to this important tourist city. *pourashava* reports that a substantial amount of revenue budget needs to spent for the cleaning of drainage after flash flood. *pourashava* does not have automatic cleaning equipment and all cleaning is done manual and disposal of sediments and garbage is usually done just besides the drain, which not good practice in terms of environmental perspective. these conditions are especially damaging in Wards 1, 2, 3 and 4 and 12.

B. Existing Situation

21. Urban flooding and lack of drainage capacity are considered the main challenges in the

existing and drainage flood control facing Cox's Bazar *pourashava*. In the existing system there are insufficient open surface water drains (constructed and natural) to address the needs of a growing population. Cox's Bazar *pourashava* is facing both water logging and drainage congestion which pose a severe risk during high precipitation periods and extreme rainfall events, and are linked to non-functioning flood prevention structures (sluices of BWDB). Though flooding occurs regularly, the *pourashava* as a whole is unable to manage the expected impacts on its urban population. When hill cutting takes place, mudslides get into some of the canals. This also creates flash floods.

22. Encroachments and filling of *charras*[9] and canals with domestic and commercial wastes reduced the charras in size, capacity and efficiency and the related poor management of municipal solid and hazardous waste also causes a large percentage of drainage congestion. It is also creating an increasingly grave environmental threat and health hazard.

23. The main waterlogging and drainage congested areas are Wards 1, 10 and 12, and part of Wards 2, 5, 6 and 11. The depth of inundation of water logging is 1~2 feet and the depth of inundation lasts for 5~6 hours.

24. The noted *khals* and *charras* passing through the *pourashava* and responsible for draining out almost the total runoff from the *pourashava* are as follows:

(i) Samrai khal: Length 3.60 km. Start from near the central bus terminal and passing through Wards 5 and 6, falling to the Bakkhali River;
(ii) Rumali Charra: Length 3.25 km. Generating from the hilly areas outside the *pourashava*; then enter into the *pourashava* near the police line and passing through Wards 5 and 6, falling to the Bakkhali River;
(iii) Tarabuniar Charra: Length about 3.00 km. Generating from the hilly areas inside the *pourashava* and passing through Wards 5 and 7, falling to the Bakkhali river;
(iv) RRRC office to Nazirartek khal: Length about 5.00 km. The original canal generates from Kalatali area of the *pourashava* and passing through Wards 11, 12 and 1, falling to the Bakkhali River. The part from Kalatali area to the RRRC office of it has been developed as RCC rectangular drain under UGIIP-2 and other source;
(v) Bara Chara: Flowing along south and eastern foothills of the *pourashava* between hills and crossing the marine drive road in Ward 12, falling to the sea;
(vi) Chalbazar Charra: It has two parts. One part starting from chal bazaar of
(vii) Barabazar and fall into the Bakkhali River via Peshkar para damaged sluice. The other part also starting from Barabazar, falling to the Bakkhali River via Hangar para sluice. The Charra is passing through Ward 4;
(viii) Murang Charra: Starting from the hill near light house, running beside circuit house and passing through Wards 8 and 10, falling to the Bakkhali River; and
(ix) Dikkul Charra: Starting from Upzilla office outside the *pourashava* and passing through Ward 6, falling to Bakkhali River.

25. **Location of outfall.** Although the *pourashava* is bounded by the Bay of Bengal at the south it is not justified to discharge the drains directly to the sea for environmental and ecological reason. The Bakkhali River which is flowing along the north-eastern side of the *pourasahva* is the main outfall for the drains and *khals*. The river is falling to the Moheshkhali channel at the north- west corner of the *pourashava*. The other notable outfall is the Bara

[9] Natural drainage channel.

Charra, generating from the hills and falling to the sea at the southern end of the *pourashava*.

26. The reason of poor drainage system of the *pourashava* is poor O&M due to the lack requisite manpower, equipment and resources. For that the natural canals (khal/charras) flowing through the *pourashava* is not properly maintained. Unauthorized occupation of the khals/charras with constructions on the khals/charras reduced the khal/charras in size, capacity and efficiency and thereby lingering the drainage period. Drainage capacity of the existing system is also affected by siltation from hillside erosion, a side effect of illegal deforestation ("hill-cutting") and expansion of informal settlements, lack of proper maintenance and insufficient retention and detention capacity to support overflow conditions.

27. The constructed drains are also not cleaned in time. Due to the absence of timely cleaning those drains are found full of solid wastes, especially in the Boro bazaar areas. All sorts of wastes, including animal wastes, are dumped in the drains causing drainage congestions in the upper parts of the influence area of the drains.

28. Drains are receiving in some cases domestic sewage especially from hotel/motel in hotel motel zone and or some other biological waste as waste (Photo above). Therefore, water quality of the drains is poor. Discharge of this untreated drain water to river or other water bodies will certainly reduce the water quality of the river or other receiving water bodies.

Figure 1: Existing drain at Cox's Bazar pourashava

Drainage congestion due to disposal of solid waste in the drain

A drain with high turbidity and organic load of domestic sewage near Ocean Paradise hotel

Drainage canal following towards Bakkhali river

C. Proposed Drainage and Flood Control Interventions

29. To improve the drainage system, 12 drains and charras and 21 roadside drains have

been proposed. The improvement works include re-excavation, lining the charras' sides and bed with concrete cement (with nominal reinforcement) for trapezoidal sections, construction of retaining walls with side walkway along the charras for provision of inspection and O&M. Construction of box culverts where needed, construction of new drains and reconstruction of damaged, faulty designed and ineffective drains.

30. The locations of proposed interventions are shown on Figure 2. The drainage alignments are visited and examined extensively by the TA 8913 consultants for project preparation of additional financing. Rainfall and flooding information were collected including history of stagnation, over-flow causing inundation of adjoining areas. The existing conditions were assessed and used as basis for widening or deepening requirements, re-sectioning needs, longitudinal gradients and location of outfall. The list of proposed drainage network is shown in Table 6 and preliminary designs are shown in Figures 3 to 4.

Table 6: Proposed Components of the Cox's Bazaar Drainage Subproject

Contract Package No.	ID	Details Subprojects Description	Length	Remarks (Existing/New)
UGIIP-III-2/AF/COX'S/DR-01/2017	D-01	A) construction of RCC drain from RRRC office to airport culvert.pr-01, ch-0.00-1545.00m. B) construction of 2 vent box culvert ch. 1293.00m.	1545 m	New drain on the ROW of a khal/canal
	D-04	A) construction of RCC drain with footpath at Cholbazar Charra from bara bazar to Bankkhali River. Ch-0.00-875.00m. B) construction of RCC u- drain at Tekpara from Ful Bag culvert Bankkhali River. Ch-0.00-265.00m.	1140 m	New drain on the ROW of charras
UGIIP-III-2/AF/COX'S/DR-02/2017	D-08	A) construction of RCC u-drain from Dolphin Mour to Ocean Paradise. Ch-0.00 to 353.60m b) construction of RCC U-drain with slab from Dolphin Mour to Nirsorgo. Ch-0.00 to 1700.00m c) construction of RCC U-drain from Nirsorgo to Bara Chara. Ch-1700.00 to 2600.00m	2953.60 m	New drain alongside the existing road
UGIIP-III-2/AF/COX'S/DR-03/2017	D-02	A) construction of RCC u-drain with footpath at Rumaliya Charra from Police Line to Bankkhali River. Link-2 ch-2059-3509.00m. B) construction of RCC u-drain with footpath at Rumaliya Charra from police line to bankkhali river. Link-1 ch-0.00 to 750.00m. C) construction of RCC u-drain with footpath at Rumaliya Charra from police line to Bankkhali River. Link-3 ch-0.00-100.00m .	2300 m	New drain on the ROW of charras
UGIIP-III-II/AF/COX'S/DR-04/2017	D-02	Construction of RCC u-drain with footpath at rumaliya charra from police line to bankkhali river. Ch-940.00 to 2059.00m.	1119 m	New drain on the ROW of charras
UGIIP-III-II/AF/COX'S/DR-05/2017	D-02	A) construction of RCC u-drain with footpath at Rumaliya Charra from police line to Bankkhali River. Ch-0.00-940.00m.	1140 m	New drain on the ROW of charras

Contract Package No.	ID	Details Subprojects Description	Length	Remarks (Existing/New)
		B) construction of RCC u-drain with footpath at Rumaliya Charra from police line to Bankkhali River. Link-2 ch-0.00-200.00m.		
		Total length	**10187.60 m**	

D. Project Activities and Schedule

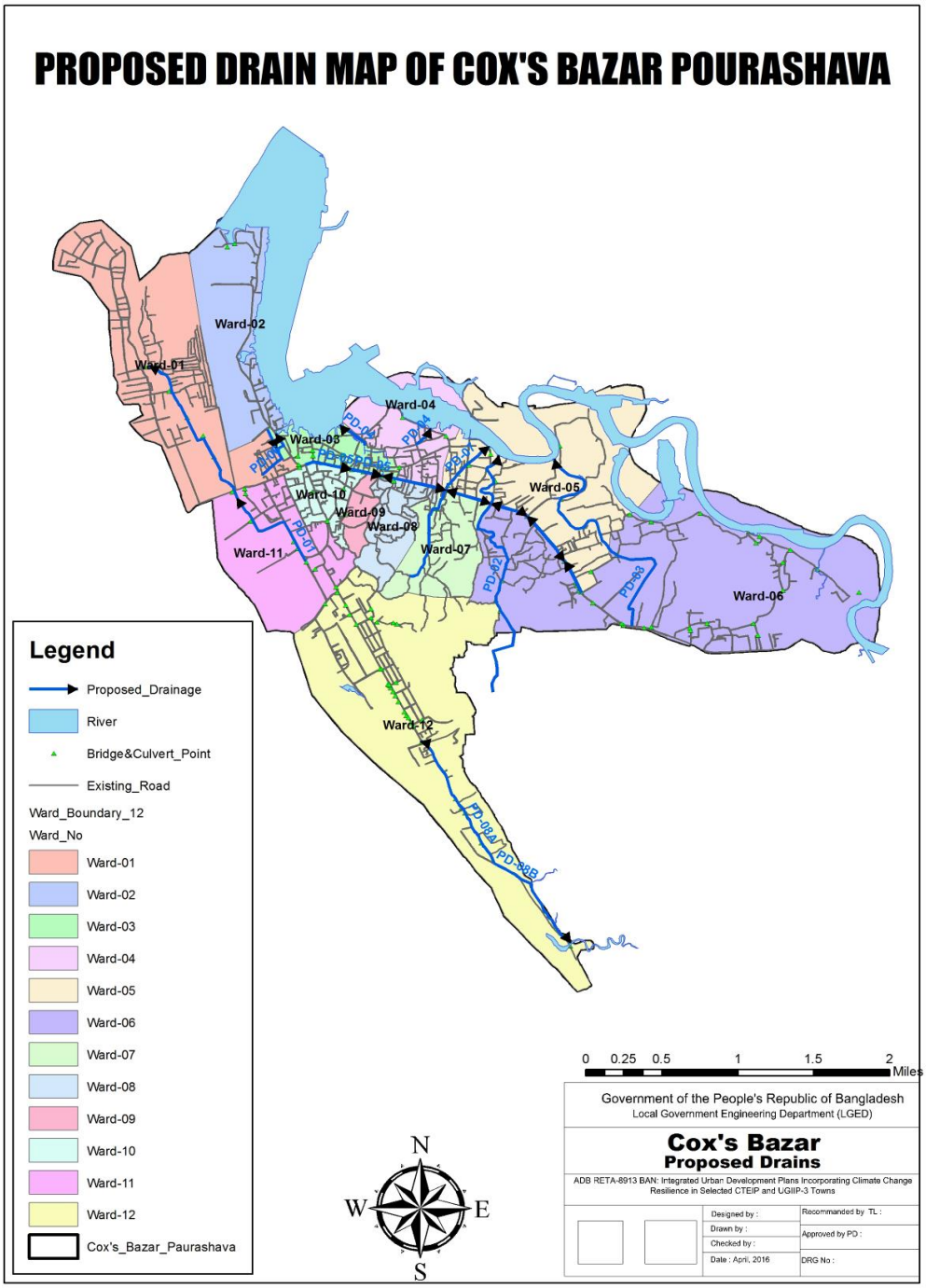
31. Implementation of UGIIP-3 is in three phases based on achievement of governance criteria of the *pourashavas*. The additional financing will provide support for the project's (i) second phase = 24 months of that 18 months is assumed for construction, and (ii) third phase of UGIIP-3 = 26 months.

32. Proposed drains will be implemented in second and third UGIIP-3 phase. Detail design of drains under second phase of UGIIP-3 has been done by the TA 8913 consultants and may be updated during implementation stage.[10] It is estimated that construction period for implementation will cover 18 months.

33. The final detailed implementation schedule will be provided in the updated IEE once the detailed design phase will be completed.

[10] Updated IEE will be submitted to ADB for final review and disclosure prior to award of contract.

Figure 2: Proposed drain interventions at Cox's Bazar pourashava



Source: TA 8913 Report for UGIIP-3 additional financing project preparation

Figure 3: Layout of RCC u-drain from RRRC Office to Airport Culvert

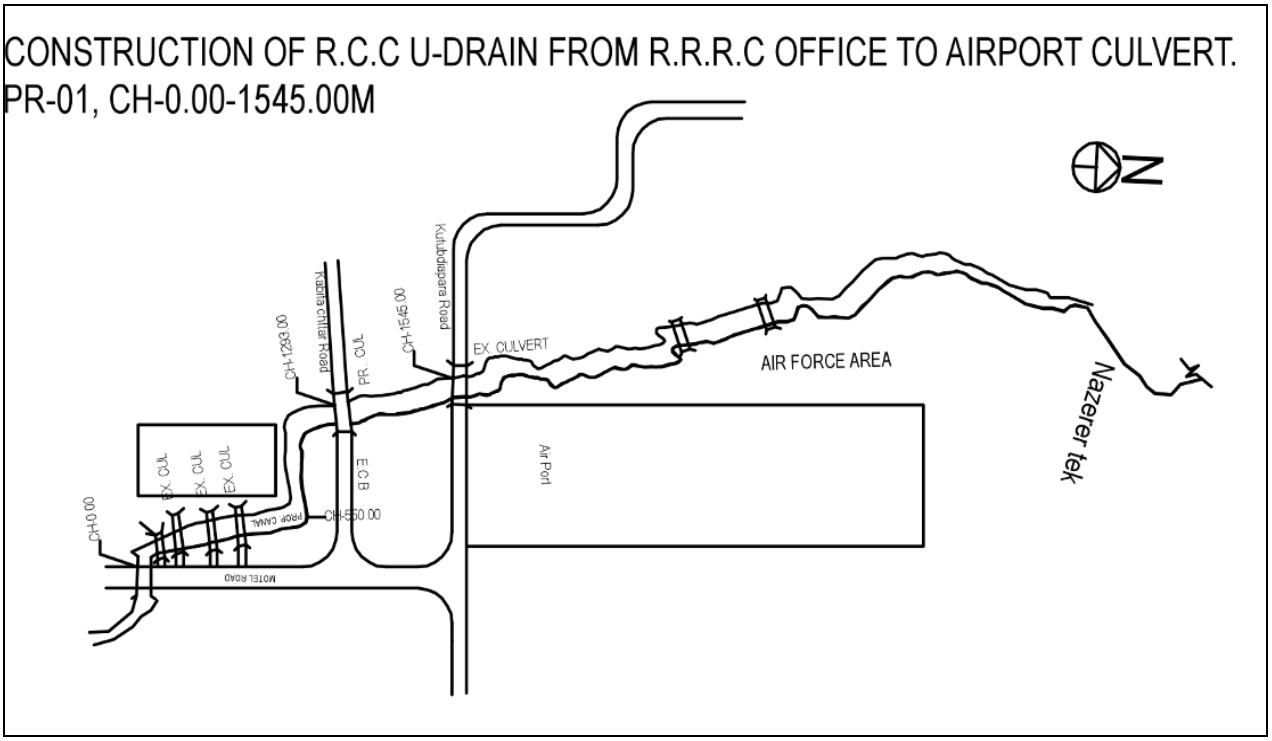
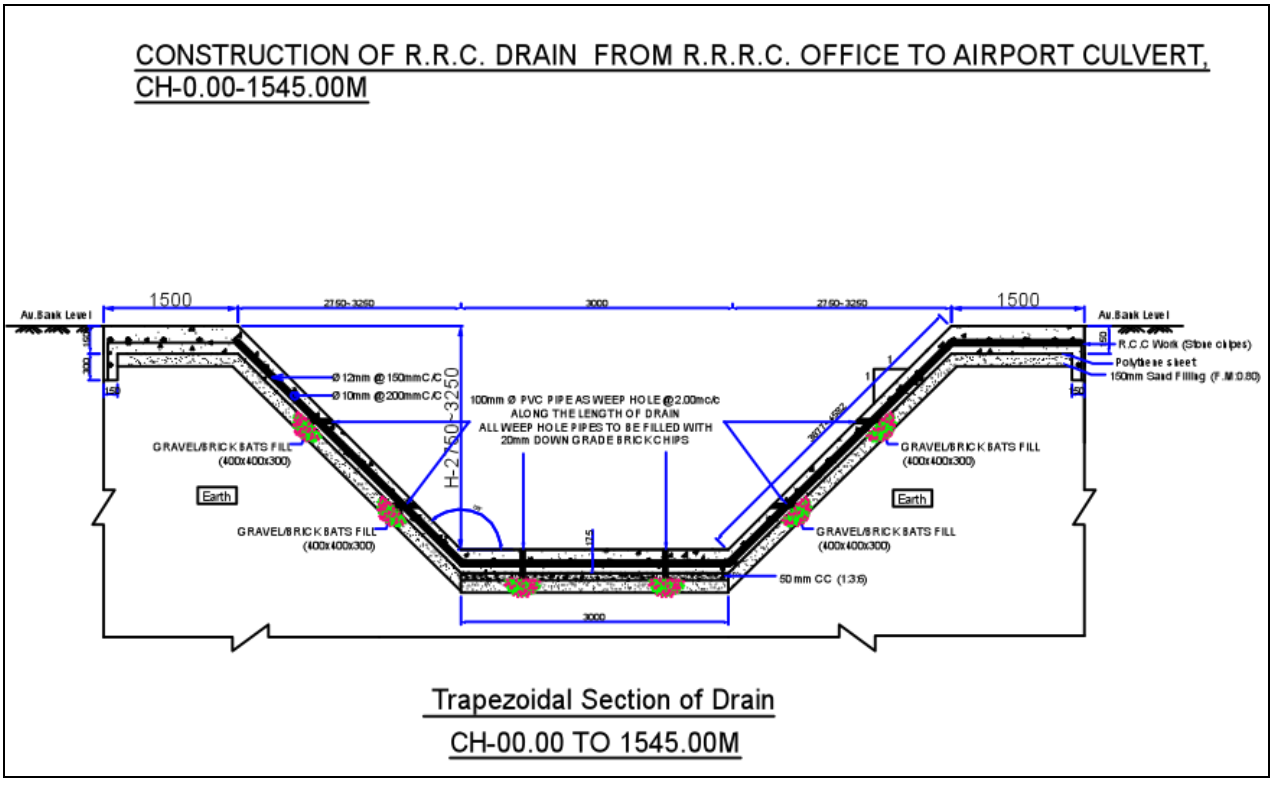


Figure 4: X-section of trapezoidal u-drain



IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Environment

1. Landforms and Geology

34. The Bengal basin contains 15 km thick sequence of Cretaceous to Resent sediments and occupies 100,000 km^2 low land flood plain and delta. The combined deltas of Ganges, Brahamaputra and Meghna (GBM) river system lie within Bangladesh. The geological succession of Bangladesh shows that the sub-surface stratigraphy includes: (i) the Precambrian, (ii) the Permain Gondwana sediments, (iii) the upper Jurassic Volcanic rocks, and (iv) a thin mantle of Cretaceous sedimentary rocks originating mainly from deposition of the denuded volcanics. Overlaying these deposits are the tertiary lime stones, sandstones, and shales. The surface geology of the country consists of holocene deposits (80%), tertiary sedimentary rocks (12%), and uplifted Pleistone clay residual (8%). The holocene deposits, consisting of unconsolidated sand, silt and clay of varying amounts, are the products of piedmont alluvial, fluvial, deltaic, or coastal activities.

35. The area is of recent origin, raised by the deposition of sediments formed due to soil erosion in the Himalayas. The process has been accelerated by tides from the sea face. The substratum consists mainly of Quaternary Era sediments, sand and silt mixed with marine salt deposits and clay. Geologists have detected a southeastern slope and tilting of the Bengal basin during the Tertiary. Because of neo-tectonic movements during the 10th-12th century AD, the Bengal Basin titled eastward

36. Cox's Bazar is defined by the Bakkhali River to the north and east; the Bay of Bengal to the west; and by the Cox's Bazar hill range to the north and south. The height of the hill range varies from 50 m to 82 m above sea level and it terminates abruptly against the beach, creating vertical sections. The major part of the *pourashava* area is low-lying. Due to its location between steep hills and the sea, and along a river, the low slope gradients and high groundwater table exacerbate chronic flooding and water logging in the low-lying areas.

2. Soil

37. Geographically, the soil can be classified into three: the Ganga Polol, the Mixed Ganga Polol and the Ganga Kotal Polol. While northern part is appropriate for good crop production, soils in the south are both saline and clayed. Soils differ from other inland soils as they are subjected to the effects of salinity and waterlogging, which naturally affect the vegetation. In places soils are semi-solid and poorly consolidated. The pH ranges widely from 5.3 to 8.0. Although the soil is in general medium textured, sandy loam, silt loam or clay loam, the grain size distribution is highly variable. Silt loam is dominant textural class.

3. Earthquake

38. Cox's Bazar is located in a seismic zone II, referred to as the medium risk zone for earthquake in the country. Seismic events in Bangladesh are relatively infrequent, but historically, have been severe, such as the earthquakes of 1930, 1950 and 2004. To address any potential impacts due to seismic activities, provisions of the Bangladesh National Building Code (BNBC) 1993 and 2006 shall be strictly followed in the detailed designs of project components, apart from consideration of seismic vulnerability in the specifications for the design and construction of the works, including the choice of materials and methods for construction

work. Cox's Bazar is also located in an active earthquake zone, on the boundary of two active plates, and is highly susceptible to earthquakes and related landslides.

4. Ambient Air Temperature, Humidity and Rainfall

39. The temperature of the country has the relationship with the period of rainfall. In general, cool. The temperature of the country has the relationship with the period of rainfall. In general, cool seasons coincide with the period of lowest rainfall. Table 7 and Figure 5 show the monthly average temperature along with average monthly humidity of the project area. Maximum mean temperature of 28.88°C was observed in May and minimum average temperature was 20.43°C in January.

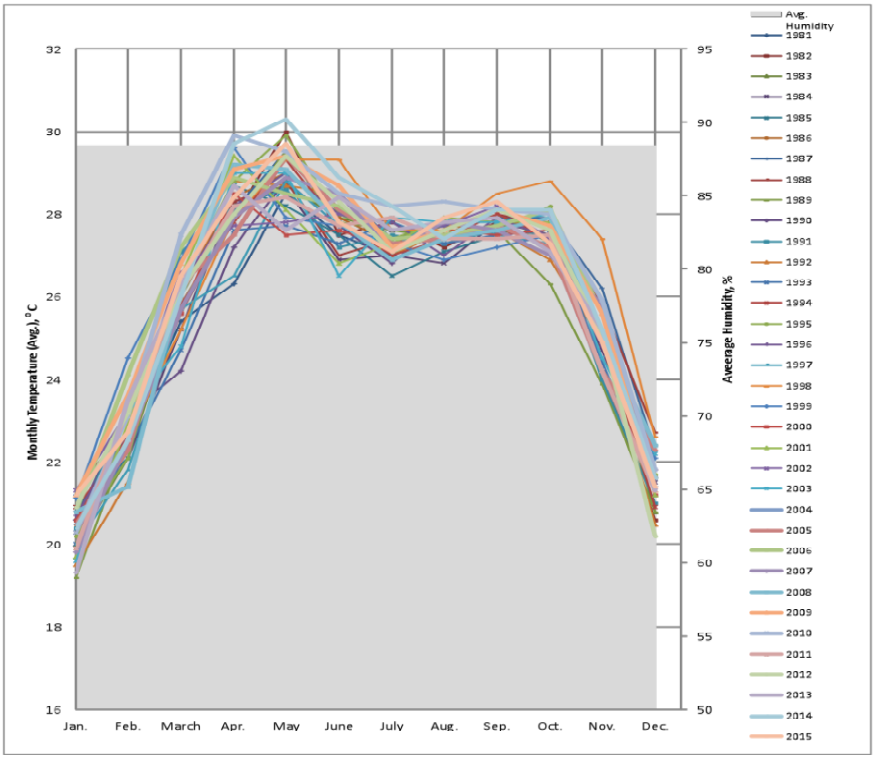
Table 7: Temperature and humidity for project area, 1981-2015

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
Mean Temp (°C)	20.43	22.79	26.06	28.33	28.88	27.90	27.39	27.53	27.80	27.59	25.08	21.61	25.95
Average Humidity (%)	71.57	69.97	74	77.17	79.7	86.6	88.4	87.4	85.3	81.9	76.4	73.89	78.914

Source: Bangladesh Meteorological Department.

40. According to the data collected from Bangladesh Meteorological Department (BMD), April to June appears to be the hottest period of the year while November to February is the coolest. Average annual rainfall in Cox's Bazar is 3803.9 mm, with maximum in July = 1,885 mm in 1987. During heavy rainfall, water logging causes 20-25 cm inundation, which lasts for 4-8 hours.

Figure 5: Average Temperature and Humidity in Cox's Bazar



41. June-October is observed to be the most humid period of the year which matches the rainfall pattern of this region as more than 70% of the yearly precipitation is encountered during this four months.

42. Flash flood is a major problem of Cox's Bazar *pourashava*. During heavy rainfall, huge runoff from the hill causes flash flood. The runoff is sometimes associated with landslide and carrying huge sediments and waste from the hill to down to the *pourashava*. It causes the siltation on the roads and drains, and causes congestions on the drains/canals and creates enormous problem on the drainage system of Cox's Bazar.

5. Water Quality

43. **Surface Water.** Main river beside Cox's Bazar *pourashava* is Bakkhali River and the channels in the district are Matamuhuri, Bakkhali, Reju Khal, Naf, Maheshkhali channel and Kutubdia channel. All the rivers are tidal. The river water is saline with high sediment load and high turbidity. Cox's Bazar consists of many ponds. Normally, households use pond water for various domestic and sometimes agriculture purposes. Ponds are also generally used for fish culture.

44. As the drains outlet will be fallen into the river, the water quality of river should be recorded for the base line. Baseline should be conducted before construction. With help of the *pourashava*, the PPTA collected sample (on 20 September 2016) from Bakkhali River, drain water near Ocean Paradise Hotel, drain water near Airport Culvert and drain water at Backhali River at outlet near 6 No Jetty and samples were tested by Center for Climate Change Sustainability Research, Dhaka University of Engineering and Technology, Gazipur. Result is shown in Table 8.

Table 8: Water Quality Analyses for Bakkhali River and drain water in Cox's Bazar

Parameter	Unit	Sample from Bakkhali River	Bangladesh Inland Surface Water Quality Standard for Recreation Purpose (ECR, 1997)	Sample from Drain Water near Ocean Paradise	Sample from Drain Water near Airport Culvert	Sample from Backhali River Water 6 No Jetty	Effluent discharge standard into inland surface water
Color	Pt-Co	104	-	183	359	74	-
Conductivity	µS/cm	681	-	161.7	1140	2.29	1200
Turbidity	NTU	37.1	-	24.7	46.3	146	-
TDS	mg/L	435	-	650	608	1674	2100
BOD_5	mg/L	10	3 or less	104	170	102	50
COD	mg/L	18	-	50	207	148	200
TSS	mg/L	181	-	254	258	925	150
DO	mg/L	4.65	5 and above	1.32	1.59	4.63	4.5-8
pH		6.83	6.5-8.5	7.52	7.36	7.22	6-9
NH_3-N	mg/L	Nil	-	1.2	4.4	7.0	50
TP	mg/L	0.3	-	8.7	6.9	0.1	-
Sulfate	mg/L	2	-	120	25	70	-
Alkalinity	mg/L	150	-	650	500	200	-
Fe	mg/L	0.96	-	0.84	1.45	1.31	1
Chloride	mg/L	156	-	125	200	1100	600
Hardness	mg/L	80	-	310	206	300	-
As	mg/L	Nil	-	0.023	Nil	Nil	0.2

45. From the above result, it is observed that the water quality for BOD_5 of Bakkali river is above the surface water quality standard for recreational use. Drain water quality is also higher for BOD, TSS for all samples and COD and Chloride and Iron for only outlet water. Dissolved Oxygen is very low for drain water. It is to be noted that the water sample was collected in post monsoon season. It is expected that water during dry season would more deteriorated.

46. **Groundwater.** Water aquifers are present beneath the vast majority of Bangladesh, which are being recharged by the major river systems and by infiltration of rainwater. Most ground water is available within 5 m of the surface. This level fluctuates seasonally, approaching the ground surface over most of the country during the months July to September. (during wet season water table varies from 5-7m and during dry season it varies from 9-10.5 m: Source DPHE).

47. The present water supply system is based on groundwater, abstracted from seven production tubewells (PTW) located at different places in the *pourashava* area with 28.37 km of pipelines of diameters between 100 mm to 250 mm. Local ground water represents a stable source of water for various activities including irrigation (both shallow and deep tube wells), domestic purposes (hand pumps) and industrial applications (deep tube wells).

48. The local groundwater level is lowered to approximately 6 m below ground level during the dry seasons, with levels returning to their normal position before the end of the monsoon reported by Department of Public Health (DPHE). This fall in groundwater levels is an entirely natural process that arises because of the hydrological link with the river. Concentration of water quality parameter on a deep tube-well sample collected by PPTA on September 20, 2016 with help of *pourashava* is shown in Table 9. Groundwater quality observed to be within in drinking water quality standard. Though subproject has minor impact on groundwater, it is recommended to monitor ground water quality during construction and operation period. Baseline should be determined before construction.

Table 9: Groundwater Quality of Cox's Bazar

Sl. No.	Water Quality Parameters	Unit	Concentration Present as per DPHE	Concentration on a deep tube-well sample during 20 September 2016 (around 150 m depth)	Bangladesh Drinking Water Quality Standard
1.	Chloride	mg/l	140	200	150-600
2.	Colour	PtCo	20	20	15
3.	Hardness	mg/l	184	1.45	200-500
4.	Conductivity	µS/cm	698	787	-
5.	Iron (Fe)	mg/l	4.66	0.5	0.3-1
6.	pH		6.91		6.5-8.5
7.	Total Dissolved Solid(TDS)	mg/L	161	504	1000
8.	Total Suspended Solid (TSS)	mg/L	28	35	10
9.	Turbidity	NTU	30.6	1.45	10
10.	Dissolved Oxygen	mg/l	1.98	-	6
11.	BOD_5 (20° C)	mg/l	10	-	0.2
12.	COD	Mg/l	31	-	4
13.	NH_3-N	mg/L	13	0.4	0.5
14.	Total Phosphate	mg/L	0.5	0.97	6
15.	Sulfate	mg/L	12	Nil	400
16.	Alkalinity	mg/L	300	402	-
17.	As	mg/L	Nil	Nil	0.05

6. Air Quality

49. Cox's Bazar is a sub-urban area of Bangladesh. In the sub-urban areas ambient air quality is dependent on many factors like air movement, traffic volume, congestion, emissions from motor vehicles, and suspended dust particles. The proposed sites are visually not found as polluted, therefore, no primary data was collected. However, a continuous monitoring scheme is essential to evaluate air quality and for the development of any plan for mitigation of health risks caused by polluted air. The six "criteria pollutants", particulate matter (PM10, PM2.5), CO, SOx, NOx have to be monitored more or less. Hence, to establish the baseline air quality, a primary analysis of air quality is proposed before start of construction. Table 10 shows the Bangladesh National Ambient Air Quality Standard comparing the WHO Guideline and US EPA Standard.

Table 10: Bangladesh National Ambient Air Quality Standard comparing the WHO Guideline and US EPA

Pollutant	Averaging Period	Bangladesh Standards[a]	WHO[b] Guideline Values (µg/m³)	US EPA Standards (µg/m³)[d]
CO	8-hour	10,000 µg/m³ (9 ppm)	10,000[c]	10,000
	1-hour	40,000 µg/m³ (35 ppm)	30,000[c]	40,000
Pb	Annual	0.5 µg/m³	0.5	–
NO_x	Annual	100 µg/m³ (0.053 ppm)	–	–
TSP	8-hour	200 µg/m³	–	–
PM_{10}	Annual	50 µg/m³	20	revoked
	24-hour	150 µg/m³	50	150
$PM_{2.5}$	Annual	15 µg/m³	10	15
	24-hour	65 µg/m³	25	35
O_3	1-hour	235 µg/m³ (0.12 ppm)	–	235
	8-hour	157 µg/m³ (0.08 ppm)	100	157
SO_2	Annual	80 µg/m³ (0.03 ppm)	–	78
	24-hour	365 µg/m³ (0.14 ppm)	20	365

CO = Carbon monoxide; NO_x = Nitrogen oxide; O_3 = ozone; Pb = lead; PM_{10} = particulate matter with a diameter of not more than 10 microns; $PM_{2.5}$ = particulate matter with a diameter of not more than 2.5 microns; SO_2 = Sulfur dioxide; S.R.O. = US EPA = United States Environmental Protection Agency; TSP = total suspended particulates; WHO = World Health Organization; µg/m³ = micrograms per cubic meter; ppm = parts per million; – = no value
Source: [a]S.R.O. No: 220-Law, 2005; [b]WHO, 2005; [c]WHO, 2000; and [d]US EPA, 2006.

7. Acoustic Environment

50. Sound is transmitted through air when an object moves, like water flowing over rocks, or air passing through vocal cords. This movement causes air waves, similar to ripples in water. When these waves reach human ears, they are transformed into sound. Sound is usually measured in decibels (dB). A decibel is a relative measure that is accompanied by a reference scale. Technically, sound pressure is 20 times the logarithm (base 10) of the ratio of the pressure level of any sound to the reference sound pressure in decibels. Sound (noise) levels can be measured and quantified in several ways. All of them use the logarithmic decibel (dB) scale. The dB scale is logarithmic to accommodate the wide range of sound intensities found in the environment. Table 12 shows typical sound levels generated by common indoor and outdoor activities, along with its effect on human.

51. Existing ambient noise levels can serve as a baseline from which to measure potential disturbance caused by project activities. Hence, to establish the baseline noise quality, a primary analysis of noise quality is proposed before start of construction at the proposed site of the subproject. The standard for noise is shown in Table 11.

Table 11: Noise Quality Standards, by Zone and Time of Day

Zone Class	Limits in dB(A)	
	Daytime (6 am – 9 pm)	Nighttime (9 pm – 6 am)
Silent zone	45	35
Residential zone	50	40
Mixed (residential/commercial/industrial) zone	60	50
Commercial zone	70	60
Industrial zone	75	70
Source: Department of Environment (DoE), Bangladesh		

Table 12: Sound levels and human response

Common Sounds	Noise Level (dB)	Effect
Carrier deck jet operation; Air raid siren	140	Painfully loud
Thunderclap	130	Painfully loud
Jet takeoff (200 feet); Auto horn (3 feet)	120	Maximum vocal effort
Pile driver; Rock concert	110	Extremely loud
Garbage truck; Firecrackers	100	Very loud
Heavy truck (50 feet); City traffic	90	Very annoying Hearing damage (8 hours)
Alarm clock (2 feet); Hair dryer	80	Annoying
Noisy restaurant; Freeway traffic; Business office	70	Telephone use difficult
Air conditioning unit; Conversational speech	60	Intrusive
Light auto traffic (100 feet)	50	Quiet
Source: Davis and Cornwell (1998)		

B. Biological Environment

52. There are no endangered species or critical habitats in the project areas. The ecological environment is characterized by a human managed sub-urban landscape. In the study area, terrestrial floras are present mainly in the homestead regions, roadsides, village groves, tourists spots, and upland/high cultivated lands. Homesteads and orchards have: betel, betel nut, kadam, coconut, date palm, sofeda, mango, jackfruit, pomegranate, guava, grapefruit, lemon, blackberries, plum, toddy palm, koroi, shisoo, shirish, rain tree, evcaiytta, bamboo, babla, jeol, neem, tamarind, banana, ipil-ipil, papaya, mehgani, debdaru, shimul, akashmoni, khai babla, jamrul, chalta, bel, amra, amloki, segun, etc. Roadside plantations includes: datepalm, road chambol, koroi, krishnachura, rain tree, banyan, shisoo, babla, akashmoni, eucalyptus, mango, blackberries, raj koroi, etc. Main crops Paddy, potato, betel leaf, vegetables. None of these species are listed as Threatened, Nearly Threatened or Rare list in IUCN Red List.

53. Fish species include rui, katla, thai puti, minar carp, silver carp, Boal, Ayre, Bain, Chital, Fasha, Bata, Magur, bele, Dari, kalibaush, Pabda, Golsha, Bele, Tengra, Puti, Fali, Kachki, Mola, Kakila, Chapila, Kholisha, Chingri, Shol, Taki, Shing, Koi, Gozar, Chela and shrimp as fresh water fish and rupchanda, shuri, latia, lakka, betki, tuna, surma, hilsha, kaika, bagda, golda, chaka, etc.

54. Reptile includes Anjila, Dhura Shap, Matia Shap, Tiktiki, Daraish Shap, Gui Shap, etc. Comon mamals are Babur, Idur, Shial, Chika, Beji, etc. Avifauna (birds) includes Choroi, Doyel, Kak, Ghugho, Shalik, Tuntuni, Machranga, Haludpakhi, Gangchil, etc. Insect fauna includes Dragon fly nymph, Damsel fly nymph, Water strider, Midge, Flies, Ant, Caddisfly, etc. None of these species are listed as Threatened, Nearly Threatened or Rare list in IUCN Red List.

55. This bio-survey data might not reflect the actual biodiversity of that area. One species found in the monsoon might not be seen in the winter. Extensive survey over the year might give an actual status of biodiversity. Present bio-survey list is a snapshot prepared based on the

species found during the field visit time.

56. There are two National Parks such as Himchuri National Park, Medhakachhapia National Park near Cox's Bazar. Among them, Himchuri National Park is 12 km from Cox's Bazar *pourashava*. Two wild life Sanctuaries named Fashiakhali and Teknaf are near Cox's Bazar. One marine protected area Swatch of No-Ground is Bay of Bengal is close to Cox's Bazar. However, subprojects would not have any impact on these due to the nature, extent and magnitude of activities.

C. Physical and Cultural Heritage

57. The Arab traders and preachers came to the ports of Chittagong and Akiab in the eighth century AD and consequently the Arab Muslims came in close contact with Cox's Bazar area situated between the two ports. The greater Chittagong including Cox's Bazar was under the rule of Harikela king Kantideva in the nineteenth century. The Arakan king Sulat Inga Chandra (930-975) captured Chittagong in 953 AD and since then Cox's Bazar had been a part of the kingdom of Arakan. Chittagong remained part of the kingdom of Arakan till its conquest by the Mughals in 1666 AD. The Mughal general Buzurg Umed Khan captured the Magh Fort on the southern bank of the Karnafuli and the Arakanise took shelter in the Ramu Fort, which was later surprised by the Mughals.

58. The East India Company, with a view to establish settlement in Cox's Bazar area, took a liberal policy of distributing land to the cultivators and this encouraged people from different parts of Chittagong district and from Arakan to settle in Cox's Bazar area. The Burmese king Bodhapaya (1782-1819) captured Arakan in 1784 AD. About thirty thousand Arakanese escaped the atrocities of the Burmese king to Cox's Bazar area in 1799 AD. The East India Company deputed one Captain Hiram Cox to arrange for the rehabilitation of the refugees (1799). Each refugee family was granted 2.4 acres of land and also granted food support for six months. Hiram Cox died (1799) before the completion of rehabilitation work. To commemorate his role in rehabilitation work a market was established and was named after him as Cox's Bazar (market of Cox) which originates the name of the place.

59. Cox's Bazar is famous in Archaeological as physical and cultural heritage. Archaeological heritage sites are Adinath Temple (Maheskhali), Tomb of Shah Umar (in Chakoria), Satgumbad Masjid of Fazl Quke at Manikpur, Hasher dighi, Bir Kamla dighi, (in Teknaf) Well of Mathin, (in Kutubdia) Kalarma Masjid, Tomb of Qutub Awliya, (in Ramu) Ramkot Hindu Mandir, Ramkot Buddhist Keyang, Lamarpara Buddhist Keyang, (in Ukhia) Patabari Buddhist Keyang, Kutupalang Buddhist Keyang, Kanabazar underground channel, (in Cox's Bazar) Agvamedha Buddhist Keyang, Buddhist Pagoda, single domed mosque at Jhilanga etc.

60. There are about 29 daily bazars and 13 weekly hats in Cox's Bazar Sadar upazila (BBS 2013). There are also 350 restaurants and 295 residential hotels in the project area.

D. Socio-economic environment

1. Population

61. Cox's Bazar (Town) consists of 12 wards and 97 mahallas. The *pourashava* covers an area of 32.9sq.km (BBS, 2011). In 2011 the population of the *pourashava* was 167,477 (BBS, 2011); the population density is 5,090 persons per km2; male 52%, female 48%. The literacy rate among the *pourashava* people is 84%.

62. Cox's Bazar *pourashava* has experienced high population growth in recent years. The annual growth rate during the last inter-census period (2001-2011) shows very high population growth rate. The Cox's Bazar Development Plan found 6.93 percent annual growth rate between 2001 and 2010, although the Plan considered it very high to sustain in the long-term future. However, the *pourashava* is likely to grow with a higher urbanization rate than the national average urban population growth rate. Thus, a 5 percent annual population growth rate for Cox's Bazar *pourashava* seems to be reasonable and likely to continue in the short-term to long-term future. Infrastructure improvements will help sustain a reasonably a high growth of population.

2. Livelihood Practices and Economic Activities

63. Agriculture 49.84%, non-agricultural laborer 7.92%, industry 1.04%, commerce 17.39%, transport and communication 2.56%, service 5.96%, construction 1.19%, religious service 0.27%, rent and remittance 1.84% and others 10.68%. (Source: Banglapedia). Both fresh water and marine fishes as very essential staple play a very important role in the economy of the locality.

64. A wide variety of indigenous and exotic fishes including carps catfishes and many smaller species are available in Cox's Bazar. Fish is and essential staple and plays a very important role in the economy of the area. In the fresh water, the popular species are ruhi (labeo rohita), katla (Catla catla), mrigel (Cirrhinus mrigala), kalabaush (labeo calbasu), airh (Mystus aor), ghonia (Labeo gonius), shoil (Channa striatus), boal (Wallagonia attu), gazar (Channa marulius), gulsha (Mystus bleekeri), koi (Anabas testudineus), shing (heteropneustes fossilis) and magur (Clarias batrachus) hilsha (Hilsa ilisa) etc.

65. Reptiles are abundant in the district. The common cobra and the krait are the chief venomous varieties of snakes, cobra (Naja naja) and python (Molunrus tivittatus) are the cause of frequent fatalities. Turtles and tortoises abound in the rivers. Lizards (Hemidactrlus prooki) are seen everywhere.

66. Cox's Bazar serves as a center for the region's agricultural and fishery production. It is also highly dependent on tourism and is considered to be the country's primary domestic tourism destination. Tourism, agriculture, and maritime and riverine fisheries are all highly climate dependent industries. Cox's Bazar is the most import marine fisheres centre in Bangladesh. popular among marine fishes are Ilisha or hilsa, rupchanda (Pampas chinensis), hail chanda (Parastromateus niger), luckwa (Polynemus indicus), lotya (Harpodon nehereus), churi (Lepturacanthus savala), poa (Pama pama), ekthoate (Hemiramphus georgii), bargaui (Bagarius yarrellii), datina (Acanthopagrus latus), tullar dandi (Whiting), bata and khorshul (Mugilcorsula), phansha (anchovy), tophshil (Polynemus paradiseus), gucchiya and bhetki are popular. Prawn farming is an important economic activity of this area.

67. Main crops are Paddy, potato, pulse, onion, garlic, ginger, betel leaf, betel nut, wheat, sugarcane, ground nut, tobacco, rubber, vegetables etc. Main fruits are banana, jackfruit, guava, coconut, papaya, guava, plum, lemon, coconut, betel nut, palm, etc.

3. Infrastructures

68. **Electricity.** All the wards and unions of the upazila are under rural electrification net-work.

69. **Water Supply.** There are 996 service connections, serving only 8% of the total production. The average water supply delivery is 10 hours per day.

70. **Sanitation.** 97% of dwelling households of the municipality use sanitary latrines and 3% of dwelling households use non-sanitary latrines; 35% pour flush toilet connected to a septic tank, 41% pit latrine with water seal, 18% pit latrine without water seal.

71. **Drainage system:** The total length of the existing drainage system of the *pourashava* is 191.00 km including 27.80 masonry drains and 12.00 km RCC drains, which reflects the existing poor drainage system.

72. **Water logging**: The main waterlogging and drainage congested areas are Wards 1, 10 and 12, and part of Wards 2, 5, 6 and 11. The depth of inundation of water logging is 1~2 feet and the depth of inundation lasts for 5~6 hours.

73. **Disposal sites.** Currently, all the collected waste by the municipality is disposed in an unauthorized landfill site located at Pona Market. Crude dumping methods are being used for waste disposal.

E. Description of Site and Surroundings

74. The *pourashava* is free from any large scale carbon emission as there is moderate number of vehicular transport and small number of smoke emitting industries in the *pourashava*. However, its river water is contaminated by salinity due to have direct link with the sea. Most of its groundwater is also saline due to saline water intrusion into the aquifer.

75. Cyclones from the Bay of Bengal regularly sweep the southern coastal parts of Bangladesh including Cox's Bazar, destroying property and life. Swelling of the sea during tropical cyclones causes river water to rise to an abnormal level causing overflowing of the banks and flooding the low lying areas of the *pourashava*. Drainage congestion caused by encroachment and waste disposal/clogging results in water logging. Other sources of drainage congestion and water logging are caused by failure of embankment, hydraulic structures and rise of riverbed due to sedimentation. Salinity intrusion into the aquifer contaminates groundwater resulting in a potable water crisis.

76. Deforestation and increased development on the hill slopes (Wards 5 and 6, as well as the surrounding areas outside of municipal boundaries) are vulnerable to landslides during high rainfall periods. Cox's Bazar is also located in an active earthquake zone, on the boundary of two active plates, and is highly susceptible to earthquakes and related landslides.

77. The municipality has population and development concentrated in some areas while some areas are underutilized, lacking a balance between the various land uses. The Climate Resilient Integrated Urban Plan report prepared by TA 8913 consultants for preparation of additional financing observes that though the municipality has a growing urban footprint, its overall sphere of influence has not increased. This growth has manifested mainly as unplanned and opportunistic development without enforcement of regulatory or urban development controls. Maintaining the competitive edge of the *pourashava* in the level of urban infrastructure services is expected for the existing and projected tourism levels, and the quality of tourism services and opportunities available to visitors to experience both the *pourashava* and its immediate environs.

F. Impact of Climate Change

78. Besides, as a coastal region *pourashava*, Cox's Bazar is under severe threat of climate change impact. It is likely to face the following potential climate change impacts:

(i) With the rise in sea level, the water level of river will rise causing overflowing of water into the low lying areas of the *pourashava* creating chronic water logging. Low-lying areas where major economic activities are located will be at risk, shaking the very basic economy of the *pourashava*.
(ii) There will be an increase in the number and severity of tropical cyclones causing damage to property and life.
(iii) The major problem contributing to Cox's Bazar's vulnerability as a whole is the lack of basic services, especially water supply, drainage, sanitation and waste management.
(iv) Unplanned development and lack of control over development arising from lack of attention to urban planning, will cost dearly in the long run.
(v) There will be increased costs of infrastructure development, and O&M.
(vi) Agriculture will be affected leading to an increase in poverty. More funds will have to be injected to tackle unemployment and poverty.
(vii) River bed rise already makes gravitational flow of drainage water into the river difficult.
(viii) Sea water rise due to climate change will cause many low lying areas of the *pourashava* to get submerged. Particularly the lowing lying areas accommodating major economic activities will be in danger, seriously affecting the livelihood of the large number of residents of the *pourashava*. Saline water intrusion into the water table will increase creating a potable water crisis. Saline water intrusion into farm land will affect agricultural production badly.
(ix) With agriculture affected in rural areas, there will be poverty and increased rural-urban migration. Urban poverty will increase, requiring more money for poverty alleviation.

V. ASSESSMENT OF ENVIRONMENTAL IMPACTS AND SAFEGUARDS

A. Methodology

79. Issues for consideration have been raised by the following means: (i) input from interested and affected parties; (ii) desktop research of information relevant to the proposed subproject; (iii) site visits; and (iv) evaluation of proposed design scope as per PPTA study and potential impacts.

80. The corridors of impact considered include: (i) existing alignment and width of drains to be constructed; and (ii) existing ROWs. No additional land is required beyond the ROWs. Categorization of the subproject and formulation of mitigation measures have been guided by ADB's REA Checklist for Roads (Appendix 1) and ADB SPS, 2009.

B. Screening out Areas of No Significant Impact

81. From the preliminary design and results of the rapid environmental assessment, it is clear that implementation of Cox's Bazaar drainage subproject will not have major negative impacts because activities will be localized/site-specific and short in duration. Moreover, the corridors of impact of the subproject will be on existing public ROWs, and construction will be

conducted within a relatively small area. Because of these there are several aspects of the environment that are not expected to be affected by the subproject (Table 13) and thus can be screened out of the assessment at this stage but will be assessed again during detailed design stage and before implementation.

Table 13: Fields in Which the Subproject Is Not expected to have Significant Impacts

Field	Rationale
A. Physical Characteristics	
Topography, landforms, geology and soils	Required amount of materials will not cause alteration of topography, landforms, geology and soils. Erosion hazard is insignificant as trenching and excavation works will be conducted only during construction stage (short-term) and specific to sites along public ROWs.
Climatic conditions	Short-term production of dust is the only effect on atmosphere. However, impact is short-term, site-specific and within a relatively small area. There are well developed methods for mitigation.
B. Biological Characteristics	
Biodiversity	Activities being located in the built-up area of Cox's Bazaar *pourashava* will not cause direct impact on biodiversity values as identified flora and fauna are those commonly found in built up areas. The construction activities do not anticipate any cutting of trees.
C. Socioeconomic Characteristics	
Land use	No alteration on land use.
Type of community spread	No alteration on type of community spread.
Socio-economic status	There is no requirement for land acquisition. Affected persons and structures will be addressed separately in the resettlement plan developed as per Government of Bangladesh laws and ADB SPS, 2009. Manpower will be required during the construction stage, this can result to generation of contractual employment and increase in local revenue.
D. Historical, Cultural, and Archaeological Characteristics	
Physical and cultural heritage	The subproject components are not located in or near and excavation works will not be conducted in the vicinities of identified historical sites.

C. Anticipated Impacts and Mitigation Measures – Planning and Design Phase

82. **Subproject selection criteria.** The project environmental assessment and review framework specifies environmental criteria to avoid or minimize adverse impacts during the identification and finalization of drainage subprojects. Table 14 summarizes site and design considerations as per preliminary design.

Table 14: Site and Design Considerations to Meet EARF Environmental Criteria

	Components	Environmental Selection Guidelines	Remarks
1.	Overall selection guideline	i. Comply with all requirements of relevant national and local laws, rules, and guidelines.	- Requisite LCC and ECC to be obtained prior to commencement of works
		ii. Avoid/minimize where possible locations in protected areas, including notified reserved forests or biodiversity conservation hotspots (wetlands, national reserves, forest reserves, and sanctuaries).	- Not present in Cox's Bazaar pourashava
		iii. Avoid possible locations that will result in destruction/disturbance to historical and cultural places/values.	- Use of "chance find" procedures in the EMP that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.
		iv. Avoid tree-cutting where possible. Retain mature roadside trees which are important/valuable or historically significant. If any trees have to be removed, plant two new trees for every	- Permit for tree-cutting to be obtained by contractor/s prior to commencement of work - Compensatory plantation for trees lost at

	Components	Environmental Selection Guidelines	Remarks
		one that is lost.	a rate of 2 trees for every tree cut, in addition to tree plantation as specified in the design, will be implemented by the contractor, who will also maintain the saplings for the duration of his contract.
		v. Ensure all planning and design interventions and decisions are made in consultation with local communities and include women. Reflect inputs from public consultation and disclosure for site selection.	- All consultations during project preparation are documented and concerns expressed by public addressed in the IEE.
		vi. Synchronize all road improvement and pipe laying works (to extent possible) to minimize disturbance and optimize use of resources (e.g., water pipes laid prior to road improvements).	- Not relevant
2.	Drainage improvement	i. Outfalls should be to suitable drainage areas (*nallas*, canals, etc.) and avoid flooding to adjacent private lands.	- Outfalls identified in the preliminary design (Choto Jamuna, Tulshiganga, existing drainage canals)
		ii. Include measures to ensure the safe disposal of canal dredge (e.g., to dumpsite or landfill) without causing an environmental hazard.	- Addressed in the EMP.

83. **Land acquisition and resettlement.** The proposed drainages will be located in public ROWs. Involuntary resettlement impacts on encroachers along ROWs will be addressed by the resettlement plan prepared for the subproject as per ADB SPS, 2009 and applicable Bangladesh laws. Cutting of trees will not be required as per preliminary design. This will be reassessed during detailed design stage and if cutting of trees will be required, compensatory plantation for trees lost at a rate of 2 trees for every tree cut will be implemented by the contractor, who will also maintain the saplings for the duration of his contract.

84. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. Locations and sitting of the proposed infrastructures were considered to further reduce impacts. The subproject will be in properties held by the *pourashava* and access to the subproject sites is through public ROW and existing roads hence, land acquisition and encroachment on private property will not occur.

85. The concepts considered in design of the Cox's Bazaar drainage subproject are: (i) locating components on government-owned land to avoid the need for land acquisition and relocation of people; (ii) using vacant right of way (ROW), and taking all possible measures in design and selection of site or alignment to avoid resettlement impacts; (iii) avoiding where possible locations that will result in destruction/disturbance to historical and cultural places/values; (iv) avoiding tree-cutting where possible; (v) ensuring all planning and design interventions and decisions are made in consultation with local communities and reflecting inputs from public consultation and disclosure for site selection.

86. **Climate Change Adaptation and Disaster Risk Management Considerations.** The expected climate change impacts on Cox's Bazar are mainly associated with: tidal flooding; cyclone related storm surge; rainfall driven drainage congestion and sea level rise. The by-products of these include temperature variations, monsoon-, flash- and tidal flooding, increased water logging and landslides. The area is also highly susceptible to earthquakes and related landslides. All these impacts are expected to increase as the *pourashava*'s low-lying topography

between the hill range and the sea further exacerbates the challenges associated with water supply, drainage, urban and transport infrastructure, community health and energy supply. They will also impact the fisheries industry and livelihoods dependent on then natural resource base.

87. Cox's Bazar is already affected by salinity intrusion due to sea level rise. Projected sea level rise due to climate change will exacerbate salinity intrusion along the rivers. This may have impact on subproject. Frequent flash flood due to heavy rainfall in the hill is a big problem of Cox's Bazar municipality. This will be accelerated due to increase of climate change impacts. It is recommended that project design construction, especially design material, method of construction should be taken appropriate to make the Project climate-proof and disaster resilient. During the detailed design, the Environment Specialist properly consulted with the design team to incorporate this impact. The climate change impact and necessary consideration in design for adaptation is shown in Table 15.

Table 15: Climate change impact and design considerations

Climate change effect/impact factor	**Impact**	**Design consideration for mitigation**
Water level high/Sea level rise	Riverbank erosion or breaching the road embankment and alongside drain, erosion/ damage of drainage outlet/canal, etc.	Tree plantation need both side of the embankment, road/ road side drain create buffer zone, use climate change consideration in structural design of intake and other construction element; introduce guide wall to protect erosion and sliding for CC roads/drain
Salinity	All construction material will be impacted due to salinity: corrosion and dampness	All construction material should saline resistant, anti-saline admixture can be used
Cyclone and tidal surge	Wind speed will damage structurally to plant and vegetation, tidal surge will damage road embankment/road side drain, backwater flow to drains	Plant timber trees, proper cross drainages should be provided to road and embankment design should consider height of the storm surge; drain valve can be used at drain outlet to protect backwater flow from drain.
Floods and water logging	Erosion to road surface and structural damage to drain and road/drain due to over topping and water logging; overflow of drain water can create nuisance and disease spreading. Frequent flash flood due to heavy rainfall in the hillside	Proper side drainage and cross drainage should be provided to road, road and drain design should consider high flood level Drain is to be designed and constructed a s RCC with trapezoidal section. Canal should be at least lined. Regular cleaning and maintenance of the drain/canal is necessary. Immediate restoration of drainage system is important after flash flood
Drought	Impact on plant and vegetation, water scarcity, construction quality may suffer due to lack of water for curing, drain blockage may happen due to disposal of waste to dry drain	Curing should be properly taken care off and sufficient water should be ensured during construction; Regular cleaning and maintenance should be done for drain
Construction materials' quality		Most durable materials possible, even if higher cost, e.g. concrete, high quality bricks should be chosen; anti saline admixture should be used; Construction quality should be monitored and controlled
Rising temperatures		Works during most favorable times of year and day should be executed; Preparing, placing and curing concrete and mortar, to ensure placement, etc., during most favorable times should be monitored and controlled; plain high-quality un-rendered brickwork and high quality cement mortar in preference to rendered low-grade bricks should be used; sulphate resisting cement should be used in vulnerable locations (higher heat gain during curing) or cement containing fly ash (less heat gain, so preferred)
Runoff		Trapezoidal section side drains with small low-flow section (cunette) for low flows should be used; Side drains should

Climate change effect/impact factor	Impact	Design consideration for mitigation
		be lined to achieve higher discharge velocities without increasing risk of scour, etc.

D. Anticipated Impacts and Mitigation Measures – Construction Phase

88. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the built-up area of the *pourashava*, will not cause direct impact on biodiversity values.

89. **Construction method.** Trenches will be dug by backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed nearby, and the materials (brought to site on trucks and stored on unused land nearby) will be placed in the trench by crane or using a small rig. The infrastructures will be constructed manually according to design specifications. Any excavated road will be reinstated. Any dredged materials will be disposed to pre-approved disposal sites.

90. There is sufficient space for a staging area, construction equipment, and stockpiling of materials. However, the contractor will need to remove all construction and demolition wastes on a daily basis.

91. Although construction of these project components involves quite simple techniques of civil work, the invasive nature of excavation and the project sites in built-up areas of Cox's Bazaar where there are a variety of human activities, will result to impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are short-term, site-specific and within a relatively small area. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, Cox's Bazar drainage subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with construction activities can be mitigated to acceptable levels with the following mitigation measures (Table 16).

Table 16: Anticipated Impacts and Mitigation Measures – Construction Phase

Field	Impacts	Mitigation Measures
A. Physical Characteristics		
Topography, landforms, geology and soils	Significant amount of gravel, sand, asphalt and cement will be required for this subproject. Extraction of construction materials may cause localized changes in topography and landforms. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Utilize readily available sources of materials. If contractor procures materials from existing burrow pits and quarries, ensure these conform to all relevant regulatory requirements. • Borrow areas and quarries (If these are being opened up exclusively for the subproject) must comply with environmental requirements, as applicable. No activity will be allowed until formal agreement is signed between PIU, landowner and contractor.
Water quality	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare and implement a spoil management plan (Appendix 2). • Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Cox's Bazaar local authority on designated disposal areas. • All earthworks must be conducted during dry season to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff. • Location for stockyards for construction materials shall be identified at least 300m away from watercourses. Place storage areas for fuels and lubricants away from any drainage leading to water bodies. • Take all precautions to minimize the wastage of water in the construction activities. • Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies. • Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low lying areas. • While working across or close to any water body, the flow of water must not be obstructed. Ensure no construction materials like earth, stone, or appendage are disposed of in a manner that may block the flow of water of any watercourse and cross drainage channels. • Monitor water quality according to the environmental management plan.
Air quality	Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather; • Use tarpaulins to cover soils, sand and other loose material when transported by trucks. • Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. • Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject).

Field	Impacts	Mitigation Measures
		• Monitor air quality.
Acoustic environment	Construction activities will be on settlements, along and near schools, and areas with small-scale businesses. Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and people. However, the proposed subproject will follow existing ROW alignment and impact is short-term, site-specific and within a relatively small area. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. • Plan activities in consultation with Cox's Bazaar local authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. • Use of high noise generating equipment shall be stopped during night time. • Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; • Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensure that these are maintained to manufacturers' specifications at all times. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required). • Monitor noise levels. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly.
Aesthetics	The construction activities do not anticipate any cutting of trees but will produce excess excavated earth (spoils), excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare the Debris Disposal Plan • Remove all construction and demolition wastes on a daily basis. • Coordinate with Cox's Bazaar local authority for beneficial uses of excess excavated soils or immediately dispose to designated areas Avoid stockpiling of any excess spoils • Suitably dispose of collected materials from drainages, unutilized materials and debris either through filling up of pits/wasteland or at pre-designated disposal locations. • All vehicles delivering fine materials to the site and carrying waste debris for disposal shall be covered to avoid spillage of materials. All existing roads used by vehicles of the contractor, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • Lighting on construction sites shall be pointed downwards and away from oncoming traffic and nearby houses.

Field	Impacts	Mitigation Measures
		• In areas where the visual environment is particularly important or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction. • The site must be kept clean to minimize the visual impact of the site. Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
B. Biological Characteristics		
Biodiversity	Activities being located in the built-up area of Cox's Bazaar p*ourashava*. There are no protected areas in or around subproject sites, and no known areas of ecological interest. There are no trees along ROWs that need to be removed.	• Check if tree-cutting will be required during detailed design stage. No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of project management unit (PMU). • If during detailed design cutting of tress will be required, compensatory plantation for trees lost at a rate of 2 trees for every tree cut, in addition to tree plantation as specified in the design, will be implemented by the contractor, who will also maintain the saplings for the duration of his contract. • All efforts shall be made to preserve trees by evaluation of minor design adjustments/ alternatives (as applicable) to save trees. • Special attention shall be given for protecting giant trees and locally-important trees (with religious importance) during implementation. • Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body in the subproject vicinity. • Prohibit employees from poaching wildlife and cutting of trees for firewood.
C. Socioeconomic Characteristics		
Existing provisions for pedestrians and other forms of transport	Road closure is anticipated. Hauling of construction materials and operation of equipment on-site can cause traffic problems. However, the proposed subproject will follow existing ROW alignment. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare and implement a Traffic Management Plan (see Appendix 3 for sample) • Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Maintain safe passage for vehicles and pedestrians throughout the construction period. • Schedule truck deliveries of construction materials during periods of low traffic volume. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of construction activities and contact numbers for concerns/complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain

Field	Impacts	Mitigation Measures
		access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. Ensure there is provision of alternate access to businesses and institutions during construction activities, so that there is no closure of these shops or any loss of clientage. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Socio-economic status	Subproject components will be located in government land and existing ROWs thus there is no requirement for land acquisition or any resettlements. Manpower will be required during the 18-month construction stage. This can result in generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term.	• Employ at least 50% of labor force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation. • Secure construction materials from local market.
Other existing amenities for community welfare	Although construction of subproject components involves quite simple techniques of civil work, the invasive nature of excavation and the subproject sites being in built-up areas of Cox's Bazaar *pourashava* where there are a variety of human activities, will result in impacts to the sensitive receptors such as residents, businesses, and the community in general. Excavation may also damage existing infrastructure (such as water distribution pipes, electricity pylons, etc) located alongside the roads. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Obtain details from pourashava nature and location of all existing infrastructure, and plan excavation carefully to avoid any such sites to maximum extent possible; • Integrate construction of the various infrastructure subprojects to be conducted in Cox's Bazaar (roads, water supply, etc.) so that different infrastructure is located on opposite sides of the road where feasible and roads and inhabitants are not subjected to repeated disturbance by construction in the same area at different times for different purposes. • Consult with local community to inform them of the nature, duration and likely effects of the construction work, and to identify any local concerns so that these can be addressed. • Existing infrastructure (such as water distribution pipes, electricity pylons, etc.) shall be relocated before construction starts at the subproject sites. • Prior permission shall be obtained from respective local authority for use of water for construction. Use of water for construction works shall not disturb local water users. • If construction work is expected to disrupt users of community water bodies, notice to the affected community shall be served 7 days in advance and again 1 day prior to start of construction. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Community health and safety	Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures. Poor safety signage and lack of barriers at	• Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Contractor's activities and movement of staff will be restricted to

Field	Impacts	Mitigation Measures
	work site and trenches will create hazard to pedestrians and children.	designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Cox's Bazaar local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/storage area on private land, he must get prior permission from the environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.[a] • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the national/regional environmental specialist's attention immediately; and (iv) taking remedial action as per national/regional environment specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the national/regional environmental specialist within 48 hours of receipt of such complaint/grievance.

Field	Impacts	Mitigation Measures
Workers health and safety	There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in urban areas. Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.	• Comply with requirements of Government of Bangladesh Labor Law of 2006 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 national/regional environmental 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[b] 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 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.
D. Historical, Cultural, and Archaeological Characteristics		

Field	Impacts	Mitigation Measures
Physical and cultural heritage	Construction works will be on existing roads and in built-up areas of Cox's Bazaar thus risk for chance finds is low.	• All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the government. • Prevent workers or any other persons from removing and damaging any fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest. • Stop work immediately to allow further investigation if any finds are suspected.

[a] These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

[b] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

E. Anticipated Impacts and Mitigation Measures – Operations and Maintenance Phase

92. In the O&M phase, the drainages and flood control structures will operate with routine maintenance, which should not affect the environment. The infrastructures will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be infrequent, affecting small areas only. O&M will be the responsibility of Cox's Bazaar local authority, which will be given training by this project.

93. Routine repairs and unblocking of drains will be very small in scale, to conducted manually by small teams of men with simple equipment (shovels, wheelbarrows, etc.) and works will be very short in duration thus will not cause significant physical impacts. Traffic may be interrupted temporarily but this work will be very small in scale, infrequent, and short in duration, so there will be no economic or other implications. To maintain the safety of workers and road-users, such work should be coordinated with the local police department so that adequate warning signs and traffic diversions can be set up when necessary. Debris/sediments from drainages need to be collected and disposed at a designated site such as the landfill. It is important that the designated disposal site's base is of a non-permeable membrane in order to prevent leachate that can contaminate the soil and groundwater. The potential adverse impacts that are associated with O&M activities can be mitigated to acceptable levels with the following mitigation measures (Table17).

Table 17: Anticipated Impacts and Mitigation Measures – O&M Phase

Field	Impacts	Mitigation Measures
A. Physical Characteristics		
Water quality	Run-off from stockpiled debris/sediments from drainages which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies. • Remove all debris/sediments immediately. • Dispose debris/sediments at a designated site such as landfill. It is important that the designated disposal site's base is of a non-permeable membrane in order to prevent leachate that can contaminate the soil and groundwater.
Air quality	Moving debris/sediments from drainages may create dusts during dry season. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Use tarpaulins to cover soils, sand and other loose material.
Acoustic environment	Temporary increase in noise level and vibrations. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Plan activities in consultation with Cox's Bazaar local authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly.
B. Biological Characteristics		
Biodiversity	Activities in the built-up area of Cox's Bazaar *pourashava*. There are no protected areas in or around subproject sites, and no known areas of ecological interest.	• No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission. • Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal).
C. Socioeconomic Characteristics		
Existing provisions for pedestrians and other forms of transport	Road closure is not anticipated. Traffic may be interrupted temporarily. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Maintain safe passage for vehicles and pedestrians during maintenance activities. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of maintenance activities and contact numbers for concerns/complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Workers health and	Workers need to be mindful of the occupational hazards	• Comply with requirements of Government of Bangladesh Labor Law of 2006

Field	Impacts	Mitigation Measures
safety	working in confined spaces such as closed drains. Potential impacts are negative and long-term but reversible by mitigation measures.	and all applicable laws and standards on workers H&S. • Ensure that all site personnel have a basic level of H&S training. • Produce and implement a O&M health and safety (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[a] 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 • 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; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Mark and provide sign boards. 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. • 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.
D. Historical, Cultural, and Archaeological Characteristics		
Physical and cultural heritage	Construction works will be on existing drainages and built-up areas of Cox's Bazaar thus risk for chance finds is low.	• All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the government. • Prevent workers or any other persons from removing and damaging any fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest. • Stop work immediately to allow further investigation if any finds are suspected.

a Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

F. Cumulative Impact Assessment

94. The cumulative impact assessment examined the interaction between the subproject's residual effects (i.e., those effects that remain after mitigation measures have been applied) and those associated with other past, existing, and reasonably foreseeable future projects or activities. The interaction of residual effects associated with multiple projects and/or activities can result in cumulative impacts, both positive and negative. The project's potential cumulative effects were considered with respect to valued components in environmental and socioeconomic categories, in four areas:

(i) of any potential residual project effects that may occur incrementally over time;
(ii) consideration of other known relevant projects or activities within the specified study area boundaries, even if not directly related to the project;
(iii) potential overlapping impacts that may occur due to other developments, even if not directly related to the proposed subproject; and
(iv) future developments that are reasonably foreseeable and sufficiently certain to proceed.

95. The project has identified the valued components as air quality, acoustic environment, socioeconomic and socio-community components, and human health and safety. There are no foreseeable projects that will overlap with the subproject. The spatial boundary of the subproject is the area along the corridor of impact (alignment and width of the drainages and ROWs) and the temporal boundary can be considered as the whole Cox's Bazaar*pourashava*.

96. It is recommended that infrastructures be (i) designed to the current best practice standard and notified Government of Bangladesh codes; (ii) built that the floods do not damage them; and (iii) side drains are to be kept free from wastes and siltation. Short-term negative impacts are the same with or without climate change measures except that with climate change measures there are increased demand for construction materials and more time to complete the works. No negative cumulative impact and the potential long-term environmental impacts are positive; including mainstreaming climate risk reduction into infrastructure development ensures subprojects infrastructure are less vulnerable to floods, storm surge, landslides and impacts of other extreme weather events.

97. **Air quality.** Emissions of common air contaminants and fugitive dust may be elevated in proximity to active work sites during construction and O&M phases, these impacts will be short-term and localized to the immediate vicinity of drainages. Greenhouse gas (GHG) emissions may increase as a result of the subproject activities (i.e., vehicle and equipment operation, concrete production, disposal of excavated material, land-filling of residual wastes). Given the subproject's relatively minor contribution to common air contaminants and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible.

98. **Acoustic environment.** Noise levels during construction and O&M activities in immediate proximity of work sites are expected to increase. The duration of exposure will be relatively brief and imperceptible. The exposure represents a temporary, localized, adverse residual effect of low significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during construction and O&M activities. The overall significance rating of potential residual effects is considered to be negligible.

99. **Socioeconomic and socio-community.** Concerns on existing provisions for pedestrians and other forms of transport will occur spatially during construction and O&M activities. Traffic movement along the roads will be improved once the activities are completed. Since the subproject will be improvement of existing infrastructures, it will not conflict with existing or planned land use. However, following improvement in infrastructures and services, added residential developments, commercial, and business facilities and increased densities are expected to develop and enhance Cox's Bazaar *pourashava*. This can be considered a long-term cumulative benefit of the subproject.

100. Given the scale of the project it is likely that local people will obtain at least temporary socio-economic benefits, by gaining employment in the construction workforce, and thus raising their levels of income. These benefits can bring wider social gains if they are directed at vulnerable[11] groups.

101. Upon completion of the project, the socio-community will be the major beneficiaries of this subproject. The citizens, businesses, and communities in Cox's Bazaar will be provided with reliable and climate-resilient drainage resulting to less flooding and enhanced safety, cost savings, and economic growth. Benefits for all Cox's Bazaar citizens include: reduced flooding and related positive economic impact, and improved quality of life. These are considered a long-term cumulative benefit.

102. **Community and workers health and safety.** No adverse residual effects to human health will occur as a result of construction or O&M activities, and mitigation measures are in place to ensure public and worker safety, and will be closely monitored. While exposure to elevated noise levels, fugitive dust and common air pollutants will occur in proximity to work sites, due to their short-term and localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health.

103. Therefore the project will benefit the general public by contributing to the long-term improvement of municipal services and community livability in Cox's Bazaar *pourashava*.

VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Approach

104. During inception stage of PPTA's engagement, consultations were held with the LGED, ADB and during site visits, consultation were held with *pourashava* local staff, local people and beneficiaries on issues pertaining to the selection of subprojects and identification of key issues including addressing the current gaps in provision of basic services and improvement of municipal infrastructures within Cox's Bazar *pourashava*. These consultations provided inputs in identification of the subprojects' needs of the communities, and the relevant stakeholders, awareness about subprojects, benefits of subprojects, possible environmental impacts and possible mitigation measures. The REA Checklist for each subproject was also shared during the consultations. Table 18 provides the summary of consultations carried out.

105. The environmental experts of the TA 8913 consultants for UGIIP-3 additional financing project preparation (Safeguard Specialists and Junior Environmental Engineers) have contacted

[11] Vulnerable groups as those without legal title to land and other assets; households headed by single earner females, the elderly or disabled; indigenous peoples (based on ADB OM); and households with incomes that are below the poverty line.

the local people through field workers and Cox's Bazar *pourashava* staff. Meetings were arranged in the form of Focus Group Discussion (FGD) with the consent of the local stakeholders at scheduled venues chosen by the locals (Figure 6). Participant attendance is attached in Appendix 4.

B. Major Findings

106. The information on the conducted FGD and key issues identified during consultations is presented on the Table 18. No vulnerable groups are identified during the consultations in the subproject area. Consultation process will continue during implementation and vulnerable groups, if any, will be included.

Table 18: Focus group discussion and key issues identified during Consultations

SL No.	Proposed Project Facility/ Alignment Related to Which Discussion Held	Date/Time	Venue	No. of Participants & gender	Key Safeguard Issues Discussed	Overall Concerns Expressed Related to Project	Suggestions From People	Willingness to Participate in Project
1.	Construction of roads and roadside drains	Date: 30-08-16 Time: 12.00 noon	Monir Moshin Bari, Islampur Basti, Ward-7 Peta Showdagar Para, Ward No-6	M=03 F=34 T=37 M= 39 F= 0 T= 39 Participants: *pourashava* staff, service man, business man, agriculture owner/laborer, worker, housewife	Drainage problems and their environmental problems. Water entering from hill containing huge sand reduces drain capacity.	People are happy of the project, but expressed that road and drainage improvement must be together	Road and drainage improvement should be altogether. Need removal of sand after flash flood.	People will extend all out supports in the project implementation including construction.
2.	Construction of RCC Drain	Date: 30-08-16 Time: 12.00 noon	Monir Moshin Bari, Islampur Basti, Ward-7 Peta Showdagar Para, Ward No-6	M=03 F=34 T=37 M= 39 F= 0 T= 39 Participants: *pourashava* staff, service man, business man, agriculture owner/laborer, worker, housewife	Drainage improvement and its related environmental; issues during construction and O&M phases	People are happy of the subproject; but expressed that it will improve the drainage partly	An integrated drainage project is required to improve the overall drainage problems in the *pourashava*; Public awareness of not using drains as dustbins along with drainage improvement is required to arrest the problems. Under the proposed project drainage improvement can be done phase-wise or with the assistance of other projects. An integrated drainage master plan is needed.	People will extend all out supports in the project implementation including construction.

Figure 6: Stakeholders consultations at Cox's Bazar (FGDs at Cox's Bazar)

C. Summary

107. People want to have all development works but they want to have sound design and construction so that they are not affected by environmental pollution. This is to be addressed in design. Construction supervision should ensure sound and sustainable engineering practice so that there is no further environmental impact to people's life. Following points from FGD can be cited:

(i) All the proposed infrastructure implementation is needed for Cox's Bazar *pourashava*, all will provide benefit, no major environmental concern
(ii) All development works are essential but sound design and construction is necessary so that they are not affected by environmental pollution.
(iii) Major problem is drainage congestion, less cleaning, drains are filled with solid waste
(iv) Water logging and flooding are major concerns, road and drains needs to be improved
(v) The causes of water logging problem is mainly the inadequate drainage network, seasonal sub-mergence, clogging due to garbage dumping
(vi) Special safety measures should be taken to avoid land subsidence due to heavy construction activities
(vii) Flooding and water logging both affect access to key activities
(viii) Traffic management is important, separate parking is necessary
(ix) During construction period public safety and workers' safety is important
(x) Noise and air pollution is required to be controlled
(xi) Drainage water from market may pollute water of river/canal

D. Proposed Future Consultation Plan

108. The future public involvement in monitoring impacts and mitigation measures during the construction and operation stages and includes a Public Consultation Plan as shown in Table 19, Public consultation plans are part of the project implementation and management plan. The Executive Agency (LGED) and Implementing Agency (Cox's Bazar *pourashava*) are responsible for public consultation during project implementation. Costs for public consultation activities during construction are proposed to be covered from budget of supervision consultancy contract.

Table 19: Public Consultation Plan

Organizer	Approach	Time and Frequency	Subject	Participants
Pre-Construction stage				
LGED and Cox's Bazar pourashava	Workshop	Before starting of construction	Disclosure of all development activities and its impact and disclosure of possible conservation and restoration of the mosque	All people of Cox's Bazar local government people, administrative staff, LGED local staff, Pourashava staff, PWD, RHD, Water Development Board, BMD, DPHE and other government departments, local public representatives, educationalist, environmentalist, business man, service holder, beneficiaries, NGOs, local leaders, local concerned people, general peoples, media, etc.
Construction stage				
LGED and Cox's Bazar pourashava	Public consultation and site visits	At least once a year	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Work staff within construction area; Residents within Construction area
	Expert workshop or press conference	As needed, based on public consultation	Comments and suggestions on mitigation measures, public opinions; adjusting mitigation measures accordingly	Experts from various sectors, media
	Public workshop	At least once a year	Adjusting mitigation measures if necessary construction impacts, comments and suggestions	Representatives of residents and social sectors
Operation Stage				
pourashava	Public consultation and site visits	At least once	Effectiveness of mitigation measures, impacts of operation, mitigation measures, comments and suggestions	Residents adjacent to project sites, users and beneficiaries
	Public satisfaction survey	At least once	Comments and Suggestions	Project beneficiaries and users

VII. GRIEVANCE REDRESS MECHANISM

109. A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of AP's concerns, complaints, and grievances about the social and environmental performance at the level of the project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

110. **Common GRM.** A common GRM will be in place for social, environmental, or any other grievances related to the project; the resettlement plans (RPs) and IEEs will follow the GRM described below, which is developed in consultation with key stakeholders. The GRM will provide an accessible and trusted platform for receiving and facilitating resolution of affected persons' grievances related to the project. The multi-tier GRM for the project is outlined below, each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required.

111. *Pourashava*-wide public awareness campaigns will ensure that awareness on grievance redress procedures is generated through the campaign. The project implementation unit (PIU) designated safeguard focal person and governance improvement and capacity development consultants (GICDC) will conduct *pourashava*-wide awareness campaigns to ensure that poor and vulnerable households are made aware of grievance redress procedures and entitlements, and will work with the PMU and management, design and supervision consultants (MDSC) to help ensure that their grievances are addressed.

112. Affected persons (APs) will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes that have already been installed by project *pourashavas* or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaints register in *pourashava* offices. Appendix 5 has the sample grievance registration form. Careful documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. The project management unit (PMU) safeguard officer will have the overall responsibility for timely grievance redressal on environmental and social safeguards issues and for registration of grievances, related disclosure, and communication with the aggrieved party through the PIU designated safeguard focal person.

113. **Grievance redress process.** In case of grievances that are immediate and urgent in the perception of the complainant, the contractor and MDSC on-site personnel will provide the most easily accessible or first level of contact for quick resolution of grievances. Contact phone numbers and names of the concerned PIU safeguard focal person and contractors, will be posted at all construction sites at visible locations.

(i) **1st Level Grievance.** The phone number of the PIU office should be made available at the construction site signboards. The contractors and PIU safeguard focal person can immediately resolve on-site in consultation with each other, and will be required to do so within 7 days of receipt of a complaint/grievance.

(ii) **2nd Level Grievance.** All grievances that cannot be redressed within 7 days at field/ward level will be reviewed by the grievance redress cell (GRC) headed by Panel Mayor of the *pourashava* with support from PIU designated safeguard focal person and MDSC regional environment and resettlement specialists. GRC will attempt to resolve them within 15 days. The PIU designated safeguard focal

person will be responsible to see through the process of redressal of each grievance.

(iii) **3rd Level Grievance.** The PIU designated safeguard focal person will refer any unresolved or major issues to the PMU safeguard officer and MDSC national environmental and resettlement specialists. The PMU in consultation with these officers/specialists will resolve them within 30 days.

114. Despite the project GRM, an aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

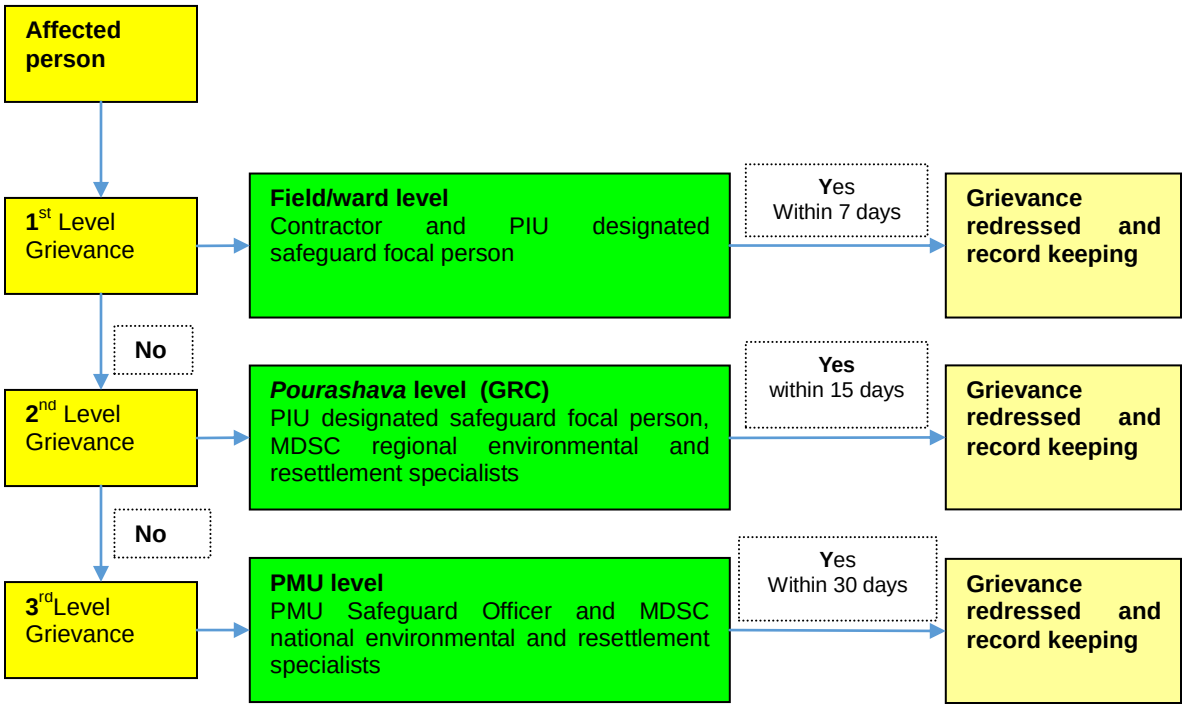
115. In the event that the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism (AM) through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB Bangladesh Resident Mission (BRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will be included in the PID to be distributed to the affected communities, as part of the project GRM.

116. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PMU office, pourashava office, and on the web, as well as reported in monitoring reports submitted to ADB on a semi-annual basis.

117. **Periodic review and documentation of lessons learned.** The PMU safeguard officer will periodically review the functioning of the GRM in each *pourashava* and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address grievances.

118. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the concerned PIU at *pourashava*-level; while costs related to escalated grievances will be met by the PMU. Cost estimates for grievance redress are included in resettlement cost estimates.

Figure 7: Grievance Redress Process



Note: GRC = Grievance Redressal Cell, GICDC = governance improvement and capacity development consultants, PIU = project implementation unit, MDSC = management design and supervision consultants, PMU =project management unit.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

119. The purpose of the environmental management plan (EMP) is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

120. A copy of the EMP must be kept on work sites at all times. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

121. For civil works, the contractor will be required to (i) establish an operational system for managing environmental impacts (ii) carry out all of the monitoring and mitigation measures set forth in the EMP; and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

A. Institutional Arrangement

122. **Executing and implementing agencies**. LGED and DPHE, both under the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), are the executing agencies (EA). LGED is responsible for providing support and guidance to *pourashavas* concerning performance criteria and *pourashava* development planning. DPHE will provide support in water supply and sanitation schemes. Participating *pourashavas* are the implementing agencies (IA).

B. Safeguard Implementation Arrangement

123. **Project management unit.** A PMU is established for the overall management of the project. The PMU is headed by Project Director (PD) supported by officials including three project managers in charge of (i) municipal infrastructure(excluding water supply and sanitation), (ii) water supply and sanitation, and (iii) governance improvement and capacity development, respectively. The PMU will receive support from national environmental specialist and national resettlement specialist on the MDSC team. Key tasks and responsibilities of the PMU safeguard (environment) officer are as follows:

(i) confirm existing IEEs/EMPs are updated based on detailed designs, and that new IEEs/EMPs are prepared in accordance with the EARF and subproject selection criteria related to safeguards;
(ii) confirm whether IEEs/EMPs are included in bidding documents and civil works contracts;
(iii) provide oversight on environmental management aspects of subprojects and ensure EMPs are implemented by project implementation unit (PIU) and contractors;
(iv) establish a system to monitor environmental safeguards of the project, including monitoring the indicators set out in the monitoring plan of the EMP;
(v) facilitate and confirm overall compliance with all government rules and regulations regarding site and environmental clearances, as well as any other environmental requirements (e.g., location clearance certificates, environmental clearance certificates, etc.), as relevant;
(vi) supervise and provide guidance to the PIUs to properly carry out the environmental monitoring and assessments as per the EARF;
(vii) review, monitor, and evaluate the effectiveness with which the EMPs are implemented, and recommend necessary corrective actions to be taken as necessary;
(viii) consolidate monthly environmental monitoring reports from PIUs and submit semi-annual monitoring reports to ADB;
(ix) ensure timely disclosure of final IEEs/EMPs in locations and form accessible to the public; and
(x) address any grievances brought about through the grievance redress mechanism in a timely manner.

124. **Project implementation unit**. The participating *pourashavas* will establish a PIU within the *pourashava* structure. The PIUs will (i) be responsible for land acquisition; (ii) take necessary action for obtaining rights of way; (iii) plan, implement and monitor public relations activities, gender mainstreaming initiatives and community participation activities at *pourashava* level; (iv) disseminate information related to the project to the public and media; (v) ensure

compliance with loan covenants concerning safeguards measures; and (vi) facilitate implementation of safeguards plans. The PIUs will each designate a Safeguard Officer[12] and will receive assistance from the assigned MDSC regional environmental specialist to:

(i) update IEEs/EMPs during detailed design stage and prepare new IEEs/EMPs in accordance with the EARF;
(ii) conduct environmental compliance audit of existing facilities as per Item F, Appendix 5 of ADB SPS, 2009;
(iii) include IEEs/EMPs in bidding documents and civil works contracts;
(iv) comply with all government rules and regulations;
(v) take necessary action for obtaining rights of way;
(vi) oversee implementation of EMPs including environmental monitoring by contractors;
(vii) take corrective actions when necessary to ensure no environmental impacts;
(viii) submit monthly environmental monitoring reports to PMU,
(ix) conduct continuous public consultation and awareness;
(x) address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs; and
(xi) organize an induction course for the training of contractors preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures; and taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation.

125. **Project Management, Design and Supervision Consultants (MDSC).** MDSC will be engaged to work closely with and advise the PMU, to be involved in project supervision including monitoring during construction phase. The MDSC will have one national environmental specialist and three regional environmental specialist as well as one national resettlement specialist and three regional resettlement specialist. The MDSC national environmental specialist will, but not limited to:

(i) work under the general supervision of the team leader and the deputy team leader;
(ii) review the environmental guidelines and requirement of the government of Bangladesh and ADB SPS, 2009, environmental subproject selection guidelines and EARF;
(iii) Guide the implementation of future subprojects;
(iv) provide technical support to the PMU and PIUs including review and update of EARF and guidelines for specific type of subprojects and assist in preparing terms of reference for environmental assessment;
(v) assist and guide the MDSC regional environmental specialists to provide support to environmental management functions including updating subproject IEEs in respect to EMP;
(vi) assist in preparing IEEs and in monitoring impact and mitigation measures associated with subprojects;
(vii) assist PIUs and MDSC regional environmental specialists working in the steps for preparing the EIA/IEE, capacity building and training, preparation of guidelines and procedure and subproject specific guidance;

[12] It is recommended that existing *pourashava* health officer or executive engineer will also work as safeguard officer in addition to his/her regular responsibilities within the *pourashava*.

(viii) provide support and guidance to PIUs in undertaking environmental monitoring
(ix) support PMU in submitting semi-annual environmental monitoring reports to ADB;
(x) facilitate in grievance redress and corrective actions;
(xi) train PIU officials regarding environmental requirement and issues; and
(xii) perform any other task assigned by the team leader, deputy team leader and the project director.

126. The MDSC regional environmental specialists will, but not limited to:

(i) work under the supervision and guidance of the team leader, deputy team leader and MDSC national environmental specialist;
(ii) assist PIUs in preparing and updating IEEs including EMPs in accordance with the EARF, and assist in monitoring impact and mitigation measures associated with subprojects including implementation of EMPs by contractors;
(iii) assist in preparation of IEEs and in the environmental review of subproject consisting of screening at *pourashava* level by PIU through a committee formed with municipal mayor as chairman and representatives from DOE, LGED and other relevant district office as members;
(iv) assist PIUs in the steps for preparing EIA/IEE, capacity building and training, preparation of guidelines and procedure and subproject specific guidance;
(v) support PIU in environmental monitoring and submit monitoring reports to PMU as inputs into the semi-annual monitoring report submitted to ADB;
(vi) undertake mitigation measures and other specific measures in the construction contract;
(vii) facilitate in grievance redress and corrective actions;
(viii) follow subproject selection guidelines and EARF to ensure compliance with the environmental guidelines and requirement of the Government of Bangladesh and ADB SPS, 2009;
(ix) support PMU and MDSC national environment specialist by providing data, information and all other requested assistance;
(x) train PIU officials regarding environmental issues
(xi) perform any other task assigned by MDSC national environment specialist, team leader, deputy team leader and the project director.

127. **Civil works contracts and contractors**. EMPs are to be included in bidding and contract documents and verified by the PIUs and PMU. The contractor will be required to designate an environmental supervisor to (i) coordinate with MDSC on updating the IEE/EMP based on detailed designs, and (ii) ensure implementation of EMP during civil works. Contractors are to carry out all environmental mitigation and monitoring measures outlined in their contract.

128. **Governance Improvement and Capacity Development Consultants (GICDC).** The PMU and PIUs will require support on a range of activities related to governance improvement and capacity development of *pourashavas*. The GICDC will support PMU and PIUs in implementing urban government improvement action plan (UGIAP) by providing capacity development, community mobilization and other facilitation services. There will be 4 GICDC regional offices consisting of 4 regional coordinators at each regional office. There will be 2community mobilizers in each project *pourashava*. The regional coordinators will assist *pourashavas* and the local capacity development experts in the activities related to community participation and inclusive development. The community mobilizers will be posted at the

pourashava and will (i) have to work maintaining close liaison with the mayor, councilors, *pourashava* staffs and communities, (ii) provide assistance and support to PIU regarding planning and implementation of citizen awareness and participation activities, urban planning, equity and inclusiveness of women and urban poor. The GICDC will also have a training specialist who will be responsible for identifying and coordinating capacity building activities at *pourashava* level.

Figure 8: Safeguards Implementation Arrangement

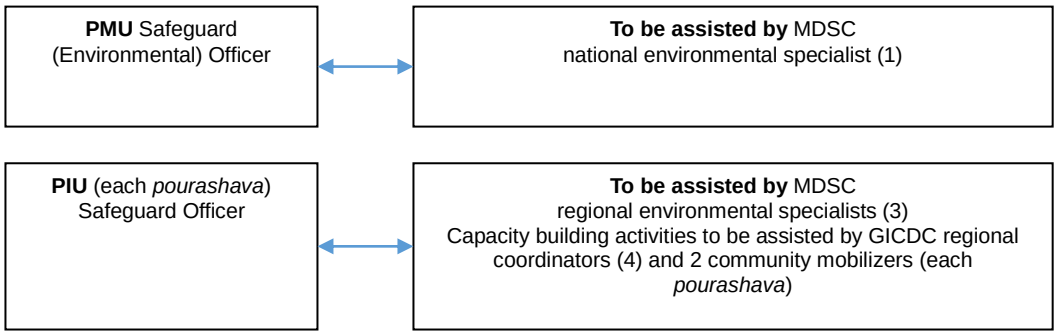


Table 20: Environmental Management and Monitoring Plan – Prior, During, and Post Construction Phase

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
1. Prior to Construction Activities						
Consents, permits, clearances, no objection certificate (NOC), etc.	Failure to obtain necessary consents, permits, NOCs, etc can result to design revisions and/or stoppage of works	• Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works. • Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc. • Include in detailed design drawings and documents all conditions and provisions if necessary	Project management unit (PMU), project implementing unit (PIU), Management Design Supervision Consultants (MDSC)	• Incorporated in final design and communicated to contractors.	• Prior to award of contract	• No cost required. Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PMU and PIU. • • Mitigation measures are included as part of TOR of PMU, PIU, MDSC
Updating of IEE based on detailed design	Site-specific impacts not identified, mitigation measures not appropriate and sufficient to address impacts	• Update IEE and EMP based on detailed design • Ensure updated EMP is provided to contractors • Relevant information disclosed	PMU	• Updated IEE and EMP reviewed, approved and disclosed	• Upon completion of detailed design	• No additional cost required
Existing utilities	Disruption of services.	• Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction activities • Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. • Require contractors to prepare spoils management plan (see Appendix 2 for outline) and traffic management plan (see Appendix 3 for sample)	PMU, PIU, MDSC	• List of affected utilities and operators; • Bid document to include requirement for a contingency plan for service interruptions (example provision of water if disruption is more than 24 hours), spoil management plan (Appendix 2), and traffic management plan	• During detailed design phase • Review of spoils management plan: Twice (once after first draft and once before final approval)	• No cost required. • Mitigation measures are included as part of TOR of PMU, PIU, MDSC.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
				(Appendix 3)		
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	• Determine locations prior to award of construction contracts.	PMU, PIU, and MDSC	• List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. • Written consent of landowner/s (not lessee/s) for reuse of excess spoils to agricultural land	• During detailed design phase	• No cost required. • Mitigation measures are included as part of TOR of PMU, PIU, and MDSC.
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	• Prepare list of approved quarry sites and sources of materials	PMU, PIU, and MDSC	• List of approved quarry sites and sources of materials; • Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	• During detailed design phase, as necessary with discussion with detailed design engineers and PIUs	• No cost required. • Mitigation measures are included as part of TOR of PMU, PIU, and MDSC.
EMP Implementation Training	Irreversible impact to the environment, workers, and community	• Project manager and all key workers will be required to undergo EMP implementation including spoils management, Standard operating procedures (SOP) for construction works; health and safety (H&S), core labor laws, applicable environmental laws, etc	Construction Contractor	• Proof of completion (Safeguards Compliance Orientation) • Posting of proof of completion at worksites • Posting of EMP at worksites	• During detailed design phase prior to mobilization of workers to site	• Cost of EMP Implementation Orientation Training to contractor is responsibility of PMU and PIU. • Other costs responsibility of contractor.
2. During Construction Activities						
A. Physical Characteristics						
Topography, landforms, geology and	Significant amount of gravel, sand, and cement will be	• Utilize readily available sources of materials. If contractor procures materials from existing	Construction Contractor	• Records of sources of materials	• Monthly by PIU	• Cost for implementation of mitigation

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
soils	required for this subproject. Extraction of construction materials may cause localized changes in topography and landforms. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	burrow pits and quarries, ensure these conform to all relevant regulatory requirements. • Borrow areas and quarries (If these are being opened up exclusively for the subproject) must comply with environmental requirements, as applicable. No activity will be allowed until formal agreement is signed between PIU, landowner and contractor.				measures responsibility of contractor.
Water quality	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Cox's Bazaar local authority on designated disposal areas. • All earthworks must to be conducted during dry season to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff. • Location for stockyards for construction materials shall be identified at least 300m away from watercourses. Place storage areas for fuels and lubricants away from any drainage leading to water bodies. • Take all precautions to minimize the wastage of water in the construction activities. • Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system. Install temporary silt traps or	Construction Contractor	• Areas for stockpiles, storage of fuels and lubricants and waste materials; • Number of silt traps installed along trenches leading to water bodies; • Records of surface water quality inspection; • Effectiveness of water management measures; • No visible degradation to nearby drainages, khals or water bodies due to construction activities	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		sedimentation basins along the drainage leading to the water bodies. • Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low lying areas. • While working across or close to any water body, the flow of water must not be obstructed. Ensure no construction materials like earth, stone, or appendage are disposed of in a manner that may block the flow of water of any watercourse and cross drainage channels. • Monitor water quality according to the environmental management plan.				
Air quality	Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather; • Use tarpaulins to cover soils, sand and other loose material when transported by trucks. • Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. • Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject). • Monitor air quality.	Construction Contractor	• Location of stockpiles; • Number of complaints from sensitive receptors; • Heavy equipment and machinery with air pollution control devices; • Certification that vehicles are compliant with air quality standards.	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
Acoustic environment	Construction activities will be on settlements, along and near schools, and areas with small-scale businesses. Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and people. However, the proposed subproject will follow existing ROW alignment and impact is short-term, site-specific and within a relatively small area. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. • Plan activities in consultation with Cox's Bazaar local authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. • Use of high noise generating equipment shall be stopped during night time. • Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; • Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensure that these are maintained to manufacturers' specifications at all times. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required). • Monitor noise levels. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in	Construction Contractor	• Number of complaints from sensitive receptors; • Use of silencers in noise-producing equipment and sound barriers; • Equivalent day and night time noise levels	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		a posted noise hazard area must wear hearing protection. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly.				
Aesthetics	The construction activities do not anticipate any cutting of trees but will produce excess excavated earth (spoils), excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare the Debris Disposal Plan • Remove all construction and demolition wastes on a daily basis. • Coordinate with Cox's Bazaar local authority for beneficial uses of excess excavated soils or immediately dispose to designated areas Avoid stockpiling of any excess spoils • Suitably dispose of collected materials from drainages, unutilized materials and debris either through filling up of pits/wasteland or at pre-designated disposal locations. • All vehicles delivering fine materials to the site and carrying waste debris for disposal shall be covered to avoid spillage of materials. All existing roads used by vehicles of the contractor, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • Lighting on construction sites shall be pointed downwards and away from oncoming traffic and nearby houses. • In areas where the visual environment is particularly important or privacy concerns	Construction Contractor	• Number of complaints from sensitive receptors; • Worksite clear of hazardous wastes such as oil/fuel • Worksite clear of any wastes, collected materials from drainages, unutilized materials and debris • Transport route and worksite cleared of any dust/mud	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of) subproject components	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction. • The site must be kept clean to minimize the visual impact of the site. Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;				
B. Biological Characteristics						
Biodiversity	Activities being located in the built-up area of Cox's Bazaar *pourashava.* There are no protected areas in or around subproject sites, and no known areas of ecological interest. There are no trees at the site that need to be removed.	• Check if tree-cutting will be required during detailed design stage. No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of the environment management specialist. • If during detailed design cutting of tress will be required, compensatory plantation for trees lost at a rate of 2 trees for every tree cut, in addition to tree plantation as specified in the design, will be implemented by the contractor, who will also maintain the saplings for the duration of his contract. • All efforts shall be made to preserve trees by evaluation of minor design adjustments/ alternatives (as applicable) to save trees. • Special attention shall be given for protecting giant trees and locally-important trees (with religious importance) during implementation.	Construction Contractor	• PMU and PIU to report in writing the number of trees cut and planted if tree-cutting will be required (to be determined during detailed design stage) • Number of complaints from sensitive receptors on disturbance of vegetation, poaching, fishing, etc.	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of) subproject components	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		• Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body in the subproject vicinity. • Prohibit employees from poaching wildlife and cutting of trees for firewood.				
C. Socioeconomic Characteristics						
Existing provisions for pedestrians and other forms of transport	Road closure is not anticipated. Hauling of construction materials and operation of equipment on-site can cause traffic problems. However, the proposed subproject will follow existing ROW alignment. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare and implement a Traffic Management Plan (see Appendix 3 for sample) • Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Maintain safe passage for vehicles and pedestrians throughout the construction period. • Schedule truck deliveries of construction materials during periods of low traffic volume. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of construction activities and contact numbers for concerns/complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain access across for	Construction Contractor	• Traffic route during construction works including number of permanent signages, barricades and flagmen on worksite as per Traffic Management Plan (see Appendix 3 for sample); • Number of complaints from sensitive receptors; • Number of signages placed at project location • Number of walkways, signages, and metal sheets placed at project location	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of) subproject components	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. Ensure there is provision of alternate access to businesses and institutions during construction activities, so that there is no closure of these shops or any loss of clientage. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.				
Socio-economic status	Subproject components will be located in government land and existing ROWs thus there is no requirement for land acquisition or any resettlements. Manpower will be required during the XXX-months construction stage. This can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term.	• Employ at least 50% of labor force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation. • Secure construction materials from local market.	Construction Contractor	• Employment records; • Records of sources of materials • Records of compliance to Bangladesh Labor Law of 2006 and other applicable standards	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of) subproject components	• Cost for implementation of mitigation measures responsibility of contractor.
Other existing amenities for	Although construction of subproject	• Provide safety signage at all sites visible to public	Construction Contractor	• Utilities Contingency Plan	• Visual inspection by	• Cost for implementation

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
community welfare	components involves quite simple techniques of civil work, the invasive nature of excavation and the subproject sites being in built-up areas of Cox's Bazaar *pourashava* where there are a variety of human activities, will result to impacts to the sensitive receptors such as residents, businesses, and the community in general. Excavation may also damage existing infrastructure (such as water distribution pipes, electricity pylons, etc) located alongside the roads. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Obtain details from pourashava nature and location of all existing infrastructure, and plan excavation carefully to avoid any such sites to maximum extent possible; • Integrate construction of the various infrastructure subprojects to be conducted in Cox's Bazaar (roads, water supply, etc.) so that different infrastructure is located on opposite sides of the road where feasible and roads and inhabitants are not subjected to repeated disturbance by construction in the same area at different times for different purposes. • Consult with local community to inform them of the nature, duration and likely effects of the construction work, and to identify any local concerns so that these can be addressed. • Existing infrastructure (such as water distribution pipes, electricity pylons, etc.) shall be relocated before construction starts at the subproject sites. • Prior permission shall be obtained from respective local authority for use of water for construction. Use of water for construction works shall not disturb local water users. • If construction work is expected to disrupt users of community		• Number of complaints from sensitive receptors	PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of) subproject components	of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		water bodies, notice to the affected community shall be served 7 days in advance and again 1 day prior to start of construction. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.				
Community health and safety	Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures. Poor safety signage and lack of barriers at work site and trenches will create hazard to pedestrians and children.	• Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Contractor's activities and movement of staff will be restricted to designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Cox's Bazaar local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/storage area on private land, he must get prior permission from the environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-	Construction Contractor	• Number of permanent signages, barricades and flagmen on worksite as per Traffic Management Plan (see Appendix 3 for sample); • Number of complaints from sensitive receptors; • Number of walkways, signages, and metal sheets placed at project location • Agreement between landowner and contractors in case of using private lands as work camps, storage areas, etc.	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of) subproject components	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.[a] • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • Interested and affected parties need to be made aware of the				

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the national/regional environmental specialist's attention immediately; and (iv) taking remedial action as per national/regional environment specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the national/regional environmental specialist within 48 hours of receipt of such complaint/grievance.				
Workers health and safety	There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in urban areas. Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.	• Comply with requirements of Government of Bangladesh Labor Law of 2006 and all applicable laws and standards on workers 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	Construction Contractor	• Site-specific H&S Plan • Equipped first-aid stations • Medical insurance coverage for workers • Number of accidents • Records of supply of uncontaminated water • Condition of eating areas of workers • Record of H&S orientation	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of)	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		health and safety (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[b] 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		trainings • Use of personal protective equipment • % of moving equipment outfitted with audible back-up alarms • Permanent sign boards for hazardous areas • Signages for storage and disposal areas • Condition of sanitation facilities for workers	subproject components	

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		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.				
D. Historical, Cultural, and Archaeological Characteristics						
Physical and cultural heritage	Construction works will be on existing roads and in built-up areas of Cox's Bazaar thus risk for chance finds is low.	• All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the government. • Prevent workers or any other persons from removing and damaging any fossils, coins,	Construction Contractor	• Records of chance finds	• Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		articles of value of antiquity, structures and other remains of archaeological interest. • Stop work immediately to allow further investigation if any finds are suspected.			sites to be finalized during detailed design stage and final location of) subproject components	
E. Others						
Submission of EMP implementation report	Unsatisfactory compliance to EMP	• Appointment of supervisor to ensure EMP implementation • Timely submission of monitoring reports including pictures	Construction contractor	• Availability and competency of appointed supervisor • Monthly report	• Monthly monitoring report to be submitted by PIU to PMU • PMU to submit semi-annual monitoring report to ADB	• Cost for implementation of mitigation measures responsibility of contractor.
3. Post-construction Activities						
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	• Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and • All excavated roads shall be reinstated to original condition. • All disrupted utilities restored • All affected structures rehabilitated/compensated • The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. • All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be topsoiled and regrassed using the guidelines set out in the	Construction Contractor	• PMU report in writing that (i) worksite is restored to original conditions; (ii) camp has been vacated and restored to pre-project conditions; (iii) all construction related structures not relevant to O&M are removed; and (iv) worksite clean-up is satisfactory.	• Prior to turn-over of completed works to pourashava	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		revegetation specification that forms part of this document. • The contractor must arrange the cancellation of all temporary services. • Request PMU/CSS to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.				

[a] These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

[b] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

Table 21: Environmental Management and Monitoring Plan – O&M Phase

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	• Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and • All excavated roads shall be reinstated to original condition. • All disrupted utilities restored • All affected structures rehabilitated/compensated • The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. • All hardened surfaces within the construction camp area shall be ripped, all imported materials	Construction Contractor	• PMU/MDSC report in writing that (i) worksite is restored to original conditions; (ii) camp has been vacated and restored to pre-project conditions; (iii) all construction related structures not relevant to O&M are removed; and (iv) worksite clean-up is satisfactory.	• Prior to turn-over of completed works to pourashava	• Cost for implementation of mitigation measures responsibility of contractor.

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		removed, and the area shall be topsoiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. • The contractor must arrange the cancellation of all temporary services. • Request PMU/CSS to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.				

Table 22: Environmental Management and Monitoring Plan – O&M Phase

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
A. Physical Characteristics						
Water quality	Run-off from stockpiled debris/sediments from drainages which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies. • Remove all debris/sediments immediately. • Dispose debris/sediments at a designated site such as landfill. It is important that the designated disposal site's base is of a non-permeable membrane in order to prevent leachate that can contaminate the soil	• Cox's Bazaar pourashava	• No visible degradation to nearby drainages, khals or water bodies due to construction activities	• Duration of repair works	• Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		and groundwater.				
Air quality	Moving debris/sediments from drainages may create dusts during dry season. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Use tarpaulins to cover soils, sand and other loose material.	• Cox's Bazaar *pourashava*	• No complaints from sensitive receptors	• Duration of repair works	• Included in O&M cost
Acoustic environment	Temporary increase in noise level and vibrations. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Plan activities in consultation with Cox's Bazaar local authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly.	• Cox's Bazaar pourashava	• No complaints from sensitive receptors	• Duration of repair works	• Included in O&M cost
B. Biological Characteristics						
Biodiversity	Activities in the built-up area of Cox's Bazaar *pourashava.* There are no protected areas in or around	• No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission. • Prevent workers or any other person from	• Cox's Bazaar pourashava	• No complaints from sensitive receptors	• Duration of repair works	• Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
	subproject sites, and no known areas of ecological interest.	removing and damaging any flora (plant/vegetation) and fauna (animal).				
C. Socioeconomic Characteristics						
Existing provisions for pedestrians and other forms of transport	Road closure is not anticipated. Traffic may be interrupted temporarily. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Maintain safe passage for vehicles and pedestrians during maintenance activities. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of maintenance activities and contact numbers for concerns/complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work	• Cox's Bazaar pourashava	• No complaints from sensitive receptors	• Duration of repair works	• Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		schedules. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.				
Workers health and safety	Workers need to be mindful of the occupational hazards working in confined spaces such as closed drains. Potential impacts are negative and long-term but reversible by mitigation measures.	• Comply with requirements of Government of Bangladesh Labor Law of 2006 and all applicable laws and standards on workers H&S. • Ensure that all site personnel have a basic level of H&S training. • Produce and implement a O&M health and safety (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	• Cox's Bazaar pourashava	• No complaints from sensitive receptors • No complaints from workers related to O&M activities • Zero accident	• Duration of repair works	• Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		supply of sterilized dressing materials and appliances • 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; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Mark and provide sign boards. 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. • 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.				
D. Historical, Cultural, and Archaeological Characteristics						
Physical and cultural heritage	Construction works will be on existing drainages and built-up areas	• All fossils, coins, articles of value of antiquity, structures and other remains of	• Cox's Bazaar pourashava	• Records of chance finds	• Duration of repair works	• Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
	of Cox's Bazaar thus risk for chance finds is low.	archaeological interest discovered on the site shall be the property of the government. • Prevent workers or any other persons from removing and damaging any fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest. • Stop work immediately to allow further investigation if any finds are suspected.				

C. Institutional Capacity Development Program

129. The MDSC national and regional environmental specialists will be responsible for trainings on environmental awareness and management in accordance with both ADB and government requirements. Specific modules customized for the available skill set will be devised after assessing the capabilities of the target participants and the requirements of the project. Typical modules would be as follows: (i) sensitization; (ii) introduction to environment and environmental considerations in water supply and wastewater projects; (iii) review of IEEs and integration into the project detailed design; (iv) improved coordination within nodal departments; and (v) monitoring and reporting system. The contractors will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. The proposed training project along with the frequency of sessions is presented in Table 23.

Table 23: Training Program for Environmental Management

Items	**Pre-construction/prior to construction**	**Construction**	
Training Title	Orientation workshop	Orientation program/ workshop for contractors and supervisory staffs	Experiences and best practices sharing
Purpose	To aware the participants of the environmental safeguard requirements of ADB and GOB and how the project will meet these requirements	To build the capacity of the staffs for effective implementation of the designed EMPs aimed at meeting the environmental safeguard compliance of ADB and GOB	To share the experiences and best practices aimed at learning lessons and improving implementation of EMP
Contents	**Module 1: Orientation** • ADB Safeguards Policy Statement • Government of Bangladesh Environmental Laws and Regulations **Module 2: Environmental Assessment Process** • ADB environmental process, identification of impacts and mitigation measures, formulation of an environmental management plan (EMP), implementation, and monitoring requirements • Review of environmental assessment report to comply with ADB requirements • Incorporation of EMP into the project design and contracts	• Roles and responsibilities of officials/contractors/consultants towards protection of environment • Environmental issues during construction • Implementation of EMP • Monitoring of EMP implementation • Reporting requirements	Experiences on EMP implementation – issues and challenges Best practices followed
Duration	1 day	1 day	1 day on a regular period to be determined by PMU, PIUs, and PMSC
Participants	LGED, DPHE, PMU, and PMU staffs (technical and environmental) involved in the project implementation	PMU PIUs Contractors	PMU PIUs Contractors

D. Staffing Requirement and Budget

130. Costs required for implementing the EMP will cover the following activities:

(i) Updating IEE, preparing and submitting reports and public consultation and disclosure;

(ii) Application for environmental clearances; and

(iii) Implementation of EMP, environmental monitoring program and long-term surveys.

131. The infrastructure involved in each scheme is generally straightforward and will take between three and nine months to build. Environmental monitoring during construction will also be straightforward and will involve periodic site observations and interviews with workers and others, plus checks of reports and other documents. This will be conducted by MDSC environmental management specialist assisted by the PMU environment officer. The environmental management specialist will use the IEE as necessary and perform tasks as specified in the TOR. Therefore no separate budget required for MDSC environment management specialist.

132. The cost of mitigation measures and surveys during construction stage will be incorporated into the contractor's costs, which will be binding on him for implementation. The surveys will be conducted by the contractors.

133. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of Cox's Bazar *pourashava*. All monitoring during the operation and maintenance phase will be conducted by LGED and DPHE, therefore, there are no additional costs.

134. The indicative costs to implement the EMP are shown in Tables 24-25 (by source of funds).

Table 24: Cost Estimates to Implement the EMP

	Particulars	Stages	Sub-project /package	Total number	Rate (BDT)	Cost (BDT)	Costs covered by
A. Mitigation Measures							
1.	Environmental mitigation / enhancement measures integrated into the designs and costs included as part of civil works	Construction				Covered under BoQ of Construction Document (CCD)	Civil Works Contract
2	Compensatory plantation measures	Construction	Per tree	50	1,500	75,000	Civil works contract
B. Monitoring parameter for establishing baseline during detailed design/before construction							
1	Air Quality Monitoring	Before construction	Per contract package	1	20,000	20,000	Civil works contractor
2	Noise level	Before construction	Per contract package	5	5,000	25,000	Civil works contractor
3	Water Quality monitoring (Surface water)	Before construction	Per contract package	1	20,000	20,000	Civil works contractor
C. Monitoring parameter during construction							
1.	Air Quality monitoring	Construction	Per contract package	2	20,000	40,000	Civil works Contract
2.	Noise level	Construction	Per contract package	5	5,000	25,000	Civil work contractor
3.	Water Quality monitoring (Surface water)	Construction	Per contract package	2	20,000	40,000	Civil work Contractor
4.	Survival Rate of Plantation and landscaping	Post construction	Per contract package,	2	5,000	10,000	Civil work Contractor
D. Monitoring Parameter during operation							
1.	Water Quality monitoring (Surface water)	Operation	Per subproject per year	2	20,000	40,000	Cox's Bazar *pourashava*
2.	Survival Rate of Plantation and landscaping	Operation	Per subproject per year (where applicable)	2	5,000	10,000	Cox's Bazar *pourashava*
E. Capacity Building							
1.	i) Orientation workshop for officials involved in the project implementation on ADB Safeguards Policy Statement, Government of Bangladesh environmental laws and regulations, and environmental assessment process; (ii) induction course contractors, preparing them on EMP	Module 1 – immediately upon engagement of the MDSC environmental specialists Module 2 – prior to award of civil works contracts (twice a year for 3.5 years)	lump sum 1 times 7 times		Module 1 –50,000 Module 2 –50,000 Module 2 –50,000	450,000	Covered under MDSC

	Particulars	Stages	Sub-project /package	Total number	Rate (BDT)	Cost (BDT)	Costs covered by
	implementation and environmental monitoring requirements related to mitigation measures; and taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;	Module 3 – prior to start of Phase 3 and upon completion of the project	1 times (Combined for all subprojects)				
3.	Experiences and best practices sharing	Construction (before phase 2)	Cumulative for all subprojects	LS		100,000	Covered under MDSC
D	Public Consultation	During detailed design (For update of IEE/EIA) and preconstruction		LS		500,000	Covered under MDSC
E	GRM implementation	During construction	As per requirement			As per PMU budget	Covered under PMU & PIUs
F	Consultant cost						
	MDSC national environmental specialist (1 person)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36 person months	320,000 per person month	11,520,000	Remuneration and budget for travel covered in the MDSC contract
	MDSC regional environmental specialists (2 persons)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36+17 each = 53 person-months	320,000 per person-month	16,960,000	Remuneration and budget for travel covered in the MDSC contract
G	**Administrative cost**						
	Legislation, permits, and agreements	During construction Permit for excavation, tree-cutting permits, etc	Per package	LS		50,000	These consents are to be obtained by contractor at his own expense.
	Environmental assessment and environmental clearances as per ECA and ECR requirements	Before construction ECC for red and Orange subproject	Per subproject (where applicable)	LS		500,000	LGED cost for municipal infrastructure
H	**Other costs**						
	Any unanticipated impact due to project implementation	Mitigation of any unanticipated impact		LS		Contractors' liability	Can be covered through contractor's

	Particulars	Stages	Sub-project /package	Total number	Rate (BDT)	Cost (BDT)	Costs covered by
		arising during construction phase and defect liability period					insurance

Table 25: Cost Estimates to Implement the EMP (by source funding)

	Particulars	Stages	Sub-project/package	Total number	Rate (BDT)	Cost (BDT)	Costs covered by
A. Contractor							
1.	Environmental mitigation / enhancement measures integrated into the designs and costs included as part of civil works	Construction				Covered under BoQ of Construction Document (CCD)	Civil Works Contract
2	Compensatory plantation measures	Construction	Per tree	50	1,500	75,000	Civil works contract
3.	Air Quality Monitoring	Before construction	Per contract package	1	20,000	20,000	Civil works contractor
4.	Noise level	Before construction	Per contract package	5	5,000	25,000	Civil works contractor
5.	Water Quality monitoring (Surface water)	Before construction	Per contract package	1	20,000	20,000	Civil works contractor
6.	Air Quality monitoring	Construction	Per contract package	2	20,000	40,000	Civil works Contract
7.	Noise level	Construction	Per contract package	5	5,000	25,000	Civil work contractor
8.	Water Quality monitoring (Surface water)	Construction	Per contract package	2	20,000	40,000	Civil work Contractor
9.	Survival Rate of Plantation and landscaping	Post construction	Per contract package	2	5,000	10,000	Civil work Contractor
10.	Any unanticipated impact due to project implementation	Mitigation of any unanticipated impact arising during construction phase and defect liability period		LS		Contractors' liability	Can be covered through contractor's insurance
B. PIU/*Pourashava*							
1.	Water Quality monitoring (Surface water)	Operation	Per subproject per year	2	20,000	40,000	Cox's Bazar *pourashava*
2.	Survival Rate of Plantation and landscaping	Operation	Per subproject per year (where applicable)	2	5,000	10,000	Cox's Bazar *pourashava*
C. MDSC							
1	i) Orientation workshop for officials involved in the project implementation on ADB	Module 1 – immediately upon engagement of the MDSC environmental	lump sum 1 times		Module 1 –50,000 Module 2 –50,000 Module 2 –50,000	450,000	Covered under MDSC

	Particulars	Stages	Sub-project/package	Total number	Rate (BDT)	Cost (BDT)	Costs covered by
	Safeguards Policy Statement, Government of Bangladesh environmental laws and regulations, and environmental assessment process; (ii) induction course contractors, preparing them on EMP implementation and environmental monitoring requirements related to mitigation measures; and taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;	specialists Module 2 – prior to award of civil works contracts (twice a year for 3.5 years) Module 3 – prior to start of Phase 3 and upon completion of the project	7 times 1 times (Combined for all subprojects)				
2	Experiences and best practices sharing	Construction (before phase 2)	Cumulative for all subprojects	LS		100,000	Covered under MDSC
3	Public Consultation	During detailed design (For update of IEE/EIA) and preconstruction		LS		500,000	Covered under MDSC
4	MDSC national environmental specialist (1 person)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36 person months	320,000 per person month	11,520,000	Remuneration and budget for travel covered in the MDSC contract
5	MDSC regional environmental specialists (2 persons)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36+17 each = 53 person-months	320,000 per person-month	16,960,000	Remuneration and budget for travel covered in the MDSC contract
D. PMU							
1	GRM implementation	During construction	As per requirement			As per PMU budget	Covered under PMU & PIUs
2	Legislation, permits, and agreements	During construction Permit for excavation, tree- cutting permits, etc	Per package	LS		50,000	These consents are to be obtained by contractor at his own expense.
3	Environmental assessment and environmental clearances as per ECA and ECR requirements	Before construction ECC for red and Orange subproject	Per subproject (where applicable)	LS		500,000	LGED cost for municipal infrastructure

IX. MONITORING AND REPORTING

135. PMU will monitor and measure the progress of EMP implementation. The monitoring activities will correspond with the project's risks and impacts, and will be identified in the IEEs for the projects. In addition to recording information on the work and deviation of work components from original scope PMU, PIU, and MDSC will undertake site inspections and document review to verify compliance with the EMP and progress toward the final outcome.

136. MDSC will submit monthly monitoring and implementation reports to PMU, who will take follow-up actions, if necessary. PMU will submit semi-annual monitoring reports to ADB (as per sample in Appendix 6). Subproject budgets will reflect the costs of monitoring and reporting requirements. Monitoring reports will be posted in a location accessible to the public.

137. LGED will document monitoring results, identify the necessary corrective actions, reflect them in a corrective action plan, and for each quarter, will study the compliance with the action plan developed in the previous quarter. Compliance with loan covenants will be screened by the Local Government Division (LGD) of the Ministry of Local Government, Rural Development, and Cooperatives (MLGRDC).

138. ADB will review project performance against the MLGRDC's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system. ADB will monitor projects on an ongoing basis until a project completion report is issued. ADB will carry out the following monitoring actions to supervise project implementation:

(i) conduct periodic site visits for projects with adverse environmental or social impacts;
(ii) conduct supervision missions with detailed review by ADB's safeguard specialists/officers or consultants for projects with significant adverse social or environmental impacts;
(iii) review the periodic monitoring reports submitted by EAs to ensure that adverse impacts and risks are mitigated, as planned and as agreed with ADB;
(iv) work with EAs to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the legal agreements, and exercise remedies to re-establish compliance as appropriate; and
(v) prepare a project completion report that assesses whether the objective and desired outcomes of the safeguard plans have been achieved, taking into account the baseline conditions and the results of monitoring.

X. CONCLUSION AND RECOMMENDATION

139. The process described in this document has assessed the environmental impacts of all elements of Cox' Bazar drainage subproject. All potential impacts were identified in relation to design and location, construction, and operation phases.

140. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible; thus, environmental impacts as being due to the project design or location were not significant.

141. Most of the individual elements of the subproject are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly

significant. Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other excavation. However, the routine nature of the impacts means that most can be easily mitigated. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. Mitigation will be assured by a program of environmental monitoring to ensure that all measures are implemented, and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

142. The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB and LGED project websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

APPENDIX 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Country/Project Title: Bangladesh: Third Urban Governance and Infrastructure Improvement (Sector) Project (UGIIP-3) – Additional Financing

Drain Improvement Rapid Environmental Assessment (REA) Checklist

Town: Cox's Bazar
Subproject Title: Development of drainage system with rehabilitation of Khal from RRRC office to Nazirartek

Screening questions	Yes	No	Remarks
A. Project siting Is the project area…			
•Densely populated?	✓		Area of Cox's Bazar *pourashava* is 22.6 km^2 with population of 167,477; density of 7,410 person per km^2.
•Heavy with development activities?		✓	The area is dominated by residential and tourist hotel and motel. A trace area is composed of agricultural land (newly formed wards).
Adjacent to or within any environmentally sensitive areas?			
•Cultural heritage site		✓	
•Protected area		✓	
•Wetland		✓	
•Mangrove		✓	
•Estuarine		✓	
•Buffer zone of protected area		✓	
•Special 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?		✓	Not applicable.
•Encroachment on precious ecology (e.g. sensitive or protected areas)?		✓	Not applicable.
•Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		✓	Not anticipated.
•Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		✓	Not anticipated.
•Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?		✓	Not anticipated.
•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?		✓	Not applicable. Construction will not involve use explosives and chemicals. Excavation will be done manually. Construction contractors will be required to implement health and safety (H&S) plan.
•Noise and vibration due to blasting and other civil works?	✓		Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and people. The impacts are negative but temporary, short-term, site-specific and not significant within a relatively small area and reversible through mitigation measures specified in the EMP.
•Dislocation or involuntary resettlement of people?		✓	Not applicable. Land acquisition and resettlement are

Screening questions	Yes	No	Remarks
			not required for the subproject.
•Dislocation and compulsory resettlement of people living in right-of-way?		✓	Not applicable. There are no encroachers or residential/commercial structures in the ROWs
•Disproportionate impacts on the poor, women and children, indigenous peoples or other vulnerable groups?		✓	Not applicable.
•Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		✓	Not applicable.
•Hazardous driving conditions where construction interferes with pre-existing roads?		✓	Road closures are not required. Construction contractors will be required to implement traffic management plan and coordinate with local authority.
•Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI and HIV/AIDS) from workers to local populations?		✓	Construction contractors will be required to provide sanitation facilities and ensure proper waste management at all times. Contracts will include provisions on STI and HIV/AIDS.
•Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		✓	Construction contractors will be required to ensure cleanliness at all times to prevent breeding of mosquitoes and rodents.
•Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?		✓	Not applicable.
•Increased noise and air pollution resulting from traffic volume?		✓	Not anticipated.
•Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		✓	Not anticipated.
•Social conflicts if workers from other regions or countries are hired?		✓	Priority in employment will be given to local residents.
•Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Improved management systems through capacity building and institutional development will ensure reduced burden on services and infrastructure.
•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?		✓	Not applicable. Construction will not involve use of explosives and chemicals.
•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?		✓	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.

A Checklist for Preliminary Climate Risk Screening

Screening Questions		Score	Remarks[a]
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	Project site is located in areas subject to cyclones and flooding. Components are designed to withstand such events
	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)?	1	Project design will include safe clearances and take into account peak water flow.
Materials	Would weather, current and likely future climate		The area does not experience large

Screening Questions		Score	Remarks[a]
and Maintenance	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	temperature range (between 5 and 36 degrees C)
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	1	Possible temporary loss of capacity of drain for short periods due to damage in extreme events (due to accumulation of sand within the drain)
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	The drains are designed on basis of peak water flow.

[a] 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.

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 risk

Subproject Classification as per ADB SPS 2009:
The impacts are minor, local and mostly construction related. It is construction of main drains and drainage outfall. No significant irreversible impacts are envisioned on human populations or environmentally sensitive areas including wetlands, forests, grasslands, and other natural habitats. All impacts can be mitigated under the scope of IEE.
Classification: Category B

Subproject Categorization as per DOE (ECR 1997)
Classification: Red (Engineering construction more than one hundred thousand taka)
Environmental Assessment Requirements: IEE as per SPS and EIA as per DOE

All other subprojects of drain at Cox's Bazar are similar or lower environmental impact category. Some subprojects are existing drain improvement only require EMP for those improvement work.

Prepared by TA 8913 consultant team for project preparation of UGIIP-3 additional financing
Designation: International Environmental Safeguard Specialist and National Environmental Safeguard Specialist
Date: August-October 2016

APPENDIX 2: SAMPLE OUTLINE SPOILS MANAGEMENT PLAN

I. Spoils information

   A. Materials type
   B. Potential contamination
   C. Expected volume and sources
   D. Spoil classification

II. Spoils management

   A. Transportation of spoil
   B. Storage of spoil
   C. Contaminated spoil
   D. Approved reuse and/or disposal sites

III. Records of reuse and/or disposal

APPENDIX 3: SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

(i) the safety of pedestrians, bicyclists, and motorists traveling through the construction zone;
(ii) protection of work crews from hazards associated with moving traffic;
(iii) mitigation of the adverse impact on road capacity and delays to the road users;
(iv) maintenance of access to adjoining properties; and
(v) addressing issues that may delay the project.

B. Operating Policies for TMP

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

(i) Make traffic safety and temporary traffic control an integral and high-priority element of every project from planning through design, construction, and maintenance.
(ii) Inhibit traffic movement as little as possible.
(iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
(iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
(v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
(vi) Train all persons that select, place, and maintain temporary traffic control devices.
(vii) Keep the public well informed.
(viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

3. **Figure A4.2 to Figure A4.12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

C. Analyze the impact due to street closure

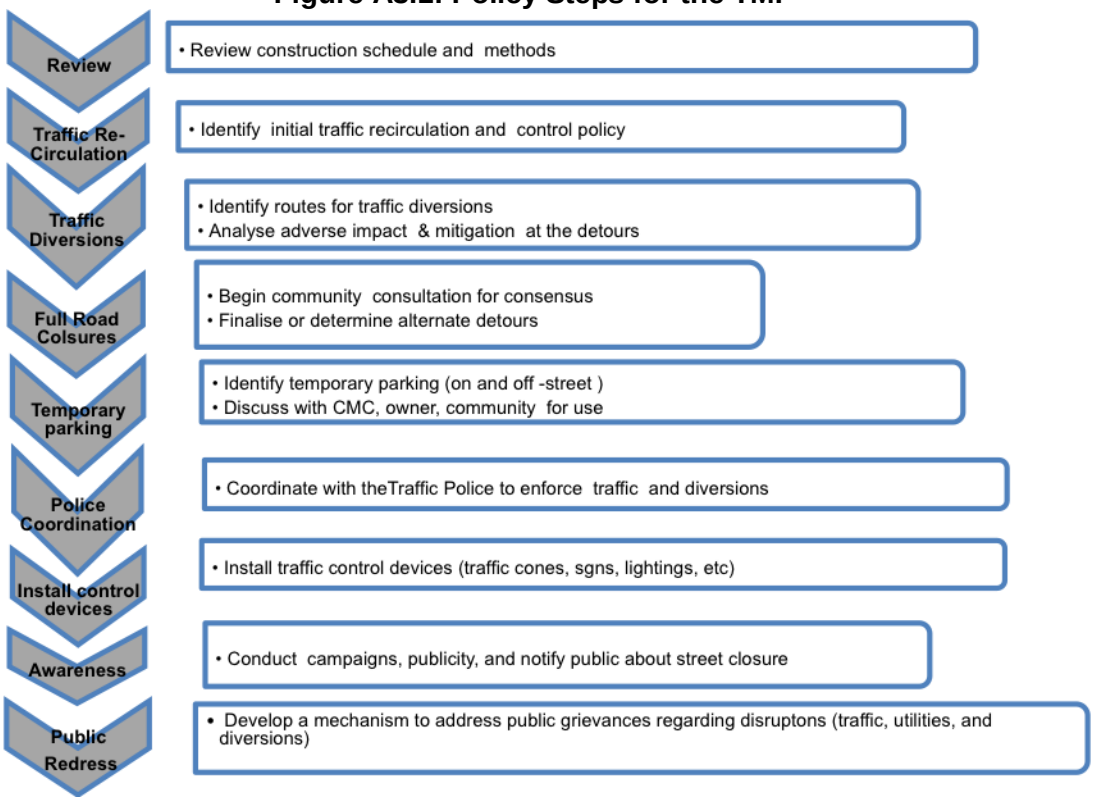
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the ULB/CMC/Public Works Department (PWD) to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
(iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;

(iv) determining if additional traffic control or temporary improvements are needed along the detour route;
(v) considering how access will be provided to the worksite;
(vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
(vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

5. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

Figure A3.1: Policy Steps for the TMP



D. Public awareness and notifications

6. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

7. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

8. The PIU will also conduct an awareness campaign to educate the public about the following issues:

(i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
(ii) defensive driving behaviour along the work zones; and
(iii) reduced speeds enforced at the work zones and traffic diversions.

9. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

10. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

(i) explain why the brochure was prepared, along with a brief description of the project;
(ii) advise the public to expect the unexpected;
(iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
(iv) educate the public about the safe road user behaviour to emulate at the work zones;
(v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
(vi) indicate the office hours of relevant offices.

E. Install traffic control devices at the work zones and traffic diversion routes

11. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

(i) Signs
(ii) Pavement Markings
(iii) Channelizing Devices
(iv) Arrow Panels
(v) Warning Lights

12. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

13**.** **Figure A3.2 to Figure A3.12** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

(i) Work on shoulder or parking lane
(ii) Shoulder or parking lane closed on divided road
(iii) Work in Travel lane
(iv) Lane closure on road with low volume
(v) Lane closure on a two-line road with low volume (with yield sign)
(vi) Lane closure on a two-line road with low volume (one flagger operation)
(vii) Lane closure on a two lane road (two flagger operation)
(viii) Lane closure on a four lane undivided Road
(ix) Lane closure on divided roadway
(x) Half road closure on multi-lane roadway
(xi) Street closure with detour

14. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

15. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

Figure A3.2 & A3.3: Work on shoulder or parking lane and shoulder or parking lane closed on divided road

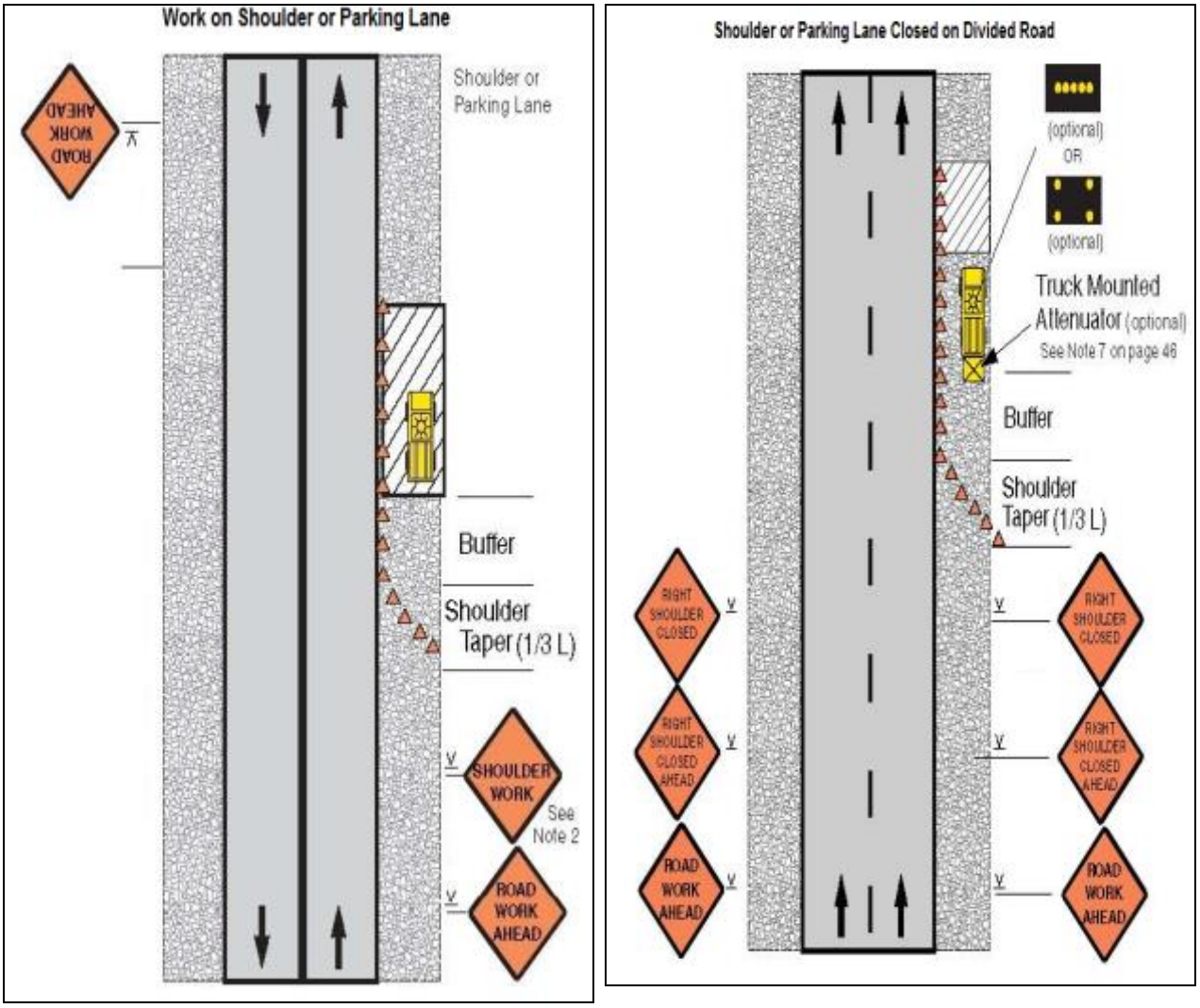
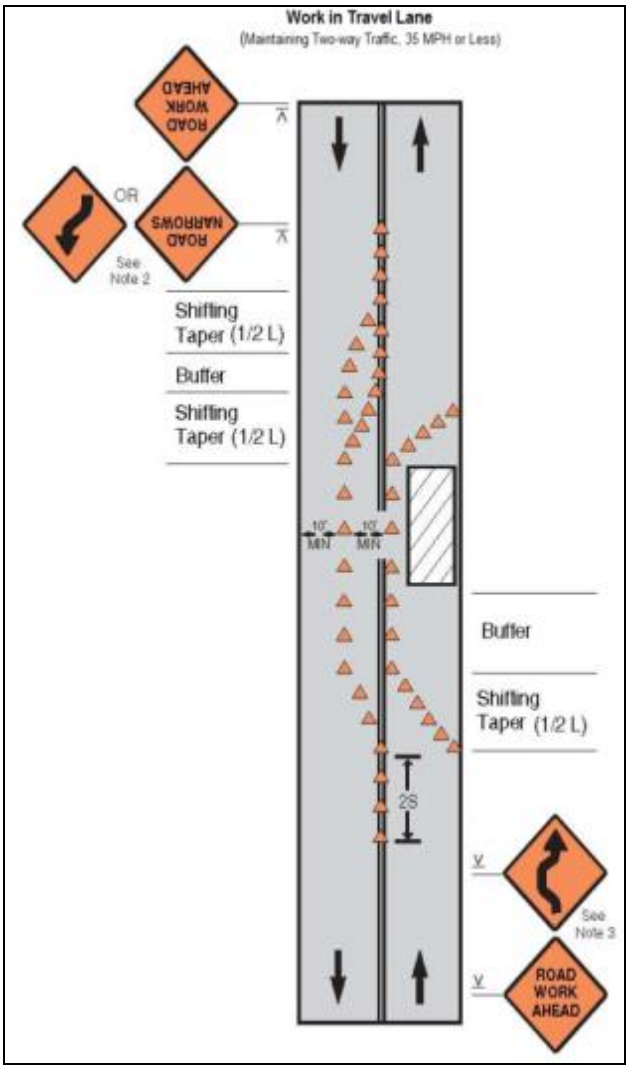


Figure A3.4 & A3.5: Work in Travel lane & Lane closure on road with low volume



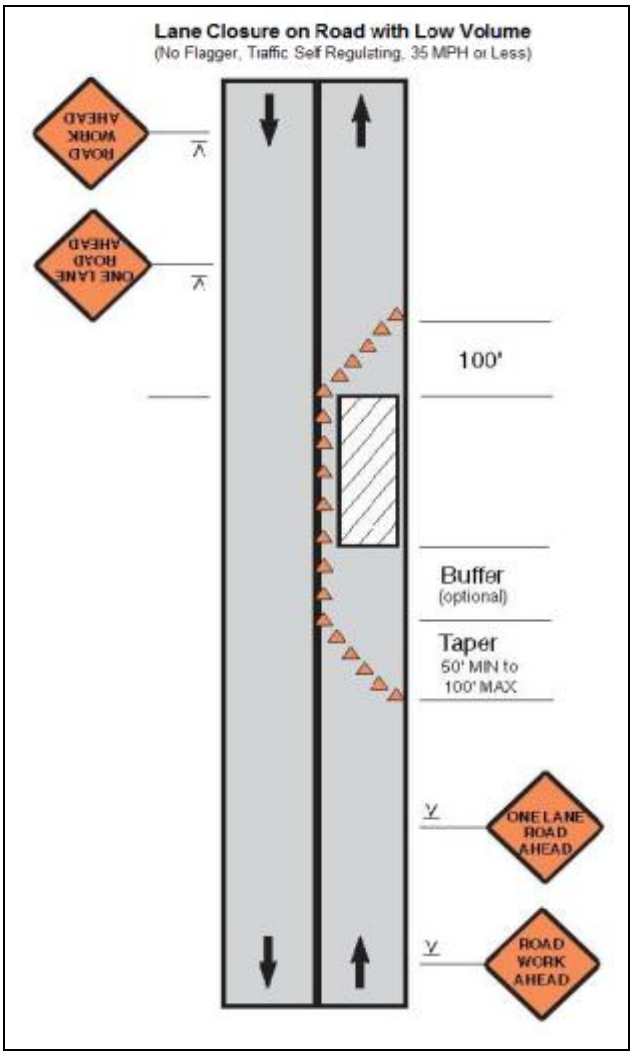
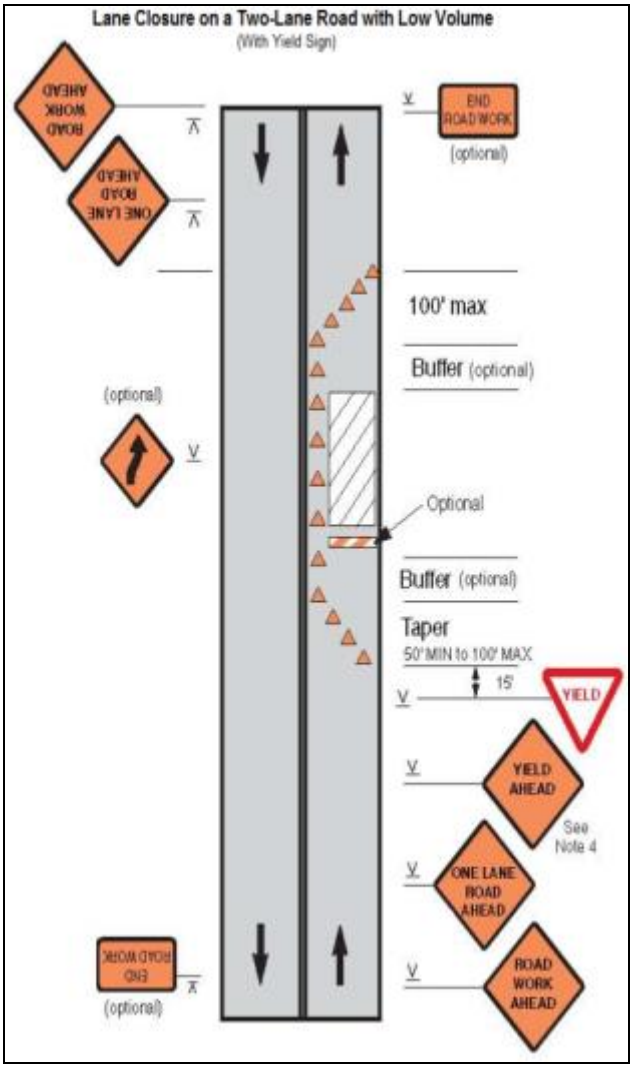


Figure A3.6 & A3.7: Lane closure on a two-line road with low volume (with yield sign) & Lane closure on a two-line road with low volume (one flagger operation)



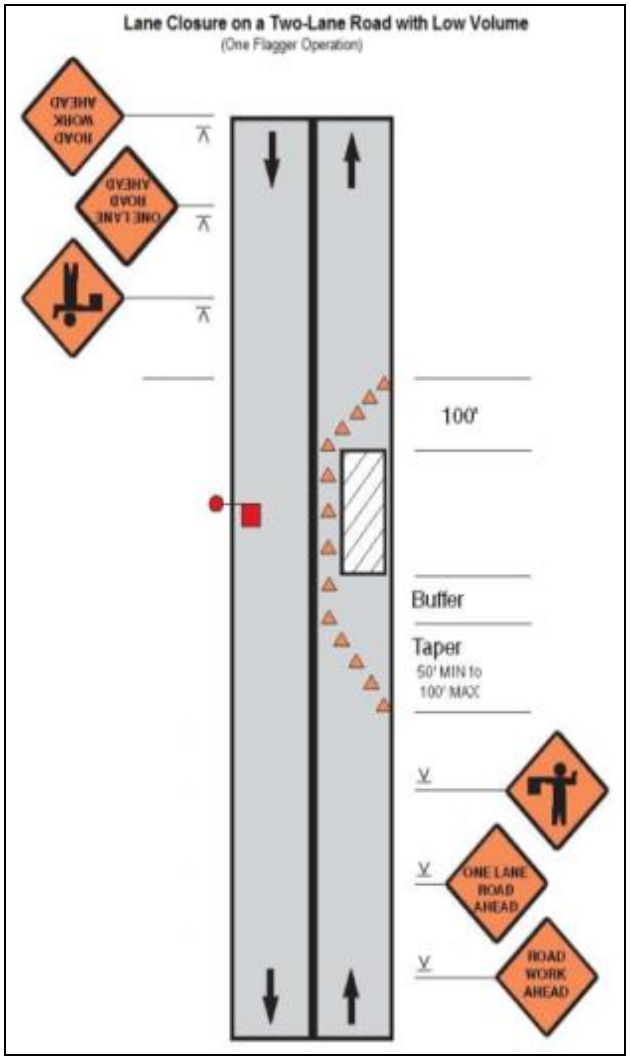


Figure A3.8 & A3.9: Lane Closure on a Two-Lane Road (Two Flagger Operation) & Lane Closure on a Four-Lane Undivided Road

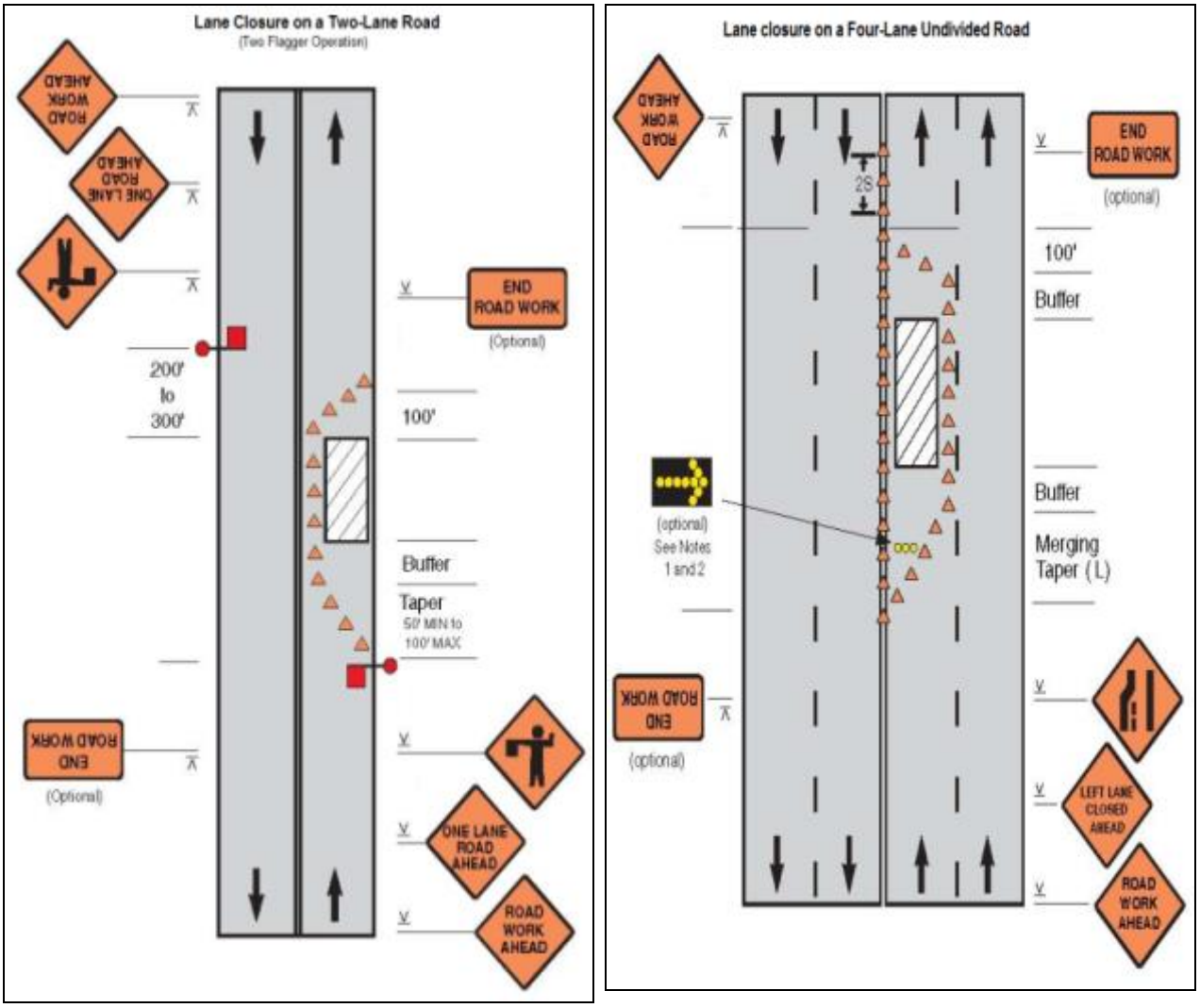


Figure A3.10 & A3.11: Lane Closure nn Divided Roadway & Half Road Closure On Multi-Lane Roadway

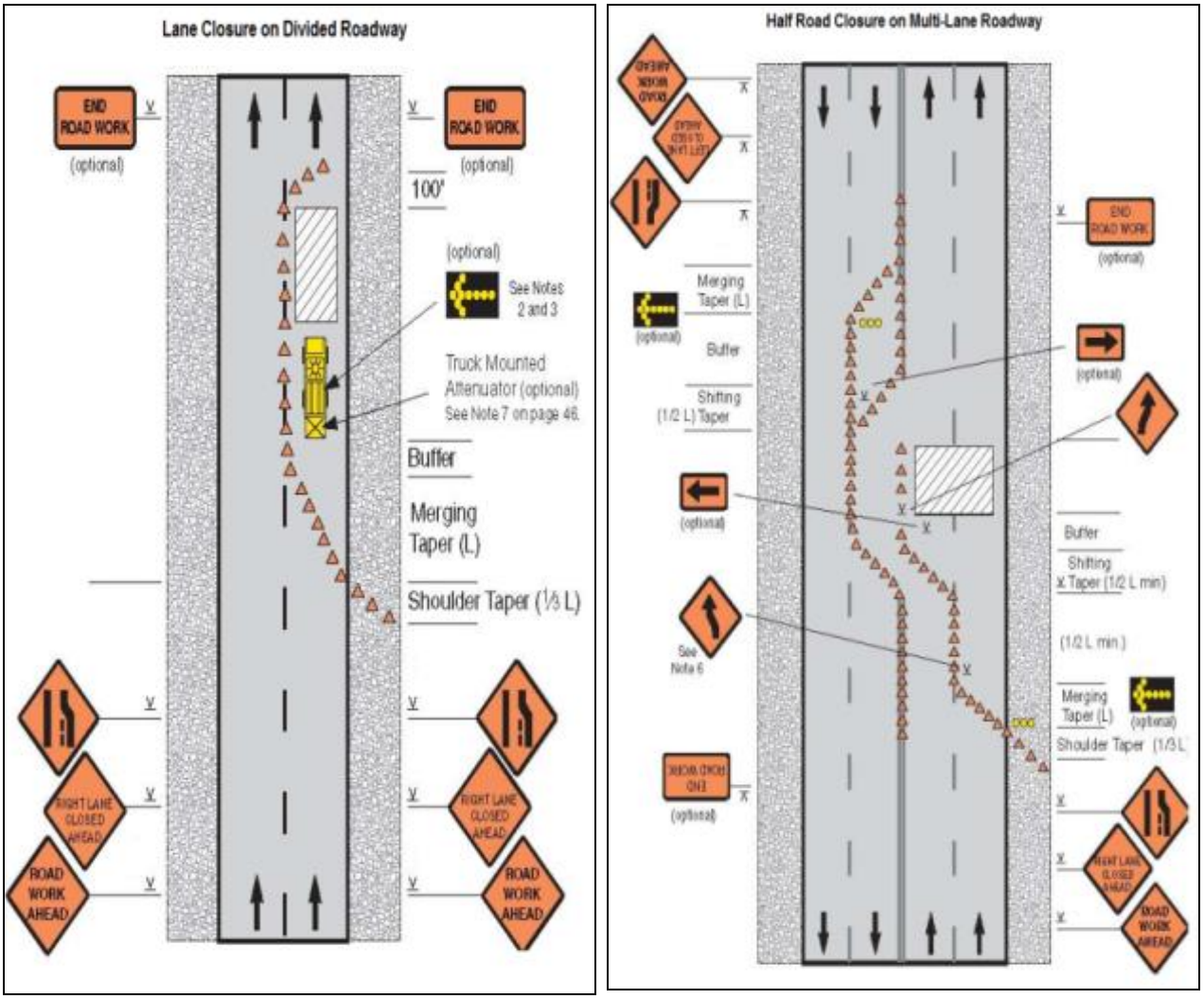
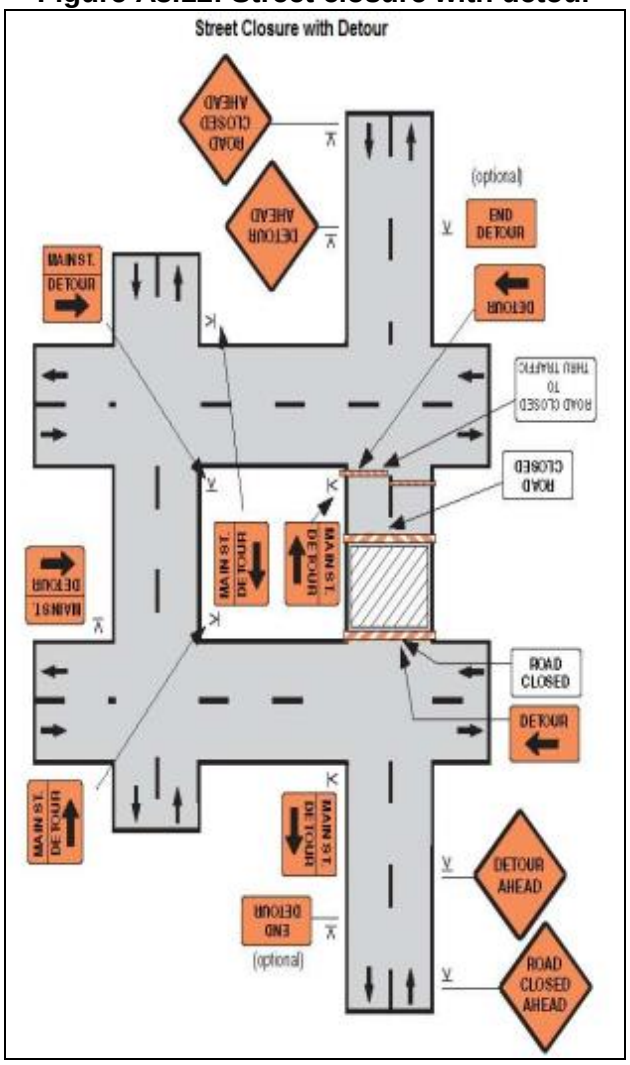


Figure A3.12: Street closure with detour



APPENDIX 4: FGD ATTENDANCE SHEET

Cox's Bazar Town
Component: Drain/Khal
Location: Islampur Basti, Ward-7
Meeting Place: Monir Moshin Bari, Islampur Basti
Date: 30-08-16 Time: 12.00 noon

Sl. No.	Name of the Participant	Sex	Occupation	Cell Number
1	Md. Nurul Alam	Male	XEN, Pourashova	01688-559151
2	Ms. Moriom	Female	House wife	
3	Ms. Amina	Female	House wife	
4	Ms. Jamila	Female	House wife	
5	Ms. Razia	Female	House wife	
6	Ms. Rozina	Female	House wife	
7	Ms. Momtaz	Female	House wife	
8	Ms. Aziza	Female	House wife	
9	Ms. Monjura	Female	House wife	
10	Ms. Sobura	Female	House wife	
11	Ms. Monwara	Female	House wife	
12	Ms. Sakera Begum	Female	House wife	
13	Ms. Arafa	Female	House wife	
14	Ms. Renu Ara Begum	Female	House wife	
15	Asraful Huda Siddiki	Male	Counselor	01819-102984
16	Ms Laila	Female	House wife	
17	Ms. Fatima	Female	House wife	
18	Ms. Khairunessa	Female	House wife	
19	Ms. Rahima	Female	House wife	
20	Ms. Solima	Female	House wife	
21	Ms. Mahmuda	Female	House wife	
22	Ms. Halima	Female	House wife	
23	Ms. Toyoba	Female	House wife	
24	Ms. Salina	Female	House wife	
25	Ms, Fatima	Female	House wife	01813-406163
26	Ms. Hosneara	Female	House wife	
27	Ms. Sofura	Female	House wife	
28	Ms. Rahima	Female	House wife	
29	Ms. Mobina	Female	House wife	
30	Nazmul Hasan	Male	Service	01815-343148
31	Ms Shamini Akhter	Female	Service	01712-210704
32	Ms. Shamsun Nahar	Female	House wife	01843-640313
33	Ms. Nurjahan	Female	House wife	01820-298884
34	Ms. Sabina Iasmeen	Female	House wife	01843-728581
35	Ms. Razia	Female	House wife	01822-778143
36	Ms. Hasina	Female	Business	01811-531962
37	Parvin Akhter	Female	House wife	01856-583830

Participants List

Cox's Bazar Town
Location:Peta Showdagar Para, Ward No-6
Meeting Place: Habibur Rahman Dalim Tea Stall
Date: 30-08-16 Time: 10.40 am

SL No	Name	Sex	Occupation	Cell Number
1	Omar Sidique Lalu	Male	Counselor, Ward-6	01817-201217
2	Soramian Sikder	Male	Business	01825-011456
3	Md. Feroze	Male	Business	01866-494756

SL No	Name	Sex	Occupation	Cell Number
4	Md. Khorshed Alam	Male	Labour	01837-920330
5	Sekandar	Male	Transport	01838-031966
6	Saidul Islam	Male	Student	01845-094191
7	Abul Bashar	Male	Labour	
8	Nashir Uddin	Male	Agriculture	01819-063180
9	Shohidul Islam	Male	Agriculture	01819-850339
10	Fazal Kabir	Male	Agriculture	01824-911612
11	Sonto Bas	Male	Agriculture	
12	Kamal	Male	Agriculture	01835-561189
13	Zotinra Das	Male	Service	01829-666944
14	Kabir	Male	Agriculture	01856-781911
15	Mokammel	Male	Agriculture	01878-681199
16	Mosfakmal	Male	Agriculture	01824-416442
17	Lalu	Male	Agriculture	01824-320344
18	Alam	Male	Agriculture	01718-671916
19	Nur Mian	Male	Agriculture	
20	Sujib Borua	Male	Agriculture	01825-437324
21	Souiod Karim	Male	Agriculture	
22	Nurul karim	Male	Business	
23	Jashim Uddin	Male	Agriculture	
24	Nezam Uddin	Male	Agriculture	01843-636740
25	Hali Chalan Borua	Male	Agriculture	
26	Badon Borua	Male	Agriculture	01840-329734
27	Murshed Alam	Male	Business	01864-364372
28	Pradif Borua	Male	Agriculture	
29	Muhammed Jashim	Male	Business	01834-886661
30	Mojibur Rahman	Male	Business	01811-831664
31	Saidul Islam	Male	Business	01845-094191
32	Md. Toyub	Male	Business	01820-185535
33	Numanul Karim	Male	Business	01827-237259
34	Subrata Borua	Male	Agriculture	01829-683160
35	Monjur Alam	Male	Agriculture	01853-143872
36	Mostafa Kamal	Male	Business	01830-041968
37	Mubarak	Male	Business	01838-050319
38	Md. Didar Alam	Male	Agriculture	01851-639283
39	Shaha Alam	Male	Agriculture	

APPENDIX 5: SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Bangla and English)

The _____Project welcomes complaints, suggestions, queries and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date		**Place of Registration**			
Contact Information/Personal Details					
Name		**Gender**	* Male * Female	**Age**	
Home Address					
Place					
Phone no.					
E-mail					
Complaint/Suggestion/Comment/Question Please provide the details (who, what, where, and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or u te on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of Official Registering Grievance)	
Mode of Communication: Note/Letter E-mail Verbal/Telephonic	
Reviewed by: (Names/Positions of Officials Reviewing Grievance)	
Action Taken:	
Whether Action Taken Disclosed:	Yes No
Means of Disclosure:	

APPENDIX 6: SAMPLE SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE

This template must be included as an appendix in the EIA/IEE that will be prepared for the project. It can be adapted to the specific project as necessary.

I. Introduction

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number	Roles
1. PMU				
2. PIUs				
3. Consultants				

- Overall project and sub-project progress and status
- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package Number	Components/List of Works	Contract Status (specify if under bidding or contract awarded)	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M)[a]	If On-going Construction	
				%Physical Progress	Expected Completion Date

[a] If on-going construction, include %physical progress and expected date of completion.

II. Compliance status with National/ State/ Local statutory environmental requirements

Package No.	Subproject Name	Statutory Environmental Requirements[a]	Status of Compliance[b]	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish[c]

[a] Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.).
[b] Specify if obtained, submitted and awaiting approval, application not yet submitted.
[c] *Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.*

III. Compliance status with environmental loan covenants

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

IV. Compliance Status with the Environmental Management and Monitoring Plan

- Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

Package-wise IEE Documentation Status

Package Number	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
	Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractor/s (Yes/No)		

- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.

Package-wise Contractor/s' Nodal Persons for Environmental Safeguards

Package Name	Contractor	Nodal Person	Email Address	Contact Number

- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below

Summary of Environmental Monitoring Activities (for the Reporting Period)[a]

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

[a] Attach Laboratory Results and Sampling Map/Locations.

Summary of Environmental Monitoring Activities (for the Reporting Period)[a]

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

[a] Attach Laboratory Results and Sampling Map/Locations.

Overall Compliance with CEMP / EMP

No.	Sub-Project Name	EMP / CEMP Part of Contract Documents (Y/N)	CEMP / EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

V. Approach and Methodology for Environmental Monitoring of the Project

- Briefly describe the approach and methodology used for environmental monitoring of each sub-project

VI. Monitoring of Environmental Impacts on Project Surroundings (ambient air, water quality and noise levels)

- Discuss the general condition of surroundings at the project site, with consideration of the following, whichever are applicable:
    - Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
    - Identify if muddy water is escaping site boundaries or if muddy tracks are seen on adjacent roads.
    - Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these are intact following heavy rain;
    - Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area in the Appendix.
    - Confirm spill kits on site and site procedure for handling emergencies.
    - Identify any chemical stored on site and provide information on storage condition. Attach photograph.
    - Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
    - Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
    - Provide information on barricades, signages, and on-site boards. Provide photographs in the Appendix.
    - Indicate if there are any activities being under taken out of working hours and how that is being managed.

- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements

As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (Government Standard)	
			Day Time	Night Time

Vii. Grievance Redress Mechanism

- Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).

Viii. Complaints Received During the Reporting Period

- Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

Ix. Summary of Key Issues and Remedial Actions

- Summary of follow up time-bound actions to be taken within a set timeframe.

Appendixes

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Environmental site inspection report
- All supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors
- Others

APPENDIX 7: ENVIRONMENTAL STANDARDS

SCHEDULE-2
Standards for Air

Density in microgram per cusec meter

Sl. No.	Categories of Area	Suspended Particulate Maters (SPM)	Sulphur-dioxide	Carbon Monoxide	Oxides Nitrogen
a.	Industrial and mixed	500	120	5000	100
b.	Commercial and mixed	400	100	5000	100
c.	Residential and rural	200	80	2000	80
d.	Sensitive	100	30	1000	30

Notes:

(i) At national level, sensitive area includes monuments, health center, hospital, archeological site, educational institution, and government designated areas (if any).

(ii) Industrial units located in areas not designated as industrial areas shall not discharge pollutants which may contribute to exceeding the standard for air surrounding the areas specified at Sl. nos. c and d above.

(iii) Suspended Particulate Matter means airborne particles of a diameter of 10 micron or less.

SCHEDULE -3
Standards for Water

A. Standards for inland surface water

Best Practice based classification Parameter		Parameter			
		pH	BOD mg/l	DO mg/l	Total Coliform number/100
a.	Source of drinking water for supply only after disinfecting:	6.5-8.5	2 or less	6 or above	50 or less
b.	Water usable for recreational activity :	6.5 - 8.5	3 or less	5 of more	200 or less
c.	Source of drinking water for supply after conventional treatment :	6.5 - 8.5	6 of less	6 or more	5000 or less
d.	Water usable by fisheries:	6.5 - 8.5	6 of less	5 or more	---
e.	Water usable by various process and cooling industries :	6.5 - 8.5	10 or less	5 or more	5000 or less
f.	Water usable for irrigation:	6.5 - 8.5	10 or less	5 or more	1000 or less

Notes:

(i) In water used for pisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.

(ii) Electrical conductivity for irrigation water - 2250 µmhoms/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

Standards for drinking water

Sl. No	Parameter	Unit	Standards
1	**2**	**3**	**4**
1.	Aluminum	mg/l	0.2
2.	Ammonia (NH_3)	"	0.5
3.	Arsenic	"	0.05
4.	Balium	"	0.01
6.	BOD5 20°C	"	0.2
7.	Boron	"	1.0
8.	Cadmium	"	0.005
9.	Calcium	"	75
10.	Chloride	"	150 - 600*
11.	Chlorinated alkanes carbontetrachloride	"	0.01
	1.1 dichloroethylene	"	0.001
	1.2 dichloroethylene	"	0.03
	tetrachloroethylene	"	0.03
	trichloroethylene	"	0.09
12.	Chlorinated phenols - pentachlorophenol	mg/l	0.03
	- 2.4.6 trichlorophenol	"	0.03
13.	Chlorine (residual)	"	0.2
14.	Chloroform	"	0.09
15.	Chromium (hexavalent)	"	0.05
16.	Chromium (total)	"	0.05
17.	COD	"	4
18.	Coliform (fecal)	"	0
19.	Coliform (total)	"	0
20.	Color	"	15
21.	Copper	"	1
22.	Cyanide	"	0.1
23.	Detergents	"	0.2
24.	DO	"	6
25.	Fluoride	"	1
26.	Hardness (as CaCO3)	"	200 - 500
27.	Iron	"	0.3 - 1.0
28.	Kjeldhl Nitrogen (total)	"	1
29.	Lead	"	0.05
30.	Magnesium	"	30 - 35
31.	Manganese	"	0.1
32.	Mercury	"	0.001
33.	Nickel	"	0.1
34.	Nitrate	"	10
35.	Nitrite	"	<1
36.	Odor	"	Odorless
37.	Oil and grease	"	0.01
38.	pH	"	6.5 - 8.5
39.	Phenolic compounds	"	0.002
40.	Phosphate	"	6
41.	Phosphorus	"	0
42.	Potassium	"	12
43.	Radioactive materials (gross alpha activity)	Bq/l	0.01

Sl. No	Parameter	Unit	Standards
1	2	3	4
44.	Radioactive materials (gross beta activity)	Bq/l	0.1
45.	Selenium	mg/l	0.01
46.	Silver	"	0.02
47.	Sodium	"	200
48.	Suspended particulate matters	"	10
49.	Sufide	"	0
50.	Sulfate	"	400
51.	Total dissolved solids	"	1000
52.	Temperature	°C	20-30
53.	Tin	mg/l	2
54.	Turbidity	JTU	10
55.	Zinc	mg/l	5

SCHEDULE - 4
Standards for Sound

Sl. No.	Category of areas	Standards determined at dBa unit	
		Day	Night
a.	Silent zone	45	35
b.	Residential area	50	40
c.	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50
d.	Commercial area	70	60
e.	Industrial area	75	70

Notes:

(i) The time from 6 a.m. to 9 p.m. is counted as daytime.
(ii) The time from 9 p.m. to 6 a.m. is counted as night time.
(iii) Area up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

SCHEDULE – 5
Standards for Sound originating from Motor Vehicles or Mechanized Vessels

Category of Vehicles	Unit	Standards	Remarks
*Motor Vehicles (all types)	dBa	85	As measured at a distance of 7.5 meters from exhaust pipe.
		100	As measured at a distance of 0.5 meter from exhaust pipe
Mechanized Vessels	dBa	85	As measured at a distance of 7.5 meters from the vessel which is not in motion, not loaded and is at two thirds of its maximum rotating speed.
		100	As measured at a distance of 0.5 meter from the vessel which is in the same condition as above.

Notes:

(i) At the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows:-
(ii) Diesel engine - maximum rotating speed.
(iii) Gasoline engine -at two thirds of its maximum rotating speed and without any load.
(iv) Motorcycle - If maximum rotating speed is above 5000 rpm; two- thirds of the speed, and if maximum rotating speed is less than 5000 rpm, three-fourth of the speed.

SCHEDUEL - 6
Standards for Emission from Motor Vehicles

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit	65
	(HSU)	
Carbon Monoxide	gm/k.m.	24
	percent area	04
Hydrocarbon	gm/k.m.	02
	ppm	180
Oxides of Nitrogen	gm/k.m.	02
	ppm	600

As measured at two thirds of maximum rotating speed.

SCHEDULE- 7
Standards for Emission from Mechanized Vessels

Parameter	Unit	Standard Limit
Black Smoke*	Hartridge Smoke Unit (HSU)	65

As measured at two thirds of maximum rotating speed.

SCHEDULE - 8
Standards for Odor

Parameter	Unit	Standard Limit
Acetaldehyde	ppm	0.5 - 5
Ammonia	"	1 - 5
Hydrogen Sulfide	"	0.02-0.2
Methyl Disulfide	"	0.009 - 0.1
Methyl Sulfide	"	0.01 - 0.2
Styrene	"	0.4 - 2.0
Trim ethylamine	"	0.005 - 0.07

Notes:

(i) Following regulatory limit shall be generally applicable to emission/exhaust outlet pipe f above 5 meter height:
$Q = 0.108 \times He^2Cm$ (Where Q = Gas Emission rate Nm^3/hour)
He = Height of exhaust outlet pipe (m)
Cm = Above mentioned limit (ppm)
(ii) In case where a special parameter has been mentioned, the lower limit shall be applicable for warning purpose, and the higher limit shall be applicable for prosecution purpose or punitive measure.

SCHEDULE – 9

SCHEDULE – 9
Standards for Sewage Discharge

Parameter	Unit	Standard Limit
BOD	miligram/l	40
Nitrate	"	250
Phosphate	"	35
Suspended Solids (SS)	"	100
Temperature	Degree Centigrade	30
Coliform	number per 100 ml	1000

Notes:

(i) This limit shall be applicable to discharges into surface and inland waters bodies.

(ii) Sewage shall be chlorinated before final discharge.