

Initial Environmental Examination (IEE)

PUBLIC

Project Number: 34418-025

December 2023

Bangladesh: Climate Resilient Integrated Southwest Project for Water Resources Management

Intervention: Riverbank Protection Works

Prepared by Bangladesh Water Development Board (BWDB), Government of Bangladesh for
the Asian Development Bank (ADB).

This Initial Environmental Examination (IEE) is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "terms of use" section of ADB's website.

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ABBREVIATIONS

ADB	-	Asian Development Bank
AF	-	Additional Finance
BWDB	-	Bangladesh Water Development Board
DoE	-	Department of Environment
EARF	-	Environmental Assessment and Review Framework
ECA	-	Environment Conservation Act
ECC	-	Environmental Clearance Certificate
ECOP	-	Environmental Code of Practice
ECR	-	Environment Conservation Rules
EDC	-	Executive Development Centers
EMP	-	Environmental management Plan
FCD/I	-	Flood Control Drainage / Irrigation
FGD	-	Focus Group Discussions
ICPM	-	Indicative Country Pipeline and Monitoring
IEE	-	Initial Environmental Examination
IT	-	Information Technology
LCC	-	Location Clearance Certificate
MOF	-	Ministry of Finance
MoEFCC	-	Ministry of Environment, Forest and Climate Change
MoLE	-	Ministry of Labour and Employment
MOWR	-	Ministry of Water Resources
NEMAP	-	National Environmental Management Action Plan
NEP	-	National Environmental Policy
NOC	-	No Objection certificate
NWP	-	National Water Policy
PWD	-	Public Works Department
REA	-	Rapid Environmental Assessment
SAIWRMP	-	Southwest Area Integrated Water Resources Planning and Management Project
SPS	-	Safeguard Policy Statement
WMA	-	Water Management Association
WMG	-	Water Management Group
WMO	-	Water Management Organization

EXECUTIVE SUMMARY

INTRODUCTION

The proposed Climate Resilient Integrated Southwest Project for Water Resources Management will support sustainable water resource management for improving agricultural and fisheries production, livelihood support and disaster and climate resilience in southwest part of Bangladesh after the success of the Southwest Area Integrated Water Resources Planning and Management Project (SAIWRMP) and its additional financing (AF). The proposed project will ensure the implementation of an integrated water resources management project for improvement of drainage congestion in Tungipara and Kotalipara *upazillas* under Gopalganj District. After preliminary discussion with Government of Bangladesh, Asian Development Bank (ADB) included this project in the indicative country pipeline and monitoring (ICPM) report 2022–2024 aiming to support sustainable water resource management for improving agricultural and fisheries production, livelihood support and disaster and climate resilience in southwest part of Bangladesh.

Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources (MOWR) is the executive agency of the project. Project implementation institutionalizes effective mechanisms to plan, develop, and manage water resources and deliver support services with the regular setup of BWDB and line departments, with outsourcing to the private sector including nongovernment organizations (NGOs). A project management office is established in the Gopalganj of BWDB to manage overall project implementation, while day-to-day implementation is done in subproject management offices.

This initial environmental examination (IEE) has been prepared, in accordance with the environmental assessment requirements of the ADB and the government, as well as the guidance provided by the environmental assessment and review framework (EARF) developed for guiding the environmental safeguards principles adopted for the project, to help ensure that the infrastructure proposed under the Investment Project part of the Program meets a high standard for environmental and social responsibility. As proposed investments are dispersed across many locations within Tungipara and Kotalipara *upazillas*, it is considered appropriate for each location to be covered by a context-specific IEE; **this IEE report is applicable to Riverbank Protection Works under the project.**

LEGAL AND POLICY FRAMEWORK

The lead environmental agency in Bangladesh is the Department of Environment (DOE), under the Ministry of Environment, Forests and Climate Change (MOEFCC). DOE is charged with furthering environmental conservation, improvement of environmental standards, and control and mitigation of environmental pollution. This mandate positions DOE as a key regulator of a broad range of developments in the infrastructure, industrial and commercial sectors, including both publicly and privately funded initiatives. DOE is responsible for administering the country's central environmental law, which provides the framework for environmental impact assessment.

Occupational health and safety are key considerations of the environmental assessment of proposed infrastructure. The Ministry of Labour and Employment (MoLE), particularly its Department of Labour and Department of Factory and Establishment Inspection, is of direct relevance to the environmental assessment process, as it administers and enforces the country's

legislation, rules and standards governing industrial workplaces, including construction sites and most industrial facilities where physical labour is undertaken.

Anticipated DoE assessment category. The river protection works proposed under the project will appropriately be considered to fall into the 'RED' assessment category (Table II 7). Under RED category, the environmental compliance certificate (ECC) obtaining process will require an IEE for the application process and later an EIA as a final requirement for ECC. This IEE report will be reviewed by DoE, and the anticipated categorization will be confirmed at that time.

Updated ADB categorization. Based on the findings presented in this IEE, it is confirmed that river protection works of about 2.4 of stretch at two different places will have at least some negative impacts requiring mitigation, but also unlikely that any will generate impacts of a scale, complexity or severity that would warrant detailed environmental research or development of highly novel mitigation strategies. Accordingly, the Category B classification, assigned to the project at the early concept stage based on ADB screening, is considered valid for this investment location. This could change if the design, scale, nature or location of any proposed components undergoes significant modification before or after project approval.

PROJECT DESCRIPTION

1. The proposed river protection works will take place in four locations of Gopalganj: (i) Manikdah, and (ii) Chitolia. Total length of the river protection works will be 2,400m. Thousands of houses are at risk of being drowned in the riverbed due to the fragile riverbanks of the Bhagiyar, Modhumati, and Madharipur Beel Route (MBR) rivers. Some areas are especially prone to erosion, and bank protection is required to save the homestead as well as the agricultural land near the bank of rivers. Total 5.76 km bank of seven (07) locations are extremely vulnerable to erosion. Based on the vulnerable riverbank locations, two locations have been decided to construction bank protections.

BASELINE ENVIRONMENT

The project area is located within the floodplain of the Modhumati, Baghiyarkul, Shyaldhah, Ghagor River, and MBR. The proposed project is situated in Sadar and Rajoir Upazila of Madaripur District and in Kotalipara Upazila of Gopalganj District.

The study region belongs to the **Gopalganj-Khulna Peat Basin**. This is the largest peat stock basin of Bangladesh. The basins are deeply flooded by clear rainwater during the monsoon. In the basin close to Khulna, the floodwater is somewhat brackish.

Topographic relief. The project area is basically flat with comparatively high land along the northern and eastern boundaries and a low-lying area in the interior. The land elevation varies from 1.83m PWD near the northern boundary and 1.22 m PWD along the south-western boundary to possibly below 0.00m PWD in the beel area.

Geology and geomorphology. The district's geology reflects the riverine and deltaic processes that have shaped it over time, as well as the tectonic activity that has occurred in the Indian subcontinent since the Cretaceous period. The sub-soil in Gopalganj consists of alluvial deposits from different rivers, such as the Ganges, the Brahmaputra, and the Meghna. These deposits are

made up of clay, silt, sand, and gravel, and their thickness and composition vary depending on the location and depth.¹

River Network in the Project Vicinity. Ghagor River System passes through the west and south of the project which is directly interlinked to the river Madhumati. This river is basically the tidal in nature and the main source of surface water during the dry season. Sometimes this is also the source of flooding during monsoon. The salinity in the specified river system remains below 1 parts per thousand (ppt) from June to February and may rise as high as 3 ppt during March to May. The gross tolerable limit of salinity for irrigation water is 2.5 ppt.

Waterlogging. A large area of the subproject suffers from drainage congestion due to siltation of khal mouth and profuse growth of water hyacinth mainly. Thus, vast beel (lowland) areas remain waterlogged and become unsuitable for growing agricultural crops during kharif season, where fish is cultivated in wide areas by the influential persons.

Flooding. The 2020 flood caused huge losses to fish farmers², the 2017 flood breached the Gandak river embankment³, and the 2007 flood that killed 14 people and displaced thousands. The floods also caused huge losses to fish farmers in Gopalganj, estimated at around Tk 50 crore (about \$6 million), as about 3,212 metric tonnes of fish from their ponds escaped into floodwaters. The floods also disrupted the transportation and communication networks in the district, as roads and bridges were damaged or submerged.

Agriculture. The present cultivable area has been estimated at 80% of the gross area (12000 hectares (ha)). The calculated cultivable area is 9,600ha. With a present cropped area of 13,722ha, resulting in a cropping intensity of 143%. The future total cropped area, after rehabilitation and proper flood control, has been estimated at 17,461ha with a cropping intensity of 182%.

2. **Fisheries.** Fisheries are an important source of income in the subproject area. During the rainy season and subsequent flooding some 64% of the areas are used for fisheries resource in the form of pond aquaculture, gher fishery, nursery, flood plain, fingerling stocking and pen culture etc. The present yield of floodplains is 130 kilogram per hectare per year (kg/ha/yr), but declining due to increasing local demand, overfishing and lack of re-stocking.

ANALYSIS OF ALTERNATIVE

3. Erosion causes loss of land, life and property while accretion results in the emergence of new lands which can be used for farming and agriculture. In Gopalganj 1362 households have been affected by river erosion during 2015-2020 according to the Bangladesh Bureau of Statistics (BBS 2021). These locations are the inner bends, abandoned channels, deeper channels with strong currents and along the shoals. The proposed locations are vulnerable to bank erosion and needs protective works. At this point, riverbank protection works are the best possible course of action to prevent erosion. The 'alternative' will be 'no action', which is not rational at the moment

¹ Islam, S. and Shaik, ME. (2020) Geotechnical Properties of Gopalganj Sub-soil in Bangladesh. Landscape Architecture and Regional Planning. Vol. 5, No. 2, 2020, pp. 27-32. doi: 10.11648/j.larp.20200502.12

² URL: <https://www.frontiersin.org/articles/10.3389/fenvs.2021.759547/full> date accessed: 13 July 2023

³ URL: <https://doi.org/10.3389/feart.2022.1053829> date accessed: 13 July 2023

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION

Climate change, sea level rise and water level

Impacts. In both Madaripur and Khulna stations, the rainy season is going to shift towards post-monsoon (i.e., Sep-Oct) while winter and dry season is going to lose rainfall up to 12.2%. This implies that the usual high waters in the rivers might come later in the post monsoon, and a certain peak in high level water might exert more pressure on the riverbanks leading towards riverbanks erosion. All the target construction sites (i.e., riverbank protection works) flood after heavy rains, when the catchment area overflows, since drainage systems are already clogged. Considering the climate change projections in Bangladesh predicting more and more intense rainfall over shorter period of time and shifting of monsoon demands the river protection works needs to adjust with the new reality. The projected intensifying rainfall over Bangladesh under climate change scenarios, specially under shared socioeconomic pathway (SSP) 1-8.5 scenarios, estimating river water level will play a crucial role in future development.

Mitigation: Given the projection of higher precipitation in short period of time due to climate change, additional consideration of water levels is proposed for construction to remedy the erosion and flooding problems. It is assumed that after construction of the river protection works, the flooding problem will be resolved. However, during the design of the protection works, it needs to be considered that recent climate change projections suggest higher amount of rainfall in a small window of time in the future. The depth and length of the embankments need to be designed accordingly.

Aquatic flora and fauna

Impacts. The eroded areas, especially river bank lack vegetation cover. Hence, riverbank protection works won't involve removing any vegetation. Therefore, no impact is expected.

Mitigation. Although no impact is envisaged for the proposed construction interventions, plantation of deep-rooted vegetation along the shoulder of the embankments is recommended.

Sediment Dispersal

Impacts. Borrowing material from the riverbanks may potentially cause increased sediments in the rivers. Similarly, excavation of water channels if carried out in water can potentially increase their sediment load. Excavated material from the channels, if left along their banks may again enter the water thus increasing their sediment load. In addition, construction material, loose earth/soil, demolition debris, and other materials may enter the river or other water bodies causing increased sediments. Run off from construction sites, camps, and other temporary facilities may enter water bodies increasing their sediment load.

Mitigation. The following mitigation measures are to be implemented to address the above concerns: (i) Contractor will protect untreated embankment slopes; (ii) Contractor will excavate channels after dewatering them in case of manual excavation; (iii) Contractor will not leave excavated earth and silt on channel banks; (iv) Contractor will implement measures to protect channels from run-off from working areas and camps; and (v) The contractor will obtain borrowing material from river banks in such a manner so that there is no increase of siltation in rivers, and will not leave loose soil after excavation..

Fisheries

Impacts. Only during the construction, fish migration may be disturbed within the construction and transportation area. This impact may be very limited due to adoption of the Environmental

Management Plan (EMP) during the construction period. However, construction activities may also cause migration of some bottom feeder fish species from the construction zone. On the other hand, increased turbidity in water columns may attract some fish species for food sourcing. In general, there may be a minor change in fish composition only during construction, but it would not affect the local fish diversity.

Mitigation. During construction operations, it is quite it is not possible to avoid the impact on the fisheries. However, the impacts are not permanent. After construction the river will be deeper to host a variety of fishes at different layers. Moreover, with the assistance of WMGs and WMAs, some fish sanctuaries can be developed after construction at the lower stretch of the river.

Water quality

Impacts: Construction materials, demolished debris, fuel both from transportation vessel and construction machineries (piling machine, pump etc.) may degrade the soil and water quality. The construction workers will generate domestic solid waste and wastewater including sewage. The amount of domestic wastewater generated by the construction workers is assumed to be equal to the amount of water usage. Oily water, waste oils, oily rags and other similar wastes will be generated from workshop. The stores and warehouse will generate solid waste such as empty cement bags, cardboards and wooden crates. Improper disposal of these waste streams can potentially contaminate the soils and water resources of the area. Soil and water contamination can potentially have negative impacts on the local community, natural vegetation, agriculture and biological resources of the area including aquatic flora and fauna.

Mitigation: An Emergency Response Plan encompassing spill response should be a required element of the Contractor Environmental Management Plan (CEMP). Appropriate contents of an Emergency Response Plan are listed on the sample outline of a CEMP provided in Appendix 9.

Employment and Livelihoods

Impacts. There will be twofold impacts: affected people (indirect: fishermen) may lose their income opportunity; on the other hand, locals to be employed by the project will get income opportunity. If local people get access to project employment, then the income level of the locals will increase.

Mitigation. A social study is underway (i.e., livelihoods) to address the issue. It is likely the fishermen who is likely to be affected by the intervention will be identified and compensated. Later on, the fishermen will be trained to use special designated areas of the river for fishing purposes.

PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

Given the nature of the intervention, construction will take place within the river boundary. The stakeholders identified for the proposed construction activity include officials from BWDB, and local communities living on the banks of the target rivers who might be affected—positively or negatively—by implementation of the investments. Project stakeholders were initially identified on a theoretical level through a series of scoping discussions amongst the multi-disciplinary Technical Assistance (TA) study team, encompassing such matters as physical proximity, land use, resource flows, traffic composition, local employment, and business. The understanding of stakeholder groups was further refined in cooperation with the locally stationed BWDB officer who

understands the project very well and is aware of the local socio-economic and environmental setting.

Consultations with the BWDB took place over June – July 2023 in Faridpur local BWDB office. During the consultation, the Institutional Strengthening and Project Management Consultant (ISPMC) were also consulted. The BWDB officials and ISPMC explained the need for interventions and accompanied the TA consultants on field visits. During the time of field visits to the proposed intervention (June 2023 – July 2023) the TA consultants visited the local communities living on the banks of the rivers and conducted both formal and informal discussions.

Meetings with BWDB and local communities. The TA team met the BWDB officials and the ISPMC several times during project preparation. Apart from the possibilities and process of implementation of the whole project, the points of discussions also included the need assessment of riverbank protection works and other canals within the project boundary. This IEE extracted the construction related activities and environmental concerns from all the discussions.

GRIEVANCE REDRESS MECHANISM

The objective of the grievance redress mechanism (GRM) is to resolve complaints as quickly as possible and at the local level through a process of conciliation; and, if that is not possible, to provide clear and transparent procedures for appeal. A well-defined grievance redress and resolution mechanism will be established to resolve grievances and complaints in a timely and satisfactory manner. All affected persons will be made fully aware of their rights, and the detailed grievance redress procedures will be publicized through an effective public information campaign.

An additional mechanism shall be set up by the SOU to accept and address complaints from workers employed in the construction works, concerning working conditions, living conditions in construction camps, safety and health issues, labor rights violations, mistreatment, or any other matter. All laborers, skilled workers, and site engineers employed on site by the primary Contractor or by any of its sub-Contractors shall have access to the mechanism. All workers will receive an orientation to the workers' GRM during pre-construction induction training. Workers will be able to lodge grievances with on-site personnel of the CSC, who will record the complainant's name, position, employer, and contact information, as well as a description of the complaint and the time, date and place at which the complaint was reported. The CSC will inform the SOU, which will record the grievance in a grievance register. The CSC will convene a meeting of the complainant or complainants, the sub-Contractor involved, the Primary Contractor, and any labor syndicate to which the complainant(s) may belong, in an effort to decide on an appropriate resolution of the complaint. The CSC will work with the relevant BWDB's Environmental Safeguards Focal Person (ESFP) and on-site Environment, Health and Safety Officer (ESFO) to monitor implementation of the proposed resolution and confirm absence of retaliation on the part of the Contractor involved. If the complaint cannot be resolved to the satisfaction of the complainant(s), the CSC will provide the complainant(s) with the necessary contact information to file a complaint with MOLE. The CSC will compile a complete record of the grievance, including measures taken for resolution and follow-up checks by the ESFP and EHSO, as well as any referral to MOLE and subsequent evolution of the case, and provide the record to the SOU for preservation in its grievance register.

ENVIRONMENTAL MANAGEMENT PLAN

Each of the entities identified above has multiple responsibilities, the fulfilment of which is required for full and effective implementation of the EMP. These responsibilities are detailed in Table IX-1 below.

Table I-1 EMP implementation responsibilities

Entity	Responsibilities in EMP Implementation
Project Management Office (PMO)	• Prepare operations and maintenance procedures for facilities under construction, ensuring their compliance with the EMP. • Work with the SOU to train facility personnel on EHS aspects of facility operation in advance of commissioning, to ensure effective EMP implementation during the operation period
Subproject Management Office (SMO)	• Ensure that EMP implementation is recognized as a critical element of overall project implementation. • Enable and adequately staff SOU. • Oversee rigorous review of bids and prioritize selection of Contractors with strong environmental compliance track records. • Coordinate with PMO as needed to ensure smooth implementation of EMP
Safeguards Oversight Unit (SOU) under PMO	• Ensure EMP provisions are fully reflected in civil works bid documents. • Advise and support SMO on Contractor selection and other procurement decisions. • Guide and support ESFP and EHSOs to ensure timely and competent execution of site-level oversight activity. • Collect and collate progress reports and environmental monitoring reports for each location to assemble comprehensive quarterly monitoring reports for submission to ADB. • Work with CSCs and primary Contractors to develop and deliver periodic EHS training for sub-Contractors and their workers. • Work with CSCs to train facility managers or their EHS personnel in advance of commissioning, to ensure effective EMP implementation during the operation period. • Administer the GRM • Support PMO in obtaining environmental clearances and renewals
Environmental Safeguards Focal Person (ESFP) under PMO	• Oversee the safeguards compliance process for all Investment Project sites under the PMO's control, liaising with the SMO-appointed Project Manager and with support from SOU and EHSOs • Prepare and submit quarterly progress reports for the sites owned by their home agencies to the SMO and SOU • Chair LGRC when needed to address Level 2 grievances regarding project implementation activities
Environmental coordinator/manager at SMO	• Oversee the safeguards compliance process for the investment sites for the designated intervention areas • Liaison with the ESFP for monthly report and day to day update • Supervise the EHSO
Environment, Health and Safety Officers (EHSOs)	• Conduct regular monitoring of conditions on site, including compliance with prescribed mitigation strategies, and submit EHS monitoring reports on a monthly basis to the Environmental Coordinator at SMO • Identify worker training needs and support SOU and CSC in development and delivery of training
Construction Supervision Consultants (CSC)	• Review and approve CEMPs and quarterly environmental monitoring reports submitted by Contractors. • Guide and assist PMO, through ESFPs, in monitoring of CEMP implementation and site conditions, including preparation of quarterly progress reports for submission to SOU. • Direct and supervise corrective action by Contractors as needed. • Collaborate with SOU on development of safeguards training for sub-Contractors and workers

Entity	Responsibilities in EMP Implementation
Contractors	- Prepare and implement CEMP for each site, based on EMP prescriptions and international best practices. - Conduct quarterly EHS monitoring on all sites under their control and submit quarterly monitoring reports to CSC for review. - Implement corrective actions as directed by CSC and/or ESFP
Department of Environment (DOE)	- Review environmental clearance applications, including IEE and EMP - Review annual environmental monitoring reports submitted by SOU during construction phase. - Review applications for environmental clearance renewals
ADB	- Review and clear IEE and EMP, EARF and environmental monitoring reports - Publicly disclose IEE and EMP, EARF and environmental monitoring reports on ADB website - Review biannual environmental monitoring reports prepared by PMU and publicly disclose them on ADB website

The findings of the environmental impact analysis are presented in Section VI of the IEE report. The potential impacts and corresponding measures that are prescribed in order to mitigate the negative impacts or enhance positive ones are collected in Table IX-3. The measures prescribed apply to the pre-construction, during construction and post-construction phases of the project. All measures listed in Table IX-3 are requirements, based on the investment plan as proposed at the time of preparation. All measures assigned to Contractors should be reflected in bidding documents, and serve as the basis for the CEMPs, which must be prepared to cover all sites at this investment location.

Monitoring parameters for each prescribed mitigation and enhancement measure are identified in Table IX-3. Specific monitoring responsibilities, including the monitoring and reporting timetable for each, are detailed in Table IX-4.

As will be noted from the preceding table and figures, several entities are expected to submit regular monitoring reports as a fundamental contribution to effective implementation of the EMP. These reporting processes are summarized in Table IX-5 for clarity. A sample outline of a semi-annual monitoring report as must be prepared by the SOU for submission to ADB (which can also be adapted for quarterly monitoring reports as must be prepared for DOE) is provided in Appendix 17.

Table I-2 Monitoring reporting requirements.

Report type	Prepared by	Submitted to	Frequency
Construction phase			
Contractor EHS monitoring reports	Contractor	ESFP	Monthly
Site EHS monitoring reports	EHSO	ESFP	Monthly
Progress reports (safeguards sections)	ESFP	SMO/SOU	Quarterly
Environmental monitoring reports	SOU	DOE	Quarterly
Environmental monitoring reports	SOU	ADB	Semi-annually
Operation phase			
Environmental monitoring reports	SMO units and PMO	DOE	Quarterly

4. Institutions Strengthened through Training and Advisory Support. The Project will provide training to strengthen project institutions, including operating staff and trainers, with a distinct output target to create a pool of professional staff who institutionalize the participatory

and integrated business processes embodied in the National Water Policy (NWP) and Rules of Participatory Water Management, with progressively reducing consultancy support that is provided with a clear exit strategy and performance targets for relevant staff positions. Project training will enhance skills for participatory Integrated water management plan (IWMP) preparation; socially inclusive WMA development and management; management of diverse stakeholder interests; resettlement; design and construction management; environmental management; agriculture, fishery, and livelihood enhancement; sustainable operations and maintenance (O&M); and quality control.

Training needs

Contractors. International construction contractors working in Bangladesh are well aware of safeguards requirements, and knowledgeable on global best practices in impact mitigation and site management. Effective oversight and enforcement, not training, is needed to ensure strong EMP performance from these firms. However, the local firms acting as contractor or sub-contractors, which will undertake most of the physical work of infrastructure development, can in most cases be expected to be less aware and less experienced regarding safeguards requirements, and minimally concerned with international standards of practice. Local firms will benefit from training to strengthen their knowledge and awareness and help ensure strong compliance on this project and other projects in the future.

Workers. Primary contractors and their sub-contractors should provide adequate training to workers in their employ to ensure safe and sanitary workplaces and full compliance with all prescriptions of the EMP, but often fall short in this regard. It is therefore usually necessary and appropriate for the SMO to implement supplemental worker training. Such training should be designed by the SOU in collaboration with the CSC and implemented by the SOU through the site-level EHSOs. Worker training should be provided prior to the start of construction, and whenever new sub-contractors and crews of workers are brought onstream; refresher training should be given any time site monitoring reveals recurrent patterns of non-compliance that can be attributed to lack of worker knowledge or awareness.

Training. Selected personnel of the BWDB, PMO and SMO and contractors will receive training in environmental management, environmental monitoring and supervision, mitigation planning, emergency response, public consultation and use of the GRM, occupational and community health and safety, and other environmental management topics. The topics, methods, and estimated costs of the training are outlined in Table IX-7. Training sessions will use a workshop format. Training will be developed and provided by the environmental consultants with support of other experts engaged under the grant implementation consultant services.

EMP implementation cost. Cost estimates for mitigation measures, environmental monitoring, public consultations, and capacity building are summarized in Table IX 8. Contractors will bear the direct costs of all mitigation measures during construction, which will be included in the tender and contract documents; this includes features built into facility designs in order to prevent environmental impacts from arising. The PMO and SMO will bear the costs related to mitigation measures during operation. Costs related to environmental supervision during construction will be borne by the PMO (for hiring a licensed laboratory to conduct quarterly monitoring), the PMO (for the activities of the environmental consultants) and by the contractors (for monitoring work carried out by the EHSOs). During the operation phase and monitoring costs will be borne by the PMO and SMO (for regular monitoring activity of their site EHSOs).

CONCLUSION AND RECOMMENDATION

This IEE report on investments planned for river protection works in Gopalganj has been prepared based on desktop study, field reconnaissance of the planned building site and surrounding areas, and consultations with institutional stakeholders and members of the public in the projected area of influence. The report comprises a comprehensive consideration of the environmental, health and safety impacts that can be anticipated to arise from the project. The EMP has been prepared in line with the ADB's Safeguards Policy Statement (SPS) 2009 and DoE environmental assessment requirements, and the mitigation strategies prescribed within it reflect current international best practices, as exemplified by the World Bank Group's Environment, Health and Safety Guidelines.

While residual negative impacts have been identified, it is also acknowledged that the investments are expected to have significant positive economic impacts for local communities, and these are to be weighed against the residual negative impacts. Generally, very positive perceptions and expectations were expressed about the planned investments during consultations carried out as part of IEE preparation, and while the local communities are clearly concerned about the riverbank erosion and crop damage, they expect that some minor problems can be faced by the local communities for the greater good. It seems clear that local community leaders see the investment as a potential benefit for them.

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I. INTRODUCTION

A. Background

5. The Southwest Area Integrated Water Resources Planning and Management Project (SAIWRPMP), implemented by the Bangladesh Water Development Board (BWDB) and supported by the Asian Development Bank (ADB) and the Government of Netherlands, sought to enhance the livelihood of the rural population by improving the productivity and sustainability of existing underperforming flood control and drainage/irrigation (FCD/I) schemes through holistic and participatory planning, development, and management of water, and delivery of support services to address locally identified constraints on agriculture, fisheries, and livelihood development. ADB supported the Southwest Area Integrated Water Resources Planning and Management Project in 2005 whose successes in pioneering sustainable and participatory approaches in Water Resource Management (WRM) were replicated under a subsequent additional financing project in 2015.¹ Important lessons from these projects and other interventions in the country and sector are: (i) communities are central for social, environmental and financial sustainability of ground level adaptation initiatives, (ii) highly localized demand based strategy is needed for design of FCD/I infrastructure, (iii) poverty reduction initiatives need to be integrated with agri-value chains for multiplier effect on the rural economy, (iv) knowledge management of climate-related information is necessary at the institutional and community levels for decentralized, effective and sustainable WRM, (v) ground level coordination and integrated delivery of government interventions is critical for effective utilization of funds, and (vi) nature-based solutions (NBS) and innovations are location-specific and new solutions need to be continuously piloted in small scale and successful innovations selected for scaling.

6. The proposed Climate Resilient Integrated Southwest Project – Water Resources Management is built upon the success of SAIWRMP and AF and proposed to support sustainable water resource management for improving agricultural and fisheries production, livelihood support and disaster and climate resilience in the southwest part of Bangladesh. The proposal will cover Tungipara and Kotalipara *upazillas* with an estimated total area of 55,165 hectares (ha) comprises of four subprojects viz. (i) Tarail-Pachuria (21,606 ha), (ii) Satla-Bagda Polder-1 (14,600 ha), (iii) Ramshil-Kafulabari (6,959 ha) and (iv) Rajoir-Kotalipara (12,000 ha) with proposed 17 water management associations (WMAs) and 172 water management groups (WMGs) and an additional subproject in the Beel-Kajulia (26,800 ha). The physical interventions under the ensuing project will include strengthening climate change- and disaster-resilience of FCD/I structures, such as river and channel dredging, re-sectioning and construction of embankments, rehabilitation of existing regulators and gates and construction of new regulators, re-excavation of khals, protective works, and construction of other structures, while the non-physical interventions will include support for capacity building and training of beneficiaries and relevant stakeholders in O&M of assets developed under the ongoing and ensuing projects, increase productivity of agriculture and fisheries, and gender and livelihood trainings. The BWDB is the Executive Agency for the project.

7. **Enabling environment.** The Bangladesh Delta Plan (BDP) 2100 identifies flooding, drainage congestion, water logging, arsenic contamination of groundwater, and water deficits in dry season as the principal challenges affecting areas of ensuing project. The government has put in place several strategic plans, policies and laws and doubled its climate-relevant budgetary allocation in financial year (FY) 2022 to 0.73% of national GDP to implement these policies and

¹ADB. 2005. [Bangladesh: Southwest Area Integrated Water Resources Planning and Management](#). Manila; ADB. 2015. [Southwest Area Integrated Water Resources Planning and Management Project - Additional Financing](#). Manila.

plans effectively.² The government's sector strategies emphasize sustainable intensification and diversification of climate resilient agricultural production systems with strong value chain integration to achieve community-centric, resilient, sustainable and inclusive growth. The BDP 2100, the National Adaptation Plan 2023-2050 (NAP) and Mujib Climate Prosperity Plan are the principal planning documents on climate change.³ These documents advocate (i) moving WRM beyond physical infrastructure to building systemic climate resilience of critical infrastructures and its operations through a localized participatory approach, (ii) integrating adaptation strategies into planning and capacity building across sectors, and (iii) future-proofing locally-led adaptation outcomes. The Eighth Five Year Plan focuses on scaling up of existing WRM good practices, climate resilience of critical FCD/I schemes through participatory WRM that is integrated with livelihood diversification to ensure benefits for the poor, women, and other excluded groups.⁴ The development and management of water resources is entrusted to the BWDB under the Ministry of Water Resources (MOWR), and minor and small-scale irrigation and FCD/I schemes are with the Local Government Engineering Department.

8. **Strategic alignment.** The proposed project is aligned with the ADB Bangladesh country partnership strategy 2021–2025 “Strategic Objective 2: Promote green growth and climate resilience”. The project focuses on building resilience to climate shocks through climate resilient WRM and agricultural practices. It is aligned with and contributes to targets of NAP 2023-2050, BDP2100, 8th Five Year Plan, and Mujib Climate Prosperity Plan (para. 8)⁵. Within ADB, the project contributes to (i) operational priorities of ADB's Strategy 2030, (ii) country partnership strategy for Bangladesh, 2021–2025, in particular strategic objective 2 (promote green growth and climate resilience) and 3 (strengthen human capital and social protection), (iii) country sector strategy by providing tailored solutions to address specific agronomic, hydrological, ecological, social, and climatic challenges of the project area (footnote 2), and (iv) \$100 billion climate adaptation finance target. The project complements national programs of other development partners engaged in the sector as well as ADB initiatives in the country and will coordinate efforts..

B. The Project and Interventions

1. Project aim

9. The areas of Tungipara Upazila and Kotalipara Upazila under Gopalganj District are under severe drainage congestion. The land elevation of Tungipara and Kotalipara is lower compared to the surrounding areas, consequently local rainfall runoff accumulates in the study areas, specially the major haor-like depressions existing in the 2 Upazilas under Gopalganj District, Drainage of the areas is also impeded by high water levels of the peripheral rivers during monsoon along with tidal backwater effects from the perennial tidal rivers. The long-time intensive drainage

²Government of Bangladesh. 2022. [National Adaptation Plan of Bangladesh \(2023-2050\)](#). Dhaka.

³Government of Bangladesh. 2018. [Bangladesh Delta Plan 2100](#). Dhaka;

Government of Bangladesh. 2022. [Mujib Climate Prosperity Plan 2022-2041](#). Dhaka.

⁴Government of Bangladesh. 2020. [Eighth Five Year Plan \(July 2020–June 2025\): Promoting Prosperity and Fostering Inclusiveness](#). Dhaka.

⁵The project will contribute to NAP targets through protection of (i) 1.10 million hectares of croplands from flood inundation, (ii) critical infrastructures from frequent climate induced disasters, (iii) 300,000 households from flood related sicknesses annually, (iv) livelihoods of 4.0 million households dependent on fisheries from water-related disasters, and sustainably increase (v) rice production by 10.3 million tons a year to benefit 70% crop-dependent households, and (vi) livestock production by 5%. The project will also contribute to NAP's high priority actions: (i) WRM7: construction and rehabilitation of flood and drainage management measures with eco-engineering solutions, (ii) WRM21: remodeling of water-regulating and cross drainage structures considering climate change scenarios, (iii) WRM18: planned, participatory and coordinated land and water resources management, (iv) WRM4: strengthening early warning and dissemination services for climate change-induced slow onset and sudden extreme water hazards using ICT and AI, and (v) CDM6: Increase the resilience of vulnerable poor communities by introducing gender-, age- and disability-responsive diversified livelihoods, effective insurance mechanisms and climate resilience funds.

congestion of the areas affects the agriculture, fishery, livestock practices of the area affecting income generation, social and environmental issues of the population and the areas affecting total development potentials. The proposed project will ensure the implementation of an integrated water resources management project for improvement of drainage congestion in Tungipara and Kotalipara *upazillas* under Gopalganj and Madaripur districts. After preliminary discussion with GoB, ADB included this project in the indicative country pipeline and monitoring (ICPM) report 2022-2024 aiming to support sustainable water resource management for improving agricultural and fisheries production, livelihood support and disaster and climate resilience in southwest part of Bangladesh.

10. The following structural activities are planned for the project⁶: (i) Regulator-Boat-pass (rehabilitation); (ii) re-excavation of khals; (iii) re-sectioning of embankment; (iv) check structure; (v) foot Bridge/culvert; (vi) river dredging; (vii) protective works; (viii) office building/inspection bungalow; (ix) WMG offices (new); (x) arsenic free tube well.

11. The non-structural activities include: community capacity enhancement for participatory operations and maintenance (O&M) such as: (i) formation and registration of WMAs and WMGs for O&M with BWDB providing annual maintenance funding, training, support and monitoring; (ii) livelihood support programs and courses will be identified for affected persons as well as for persons living in the project area include vocational skills development and various livelihood trainings, for example: crop and fisheries, homestead small livestock and poultry rearing, handicrafts and tailoring, establishment of fish sanctuaries, and so on. Participants for the courses will be carefully screened for interests while checking their suitability. Follow up monitoring and training will be provided, as well as start-up equipment and materials. To encourage women's participation care facilities for infants and children, as well as segregated toilets, will be provided at training venues.

2. Outputs and outcomes

A. Impact and outcome

12. The proposed project will build on past successes in enhancing the rural household incomes by improving productivity, effectiveness, and sustainability of existing underperforming FCD/I schemes, enhancing livelihood opportunities and ensuring participatory water resource management for economic purposes. The project interventions under the four subprojects, (i) Tarail–Pachuria, (ii) Ramshil–Kafulabari, (iii) Satla–Bagda, and (iv) Rajoir–Kotalipara, will improve drainage across 55,165 ha benefitting about 460,000 people by addressing constraints in agriculture, fisheries and livelihood development through holistic, gender-sensitive and socially inclusive participatory planning, digitization of water resources management and associated support services. It will also prepare an integrated water management plan (IWMP) for an additional subproject in Beel-Kajulia covering about 26,800 ha area with 192,000 people. The project will continue best practices of ADB's previous projects by focusing on innovative pilots in digital transformation of grassroots organizations through unique farmer database and digital early warning systems.

B. Outputs

⁶ Ministry of Water Resources (MOWR) 2023. Development Project Proposal (DPP) Implementation of Integrated Water Resources Management for Improvement of Drainage Congestion in Tungipara & Kotalipara *upazilla* under Gopalganj district. Bangladesh Water Development Board (BWDB), Ministry of Water Resources (MOWR), Government of Bangladesh.

13. The Project outputs are following:

14. **Output 1. Capacity of Water Management Organizations for sustainable climate resilient planning and management of water resources and livelihood development strengthened.** Participatory and climate adaptive O&M approaches to FCD/I infrastructure will ensure operational efficiency, effectiveness, social and financial sustainability and resilience throughout the life of project assets. The output will support (i) formation of WMOs in four subproject areas with 70% beneficiary households enrolled as members, including 33% women members, (ii) capacity development of 172 WMGs to participate in the design, construction and O&M of FCD/I infrastructure based on principles of climate resilience and the government's guidelines for participatory WRM, and (iii) establishment of joint management committees for O&M of FCD/I assets. The output will support formulation of one IWMP and 17 subunit implementation plans (SIPs) based on community demand, and train WMGs in implementation of IWMP and SIPs, that will include specific requirements for climate resilient management of FCD/I assets, mechanism for collecting and managing user fees, and audit procedures, thereby ensuring financial sustainability of FCD/I assets. As part of the project's poverty reduction and community-led adaptation strategy to increase resilience of rural households to climate shocks, the SIPs will implement a localized and value-chain based livelihood diversification plan that will aim to intensify and diversify livelihoods and provide trainings to WMGs in adopting climate resilient practices in agriculture, livestock, fisheries and other emerging green livelihoods.

15. **Output 2: Adaptive resilience of FCD/I schemes in project areas enhanced.** Reliability and resilience of critical WRM infrastructure and services is a critical challenge that is sought to be addressed under this output. The FCD/I interventions are designed based on hydrological subunits, considering the complex and dynamic socio-hydrological systems and co-dependent sociological and hydrological cycles of the project area, to increase productivity and efficiency of WRM and withstand and respond to climate-induced biophysical variability. Climate adaptive engineering solutions and scaling of NBS piloted under previous ADB supported projects in the region and piloting of new NBS approaches will be supported under this output. The FCD/I schemes will help resolve flooding and drainage congestion challenges and increase the overall availability of land and water resources, enhancing cropping intensity and directly contributing to food security. Drainage will be improved in over 55,165 ha in four subproject to benefit about 460,000 people, and IWMP in an additional subproject will 26,800 ha to benefit 192,000 people. About 50% beneficiaries will be women. Besides FCD/I schemes, the output will also support the construction of arsenic-free tube wells, WMO training centers, and other community infrastructure to facilitate access to services and economic opportunities and improve overall quality of life. The FCD/I assets will empower communities to effectively manage water resources based on seasonal requirements of diverse economic activities, strengthening resilience of communities to climate shocks.

16. **Output 3: Institutional capacity for mainstreaming climate resilience, and sustainable participatory and integrated water resources planning, and management strengthened.** The output supports institutional capacity development of BWDB at the national level for participatory WRM for (i) efficient coordination with government departments, including departments of agricultural extension, fisheries and livestock services; (ii) management and monitoring of WMO activities; and (iii) performance monitoring and O&M of FCD/I infrastructure. The project will establish mechanisms for sustained collaboration among ground level staff of departments of agricultural extension, fisheries and livestock and others to pilot innovative adaptation practices. Mainstreaming of climate adaptation in BWDB operations will be supported

through (ii) development of farmer-information databases, (ii) establishment of knowledge management platform of climate related information by design, development and deployment of a digital operations dashboard that will (a) digitalize WRM operations by WMGs, (b) collect and disseminate timely information and advisory to WMGs on weather, climate resilient agricultural and fisheries practices, innovative climate resilient production technologies, sustainable fertilizers usage, integrated pest management, market prices, etc. through mobile alerts, and (c) enable collection of water- and produce- related data for future planning purposes. WMGs will be trained to use climate information to manage economic activities. Larger poverty reduction and community resilience objectives will be further supported by enabling access to finance for microenterprises by WMG members by facilitating use of WMG corpus through a legal regulatory mechanism under the overall audit supervision of BWDB. The output will also support readiness activities for a subsequent larger national-level policy-based program that will adopt a much wider approach to WRM—and build a comprehensive programmatic approach to project interventions including flood, drainage, riverbank erosion, irrigation and coastal management from a climate lens. The follow-on program will support NAP implementation and align with BDP2100 strategies and ADB operational priorities, integrate climate-resilient strategies and sustainable management of water as an economic resource.

17. The project strengthens critical infrastructures of riverbank protection, FCD/I through socioeconomically, hydrologically, and environmentally sustainable and climate resilient approaches to WRM, and builds BWDB's capacity in tackling climate impacts. The project places communities at the center of sustainable, inclusive and locally led poverty reduction and climate resilience strategies in line with priorities set out in the NAP and ADB Country Partnership Strategy 2021-2025. About 12 months of project period is allocated to maximizing enrolment of beneficiary households and building capacities of 172 WMGs to identify and operate FCD/I assets to best meets the economic, social and environmental needs of water and extant climate risks. SIP strategies target the climate–gender–poverty nexus by encouraging emerging sustainable green livelihood opportunities under the project. A structured knowledge management platform will be established for climate information for institutional stakeholders and communities.

C. Project interventions

18. The initial study of the proposed project covers five subprojects mainly located in the eastern side of Ghagor River. The proposed interventions in Rajoir–Kotalipara will be impacted by the hydrological behavior of the Beel-Kajulia area in the western side of the Ghagor River. The Mission identified an area adjacent to Ramshil–Kafulabari which is also under the hydraulic influence of the Ghagor River and not initially included within the project. Considering this, the ADB and BWDB agreed to include these additional areas within the project, raising the total project area to around 82,000 ha with five subprojects (i) Tarail–Pachuria, (ii) Ramshil–Kafulabari, (iii) Satla–Bagda (Polder-1), (iv) Rajoir–Kotalipara, and (v) Beel-Kajulia, and an estimated total population of 651,208 (including Beel-Kajulia). The project will prepare and implement the IWMP for Beel-Kajulia and the project management office (PMO) will include this new area in the environmental impact assessment (EIA) as per government requirement that is under preparation.

19. Based on the survey covering the initial five subproject areas, 17 WMAs will be formed, supervising 172 WMGs that will be established. Additional WMAs and WMGs corresponding to the area of Beel-Kajulia will be determined later. Table II-1 below details the proposed WMOs in the project:

Table I-1: Proposed WMOs per Subproject

Subproject	Tarail Pachuria	Ramshil-Kafulabari	Satla-Bagda	Rajoir-Kotalipara	Beel-Kajulia	Total
WMA	6	4	4	3	tbd	17
WMG	64	30	42	36	tbd	172

tbd = to be determined, WMA = water management associations, WMG = water management groups

Source: PMO, BWDB

20. The proposed main interventions included in the project are listed in Table II-2 below:

Table I-2: Proposed Intervention per Subproject

No.	Intervention	Unit	Subproject					Total
			Tarail Pachuria	Ramshil-Kafulabari	Satla-Bagda	Rajoir-Kotalipara	Beel-Kajulia	
1	Regulator/boat pass (rehab)	No.	52	6	15	-	tbd	73
2	Regulator / Boat pass (new)	No.	5	3	3	3	tbd	14
3	Khal re-excavation	km	330	10	166	25	tbd	531
4	Embankment re-sectioning	km	20	1	-	3	tbd	24
5	Embankment Construction	km	-	-	-	2	tbd	2
6	Check structures (new)	No.	8	-	4	-	tbd	12
7	bridge / culvert (new)	No.	20	3	5	3	tbd	31
8	River dredging	km	8	-	8	5	tbd	21
9	Protective work	km	2	-	-	-	tbd	2
10	BWDB Office building / IB	No.	1	-	-	1	tbd	2
11	WMO Training Center	No.	6	4	4	3	tbd	17
12	Arsenic free tube-well	No.	104	72	72	60	tbd	308
13	Inlet/Outlet (Rehabilitation)	No.	10	11	4	-	tbd	25
14	Inlet/Outlet (New)	No.	2	1	3	1	tbd	7
15	MS Gate replace EM hoist	No.	99	37	41	7	tbd	184

IB = inspection bungalows, EM = electro-mechanical, O&M = operation and maintenance, tbd = to be determined, WMO = water management organizations.

Source: PMO, BWDB

D. Implementation arrangement

21. BWDB under MOWR is the executive agency of the project. Project implementation institutionalizes effective mechanisms to plan, develop, and manage water resources and deliver support services with the regular setup of BWDB and line departments, with outsourcing to the private sector including nongovernment organizations (NGOs). A PMO will be established in the Gopalganj of BWDB to manage overall project implementation, while day-to-day implementation is done in subproject management offices (SMO). A joint management committee (JMC) will be established in each subproject with representation from WMAs, local government institutions, and line departments to decide on subproject implementation matters. A steering committee is established for central-level coordination of concerned ministries and departments.

22. Project O&M will essentially operationalize the NWP by transferring the management of subordinate infrastructures (having a command area of 2,500 ha) to WMAs and jointly managing other main facilities under the JMC. To support sustainable O&M, the Project will (i) adopt the procedure that has proved effective in small-scale FCD/I schemes with ADB assistance, as regards the transferred facilities managed by WMAs; and (ii) as to the remaining facilities, strengthen central funding and its management systems including expenditure rationalization, improved management information systems for scheme performance monitoring and O&M

planning, and performance-based priority allocation of O&M budgets for schemes where NWP arrangements are operating satisfactorily.

E. Capacity building

23. Capacity building of each EA/IA(s) staff and stakeholders in environmental management will aim to ensure effective implementation of the environmental assessment and review framework (EARF) and proper supervision and monitoring of environmental safeguards during implementation of various FCD/I interventions and construction of other structures. To support the PMO, a consulting team led by an international firm and comprising international and national experts will be engaged for project management and capacity strengthening. An environment, health and safety specialist is included in the team. In addition, a focal person from the PMO as well as all the Subdivisional Engineers/ Assistant Engineers of the SMOs will monitor the implementation of the environmental and social safeguards. They are tasked with the compliance and implementation of safeguards issues as per EMPs and capacity building of the other BWDB local office staff for supervision and monitoring purposes.

F. The Initial Environmental Examination (IEE)

24. This initial environmental examination (IEE) has been prepared, in accordance with the environmental safeguards requirements of ADB and GoB, as well as the guidance provided by the EARF developed for guiding the environmental safeguards principles adopted for project, to help ensure that the infrastructure proposed under the Investment Project part of the Program meets a high standard for environmental and social responsibility. As proposed investments are dispersed across many locations within Bangladesh, it is considered appropriate for each location to be covered by a context-specific IEE; **this IEE report is applicable to Riverbank Protection Work (2.40 km) under the project .**

25. The findings presented in the IEE report are based on desktop studies; discussions with BWDB, design, local knowledge of the consultants engaged in this project; visits to Gopalganj and the surrounding area; and consultations with local stakeholders, between June 14 and July 13.

1. Objective, purpose and limitations of this report

26. This IEE report describes the assessment results of environmental and social impacts caused by said intervention as described in Table I-2 item no 9 which are likely to be categorized as *Red* according to the Environmental Conservation Rules (ECR) 2023 adopted by the Bangladesh Government and category B as per ADB's Safeguard Policy Statement (SPS) 2009. The IEE report specifies measures to address such impacts. This IEE is based on the Environmental Assessment and Review Framework (EARF) prepared during the ADB preparatory site visits in July 2023 that focused on all interventions. This IEE is developed based on the site plans and information obtained during the field visits conducted by the environmental consultants; and secondary data, which characterize the environment and identify potential impacts. It contains the results of interviews and consultations with stakeholders in June-July 2023. The IEE includes an environmental management plan (EMP) outlining mitigation measures and monitoring requirements. Detailed design of subprojects will be done only after the procurement of consultancy services which therefore is not reflected in the IEE. Environmental specifications will be included in procurement documents to support integration of provisions into construction.

2. Scope

27. The scope of the report covers the existing environmental condition in the project site, assessment of potential environmental impacts during design and/or pre-construction, construction, and operation stages; description of the EMP and environmental monitoring plan; stakeholders' consultation, grievance redress mechanism, and description of the legal and administrative framework. This IEE does not provide assessment for any other/future developments or activities at the location or anywhere else within the area concern reported in this IEE document. Should any further development be planned as a result of either this Project or other related works, additional planning and assessment following the requirements of the government will be carried out separately.

28. In general, this IEE intends to:

- (i) Examine and describe the existing status of the various ecological, physical and human related components surrounding the project area;
- (ii) Predict the potential significant impacts of the project on the surrounding environment during the pre-construction, construction, operations and maintenance stages, and recommend appropriate mitigation and abatement measures; and,
- (iii) Identify residual impacts of the project and recommend appropriate short-term and long-term management plans.

3. Structure of this IEE report

29. The structure of this report follows the general guidelines of the Environmental Assessment and Review Framework (EARF) as per SPS 2009 developed for project. The structure of this report maintains the following sequence:

Executive Summary

- | | |
|------------------|--|
| Chapter 1 | <i>Introduction</i> provides the background on the project, the project's impacts and expected outcomes, administrative structure of the project, purpose and limitation of this report. |
| Chapter 2 | <i>Legal and Policy Framework</i> presents a review of relevant national laws and policies, international environmental obligations, ADB's environmental requirements, procedure of environmental clearance, environmental categorization. |
| Chapter 3 | <i>Description of the Proposed Interventions</i> provides a brief description of the Project, the location, size and need, description of project components. |
| Chapter 4 | <i>Description of the Environment</i> includes details on the baseline data of the environmental conditions in the project area (current features and conditions) |
| Chapter 5 | <i>Analysis of Alternatives</i> presents the alternatives considered during the feasibility study in order to arrive at the best option. |
| Chapter 6 | <i>Anticipated Environmental Impacts and Mitigation Measures</i> identifies the potential environmental, economic and social impacts from pre-construction, construction, and operation phase. |

- Chapter 7** *Public Consultation and Information Disclosure* discusses the issues raised during the consultations, proposed actions to address them, and the information needed to be disclosed to the public.
- Chapter 8** *Grievance Redress Mechanism* describes the process of addressing complaints.
- Chapter 9** *Environmental Monitoring Plan* outlines the environmental monitoring program, institutional responsibilities including the cost of implementing the EMP.
- Chapter 10** *Conclusion and Recommendation*
- Appendices**

II. LEGAL AND POLICY FRAMEWORK

A. Introduction

30. This section of the IEE details the Administrative Framework for the Project, covering national requirements as well as applicable international treaties and conventions. The intent of this section is to lay out the regulatory and non-regulatory performance requirements for all stages of the Project. For the purposes of this report, only those regulatory elements directly relevant to the proposed Project will be discussed. The environmental assessment requirements of both the GoB and ADB are outlined as well.

B. Institutional framework

31. The lead environmental agency in Bangladesh is the Department of Environment (DOE), under the Ministry of Environment, Forests and Climate Change (MOEFCC). DOE is charged with furthering environmental conservation, improvement of environmental standards, and control and mitigation of environmental pollution. This mandate positions DOE as a key regulator of a broad range of developments in the infrastructure, industrial and commercial sectors, including both publicly and privately funded initiatives. DOE is responsible for administering the country's central environmental law, which provides the framework for environmental impact assessment.

32. Other agencies with important environmental mandates include the Bangladesh Forests Department (also under MOEFCC), the MOWR, the Ministry of Fisheries, and the Ministry of Land. The laws and regulations administered and enforced by these other agencies do not structure the environmental assessment process directly but may often come into play in the consideration of the suitability and permissibility of proposed infrastructure developments by DOE.

33. Occupational health and safety are key considerations of the environmental assessment of proposed infrastructure. The Ministry of Labour and Employment (MoLE), particularly its Department of Labour and Department of Factory and Establishment Inspection, is of direct relevance to the environmental assessment process, as it administers and enforces the country's legislation, rules and standards governing industrial workplaces, including construction sites and most industrial facilities where physical labour is undertaken.

C. National policies, laws and rules applicable to the project

1. Central policy instruments

a. National Environmental policy 2018

34. Bangladesh adopted the National Environmental Policy (NEP) in 1992 to chart a path towards the country's sustainable development. The NEP 2018 is a revision of the NEP 1992 in the context of the new reality of climate change. The NEP 2018 also outlines a more up to date understanding of the extent and magnitude of environmental degradation that has become a fact of life in the world in general, and in Bangladesh in particular. The NEP 2018 outlines the problems of population growth, poverty, illiteracy, lack of awareness and healthcare services, limitation of arable land, unplanned development and urbanization, and industrialization as the major impediments to the conservation of the environment. The NEP sets out the basic framework for environmental action together with a set of broad sectoral guidelines for action. Major elements of the policy are:

- (i) maintaining the ecological balance for ensuring sustainable development;
- (ii) protection against natural disasters;
- (iii) identifying and controlling activities which are polluting and/or destroying the environment;
- (iv) ensuring environment-friendly development in all sectors;
- (v) promoting sustainable and sound management of natural resources; and
- (vi) active collaboration with international initiatives related to the environment.

35. The NEP, amongst other aims, seeks to ensure that transport systems, including roads and inland water transport, do not pollute the environment or degrade resources. The policy states that EIA should be conducted before projects are undertaken. The NEP 2018 includes additional elements addressing climate change mitigation and adaptation as key environmental issues facing the country and integrating a comprehensive 3R approach to the massive and growing problem of industrial and household waste that has swelled along with the country's urbanization.

36. Following are the key subject matters relevant to the preparation and implementation of project aligned with the requirements of NEP 2018:

- (i) Ensuring sustainable development through reducing human pressure on nature and natural resources
- (ii) Considering environment protection as integral part of the development programs planned to meet the need of the present and future generation
- (iii) Making natural resources extraction, use, environmental conservation etc. to be based on science
- (iv) Considering environmental impacts and risks in extracting and using natural resources
- (v) Evaluating economic contribution of ecosystem services simultaneously to that of natural resources
- (vi) Giving priority to poor and under privileged group of people in order to ensure their participation, equity, justice, accessibility to the use of natural resources and getting ecosystem services on which, they are dependent
- (vii) Taking initiatives to prevent misuse and ensure optimum of water, land, natural gas and other natural resources in the production process as well as day-to-day purposes
- (viii) Encouraging sustainable use of new and renewable resources
- (ix) Enhancing long term poverty alleviation and food security through conserving biological diversity
- (x) Realizing compensation from persons and institutes those who are liable to environmental pollution through applying polluter pay principle
- (xi) Including environmental conservation and preservation in all national policies and ensuring implementation of the environment policy at both government and non-government level
- (xii) Giving priority to preventive measures over curative measures in environmental conservation
- (xiii) Including adaptation and mitigation program in all development projects in order to address adverse impacts of climate change
- (xiv) Ensure sustainable utilization of ecosystem goods and services
- (xv) Implementation of 3R principle in utilization of resources
- (xvi) Strengthening institutional and legal capacity of institution (Government, local, private and technical) relevant to the enforcing and implementation of rules and regulation relating to environment policy and environment conservation

- (xvii) Ensuring considerations of climate change and challenges of calamities in all kinds of infrastructure projects
- (xviii) Reducing all SLCP (Short-Lived climate pollutants) which are harmful to health and environment.
- (xix) Taking development programs considering sustainable production and consumption as integral part of environmental conservation to meet the need of present and future generation.
- (xx) Allocating necessary funds to all areas of environmental conservation, preservation and control
- (xxi) Taking up programs in favor of flourishing environment friendly economy
- (xxii) Including environmental and ecological conservation particularly to introduce the environment and ecological concept in the environmental academic curriculum and textbooks of schools and colleges.

37. During environmental categorization and EIA process in this project, provisions of NEP 2018 have been considered, especially the clauses mentioned in para. 30 .

b. National Environmental Management Action Plan (NEMAP), 1995

38. The NEMAP built on the NEP to address specific issues and management requirements during the period 1995-2005 and remains a backbone of efforts to articulate national sustainability strategies. The plan includes a framework within which the recommendations of a National Conservation Strategy (NCS) are to be implemented. The NEMAP was developed with the following objectives:

- (i) Identify key environmental issues affecting Bangladesh.
- (ii) Identify actions to halt or reduce the rate of environmental degradation.
- (iii) Improve management of the natural environment
- (iv) Conserve and protect habitats and biodiversity.
- (v) Promote sustainable development.
- (vi) Improve the quality of life.

39. To this end, the NEMAP grouped all the relevant necessary actions under four heads: institutional, sectoral, location-specific and long-term issues. The institutional aspects reflect the need for inter-sectoral cooperation to tackle environmental problems requiring new institutional mechanisms at national and local levels. The sectoral aspects reflect the way the ministries and agencies are organized and make it easier to identify the agency to carry out the recommended actions. The location-specific aspect focuses on particularly acute environmental problems at local levels. And the long-term issues include environmental degradation trends that threaten to emerge as serious threats to the country's environmental quality and well-being if not proactively addressed. The proposed project addresses the NEMAP objectives (ii) to (vi).

c. Other Environment-Related Plan and Policies

40. In addition to the central environmental policy instruments, a number of other national policy efforts have significant environmental content. Prominent policy documents include the following National Plans, Policies Guidelines that confirm, compliment and support the National Environmental Policy:

- (i) National Bio-safety Strategy & Action Plan 1995
- (ii) National Biodiversity Strategy & Action Plan of Bangladesh 2016-2021
- (iii) A Roadmap for Clean Fuels and Vehicles in Bangladesh, 2011
- (iv) National Action Programme on Desertification, Land Degradation and Drought 2016-2024
- (v) Ecologically Critical Area Management Rules, 2016.
- (vi) Medical Waste (Management and Processing) Rules, 2008
- (vii) Hazardous Waste and Ship Breaking Waste Management Rules, 2011
- (viii) Bangladesh Biosafety Rules, 2012
- (ix) Bangladesh Biological Diversity Act 2017
- (x) Natural Water Reservoir Conservation Act, 2000
- (xi) National Forestry Policy 2016
- (xii) National Conservation Strategy 1998 and Draft Update 2013
- (xiii) National 3R (Reduce, Reuse & Recycle) Strategy 2010
- (xiv) Bangladesh Climate Change Strategy & Action Plan (BCCSAP) 2009
- (xv) BDP 2100
- (xvi) National Disaster Management Plan 2010.
- (xvii) Nationally Determined Contributions (NDCs)
- (xviii) Five Year Plan
- (xix) Sustainable Development Goals (SDGs)
- (xx) NAP 2022
- (xxi) Other Sectoral Policies/Strategies like Industry, Agriculture, Energy, Water, Health, etc.
- (xxii) National Bio-safety Framework and Guidelines
- (xxiii) Guidelines on Environmental Management, Waste Treatment and Workers' Occupational Health and Safety for Ship Breaking Yard in Bangladesh
- (xxiv) Establishing National Landuse and Land Degradation Profile 2018 (proposed)

41. During environmental assessment of this project, Ecologically Critical Area Management Rules, 2016; Natural Water Reservoir Conservation Act, 2000; Bangladesh Climate Change Strategy & Action Plan (BCCSAP) 2009; BDP 2100; National Disaster Management Plan 2010; NDCs; Five Year Plan; SDGs and NAP 2022 have been considered.

2. Legislations

a. **Bangladesh Environment Conservation Act (BECA), 1995 (as amended in 2000, 2002 & 2010)**

42. The Bangladesh Environmental Conservation Act (BECA), 1995 is the main legislation for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. The BECA repealed the earlier Environment Pollution Ordinance of 1977. The enabling powers of the BECA are wide ranging. Wide-ranging powers (Section 4) are given to the Director General (DG) to take various actions or measures to enforce the BECA (Table II-1). The Environment Conservation Act authorizes the DOE to undertake any activity to conserve and enhance the quality of the environment and to control, prevent and

mitigate pollution. The DOE is designated as the regulatory body and enforcement agency for all environment-related activities. The Act enables the following critical components of DOE's remit:

- (i) declaration of Ecologically Critical Areas;
- (ii) administration of the procedure for obtaining Environmental Clearance Certificates for new industrial projects;
- (iii) regulation with respect to vehicles emitting smoke harmful to the environment;
- (iv) environmental regulations for development activities;
- (v) standards for quality of air, water, noise, and soils (including river bed materials) for different areas and for different purposes;
- (vi) acceptable limits for discharging and emitting waste; and
- (vii) formulation of environmental guidelines to control and mitigate environmental pollution, conservation and improvement of the environment.

43. Amendments to the ECA in 2000, 2002 and 2010 added significant substantive and procedural scope, defining the following new areas of authority:

- (i) ascertaining responsibility for compensation in cases of damage to ecosystems;
- (ii) increased provision of preventive measures, including fines and imprisonment, and the authority to take cognizance of offences;
- (iii) restrictions on polluting automobiles;
- (iv) restrictions on the production and sale of environmentally harmful items like polythene bags;
- (v) obtaining assistance from law enforcement agencies for environmental actions;
- (vi) definition and enforcement of punitive measures;
- (vii) authority to try environmental cases;
- (viii) prohibition on hill cutting except where established to be in the national interest;
- (ix) authority to regulate management of hazardous waste produced by ship breaking yards;
- (x) prohibition of filling or alteration of waterways except when judged to be in the national interest; and
- (xi) additional powers to compel compliance with emissions standards.

Table II-1 Provisions of the BECA, 1995

Section	Provision Under Section
Section 4	Powers of the DG to enforce various provisions of the Act including setting rules and regulations for environmental conservation and protection.
Section 4A	Powers given to the DG to seek the assistance of other enforcement authority (or authorities) in its enforcement. Done indirectly by way of disconnecting power, gas, or water supply to the user.
Section 7	Allows the DG to seek compensation in cases of damage to the ecosystem or injury to person(s), whether directly or indirectly caused by a person or persons. He may also require that corrective or remedial action be taken to mitigate or ameliorate the situation.

Section	Provision Under Section
Section 8	Allows any person affected or likely to be affected as a result of pollution or degradation of the environment to apply to the DG for remedy of the damage or apprehended damage.
Section 9	DG can require the person responsible and the person in charge of the place of occurrence of an accidental pollution take measures to control or mitigate the environmental pollution.
Section 12	Requires that an Environmental Clearance Certificate be obtained before an industrial unit or project can be established or undertaken.
Section 13	Formulate and publish environmental guidelines relating to the control and mitigation of environmental pollution, conservation and improvement of the environment.
Section 14	Allows appeal against grievances to the Appellate Authority. [Note: The Appellate Authority was constituted by MoEFCC by a notification dated 03/11/1997].
Section 15	Allows the imposition of penalties for various offences.
Section 20	Power to make rules for various purposes including the setting of EIA procedures.

44. Section 12, requiring an Environmental Clearance Certificate, is effectively enforced by way of The ECR, 2023, which is made pursuant to the powers provided under Section 20 of the BECA.

b. Environment Conservation Rules, 2023

45. The MOEFCC enacted the ECR 2023 to implement the Environmental Conservation Act 1995. The rules have been effective from March 5, 2023, by repealing the ECR 1997. ECR 2023 is the most important set of regulations giving procedural substance and tools of enforcement to the aims articulated in the BECA 1995 and its amendments. The Rules specify the categorization of projects or industrial establishments by judging the severity of the project's (or industry's) impact on environment and human health.

46. ECR 2023 replaces all the old schedules stipulated in ECR 1997 and replaces the old four environmental categories i.e., 'green', 'orange A', 'orange B' and 'red' by new four categories i.e., 'green', 'yellow', 'orange' and 'red'. The new ECR also shades more lights on the determinants of environmental categorization of projects or industrial establishments, sets guideline for EIA process and report preparation along with the qualification of environmental consultants and subject matter experts responsible for preparing environmental impact assessment reports. There are 14 schedules in the ECR 2023 which are described in Table II-2. The most highlighted changes in the ECR 2023 from 1997 edition is the inclusion of stakeholder engagement in the EIA process, adoption of impact of human health, setting qualification of environmental consultants for EIA study, setting standards for wastewater quality, inclusion of a comprehensive indicative list of categorized project/industries according to its impact on environment and human health, guidelines for location setting of a project or industry, guideline for terms of reference preparation for EIA study, indicative buffer distance between project/industry and sensitive area, indicative EIA reporting guideline and guidelines for inclusion of environmental consultants within EIA study team.

Table II-2 Environmental standards specified in the ECR2023

ECR Schedule	Standard name
Schedule 1	Indicative list of projects/industrial establishment under four categories of environmental impacts
Schedule 2	Standards for water quality a. ground water, coastal waters, b. drinking water
Schedule 3	Standards for wastewater
Schedule 4	Standards for industrial wastewater
Schedule 5	Standards for category based industrial wastewater
Schedule 6	Fees for application for location clearance or environmental clearance certificates
Schedule 7	Fees for location clearance or environmental clearance certificates and renewal
Schedule 8	Fees for information collection/sample analysis from Department of Environment
Schedule 9	Guideline for location setting of industrial establishments
Schedule 10	Guideline for terms of reference preparation for environmental impact assessment
Schedule 11	Guideline for environmental impact assessment report preparation
Schedule 12	Guideline for establishment and operation of industrial effluent treatment
Schedule 13	Guideline for inclusion of environmental consultants or subject matter specialists
Schedule 14	Determinants environmental categorization of industries

c. The Environment Court Act 2010

47. The Environment Court Act 2010 was passed with a view to ensuring the expedited disposal of environmental cases. The Act, consisting of 24 sections, amends and consolidates the existing law in establishing courts and related matters to expedite the trial of environmental crimes. It establishes administrative and legal proceedings of the above-mentioned Environment Court, as well requirements to be met by said court, which may direct the investigating officer or person for further investigation into a criminal case related to a case pending against him and may determine the deadline for reporting the report. The court may impose any power environment passed by this Act or the Environment Law. A lawyer appointed by the Director General shall conduct all the cases related to the trial in the Environment Court and the prosecuted lawyer shall be deemed to be a special public prosecutor in the case of a special public prosecutor and civil nature case, in case of prosecution: Provided that empowered by the Inspector or the Director General or Any officer to assist the lawyer in managing the case. Subject to the provisions of this Act, in relation to the trial and settlement of compensation cases, the provisions of the Code of Civil Procedure shall apply, and, in that case, the Court of the Environment shall be deemed to be a civil court and enforce all the powers of the Civil Court in the trial of any compensation suit under this Act.

d. Air Pollution (Control) Rules 2022

48. Aiming to protect environmental health, the government has published a new rule based on section 20 of The Bangladesh Environment Conservation Act, 1995. The main objectives of this rule are to prevent, control, and reduce air pollution. The government will appoint a director general who will be responsible for managing and maintaining the environmental issue. The Rule specified several types of pollution such as pollution caused by factories, vehicles, construction, garbage, etc. According to the new rule, there will be a committee that will impose damages and punishment for such pollution. As stated by the rule, the government will give rewards to those who will protest against pollution and do not cause any type of pollution.

e. Noise Pollution (control) Rules, 2006

49. This rule has been promulgated under the provision of clause 20 of BECA, 1995. The rules provide for standard limits of noise level of vehicles and designated areas. According to the Rules, motor honking within a 100 m radius of a hospital, school and office is prohibited. The rules also do not allow use of brick crushers and cement mixers within a 500 m radius of a residential area. Besides, prior permission is mandatory for using loudspeakers or megaphones. The rules stipulate safety and precautionary measures in workplaces, designated authorities for allowing noise generating appliances.

f. Solid Waste Management Rules 2021

50. The Solid Waste Management Regulations 2021 were published in Bangladesh on December 23, 2021, under the Bangladesh Environmental Protection Act, 1995. The Regulations define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to Extended Producer Responsibility (EPR) on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery.

g. Environmentally Critical Areas Management Rules, 2016

51. Under the Ecologically Critical Area Rule 2016, a National Committee is to be formed which will consider the prevailing naturalness and biodiversity status of the threatened area and identify causes of deterioration and potential threat. It shall recommend to the government about alternative livelihood for the dependent population of the ECAs. This committee is also directed to supervise or provide guidance and directives to the nationally executed government development projects.

h. Other environment related rules and legislations

52. In addition to the ECA and ECR, numerous laws and supporting rules have been passed and developed to regulate the use of natural resources and protect the natural environment from deleterious activity. A summary of environment-related laws and rules, any of which may be relevant or applicable to proposed infrastructure development, is provided in Table II-3. Depending on the nature of project activities and infrastructure, No Objection Certificates (NOCs) may need to be obtained from the agencies overseeing environment-related laws and regulations as part of the environmental clearance process directed by DOE, to ensure compliance with all relevant national laws.

Table II-3 Summary of Environmental Legislations Applicable to the Proposed Project (resources protection)

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
1	National Forestry Policy (2016) Draft	The National Forestry Policy (NFP) provides the framework for the protection of the remaining forests in	Protected areas within the forest cannot be encroached by any project construction activities. No felling, cutting	Department of Forests

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
		the country and the restoration of about 20% of the country's land under the afforestation programs The priority protection areas are the habitats which encompass representative flora and fauna in the core area of national parks, wildlife sanctuaries and game reserves. Multiple-use of forest, water and fish of the Sundarbans through sustained management will be ensured, keeping the bio-environment of the area intact.	within protected or reserved forest is permitted. Not triggered by the project as the project area is outside designated forest areas declared by GoB. However, if there are any social forestry programs being implemented which are within the buffer zone of proposed intervention, the policy must apply. Such interventions are likely by the project	
2	The Forest Act (1927) and Forest (Amendment) Act (2000)	An act to control trespassing, illegal resource extraction and provide a framework for the forestry revenue collection system. To accommodate social forestry, the act was amended in 2000.	Requires clearances for any project within forest areas and clearances for any felling, extraction, and transport of forest produce. Not triggered by the project as the project area is outside designated forest areas declared by GoB. However, in future if community forestry and social forestry is considered, the intervention might trigger the act.	Department of Forests
3	The Bangladesh Wildlife (Conservation & Security) Act, 2012	To conserve and protect wildlife in Bangladesh including designation of protected areas. Protection of wildlife is provided with lists of species with four schedules: first, second, third and fourth schedule. The fourth schedule species have the highest level of protection.	Consultation and necessary permits are required if the project would pass through the wildlife sanctuaries and other protected areas. Not triggered by this project. No wildlife or endangered species were found within the project boundaries, yet. However, an ecological assessment will be undertaken by the project which will determine whether any wildlife of significant value resides within the project boundary. Then this act will trigger, and necessary management plan will be taken.	Department of Forests

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
4	Bangladesh Protected Area Management Rules 2017	The rules portray the engagement process of the government authorities and local communities on how to be engaged in protected area management declared by the government. The rules cover protective activities such as regular inspections, security maintenance, annual planning of protection, actions against illegal activities, declaration of special reservation area etc.	No activity inside a declared PA is prohibited. Not triggered by the project. The project boundaries selected are outside the designated PAs, national parks and Sanctuaries.	Department of Forests
5	National Safe Drinking Water Supply and Sanitation Policy of 1998	Ensures access to safe water and sanitation services at an affordable cost	Pourashavas and water sanitation authorities will take actions to prevent wastage of water. They will take necessary steps to increase public awareness to prevent misuse of water. Pourashavas shall be responsible for solid waste collection, disposal and their management. Triggered by the project. Labour camp and construction camp will require safe drinking water supply from pourashava, or at least needs permission from pourashava to extract groundwater. The EMP section will layout the plan for supplying safe drinking water for the construction workers and communities.	Ministry of Local Government, Rural Development, and Cooperatives
6	National Water Act 2013	Ensures Bangladesh water sources are free from any type of pollution. Pollution from water in urban outfalls and reservoirs, e.g., lakes, canals, ponds and ditches may result in amenity losses, fisheries depletion, health problems and fish and aquatic species contamination.	Secure clearance certificate on water resource development subprojects. Triggered by the intervention.	Ministry of Water Resources
11	Wetland Protection Act 2000	Advocates protection against degradation and resuscitation of natural waterbodies such as lakes,	The entire project area is a wetland. Hence the act is triggered . Any action will be	Ministry of Water Resources

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
		ponds, beels ¹⁰ , khals, tanks, etc. affected by man-made interventions or other causes. Prevents the filling of publicly owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment. Prevents unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.	assessed to see if it might degrade the wetland.	
13	The Pourashava Act 2009 / Ordinance issued for the amendment of local government (municipality) ordinance, 2009 and 2010; The Pourashava Ordinance, 1977; Municipal Administration Ordinance, 1960	Provides guidance for subproject integrated community and workers health and hygiene at the construction and operation and maintenance stages of the project	Coordinate with pourashava committees on disaster management measures, water and sanitation and waste management. Triggered. During construction design, construction and operation the acts were considered and applied.	Local Authorities
14	Bangladesh Climate Change Strategy and Action Plan of 2009	Enhances the capacity of government ministries, civil society and private sector to meet the challenges of climate change	Integrate adaptation measures for buildings in consideration of extreme climatic events. Triggered. The BCCSAP 2009 has been considered in river protection design design and also in the entire project consideration.	Ministry of Environment, Forests and Climate Change
15	Building Construction (Amendment) Act and Building Construction Rules, Bangladesh	Regulates technical details of building construction and to maintain standards of building construction	Follow specifications to ensure structural integrity of buildings. Not Triggered. During river protection works there will no construction of buildings	Ministry of Housing and Public Works

¹⁰ A beel is a billabong or a lake-like wetland with static water (as opposed to moving water in rivers and canals - typically called khals), in the Ganges - Brahmaputra flood plains of the Eastern Indian states of West Bengal, and Assam and in the country of Bangladesh.

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
	National Building Code			
16	Electricity Act 2018	Requires compensation for any damage, detriment or inconvenience caused by the project; Requires precautionary measures in laying down electricity supply lines near or where any metallic substance or line crosses to avoid electrocution; directs in powerline laying construction related activities to avoid public nuisance.	Triggered. The labor camp needs electricity supply. The following are ensured: Secure permission to supply energy and lay down or place electricity supply lines for the conveyance and transmission of electricity from respective authorities prior to any works. Give full compensation for any damage, detriment or inconvenience caused by him or by anyone employed by him/her. Take precautions in laying down electricity supply lines near or where any metallic substance or line crosses in order to avoid electrocution.	Ministry of Power, Energy and Mineral Resources
17	Standing Order on Disaster, 1999 (Updated 2010)	Enhances capacity at all tiers of government administrative and social structures for coping with and recovering from disasters	Triggered. River protection works will be undertaken to prevent future flooding and river erosion in the area.	Ministry of Disaster Management and Relief
18	National Disaster Management Act of 2012	Establishes a framework for managing disasters in a comprehensive way.	Setting-up emergency response procedures. Triggered. The project structure is to follow the setup of the Act.	Ministry of Disaster and Relief
19	East Bengal Protection and Conservation of Fish Act 1950 (1982)	Protection and conservation of fishes in inland water bodies of Bangladesh	No wetland or canal should be encroached or obstructed due to construction and operation of the projects. Not triggered. No fishpond or fisheries entities are nearby. Criteria selection for project are ensured of that.	Department of Fisheries
20	Public Procurement Rule (2008)	Applies to the procurement of goods, works or services by any government, semi-government or any statutory body established under any law; includes measures regarding the safety, security and protection of the environment in	Triggered. The PPR (2008) will be followed during procurement process of the subprojects	Ministry of Public Works

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
		construction works; requires Contractors to take all reasonable steps to safeguard the health and safety of all workers on site, protect the environment on and off the site, and avoid damage or nuisance to persons or to property of the public or others		

GOB = Government of Bangladesh.

i. Other environment related rules and legislations

53. During construction, the intervention will conform to the occupational and health related rules as outlined in the Table II-4 below.

Table II-4 Occupational and health safety related rules in Bangladesh

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 Labour (Amendment) Law, 2018	- 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
Labour Rules 2015	The Labor Rules give substantial practical heft to the Labor Act, specifying standards for workplace dimensions and features, responsibilities of employers and facility owners, limits on working hours, special rules for young workers, and many other workplace safety and worker protection matters. The Rules provide the basis for inspections of construction sites and industrial facilities by the Department of Inspection for Factories and Establishments (DIFE) under Ministry of Labour and Employment (MoLE).
The Employer's Liability Act, 1938	The Act declares that the doctrine of common employment and of assumed 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, women 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.

Title of Laws and Rules	Descriptions
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 workplace 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.

D. International commitments

54. Bangladesh has signed many international treaties, conventions and protocols that pertain to environmental conservation, pollution control, and working conditions, and these needs to be considered alongside national laws and regulations in the context of infrastructure planning. A list of the most relevant international treaties and conventions to which Bangladesh is a party is presented in Table II-5.

Table II-5 Treaties and conventions joined by Bangladesh and applicable to this project.

Treaty or Convention	Brief description
International Plant Protection Convention (Rome, 1951) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	Aims to ensure that construction work and construction materials do not introduce plant pests
Conservation of Wetlands of International Importance specially as waterfowl Habitat ("Ramsar Convention": Iran, 1971)	Conservation and proper use of wetlands and their resources; protection of significant wetlands and prevention of draining or filling during construction
Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)	Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc.
CITES Convention (Convention on International Trade in Endangered Species)	Aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival
Occupational hazards due to air pollution, noise & vibration (Geneva)	Aims to protect workers against occupational hazards in the working environment
Occupational safety and health in working environment (Geneva)	Prevent accidents and injury to health by minimizing hazards in the working environment

Treaty or Convention	Brief description
Occupational health services (Geneva)	To promote a safe and healthy working environment
Convention on Biological Diversity, (Rio de Janeiro, 1992)	Protection of biodiversity during construction and operation; underpins the value of natural resources that provide food and livelihoods throughout the world
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1992)	Aims to protect human health and the environment against the adverse effects of hazardous wastes
International (United Nations Framework) Convention on Climate Change (Kyoto Protocol, 1997)	International treaty on climate change and emission of greenhouse gases, reduce greenhouse gas concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system
Convention on Persistent Organic Pollutants, Stockholm, 2001	Restriction of use of pesticides and herbicides
Minamata Convention on Mercury, 2017	Global treaty to protect human health and the environment from the adverse effects of mercury, by addressing interim storage and disposal, sites contaminated by mercury, and mercury-related health issues

E. Environmental Assessment Process and Requirements

55. This project is subject to the environmental safeguards requirements of both the Government of Bangladesh and ADB. These requirements share some concepts and terminology and are non-contradictory. The two procedural frameworks for EIA are described in turn below.

1. National Environmental Clearance Process

56. **Categorization schemes.** The ECR 2023 stipulate a four-level color-coded typology of impact potential as the basis for determining the environmental clearance process for different types of proposed projects, and the extent of environmental assessment work that must be done in support of clearance applications submitted by proponents. The categorization framework is outlined in Table II-6.

Table II-6 Categorization scheme for determining environmental clearance requirements posed by DoE

Category	General Environmental Assessment Requirement
Green	No environmental assessment required to support application for environmental clearance
Yellow	No environmental assessment required, but detailed project information, including process flow diagrams and effluent treatment arrangement, must accompany application for environmental clearance
Orange	IEE required, and project can proceed to environmental clearance application once IEE is approved by DOE

Red	Brief IEE required to establish ToR for comprehensive EIA, and project can proceed to environmental clearance application after EIA and EMP have been approved by DOE, often subject to conditions
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DoE = Department of Environment, EIA = Environmental Impact Assessment, EMP = Environmental Management Plan, IEE = Initial Environmental Examination, ToR = terms of reference.

57. The ECR (Schedule I) provide indicative lists of types of projects, facilities and infrastructure that would normally fall into each of the four assessment categories. Although these lists are quite comprehensive, the listed types may in many cases not apply unambiguously to a given proposed infrastructure element or project activity. Further, the matters of scale and context, which determine so much of impact potential, are not strongly addressed by the indicative lists. Assigning an assessment category thus must be informed by expert judgement, based on the initial specifications of the planned project infrastructure and activities, and basic details of the project environment. DoE has noticed this. Hence the ECR 2023 includes the process of engaging experts in the EIA process. DoE reviews preliminary infrastructure plans for proposed infrastructure investments and decides regarding the categorization on a case-by-case basis.

Environmental clearance process. According to the ECR 2023, all projects/industries must apply for a Location Clearance certificate prior to the application for Environmental Clearance certificate (ECC) (Figure II-1). The DoE is responsible for awarding both certificates. Regardless of the assessment category assigned, all applications for environmental clearance must be accompanied by a NOC obtained from local authorities (Union Parishad Chairman or Upazila Nirbahi Officer in rural locations, and from several entities in urban locations such as Gopalganj), and by an application fee. NOCs may also be required from key agencies (e.g., Water Resources Planning Organization, Forests Department, Ministry of Fisheries) if the proposed project has any potential relevance for the natural resources under their remit. The proponent is responsible for obtaining the NOCs and paying the application fee. The proponent is also responsible for renewing the clearance certificate, once obtained, on a yearly (for orange and red category projects), 2-yearly (for yellow category project) or 5-yearly (for green category project) basis, paying a fee for each renewal. Fines are levied when the proponent allows the clearance certificate to lapse.

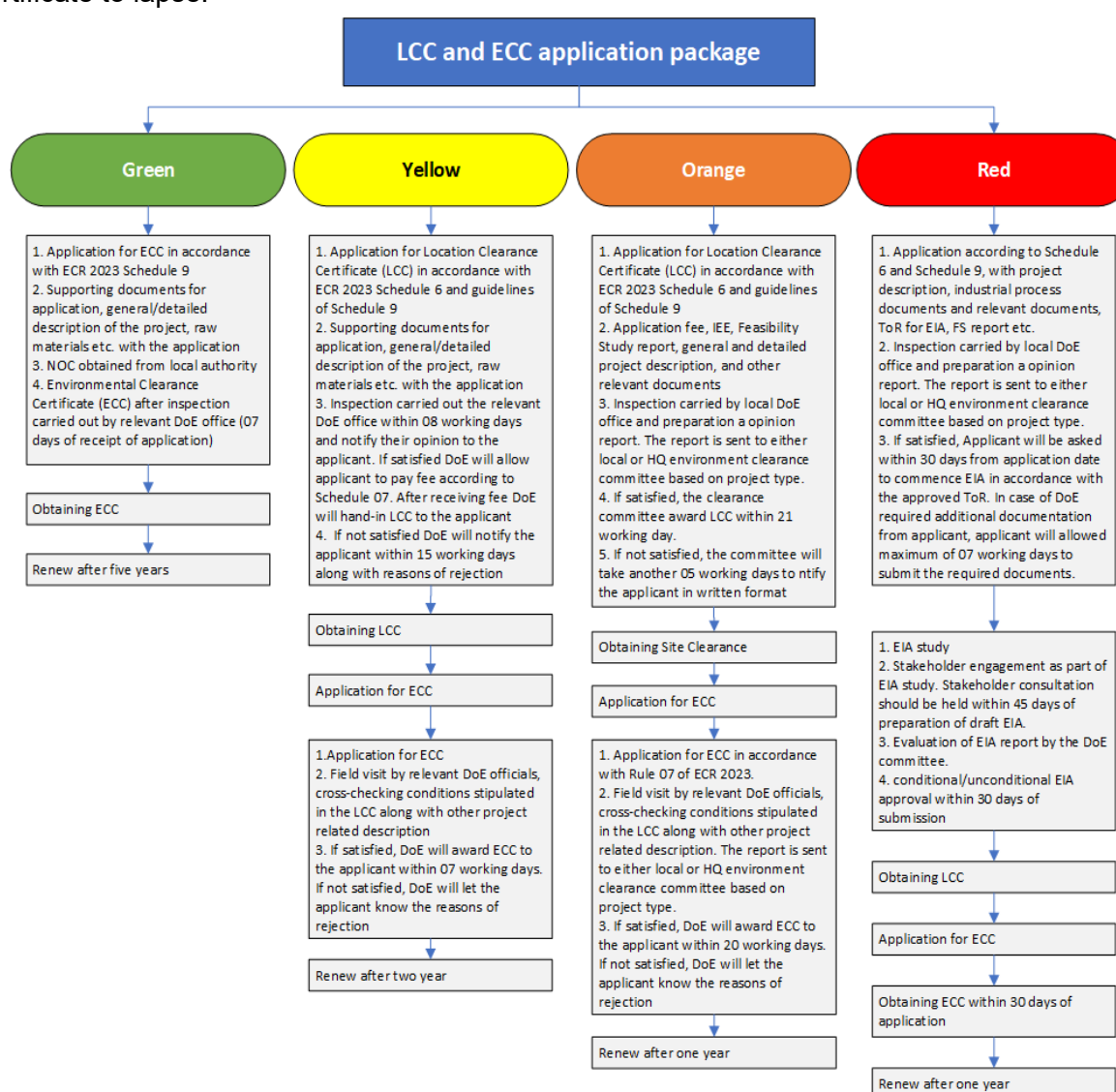


Figure II-1 Location Clearance Certificate (LCC) and Environmental Clearance certificate (ECC) application and awarding process from DoE

58. For investments that require an environmental assessment report (Orange and Red projects), DoE reviews and approves the report (either an IEE or more detailed EIA) before approving the clearance application. The approval may be subject to certain conditions, which the proponent is bound to meet to keep the clearance certificate current. Review time of clearance applications by DoE varies with project category. Environmental Review and clearance process of project is shown below (Figure II-2)¹¹.

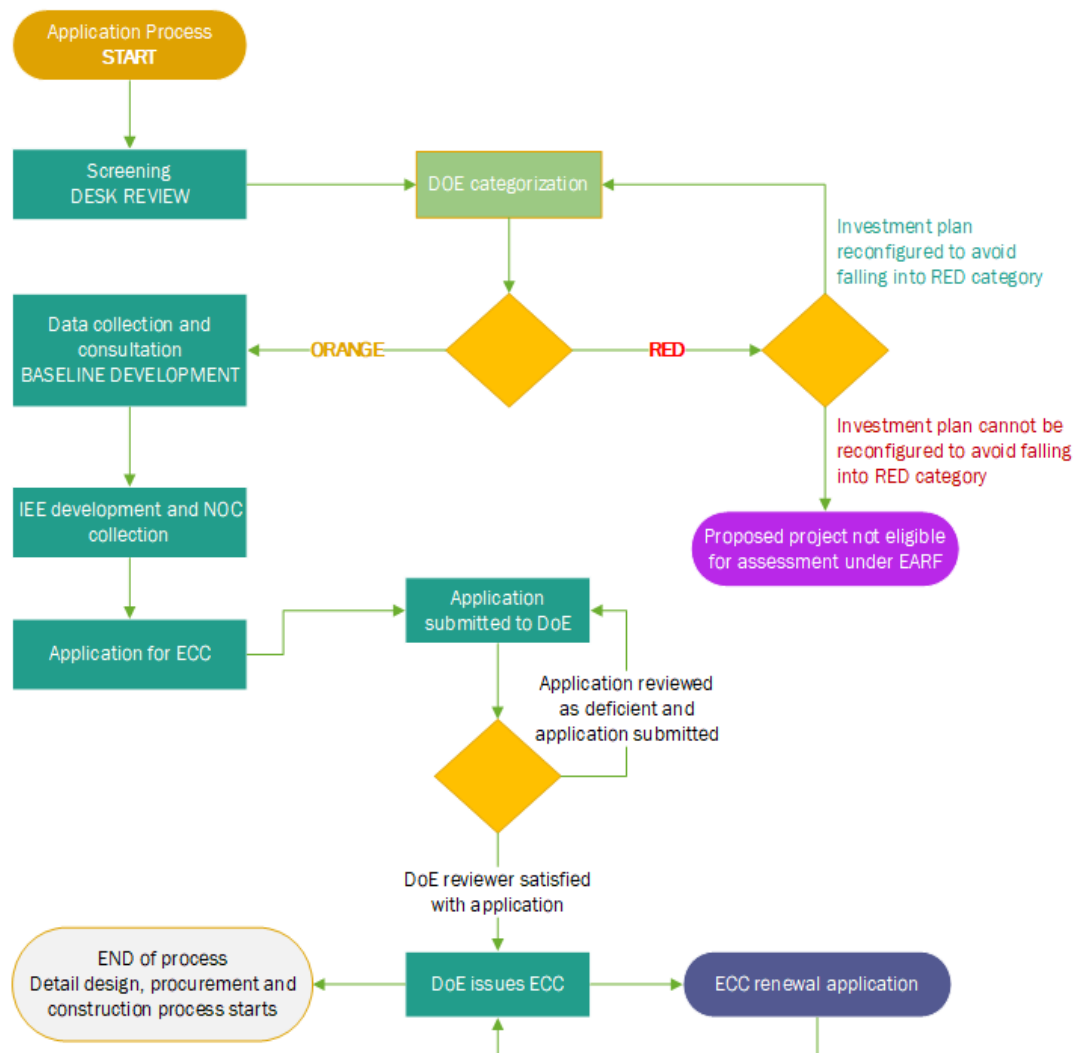


Figure II-2 Flowchart of national clearance process as applicable to Project

59. **Anticipated DoE assessment category.** The river protection works proposed under the project will appropriately be considered to fall into the 'RED' assessment category (Table II-7). Under RED category, the ECC obtaining process will require an IEE for the application process

¹¹ A useful and accessible reference on the clearance process is Department of Environment. 2010. A Guide to Environmental Clearance Procedure. Dhaka, August 2010.

and later an EIA as a final requirement for ECC. This IEE report will be reviewed by DoE, and the anticipated categorization will be confirmed at that time.

Table II-7 Anticipated project category according to the ECR 2023 and its amendments.

Project description	Similar category (ECR 23 and amendments)	Likely category	Comments
River protection works	Schedule 1: Item number 34 River, Khal, beel dredging and dredging material management	Red	River protection works will take place in two places, totalling 2.40 km.
	Schedule 1: Item No. 62 Polder construction	Red	
	Schedule 1: Item no. 60 River and basin development, Irrigation, Flood Control, and drainage project	Red	

Source: Information taken from ECR 2023 and interpreted by the TA consultant

2. ADB Environmental Assessment Requirements

60. Safeguard requirements for all projects funded by the ADB are defined in the ADB SPS 2009. This document establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound, are designed to operate in compliance with applicable regulatory requirements, and are not likely to cause significant environmental, health, or safety hazards. The SPS is one of the key Bank Policies collected in the ADB Operations Manual. The policy promotes good practice as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines.

61. The SPS 2009 provides a framework of expectations for environmental analysis, engagement with stakeholders and communities potentially affected by projects, reporting, and follow-up implementation. Key prescriptions include the following:

- (i) At an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative, and induced environmental impacts on and risks to physical, biological, socioeconomic, and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected people and concerned NGOs. If potentially adverse environmental impacts and risks are identified, the borrower/client will undertake an environmental assessment as early as possible in the project cycle. For projects with potentially significant adverse impacts that are diverse, irreversible, or unprecedented, the borrower/client will examine alternatives to the project's location, design, technology, and components that would avoid, and, if avoidance is not possible, minimize adverse environmental impacts and risks.
- (ii) The assessment process will be based on current information, including an accurate project description, and appropriate environmental and social baseline data;
- (iii) Impacts and risks will be analyzed in the context of the project's area of influence.
- (iv) Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including preconstruction, construction, operations,

decommissioning, and post- closure activities such as rehabilitation or restoration.

- (v) The assessment will identify potential trans-boundary effects as well as global impacts; and
- (vi) Depending on the significance of project impacts and risks, the assessment may comprise a full-scale EIA for Category A projects, an IEE or equivalent process for Category B projects, or a desk review.

62. Screening for potential social and environmental impacts is a critical early step in the preparation of a proposed ADB-funded project. Preliminary project conceptual designs and sites are evaluated using a standard checklist, and assigned to one of four categories, as follows:

- (i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An EIA is required.
- (ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An IEE is required.
- (iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required, although environmental implications need to be reviewed.
- (iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary.

63. Based on initial screening of components proposed, the project was assigned to Category B, pending further study. Accordingly, IEE was deemed the appropriate mode of assessment for the intervention, unless early analysis based on conceptual design specifications and field reconnaissance were to reveal potential for impacts that require study and mitigation planning of a scale and complexity better addressed through the more detailed and exhaustive EIA. IEEs and EIAs are similar in terms of procedural steps and the structure of reports, but an EIA typically requires (i) more detailed investigation of impact linkages; (ii) collection of more and higher quality baseline data regarding key impact areas; (iii) often a longer and multi-phased study period; and (iv) deeper engagement and consultation with potentially affected people.

64. Important tools and outputs specified by the SPS 2009 for IEEs and EIAs include the following:

- (i) **Environmental Management Plan.** The borrower/client will prepare an EMP that addresses the potential impacts and risks identified by the environmental assessment and prescribes appropriate mitigation measures to address them effectively.
- (ii) **Consultation and Participation.** The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
- (iii) **Information disclosure.** The borrower/client will submit to ADB the following documents for disclosure on ADB's website: (i) a draft full IEE

- (including the EMP); (ii) a new or updated IEE and corrective action plan prepared during project implementation, if any.
- (iv) **Grievance Redress Mechanism.** The borrower/client will establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project's environmental performance.
 - (v) **Monitoring reports.** Results from monitoring of the implementation of a project's EMP are reported semi-annually to the ADB, based on internal monitoring activity carried out more frequently (quarterly, monthly, weekly or daily) as appropriate to different project activities and impacts. Monitoring assesses compliance with the measures detailed in the EMP, as well as measurable effects of project activities on the environment.

65. Each of the key elements listed above is addressed in this IEE report.

66. **Updated ADB categorization.** Based on the findings presented in this IEE, it is confirmed that river protection works over 4 km of stretch at four different places will have at least some negative impacts requiring mitigation, but also unlikely that any will generate impacts of a scale, complexity or severity that would warrant detailed environmental research or development of highly novel mitigation strategies. Accordingly, the Category B classification, assigned to the project at the early concept stage based on ADB screening, is considered valid for this investment location. This could change if the design, scale, nature or location of any proposed components undergoes significant modification before or after project approval.

III. PROJECT DESCRIPTION

A. Project Location

67. The proposed river protection works will take place in four locations of Gopalganj: (i) Manikdah and (ii) Chitolia Total length of the river protection works will be 2,400 m.

68. Thousands of houses are at risk of being drowned in the riverbed due to the fragile riverbanks of the Bhagiyar, Modhumati, and MBR rivers. Some areas are especially prone to erosion, and bank protection is required to save the homestead as well as the agricultural land near the bank of rivers. Total 5.689 km bank of seven (07) locations are extremely vulnerable to erosion (Table III-1, Figure III-1 and Figure III-2).

Table III-1 Summary of vulnerable riverbanks

SI No.	Location	River name	Upazila	Erosion length (m)
	Manikdah	MBR	Gopalganj Sadar	1200
	Gobra Erosion	Modhumati River	Gopalganj Sadar	1204
	Dattar Gate Adjacent Bashuria Borni	Bhagiyar River	Tungipara	304
	Gojalia Erosion	Bhagiyar River	Tungipara	306
	Narayankhali	Shailadaha River	Tungipara	508
	Lebutoli Bridge LB	Chitolia river	Tungipara	1439
	Munshipara	Bhagiyar River	Tungipara	728
Total				5689

Source: BWDB (2023) Final Report on Detailed Study for East Gopalganj Integrated Water Resources Management Project. Dhaka, Bangladesh.

69. Based on the vulnerable riverbank locations, two locations have been decided to construction bank protections. The location and length of bank protections are provided in Table III-2 below.

Table III-2 Proposed location and length of riverbank protection works

SI No.	Name of subproject	Polder/WMA	Name of Khal /River/ Embankment	Length (m)	Cost (Lac BDT)
1	Tarail-Pachuria	Polder – 1	Riverbank Protection Work at Manikdaha km 0.000 to km 1.200	1200	5768.47
2	Tarail-Pachuria	Polder – 5	Riverbank Protection Work at Chitolia km 0.000 to km 1.20	1200	3477.23
				2400	9245.70

Source: DPP, MOWR 2023

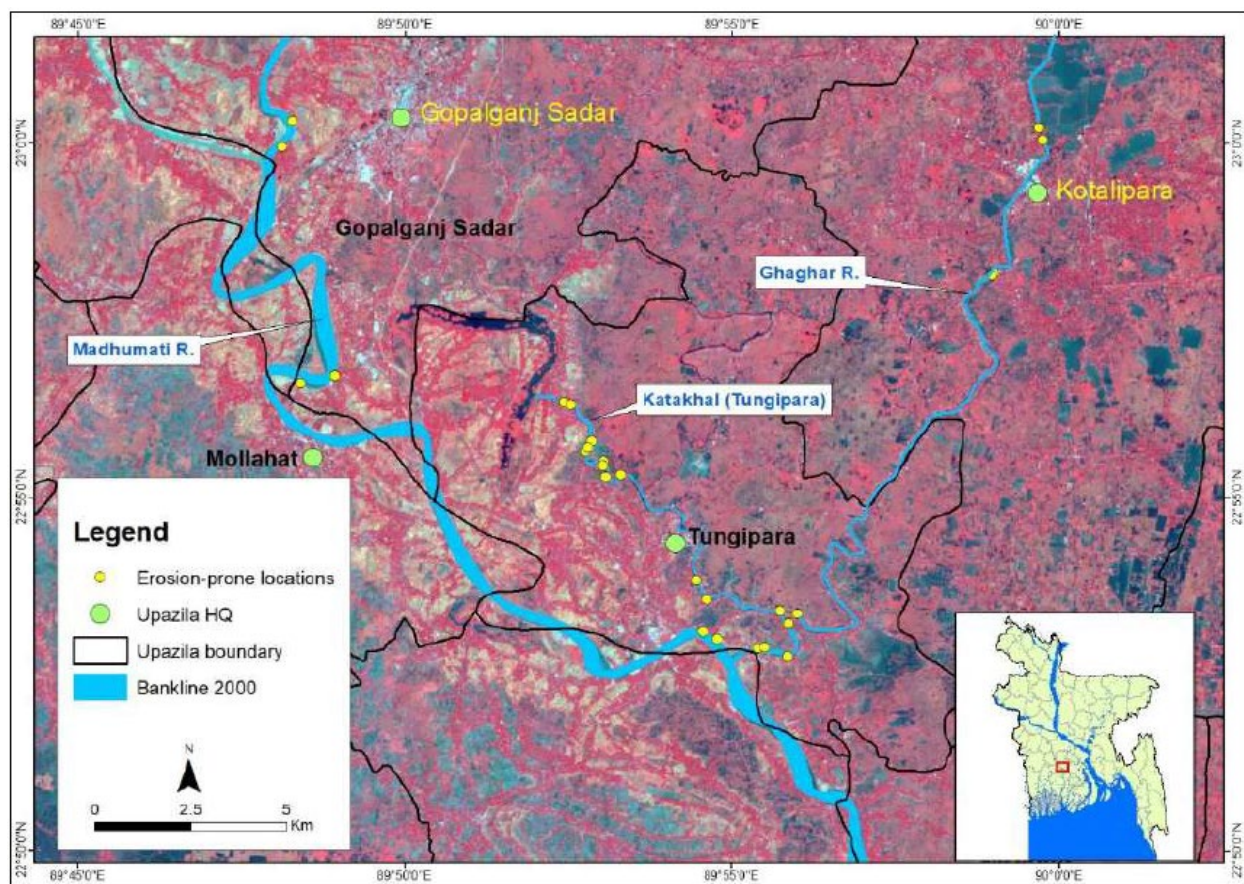


Figure III-1 Erosion prone areas of the proposed project. Source: BWDB 2023.



Figure III-2 Erosion at Chitulia river. Source: TA consultants

70. **Proposed interventions.** Figure III-2 shows a representative cross-section of riverbank protection works. Construction of riverbank protection typically involves the following activities: (i) labor sheds are constructed and stocked with construction materials (sand, cement, wood, shuttering materials etc.); (ii) sanitation facilities for work crews are constructed; (iii) riverbank slopes are developed with earth; (iv) pre-cast concrete (CC) blocks are cast or manufactured; (v) geo-textile bags are placed onto the slope below water and CC blocks are placed onto the slope above water. Launching aprons are prepared at the toe of the underwater protection and geobags and are dumped, usually in a 15m wide strip in front of the toe. Embankment slopes and crests are turfed as needed.

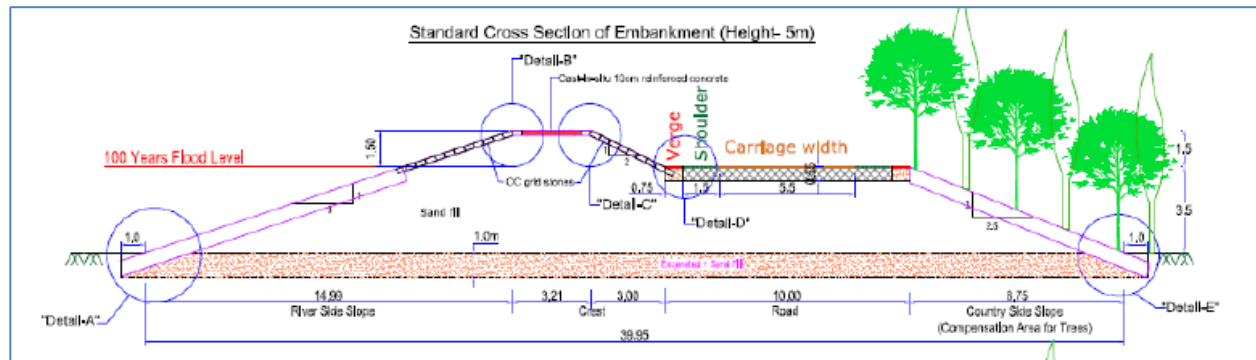


Figure III-3 Typical cross section of river protection works. Source: BWDB

71. Figure III-3 represents a section of the Chitulia river proposed for riverbank protection works, while Figure III-5 represents a cross-section of the left bank of Madhumati River. The proposed civil works for the river protections works are described below:

- **Site preparation** by manually removing all miscellaneous objects, materials from entire site and removing soil up to 15cm depth including uprooting stumps, jungle clearing, levelling dressing etc. complete as per direction of Engineer-in-Charge (EIC).
- **Engineer's site office** of minimum 38 sqm plinth area with providing necessary facilities including office furniture.
- **Manufacturing and supplying C.C. blocks** in the leanest mix. 1 :2.5:5 with cement, sand (FM>=1.5) and Stone Chips (40mm downgraded) to attain a 28-day cylinder strength of 12 N/mm² including grading, washing stone chips, mixing, laying in forms, consolidation, curing for at least 21 days, including preparation of platform, shuttering (steel shutter to be used) and stacking in measurable stacks. cost of all materials and charges, etc. complete as per direction of EIC.
- **Supply of Geo-textile bags (empty)** of different sizes and capacity at 40-410 project/work site, making the bag with standard Geo-Textile fabric (Polyester fabric, mass>= 400gm/m², EOS<=0.075 mm) and sewing in accordance with the detailed drawing and Technical Specifications included in the Tender Document and Schedule of Rates of BWDB, protecting the geo-textile bags from ultraviolet rays or any other damages including cost of all materials, labours, incidental charges etc. complete as per direction of EIC.
- **Filling and dumping of geo-textile bags** of different sizes and capacity at project/work site, protecting the geotextile bags from any damage, filling with locally available sand free from silt and clay, sewing along one transverse (top) side after filling, staking in measurable/countable stakes, marking with synthetic enamel paint during counting, dumping from properly positioned and anchored flat top engine boat over an area as per

drawing including loading, unloading, sequential piling of geo-bags on the dumping edge of boat, cost of all materials & equipment and its mobilization, labor, incidental charges etc. complete as per technical specification, approved design and direction of EIC.

- **Dumping work of Hard rock/ stone/ boulders/CC blocks/brick blocks/sand cement blocks** over a uniform area from properly positioned flat-top pontoon/barge up to an accuracy of 10cm monitoring with Total Station. The dumping area to be determined by conducting bathymetric survey, furnish topographic site plan. cross section, dumping alignment, providing location of benchmark and stake at batches of dumping activity.
- **Earth work** in cutting and filling of eroded bank of river. channel etc. to design slope, including levelling. dressing and compacting the earth in 150mm layers and preparation of the base for bank protection work and use the excess material for filling the ditches on the bank within 50 m or specified in the drawing. if no ditches to be filled then excess material shall be disposed of at least 100m from the bank line on C/S etc. complete as per direction of EIC.
- **Protective work with sand cement** (6: 1 proportion) filled 314th in 75h.g gunny bags (sand FM $\geq$ 1.00) including supply of all materials and necessary sewing. filling and placing/dumping in position and mixing with mixture machine with designed water cement ratio & curing as per specification and direction of the EIC.
- **Earth work in excavation** in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc, stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc.
- **Reinforced cement concrete works** with minimum cement content relates to mix ratio 1 :2:4 having maximum water cement ratio :: 0.45 and minimum $f_c = 26$ MPa, satisfying a specified compressive strength $f_c = 19$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type - I, best quality sand [50% quantity of best local sand (FM 12) and 50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2] and 20 mm down well graded picked Jhama brick chips conforming to ASTM C-33 including conducting necessary tests. breaking chips and screening, marking and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved.
- **Filling ditch/pond/channel/khal etc.** or land development/improvement by dredged earth from river bed (all kind of soil but excluding organic material), carried by Bulkhead / cargo / boat or any other mean, loading and unloading /Disposing /placing the dredged materials in the designated area up to 1 km from river bank by bulkhead dredger including , maintaining slopes, levelling and dressing in layers up to finished level with all lifts & leads etc. all complete as per direction of the EIC.



Figure III-5 Location map of the proposed river protection works at Chitolia river. Image from google maps.

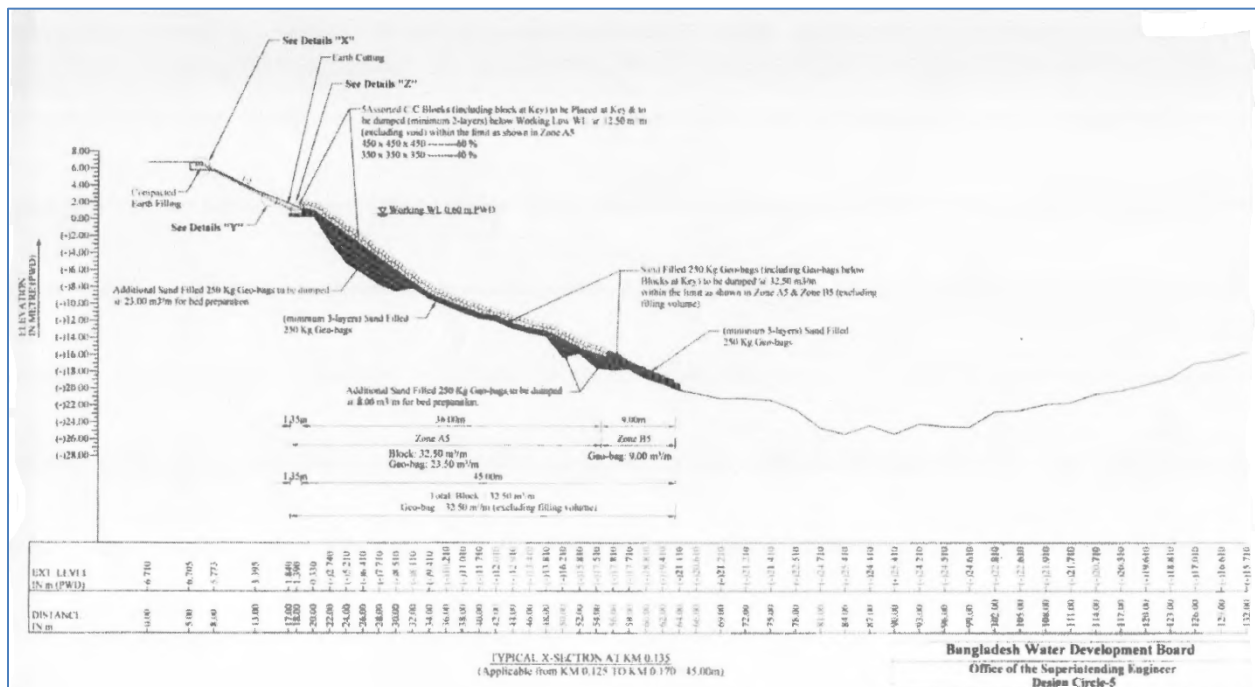


Figure III-4 **Cross section of left bank of Madhumati River.**

IV. BASELINE ENVIRONMENT

A. Location setting

72. The project area is located within the floodplain of the Modhumati, Baghiyarkul, Shyaldhah, Ghagor River, and MBR. The proposed project is situated in Sadar and Rajoir Upazila of Madaripur District and in Kotalipara Upazila of Gopalganj District. The subproject is situated within 23°00'38.5" N to 23°06' N latitudes and 90°01'14" E to 90° 5'2.6" E longitudes. The project area is bounded by Kata Kumar River on the north-east, Lower Kumar River and WAPDA Khal on the south-east, and Ghagor River and Rajoir-Kotalipara Khal on the west & north-west. The project area is lying in Mostafapur, Pearpur, Kunia of Madaripur Sadar, Rajoir & Amgram of Rajoir and Kolabaria, Radhaganj & Sadullapur of Kotalipara Upazila. The index map of the project is shown in Figure IV-1.

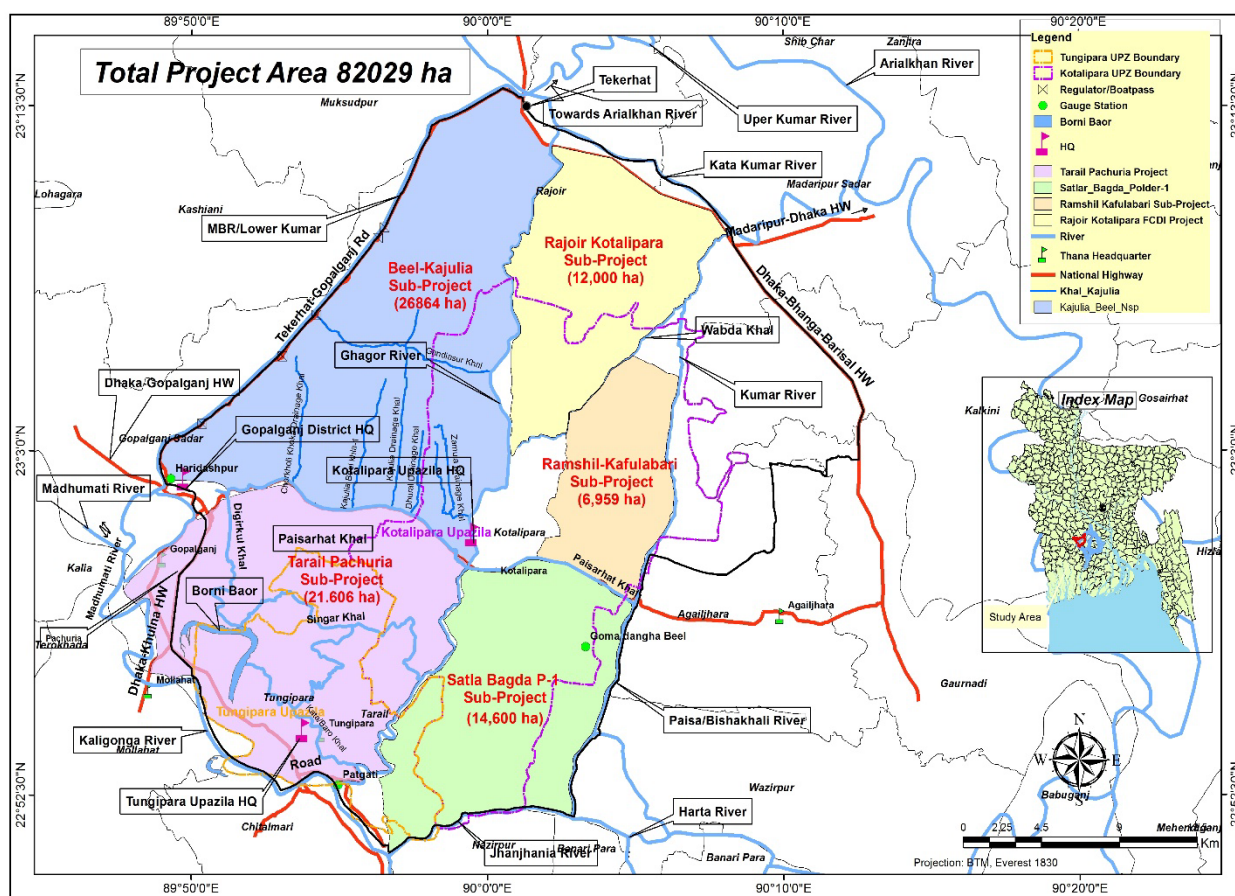


Figure IV-1 Index map of the proposed CRISP-WRM. Source: BWDB: 2023

B. Physical Environment

1. Physiography

73. **Observation.** During the monsoon season, the project area is particularly low-lying and immersed in water. As a result, except in high places, crops are not grown during the monsoon season. Around 60% land's reduced level is under 1.5m mean sea level and single cropped area. These lands are basically beel areas where water remains over 8 months in a year. Water drains very slowly from beel areas as beel connecting khals have been silted up and conveyance capacities are reduced. Structures are not fully functional; some of them are partially and some are non-functional. As a result, damage of harvesting crop from early flooding and salinity intrusion happens every year. Besides, transportation of harvesting crops is also challenging as canals are used to carry crops by small boats; because silted up canal with water hyacinth creates navigation problem. Besides, due to erosion of Madhumati, Baghiarkul, Saldaha and Ghagar rivers and MBR channels at various places in the project area, various government and private establishments including roads, ghats, croplands, houses, mosques and temples are under threat.

74. Physiographic unit.

According to the physiographic units of Bangladesh, the project region belongs to the **Gopalganj-Khulna Peat Basin**. Gopalganj-Khulna peat basin occupies a number of low-lying areas between the Ganges River Floodplain and the Ganges tidal floodplain. The major two beels of the area are Baghia Beel and Chanda Beel. Thick deposits of peat occupy perennially wet basins, but they are covered by clay around the edges and by calcareous silty sediments alongside the Ganges distributaries crossing the area. This is the largest peat stock basin of Bangladesh. The basins are deeply flooded by clear rainwater during the monsoon. In the basin close to Khulna, the floodwater is somewhat brackish. Subsiding process is still active in this physiographic unit¹².

75. Gopalganj-Khulna Beels (2,247 sq km) occupies extensive low-lying areas between the Ganges river floodplain and the Ganges tidal

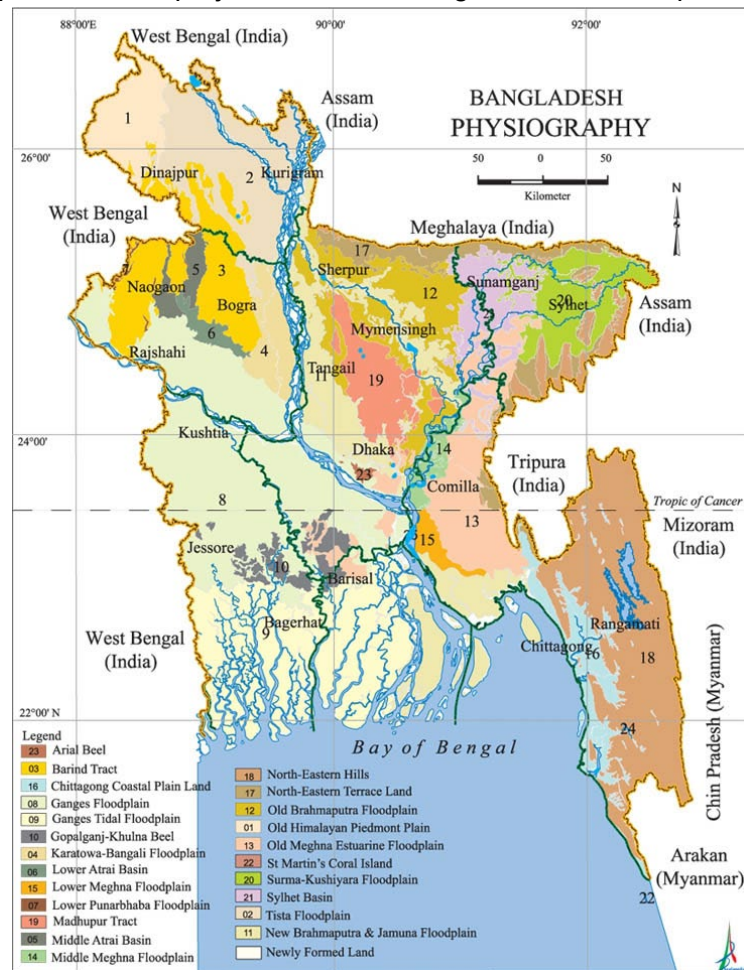


Figure IV-2 Physiographic units of Bangladesh. Project area is in Gopalganj-Khulna Peat Basin. Source: Banglapedia

¹² URL: <https://en.banglapedia.org/index.php/Physiography>, date accessed: 13 July 2023.

2. Topographic relief, land use and soils

are some well-defined low pockets in the middle of the project. The general slope of the land is north to south and east to west. The land elevation ranges from 1.22 to 1.53m near the riverbanks to possibly below 0.00m in the beel area (Figure IV-3).

78. **Land types.** The term commonly used to refer to area under different flood depths in the monsoon season is land types which, through long time usage, have come to mean the categories of land under particular flood depths during the maximum flooding period in

PUBLIC. This information is being disclosed to the public in accordance with ADB's Access to Information Policy.



system. Then a condensed system was introduced by the Master Plan Organization and is in general use for agricultural assessment. FPCO (1993) defines land types shown below on Master Plan Organization classification using the assumed water level occurring with a 1 in 5-year return period and having duration of more than 72 hours. Table -IV provides the details of land types under the subprojects' interventions.

Table IV-1 Land types and land area in the proposed subproject area where the intervention falls. Source: BWDB 2020

Land type	Elevation (m)	Project area (ha)
F ₀	0.0- 0.3m	1215
F ₁	0.3- 0.9 m	4012
F ₂	0.9-1.8m	6268
F ₃	1.8 m and above	505
Total		12,000

79. **Soils.** According to the SRDI soil classification, soils of Gopalganj region commonly belong to the Calcareous Dark Grey Floodplain soils, with some geographically limited appearances of Acid Sulphate soils and pockets of peats (Figure IV-4).

80. **Calcareous Dark Grey Floodplain soils.** Occur extensively in the Khulna region and locally on soils that comprise cambic B-horizon and lime in part or throughout the solum and with a dark grey topsoil and/or upper subsoil. There are continuous dark grey gleans as well in the Khulna region under Ganges tidal floodplain. They are Calcaric Gleysols.

81. **Acid Sulphahte soils.** Acid Sulphate soils occur in minor areas of the Ganges tidal floodplain, i.e., Khulna region. These soils contain sulphidic material, which turns extremely acid if exposed to air. The soils, which are under Mangrove Forest and flooded by saline tidal water are finely stratified soft, muddy sediments. But where it has been embanked to prevent flooding with saline water, the soils of these areas have developed profiles similar to non-calcareous grey and dark grey floodplain soils with extremely acidic horizon. They are either Thionic Fluvisols or Thionic Gleysols.

82. **Peat.** Occurs extensively in the Gopalganj-Khulna Beels. The soil contains organic matter at the surface or buried under a mineral soil layer below at a depth of up to 40 cm. The organic material that forms the Histic horizon varies from dark brown, fibrous peat to semi-liquid black muck. They have been included as Histosols.

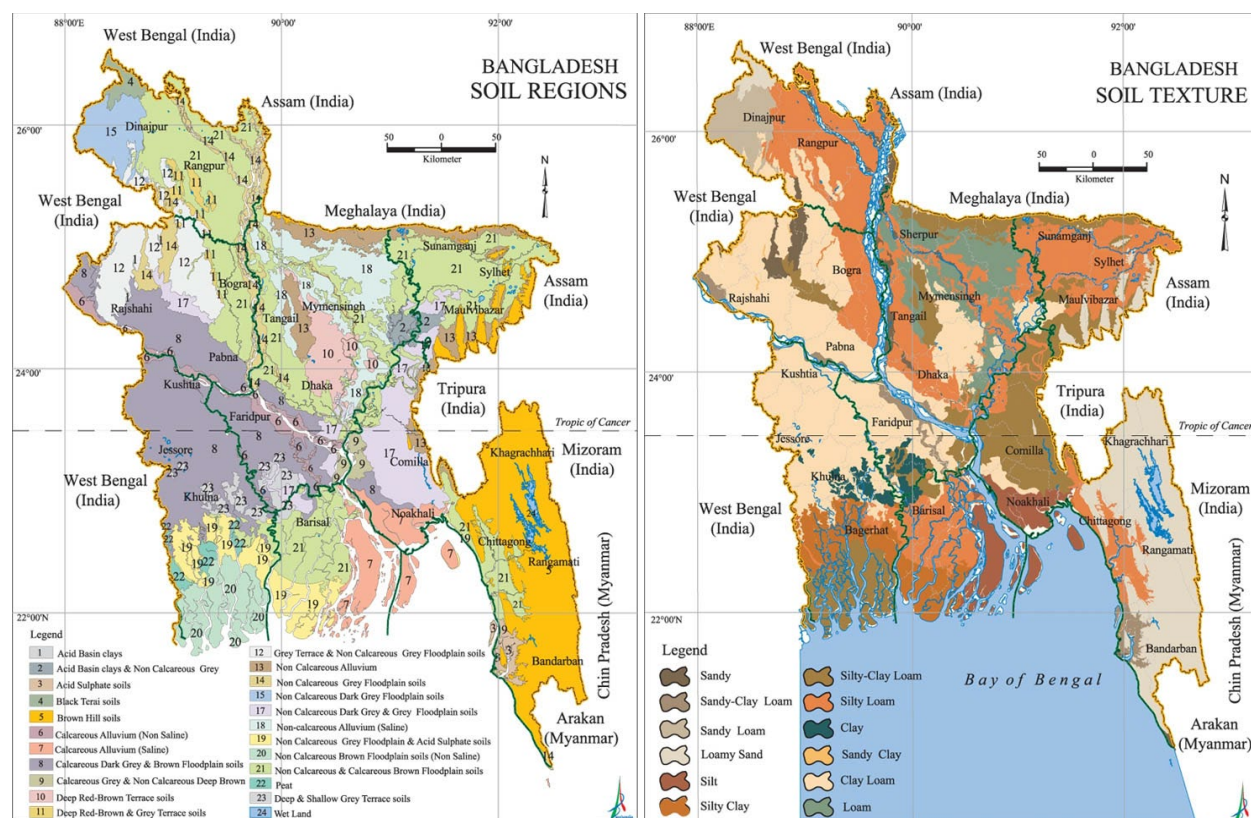


Figure IV-4 Bangladesh general soil regions and Soil textures. Gopalganj regions predominantly belong to Calcareous Dark Grey Floodplain soils with clay texture. Map courtesy: Banglapedia.

3. Geology and geomorphology

83. The district's geology reflects the riverine and deltaic processes that have shaped it over time, as well as the tectonic activity that has occurred in the Indian subcontinent since the Cretaceous period. The sub-soil in Gopalganj consists of alluvial deposits from different rivers, such as the Ganges, the Brahmaputra, and the Meghna. These deposits are made up of clay, silt, sand, and gravel, and their thickness and composition vary depending on the location and depth.¹³ The sub-soil properties affect the groundwater quality and availability, the soil fertility and erosion, and the foundation design and stability in the district.

84. The tectonic history of Gopalganj is related to the collision of the Indian Plate with the Eurasian Plate, which resulted in the formation of the Himalayas and other mountain ranges along the eastern border of Bangladesh. The down warping of the basement rocks under central and southern Bangladesh created a basin that accumulated sediments from the Cenozoic era. These sediments include units such as the Tura sandstone, the Sylhet limestone, the Kopili shale, and others that record the changes in the depositional environment from marine to deltaic. The tectonic history explains the seismic activity and vulnerability, the mineral potential and

¹³ Islam, S. and Shaik, ME. (2020) Geotechnical Properties of Gopalganj Sub-soil in Bangladesh. Landscape Architecture and Regional Planning. Vol. 5, No. 2, 2020, pp. 27-32. doi: 10.11648/j.larp.20200502.12

exploration, and the geomorphic features and evolution in the district. Figure IV-5 explains the surface geology of Gopalganj.

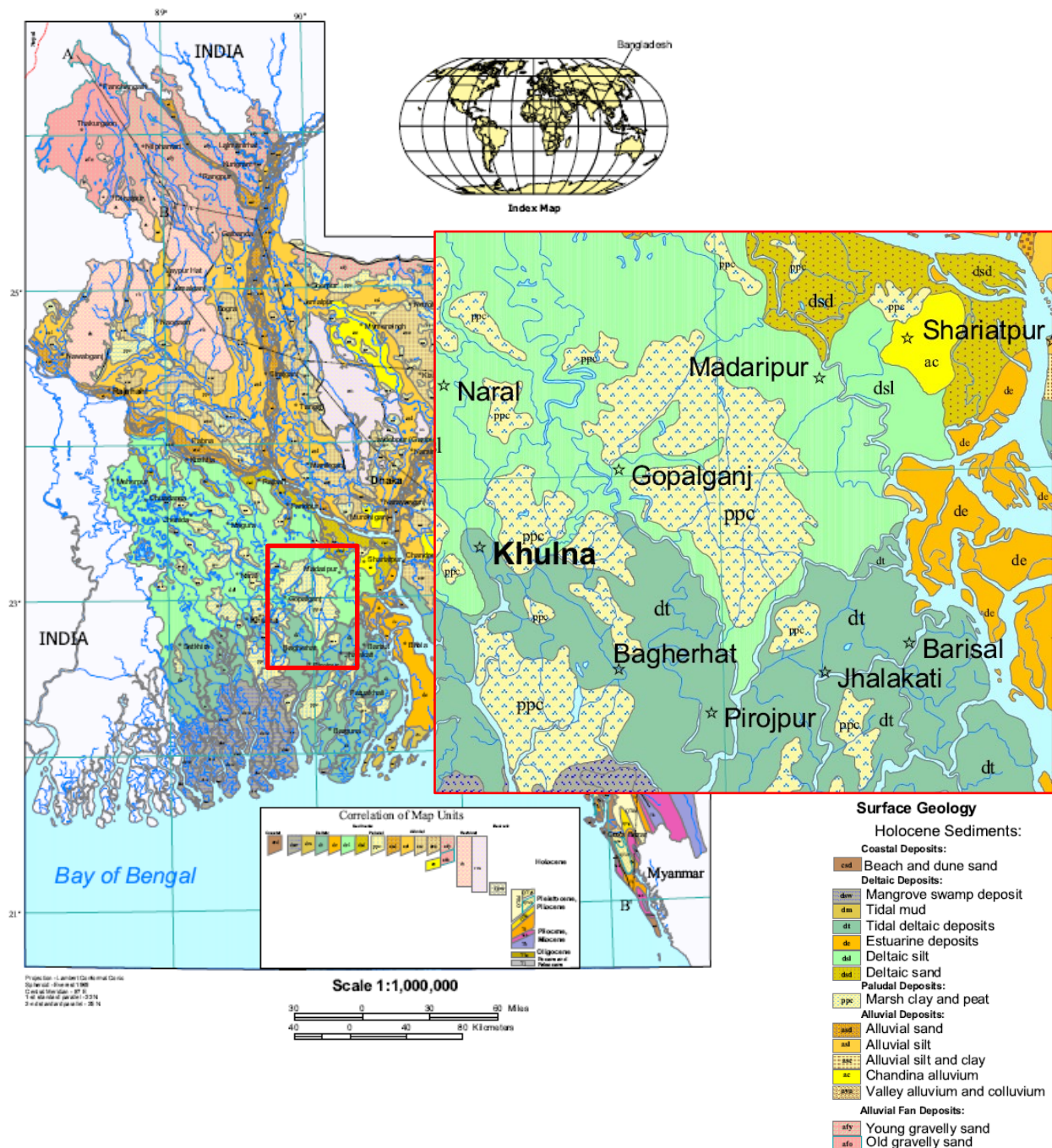


Figure IV-5 Geology of Gopalganj. Source: Alam et al. 1990

4. Seismicity

85. Bangladesh consists of six tectonic elements: (1) Himalayan Fore Deep, (2) Bogra Shelf, (3) Faridpur-Sylhet Trough (Separated by Tripura-Madhupur thrash hold), (4) Barisal –Chandpur Gravity High, (5) Hatia Trough, and (6) Indo-Myanmar Ranges. The study area is within the Faridpur Trough of the Bengal Basin. The Faridpur Trough is situated in the south-western part of the Barisal-Chandpur Gravity in close proximity North-West of Hatiya Trough/Patuakhali depression. The Faridpur trough is an elliptical depression almost adjacent to the Eocene hinge belt and are identified geophysically by gravity minima and filled up by enormous number of tertiary sediments. This can be considered broadly as carboniferous to recent sediments. It is an active deltaic trough with a subsidence rate of 2.2 cm/year or higher. In this area, three types of subsidence are recognized which are tectonic subsidence, compaction of peat layers, and human induced subsidence.

86. The Geological Survey of Bangladesh (GSB) has published an Earthquake Zoning Map based on seismic intensity. They have divided the country into three zones depending on the seismic intensity namely Zone I, Zone II and Zone III. The North and eastern regions of Bangladesh belong to Zone I (seismically most active); the Lalmai, Barind, Madhupur Tracts, Dhaka, Comilla, Noakhali and western part of Chittagong Folded belt belongs to Zone II (moderately active) while Jessore, Khulna, Barisal, Faridpur, Patuakhali, and Noakhali belong to Zone III (seismically relatively quiet).

87. According to the GSB, the study area is located within Zone III with seismic coefficient of 0.04g (Figure IV-6).

According to the BNBC (2010) zoning, the project site is located in Zone 1 with $Z = 0.12$. Hence, the proposed structure has the least vulnerability to earthquakes, but the design of civil structure needs to comply with relevant provisions on earthquake Bangladesh National Building Code 2015.

Historical record of major earthquakes

for the last 450 years from the Department of Disaster Management (2012) show that from 1762 to 2016, earthquakes originating in Bangladesh had a Richter scale magnitude ranging from 4.2 to 8.8. A maximum of about 8.8 originated from Chittagong-Arakan in 1762.

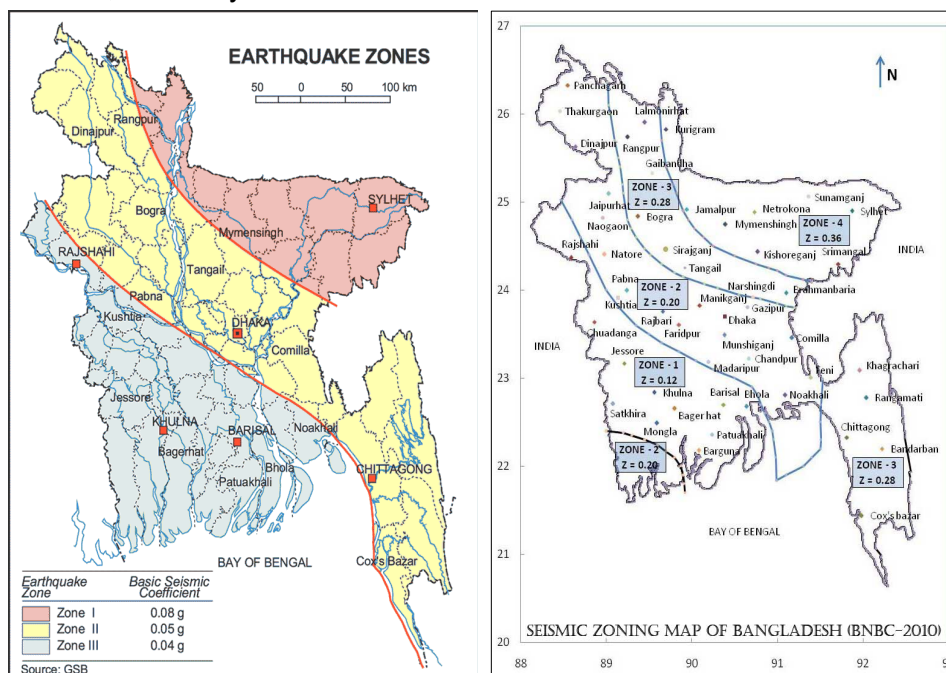


Figure IV-6 Seismic zoning map of Bangladesh (Source: GSB, URL: <http://www.gsb.gov.bd/>) and BNBC 2010

5. Hydrology and drainage system

88. **River Network in the Project Vicinity.** Ghagor River System passes through the west and south of the project which is directly interlinked to the river Madhumati. This river is basically the tidal in nature and the main source of surface water during the dry season. Sometimes this is also the source of flooding during monsoon. The salinity in the specified river system remains below 1 ppt. from June to February and may rise as high as 3 ppt. during March to May. The gross tolerable limit of salinity for irrigation water is 2.5 ppt. On the Southern part of the polder there is WAPDA khal which is directly interlinked to the River Lower Kumar around Mustafapur through lowland. There is another river in the northeast corner of the project which is Kata Kumar River source Rajoir-Kotalipara khal and interlinked to the Lower Kumar in the south-east.

89. **Network of khals (canals).** Apart from the Ghagar and Rajoir-Kotalipara khal surround the western and northern part of the project there are other rivers such as Kata Kumar, Lower Kumar and Paisa khal exists along the eastern and southern peripheries of the project as shown in the base map and the detailed map. Innumerable creeks and khals exist inside the project of which consultants could identify 15 nos. during the field work.

90. **Drainage pattern.** The main draining route of the project is from north to south. But as the area is under tidal zone during high tide water enters from South to North through the river Paisa River. The river Ghagor, Paisa and Sadullahpur rivers have major influence on the drainage system of the project area. But it has become inactive due to a huge amount of water hyacinths & internal blockage. Flow generated for Arial Khan River passes by the north side of the project area through the Lower Kumar and Bishkandia rivers.

91. **Water Level & Hydraulic gradient.** BWDB maintains water level and discharge stations at Haridaspur whereas Bangladesh Inland Water Transport Authority maintains one station at Patgati in Ghagor which lies in the western corner of the project boundary. The water level data at Takerhat (SW-187) and Tentulia (SW-197) observed station has been analyzed and determined the yearly maximum water level of both stations. Both stations are situated on the MBR. The data sets of these stations are very old. Water levels of these stations are used to determine the high-water level slope. The distance between the water level stations Takerhat and Tentulia has been measured 22.1 km. At first high water level differences were calculated and then divided by distance between two stations to calculate the high-water level slope. Later average high water level slope has been determined from the individual year high water slope. From Takerhat to Tentulia, the average high water level slope is found 2.9 cm/km.

92. **Beels.** Beels are of both perennial & seasonal types. However, the network of interconnected beels and canals in the project area are so complex and dynamic that a precise classification and assessment of these water bodies are very difficult. They vary seasonally and also from one year to the next depending upon the nature of flood which includes both river and local rainwater sources. There is no permanent water body in the project area but possess a quite numbers of low land or beels. There is no baor in the project area.

93. **Waterlogging.** A large area of the subproject suffers from drainage congestion due to siltation of khal mouth and profuse growth of water hyacinth mainly. Thus, vast beel (lowland) areas remain waterlogged and become unsuitable for growing agricultural crops during kharif season, where fish is cultivated in wide areas by the influential persons. Moreover, no other crop than only Boro (high yielding variety) can be grown in a large area due to improper drainage, which also get damaged by the early rainfall (mainly caused by climate change) at harvesting

period. A large area remains waterlogged during the kharif season restricting cultivation of T. Aman.

6. Ground water table

94. It is observed from ground water table (data collected from Ground Water Circle, BWDB) of the area that ground water table fluctuate from 4.87m to 0.20m. Fluctuation of ground water^[94] Table -IV^[95] from observed data of last 10 years. The ground water is used for supplementary irrigation of paddy and vegetables in the dry season and for domestic purposes. There are many tube wells in the polder area. Shallow tube wells are mostly used for irrigation in the field.

Table IV-2 Ground Water Fluctuation Table in and around the intervention area

Area	Water Level (max) (meter)	Water Level (min) (meter)
Gopalganj	4.87	0.28
Tungipara	3.75	0.20
Kotalipara	3.75	0.20

Source: BWDB

7. Flooding

95. With a projected population of 3,050,000¹⁴ Gopalganj lies only 2–4 meters above sea level and is increasingly affected by floods as a result of climate change (BMZ.de). The main causes of floods in Gopalganj are heavy rainfall, river overflow, and sea-level rise. The district receives an average annual rainfall of about 2000 mm, which is higher than the national average of 1600 mm. The rainfall is unevenly distributed throughout the year, with most of it occurring during the monsoon season from June to October. During this period, the district experiences intense and prolonged rainfall events, which exceed the capacity of the drainage system and cause waterlogging and inundation. The district is also surrounded by several rivers. These rivers carry large volumes of water from upstream regions during the monsoon season, and often overflow their banks and flood the adjacent areas. The rivers are also affected by tidal fluctuations and storm surges from the Bay of Bengal, which increase their water levels and aggravate the flooding situation. Moreover, the rivers are silted up due to sedimentation and erosion, which reduces their carrying capacity and increases their flood risk.

96. The 2020 flood caused huge losses to fish farmers¹⁵, the 2017 flood breached the Gandak river embankment¹⁶, and the 2007 flood that killed 14 people and displaced thousands. The floods also caused huge losses to fish farmers in Gopalganj, estimated at around Tk 50 crore (about \$6 million), as about 3,212 tons of fish from their ponds escaped into floodwaters. The floods also disrupted the transportation and communication networks in the district, as roads and bridges were damaged or submerged.

¹⁴ URL: <https://www.census2011.co.in/census/district/69-gopalganj.html> date accessed: 13 July 2023.

¹⁵ URL: <https://www.frontiersin.org/articles/10.3389/fenvs.2021.759547/full> date accessed: 13 July 2023

¹⁶ URL: <https://doi.org/10.3389/fenvs.2022.1053829> date accessed: 13 July 2023

97. The Aqueduct is an effective tool developed by World Resources Institute to predict flooding occurrences in a specific geographic area under various future climate scenarios. Flood occurrences have been projected using the Aqueduct tool for Gopalganj region under ‘optimistic’ scenario for 2050 (RCP 4.5) with a 50year return period setting using GFDL-ESM2M model. The results are given in Figure IV-7. The projection suggests there is low risk of flooding in the project area of Gopalganj with 50year return period by 2050 where flood level may reach up to 0.2 meters. However, the north of the project area is highly vulnerable to riverine flooding.

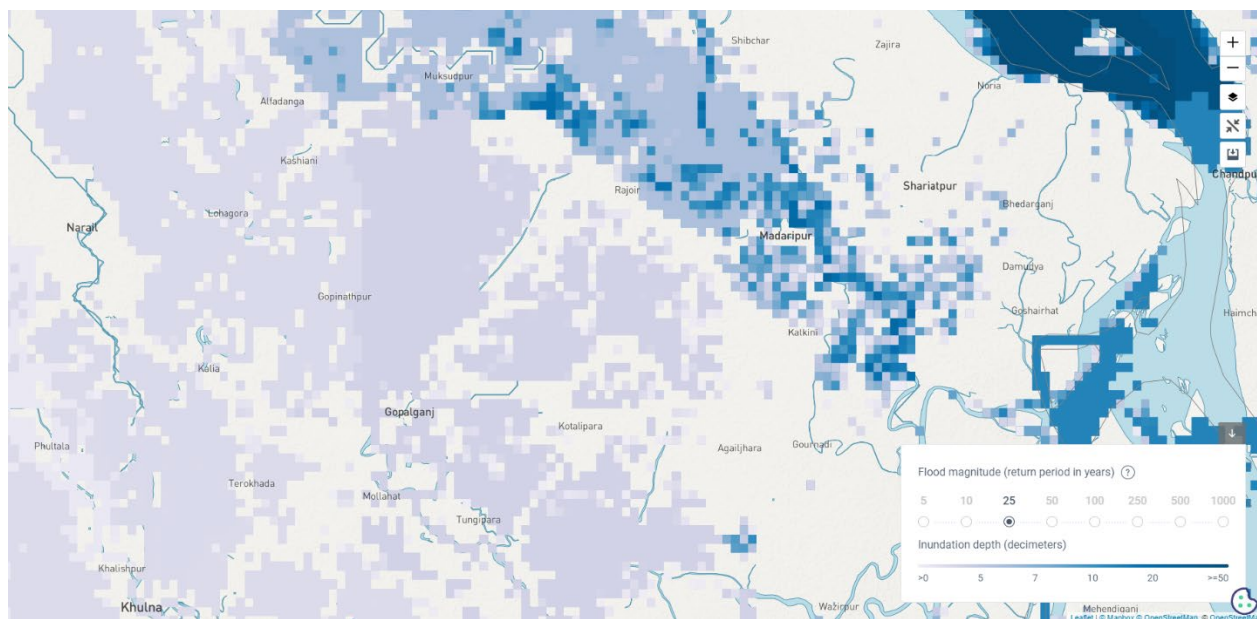


Figure IV-7 2050 flood inundation scenario (RCP 4.5) of Gopalganj region using Aqueduct tool using 50-year return period.

8. Hazard profile

98. The information tabulated below (Table IV-3) was gathered from the Disaster and Climate Risk Information Platform (DRIP) webtool (drip.plancomm.gov.bd/Home/AboutDrip). In DRIP database, all data related to natural disaster vulnerability are represented at the district level aggregation. The DRIP webtool represents hazard, exposure and risk level on a scale of 1 to 5 where the levels are very low, low, medium, high, and very high.

Table IV-3 Existing Disaster Profile at the Project Location

Disaster	Hazard Level	Exposure Level	Vulnerability Level	Risk Level
Erosion	Medium	Medium	High	Medium
Flood	Medium	Low	Very High	Medium
Sea Level Rise	Low	Medium	High	Low
Salinity	High	Medium	Very High	High
Cyclone	High	Medium	High	High
Storm Surge	Low	Medium	High	Low

Source: Compiled by TA consultants

9. Climate and climatic trends

99. The project mainly located in the south-central zone (G), according to climatic sub-region classification of Bangladesh (Figure IV-10). For climatic information of Madaripur district met station, which is nearest station of the project area has been collected for the last 23 years duration from 2000-2023. Different climatic data/information collected includes a) Rainfall, b) Temperature, c) Humidity and d) Wind speed & direction. Their average data are furnished in the following Table IV-4.

Table IV-4 Climatic data of Madaripur. Data spans from 2000 to 2023.

Year	T (°C)	T. max ave. (°C)	T. min ave. (°C)	T. max abs. (°C)	T. min abs. (°C)	Prec. (mm)	Days 1 mm	Days 0.1 mm
2000	29.2	32.0	26.4	32.0	26.4	-	-	-
2002	32.1	35.2	29.0	35.2	29.0	0.2	0	1
2003	-	28.4	-	28.4	-	0.0	0	0
2004	29.8	29.7	29.8	32.0	29.8	1.0	1	1
2005	-	-	20.8	-	20.8	-	-	-
2006	28.2	30.9	25.5	32.2	24.0	-	-	-
2007	-	-	15.0	-	15.0	-	-	-
2009	-	-	-	-	-	-	-	-
2011	28.3	30.0	26.6	35.8	11.6	717.0	41	49
2012	27.4	30.7	24.7	36.6	8.9	1098.0	82	94
2013	27.6	30.7	24.2	36.5	10.9	1792.4	96	110
2014	26.1	31.0	21.2	39.6	9.4	1283.7	84	100
2015	26.3	31.1	21.5	36.6	8.1	1638.5	97	106
2016	26.7	31.4	22.0	38.0	7.7	1713.3	93	111
2017	26.4	31.3	21.5	36.9	7.5	2505.4	107	111
2018	26.0	30.9	21.1	36.6	6.8	1687.9	105	108
2019	26.6	31.1	22.0	37.5	9.1	1432.1	81	84
2020	26.2	31.0	21.5	36.6	9.5	1594.2	103	112
2021	26.4	31.2	21.7	39.6	7.8	1366.5	96	100
2022	26.3	31.1	21.5	37.0	9.3	1710.4	79	81
2023	26.7	31.7	21.6	39.2	8.8	1233.9	62	66

Source: SYNOP / BUFR data obtained from Meteomanz.com

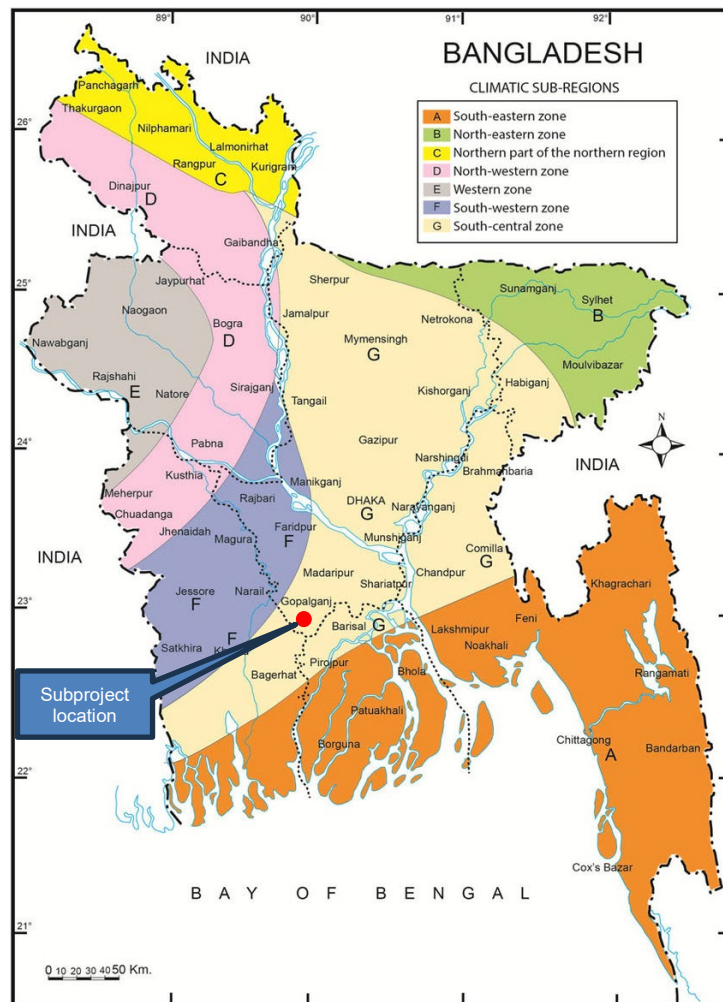


Figure IV-8 Climatic zones of Bangladesh

100. **Temperature.** The maximum temperature in Madaripur varies from 32.9°C to 34.8°C and April-May are the warmest months, while the minimum temperature varies from 16.7°C to 20°C and December-January are the coldest months. The average temperature varies from 24.6°C to 28.1°C. The monthly average of maximum and minimum temperature of Madaripur station are shown in Figure IV-9. The annual average trend for average temperature is shown in Figure IV-9. Increasing temperature trends are observed from the figures. The average and minimum temperature trends are significant at 95%.

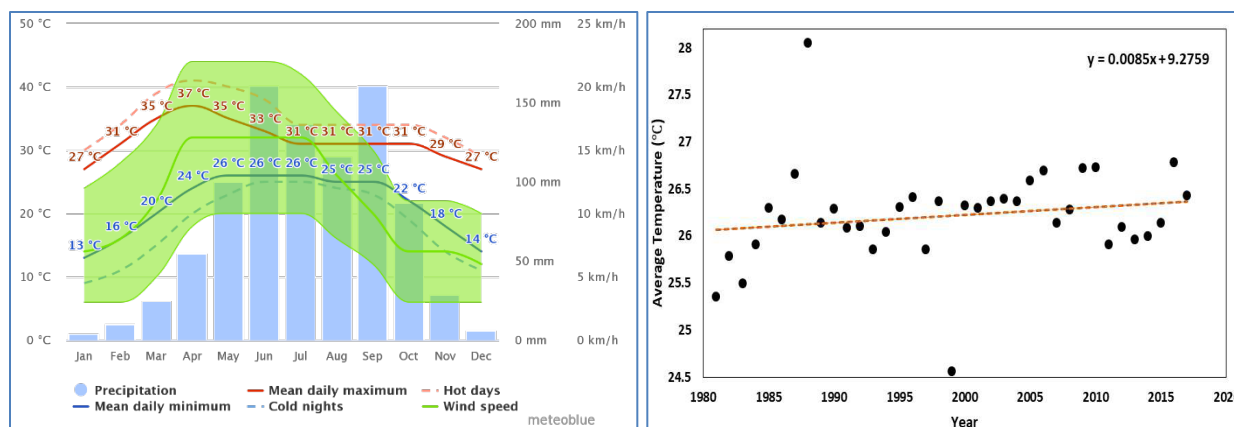


Figure IV-9 (Left) Climatogram of Madaripur showing Mean daily Minimum and Maximum temperature, precipitation, and wind speed over the year. Data spans from 1990 to 2022. Graph: meteoblue.com; (right) Annual average temperature trend of Madaripur station. Trend is rising with 95% significance.

101. **Rainfall.** The monthly maximum and average rainfall data of the last 39 years (1990-2022) of Madaripur station was collected, analyzed, and shown in Figure IV-9. The analysis of data shows that the monthly maximum rainfall varies from 41 mm to 854 mm and the monthly average rainfall varies from 5.3 mm to 390 mm. The maximum rainfall is received in September and the Minimum rainfall is received in December. The area received the maximum 854 mm rainfall in September 2004. The historical maximum annual rainfall of this station was recorded as 2865 mm in 1986 and minimum was 1304 mm in 1989 and the average annual rainfall is 1970 mm. The trend of annual total rainfall is shown in Figure IV-10. A decreasing trend can be observed from here. Trend analysis using the WB's Climate Knowledge Portal (<https://climateknowledgeportal.worldbank.org/>) reveals that in Khulna region (which also covers Gopalganj) precipitation trend is negative in the recent times (1991-2020) although due to high variability the trend is not significant (Figure IV-10).

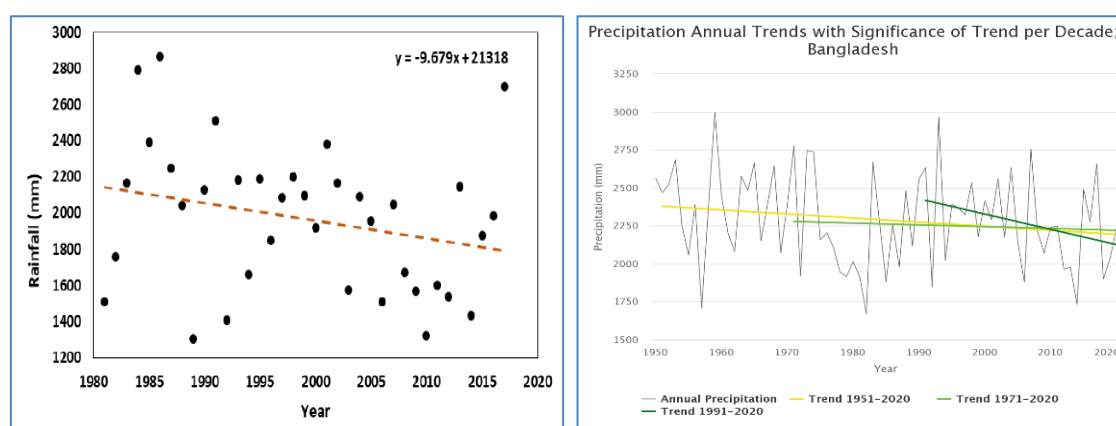


Figure IV-10 Annual precipitation trends and seasonal cycles at Madaripur station (left) and in Khulna region (right) (Source: The World bank Climate Change Knowledge Portal)

102. **Wind speed and direction.** Wind direction varies depending on the season. Therefore, the whole year has been categorized into four clusters of months and these are: Cluster-1: January-March, Cluster 2: April-June, Cluster 3: July to September, and Cluster 4: October to December. Wind speed data and direction have been obtained from meteoblue.com (Figure IV-11).

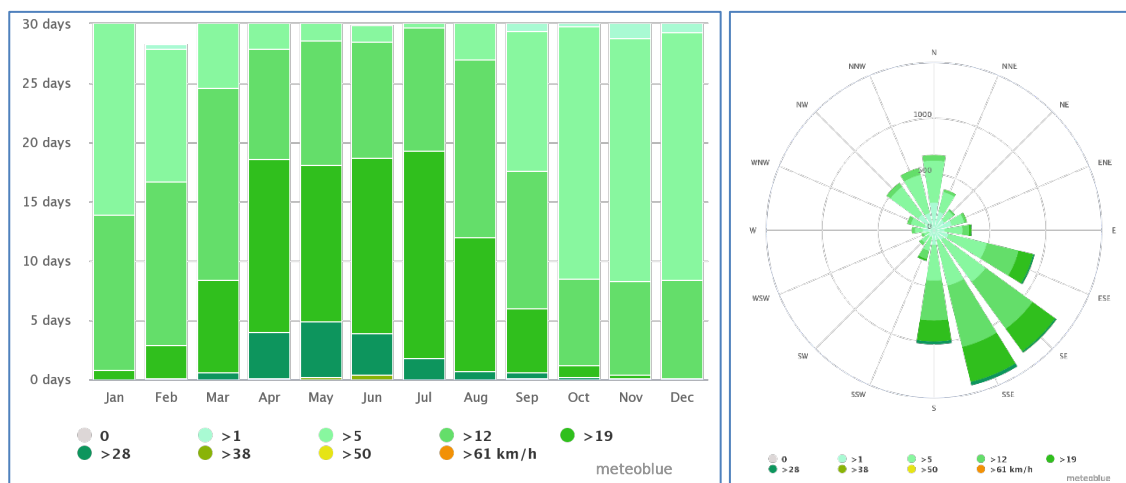


Figure IV-11 Yearly wind speed and direction of Madaripur met station. Figures produced by meteoblue.com.

10. Water level

Water level analysis for Haridaspur station on Madaripur Beel Route has been conducted for the year 1981-2009 (Figure 5.9). Maximum high tide water level is observed in September while the minimum low tide water level is observed in February. It can be observed that the surface water level is highest at the end of monsoon (August-September), then it starts decreasing and reaches its lowest at the end of winter. During pre-monsoon, the water level starts rising slowly. Average high tide and low tide water levels are found to be 1.98m and 1.62m respectively while the maximum high tide and minimum low tide water level is around 5.05m and 0.67m respectively.

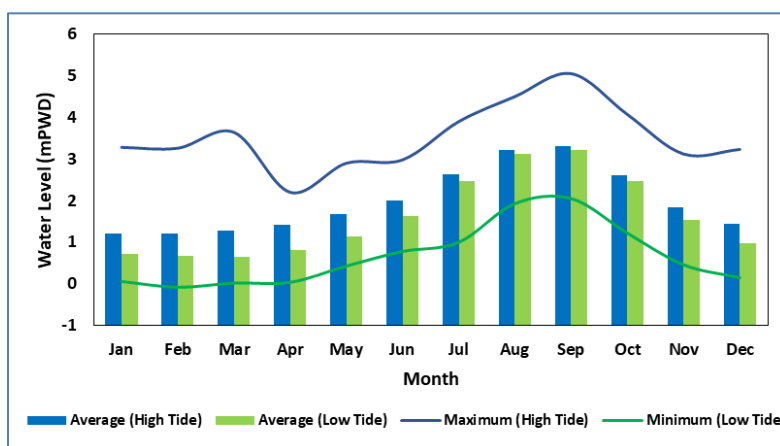


Figure IV-12 Variation of Water level at Haridaspur Station (1981-2009). Data source: BWDB

C. Biological environment

103. **Agro-ecological zone.** The gross area of the Tarail-Pachuria Subproject is 21,606 ha. It is located at Gopalganj Sadar Upazilla (30%), Tungipara (25%) and Kotalipara Upazilla (45%) of Gopalganj District in the south-western region of Bangladesh. The Subproject falls within the AEZ-14 (Gopalganj-Khulna Beels) and the area is distributed over the vast floodplain of the Gorai-Modhumoti River and the Arial Khan River. Agriculture constitutes the principal livelihood for the people living within the subproject area. Almost 70% of people live on farming and farm related works. The area is mainly rice area with some Wheat and Jute cultivation. Present cultivable area is 14,649ha. with a present cropped area of 19,057 ha, resulting in a cropping intensity of 130%. The future total cropped area, after rehabilitation and proper flood control, has been estimated at 26,892 ha. With a cropping intensity of 184%.

104. **Agriculture.** The present cultivable area has been estimated at 80% of the gross area (12000 ha.). The calculated cultivable area is 9,600ha. With a present cropped area of 13,722ha, resulting in a cropping intensity of 143%. The future total cropped area, after rehabilitation and proper flood control, has been estimated at 17,461ha with a cropping intensity of 182%.

105. **Livestock and Poultry.** The numbers of livestock and poultry in the Project area are presented in Table IV-4. Productions of livestock and poultry are mainly constrained due to diseases and death of the population. Outbreak of disease causes a considerable economic loss in livestock farming, according to Upazila Livestock offices of Kotalipara and Tungipara. Every year livestock population is affected by different diseases. Major livestock diseases for cow/bullock/ox are Foot and Mouth Disease, Sore neck (Gola fula), Black leg (Badla), Diarrhea and for Goat Peste des Petits of Ruminants. Foot and Mouth Disease, Diarrhoea, Pneumonia, Abscess etc. Major poultry diseases are Ranikhet (New castle), Cholera, Fowl pox. Duck plague and Typhoid. However, some diseases are spreading round the year. During monsoon, the soggy condition of the animal shelter promotes various kinds of diseases to the bullocks and cows.

Table IV-5 Number of Livestock and Poultry of the subproject Area

Livestock / poultry	Nos. in Kotalipara Upazila
Cow/Bullock	81,005
Goat	23,150
Sheep	305
Duck	317,284
Chicken	1,410,487
Turkey	-

Source: Based on information collected from Upazila Livestock Offices in January 2023

106. **Fisheries.** Fisheries are an important source of income in the Subproject area. During the rainy season and subsequent flooding some 64% of the areas are used for fisheries resource in the form of pond aquaculture, gher fishery, nursery, flood plain, fingerling stocking and pen culture etc. The present yield of floodplains is 130 kg/ha/yr, but declining due to increasing local demand, overfishing and lack of re-stocking. The present fish production in the area can be distinguished in fish capture in (large) open water bodies, and fish culture in (smaller) ponds and gher. Capture fisheries cover about 5.29-fold larger area than cultured fisheries, but yield is less than 2.80 times

lower. There are a lot of low land areas in Rajor- Kotalipara subproject area for their greater part utilized for aquaculture production.

107. The total annual fish production value from captured and cultured fish amounts to approximately Tk. 7687 lac. (Source- Feasibility study 2019 - 20, SWP). The productivity of cultured fish in ponds in the area is lower than the national average, mainly because of the absence of improved aquaculture know-how as evidenced by the very poor number of trained farmers. Inadequate supply of quality inputs (fertilizers, fingerlings, etc.) is another reason. Bringing the production to the national average level would require training (to be provided by DoF targeting about 10% of the farmers in the area) and quality inputs like seed fertilizer and feed.

108. Culture fishery, however, is becoming more popular as it is more profitable than rice production. Various support programs are in place to improve technology and production. Most popular are the fishponds and ditches occupying some 4.98% of the subproject area. Yields of general and advanced farmer ponds are an average of 2.90 mt/ha (nationally 4.7 t/ha). Major constraints in culture fisheries of the subproject area are quality of fry and fingerlings, lack of modern fish culture technology, quality feed, high price of fish feed, credit, fish disease and fish marketing.

109. **Fish diversity.** The water bodies are rich in fisheries as well as aquatic biodiversity. A total of 63 fisheries related species were identified during the field, FGD and Upazila fisheries office. Out of 66 species, 53 freshwater fish species, 7 exotic fish species, one species of crab and 5 species of freshwater shrimp were recorded.

110. Among the fish species Shol, Taki, Puti, Chingri, Bele, Tengra, Koi, Shing, Magur, Chanda, Kholisha, Chela, Mola etc are dominant freshwater fish species. Once a large number and big size of Boal, Chitol, Catla and Rui were available but not anymore. Elanga, Vanga, Pabda, Ghonia, Chitol, Foli, Sor punti, Bourani, Gulsha, Bele, Royna, Bashpata and Kakila are considered as threatened species in the subproject area. A list of fisheries found in the region is presented in Appendix 18.

111. **Fish migration.** Generally riverine hatchlings or fish enter into the project command area through khal during the periods of May to August each year in high tide. Not only the riverine species but also indigenous fish species migrate from river to floodplain through internal canals for feeding, breeding and rearing purpose and as well as to complete their life cycle. But peripheral river (Ghagor & Kumar rivers) along with the internal canals and floodplains of the project area have been silted up naturally. Siltation and water control structures of the command area will slightly hamper the migration of fish and other aquatic biota but adjacent river of the project is always open for free movement of fishes.

112. The riverine and subproject resident fish species migrate through regulated khals to some extent during the period of late June to mid-October. Gagor river, Kumar River, Kala bari khal, Ramnagar khal and Hashir khal along with other seasonal intimal khals are used as feeding and nursing ground for the open water fishes. Fish species such as Puti, Taki, Koi, Boal, Tengra, Gulsha, Sing, Baila and other indigenous species migrate through malfunction of regulators to these water bodies as part of their life cycle. Fish hatchling/ fries moves from river to khal through regulators during wet season when water levels are high in khals. Peripheral rivers along with internal khals of the subproject area have been silted up naturally and the reduction of migratory routes. Siltation and water control structures hamper the migration of fish and other aquatic biota.

Fish migration status is found poor to moderate in the subproject area due to improper management and poor function of the regulators.

113. **Bioecological zone.** Bangladesh's AEZs have been identified based on four factors: geomorphology, soils, flood-related land levels, and agro-climatology. Bangladesh is provisionally divided into 30 AEZs. These 30 zones are divided into 88 agro-ecological sub-regions, which are further divided into 535 agro-ecological units. Bio-ecologically the study area falls under Gopalganj-Khulna Beels (AEZ no. 14). Gopalganj-Khulna Beels (2,247 sq km) the region occupies extensive low-lying areas between the Ganges River floodplain and the Ganges tidal floodplain. The soils of the area are grey, and dark grey, acidic, heavy clays overlay peat or muck at 25-100 cm. General soil types include mainly peat and non-calcareous dark grey floodplain soils. Organic matter content is medium to high. The fertility level is medium. The Gopalganj-Khulna Beels have a wide range of ecological, socio-cultural, economic and commercial importance and values in Bangladesh. These are important habitats for a large variety of flora and fauna of local, national and regional significance. Wetlands are critically important in Bangladesh for human settlements, biodiversity, fisheries, agricultural diversity, navigation and communication, and ecotourism. Bangladesh possesses a large wetland area comprising diversified fisheries resources. All wetlands are subject to sedimentation composed of clay soils rich in organic matter, and crops, which can tolerate water logging, and inundation cover the vast flood areas of wetland (Banglapedia, 2022).

114. **Flora.** The intervention areas are comparatively low-lying area where one can find homestead forests with luxuriant growth. Those contain indigenous timber trees like karoi (*Albizzia procera*), haldu, bazna (*Zantho phylum*), karobi, sheora (*Streblus asper*), margazaj, mehogoni (*Swietenia macrophylla*), jalpai (*Elaeocarpus tectorius*), bohera (*Terminalia bellirica*), amloki (*Phyllanthus emblica*), etc. However, all these trees are scattered. Mango (*Mangifera indica*), betel nut (*Areca catechu*), jack fruit (*Artocarpus heterophyllus*), jam (*Eugenia jambolanavav*), banana (*Musa sapientum*), coconut (*Cocos nucifera*), litchi (*Litchi chinensis*), blackberry (*Syzygium cumini*), papaya (*Carica papaya*), jambura (*Citrus decumana*), lime, palm (*Borassus flabellifer*), citrus fruits, melon etc. are among common fruits found in this project areas. Besides, trees found in these project areas are gab (*Diospyros precatorius*), haritaki (*Terminalia chebula*), keora (*Sonneratia apetala*), sonali (*Cassia fistula*), etc. Almond, banyan (*Ficus benghalensis*), jam (*Eugenia jambolanavav*), tamarind or tetul (*Tamariandus indica*), bel (*Aegle marmelos*), kamranga (*Averrho karambola*), dumur (*Ficus hispida*), and some other varieties are found in this project areas. The chief species of palm are the date palm (*Phoenix sylvestris*) and the betel nut (*Areca catechu*). Date palms are rarely grown in plantations, but usually on the embankments of the fields. Clumps of bamboos are found everywhere. Medicinal plants include balola (Acacia), madar (*Erythrina ovalifolia*), bhat (Calerodendrom), haritaki (*Terminalia chebula*), chireta (*Swertia chirita*), dhuteira (*Datura metel*), etc are also found. A list of locally found flora and birds are listed in Appendix 19.

115. Marsh plants and weeds are found in great variety and luxuriance and in the beel area, the surface of the marshes is covered with huge stretches of inundated rice or with mottled floating islets of sedges and grasses and with various waterlilies, the striking of which is the makana (*Eurale ferox*). They are made into closely woven mats, while the reed called hogla is used for roofing huts (Figure IV-12).



Figure IV-13 Flora found at the proposed site

D. Socio-Economic Environment

116. **Demography.** In Rajoir Kotalipara (the proposed intervention area) the total households and population was found to be 20,820 and 93,690 respectively. The sex ratio is defined as the number of males per 100 females. In Rajoir-Kotalipara it is 103 males against 100 females. The household size is within the range of 4.5 for a single family. In a joint family, it may be more than 5, but in that case the number of couples living in the household is also proportionately more. As per BBS 2011 Population Census Report the national average household size is 4.5 and for the district of Gopalganj is 4.4.

117. **Age distribution.** In Rajoir Kotalipara the productive or 18-60 age group of population is, with (59%) significantly higher than the other two groups (1-17 and 65 years and above). The non-productive population involves those who are able to work but enjoy social benefit at the cost of productive people. Generally, children younger than 18 and adults older than above 65 are considered non-productive people.

118. In Rajoir Kotalipara subproject, the number and percentage of women headed and male headed household is (95%) and (5%) respectively. No national data is available to compare male and women headed household percentage of the subproject. However, the result is consistent with other subprojects where the percentage is less than 10%. The sources of income of those households are homestead gardening, duck and goat rearing, sewing and tailoring, making of nakshi kantha etc.

119. **Occupation.** An occupation indicates sources of income derived from work, time spent in work as well as social position. The data shows that the main occupation of the households head is farming (38%), business (26%), service (20%), housewife (3%), fishermen (1%), fish farmers (3%) and other occupation, (5%) which includes, daily wage labour, driver, carpenter etc. In all occupation categories, the status of women is extremely poor. The main reason is that women work at home for housekeeping, agricultural product processing and storage, poultry and cattle rearing and vegetable gardening. These works except housekeeping are income generating or income substitution to meet the need of household demands. In spite of intensive gender advocacy by NGOs and civil society for official and social recognition of this work as occupation, not much progress has been made.

120. **Education.** The average literacy rate of population 5 years and above in the Rajoir-Kotalipara is (94.29%) and illiterate is (5.70%), which is much higher than the national average (72%). (BBS Booklet: 2016). Among the total literate population, the male literacy is (53%) and female literacy rate is (47%).

121. **Housing.** The housing structures of most households are either corrugated sheet or brick walled (96%), followed by concrete roof (1% straw roof (2%) and others (1%), which includes leaves and polythene sheets.

122. **Drinking water.** Most of the households of the Rajoir-Kotalipara drink underground water lifted by hand tube well. The data shows that (99%) of the population drink tube well water and (1%) drive water from other sources which includes surface water, ponds and rivers. Contaminated water with arsenic was also reported but the percentage of tube wells or households using this water could not be verified due to absence of proper water testing facilities. In regard to the quality tested of drinking water about 80% mentioned that their water quality has been tested and (20%) mentioned that the quality of water has not been tested.

123. **Sanitation.** The survey data shows that most households of the surveyed area use ring-slab latrines (83%), followed by pucca (13%) and kutcha (4%). It is to be mentioned here that the broken ring slab latrines, kutcha and open latrines are considered unhygienic latrines.

V. ANALYSIS OF ALTERNATIVES

A. Need of analysis of alternatives

124. The primary objective of the “analysis of alternatives” is to identify the location/technology for a particular subproject that would generate the least adverse impact and maximize the positive impacts. The preliminary assessment of the project included an analysis of alternatives, addressing the optimal match between required technical specifications and site conditions, as well as addressing any concerns for environmental, social, and economic features in each location.

B. Current proposal

125. The coastal zone of Bangladesh is divided into 3 parts of which the central zone is the most dynamic and experiences constant process of erosion and accretion (Shaibur et al. 2020). Gopalganj falls under this region and experiences erosion accretion and Bankline shifting specially in the Madhumati River. During monsoon when the rivers and canals carry highest discharge, the river starts eroding the side banks. Some big canals situated in the study area also experience erosion. Erosion causes loss of land, life and property while accretion results in the emergence of new lands which can be used for farming and agriculture. In Gopalganj, 1,362 households have been affected by river erosion during 2015-2020 (BBS 2021). These locations are the inner bends, abandoned channels, deeper channels with strong currents and along the shoals.

126. As discussed in para. 62,63 and 64, the proposed locations are vulnerable to bank erosion and needs protective works. Table V-1 presents the potential negative impacts of the proposed interventions.

Table V-1 Summary of potential negative impacts of the current proposal

Sector	Negative Impact
Presence of important features within or around the land	None
Land (Government-owned land are to be given priority)	Riverbanks will be protected which are govt. owned land
Presence Agricultural/cropped land	None.
Village affected	None.
Families affected	None.
Loss of structures	None.
Impact on Common properties	None.
Trees to be chopped down	None.
Presence of sensitive ecosystem	None.
Presence of waterbody	None.
Tribal population affected	None.

Source: TA consultants

C. The preferred alternative

At this point, riverbank protection works are the best possible course of action to prevent erosion. The ‘alternative’ will be ‘no action’, which is not rational at the moment.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION

A. Approach and methodology

127. The IEE commenced with the review of legal requirements for the project followed by collection of technical details, and discussions with BWDB to reconfirm the data and information. Scoping of issues to be addressed in the IEE was conducted early in the assessment process (i.e., field visit) to collect the appropriate baseline information. Additional tools and methods used are described in the following:

1. Approach

128. The IEE study has been conducted following the ADB SPS 2009, World Bank's Environmental and Social Framework (ESF) 2018, EIA Guidelines for Industries, prepared by the DoE in 2021¹⁷ in accordance with the requirement of the ECR 2023. The IEE process adopted in this study involves identification of the key impacts on natural and social environment and evaluation of the significant impacts along with recommendation of initiative measures as well as listing of unresolved environmental issues. The IEE includes collection of baseline information, setting of boundaries, impact assessment, suggestion of mitigation measures and alternative sites providing an EMP.

129. This IEE study adopted a scoping of environmental assessment comprising of seven dimensions that explains the direction, magnitude, spatial extent, duration of impact, timing of impact, nature of impact and cumulativeness of the possible impacts, if they are not mitigated. This was done to capture the complex environmental impact pathway of construction projects. The steps of impact analysis and their methods are described in the later sections (VI-A- 2 to VI-A-3). Results of Impact assessment and possible remedies are described in Section VI-B and onwards. Finally, the summary results of the final assessment ratings have been presented in the form of matrix in later sections.

2. Methods of physical environmental assessment

130. The issues of physical environment have been investigated through professional observation of the study team members backed up by feedback from the local people during field visits. The base of the physical environmental assessment was data from secondary sources and field observation in combination with Google earth images. In general, the physical environmental data collection and survey was carried out by a composite method of investigation including observation, satellite image analysis and public consultation. Every analysis was done with world standardized tools and the result presented with Geographical Information System (GIS) interface. The geological and seismic issues have been taken care of through secondary information and field observations. The general geological features and the seismicity of the project and its surrounding areas were collected from available secondary literature and GSB.

131. Meteorological data such as rainfall, evapotranspiration, temperature, sunshine hours, humidity, wind speed and wind direction have been collected and analyzed for assessing local

¹⁷ DoE (2021) EIA Guidelines for Industries, Department of Environment (DoE), Ministry of Environment, Forest and Climate Change, Government of the People's Republic of Bangladesh. Dhaka, February 2021.

climate that are directly related to water resources of the study area and the project area. Meteorological data for selected stations have been collected from the Bangladesh Meteorological Department (BMD). The methods of physical assessment that have been implemented in this study is presented in later sections.

a. Primary data collection

132. Primary data sources include site visit impressions and interviews of relevant stakeholders such as local communities and local leaders. The information collected includes local topography, environmental condition, flooding condition, traffic situation, local hydrological information etc.

b. Secondary data collection

133. The secondary Information sources include published literatures, statistics, maps and reports collected from various government and non-government organizations, such as the BMD, BWDB, SRDI, GSB and the International Union for Conservation and Nature (IUCN), Bangladesh Bureau of Statistics (BBS) Population and Housing Census 2011, Community Reports of BBS. The information collected in such ways was categorized in added to the database of the baseline condition.

c. Socio-economic Survey

134. The social and economic data collection and review involved fact-finding from field, collection of data, tabulation of data, database entry, data compilation and review and the presentation of data. Secondary information including data, maps and reports have been collected from various sources. The data analyzed as part of this process has been collected from a number of secondary sources.

- **Primary data collection:** The socio-economic data especially for the social features of the Project affected area were collected through visual observation, focus group discussion and public consultations.
- **Secondary data collection:** Key secondary sources include Information on socio-economic profiles of the Project affected local communities which covers demographic profiles, education, coverage of health and sanitation facilities, use of power, agricultural land etc.
- **Public Consultations:** Focused Group discussions (FGDs) and Key Informant Interviews (KIIs) were arranged at each subproject site for public consultation. The stakeholders for the project were the possible beneficiaries of the project, and project implementation officials. In the consultations stakeholders were made aware of the project activities and consultants as well as consultants answered their queries, questions and took note of their suggestions. In addition, several informal group discussions as well one-on-one discussions were held with local people, project affected people and community representatives at the different locations of the Project sites. The team recorded their perception of the proposed work and sought their suggestions on implementation of EMP with mitigation measures on how to reduce any potential impacts on natural and social environments and mainly centered on drainages congestion, flood, local landscape, removal of tress, loss of agricultural lands, and community cohesion problems.

d. GIS and Remote sensing

135. The Geographical Information Systems (GIS) and Remote Sensing (RS) played crucial role in development and modelling of the spatial extension of environmental problems in the target city corporations such as extension of flooding, waterlogging, topography, population etc. Further, the GIS and RS technologies were used for investigations and detailed on-ground validation of spatial information on land use by using a hand-held, non-differential GPS in this IEE study. The Project alignment maps as Keyhole Markup Language zipped, Compressed Version of KML (KMZ) and Keyhole Markup Language zipped Google Earth (KML) produced during spatial modelling analysis were studied prior to field investigations, spatial analysis of satellite imagery was also used to identify land use boundaries. Based on spatial data acquisition and validated land use, the sensitive areas for sampling locations identified for biophysical survey of the Project. In addition, the GIS based maps of existing environment are produced for this IEE report from the collected information from field and acquisition of spatial data.

3. Impact assessment methodology

a. Impact categorization

136. **Significance of Impacts:** Generation of environmental and social impacts from infrastructure development is a function of the activities that take place during construction and operation of the infrastructure, on the one hand, and the particular environmental and social attributes of the local setting on the other. The people, communities and ecosystems that may be affected by a project (receptors) are variable in terms of their proximity to the construction areas; their sensitivity to influences such as noise, disturbance and emissions; and their ability to adapt to change. The activities involved in construction and operation of infrastructure also vary based on the nature of the project, the noisiness and dirtiness of the construction works required, and how long different activities are carried out in one place. The significance of impacts depends on the particular juxtaposition of activities and receptors in specific locations.

137. **Typology of impacts:** The impacts that arise from particular configurations of river protection works activities and landscape features may emerge in different forms and through various pathways. It is useful to consider the types of impacts that may come into play - some of which may be more immediately obvious than others - when assessing the potential effects of a project on people and nature in the surrounding environment.

138. Table VI-1 below explains the Impact categorization and typology adopted for this study. Figure VI-1 explains the impact assessment process that has been adopted in this study.

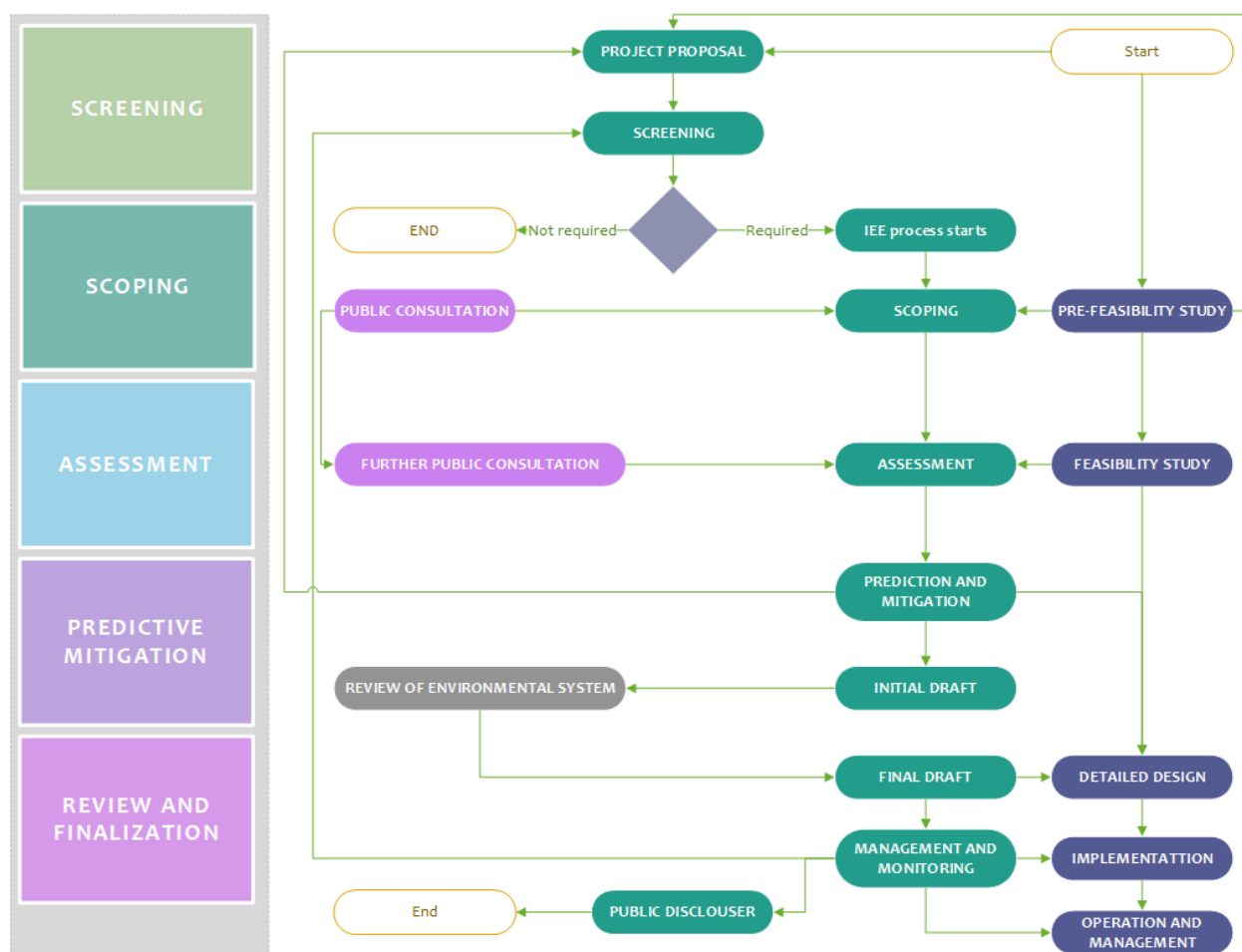


Figure VI-1 IEE process adopted for this study.

Table VI-1 Impact categorization and typology adopted for this study

Impact parameter	Types of impact				Sign
Direction of change relative to baseline conditions	POSITIVE		NEGATIVE		+/-
Magnitude of impact in relation to ability of people and ecosystem to cope with change	NONE	MINOR	MAJOR	SEVERE	D/C/B/A
Spatial extent of effects	LOCALIZED		WIDESPREAD		Loc/Wid
Duration of effects experienced	TEMPORARY		PERSISTENT		Tem/Per
Timing of effects experienced	INTERMITTENT		CONTINUOUS		Int/Con
Nature of cause-and-effect linkage between project activity and impact experienced by receptors	DIRECT		INDIRECT		Dir/Ind
Relationship of project activities to impacts from other sources in landscape	ISOLATED		CUMULATIVE		Iso/Cum

b. Spatial Scope of Analysis

87. The area of influence of an infrastructure project is defined in the SPS 2009 (p. 31) as follows:

- (i) The primary project site(s) and related facilities that the borrower/client (including its Contractors) develops or controls, such as power transmission corridors, pipelines, canals, tunnels, access roads, borrow pits and disposal areas, and construction camps;
- (ii) Associated facilities that are not funded as part of the project (funding may be provided separately by the borrower/client or by third parties), and whose viability and existence depend exclusively on the project and whose goods or services are essential for successful operation of the project;
- (iii) Areas and communities potentially affected by cumulative impacts from further planned development of the project, other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that are realistically defined at the time the assessment is undertaken; and
- (iv) Areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that might occur without the project or independently of the project.

139. The project activities will be spread over five locations in Gopalganj and Madaripur. It is expected that materials like sand and gravel will be purchased on the open market, rather than obtained from project-specific borrow pits or quarries. With respect to cumulative impacts, the proposed development of the districts does need to be understood as single piece of investment in water structures only affecting the vicinity of the respective structures, rather the impact of the whole project needs to be considered.

140. The last category to consider as being part of the area of influence - areas and communities potentially affected by developments that can be expected to result from the development of the project - is certainly relevant. The proposed developments at the riverbanks are likely to facilitate and perhaps even be a significant driver of the local environmental development trajectory, especially in the field of riverbank erosion, flooding and drainage. The infrastructure improvements can be expected to contribute to lessening the riverbank erosion and drainage congestion in the vicinity thus less disrupting the local life, commerce and trade. The scale of induced development is difficult to forecast at the time of writing, but the general nature of the anticipated change in the local economy is nevertheless taken into consideration as part of impact analysis.

141. At the site level, defining the area of influence for the purposes of assessing impact potential is a subjective, context-dependent exercise. Noise and dust from construction activity, for example, are localized impacts likely to be experienced mostly within about 100 m of the construction site boundary.

c. Substantive Scope of Analysis

142. This IEE development considers the following parameters for scope of analysis:

- (i) biodiversity, species of concern and critical habitat areas including forests, wetlands, and protected areas.
- (ii) surface water bodies and groundwater.
- (iii) air quality, including dust and emissions.
- (iv) agriculture and fertile soils.
- (v) tree cutting.
- (vi) local acoustic environment.
- (vii) drainage and waterlogging.
- (viii) waste management (construction waste and operation phase waste).
- (ix) Climate Change Mitigation and Adaptation.
- (x) land use and livelihoods.
- (xi) traffic congestion.
- (xii) community life and interaction.
- (xiii) private property and public utilities.
- (xiv) public health and safety.
- (xv) occupational health and safety, including as they relate to the COVID-19 pandemic unfolding during implementation of the Investment Project.
- (xvi) physical cultural resources.
- (xvii) possible transboundary impacts, including transmission of disease vectors, spread of invasive species, and harmful patterns of natural resource exploitation; and
- (xviii) induced development effects and cumulative impacts.

143. The degree of emphasis placed on the key parameters identified here depends on their particular relevance, given the nature of the planned construction of sites and receptors.

d. Temporal Scope of Analysis

144. Analysis of impacts and definition of suitable mitigation measures should take in all phases of the project infrastructure's development. Impacts may arise most obviously and visibly during construction, but the impacts of design and siting decisions made in the pre-construction phase, as well as the effects of intended and unintended activity at facility sites over the entire duration of the infrastructure's operating period, also need to be considered.

145. **Pre-construction phase (design impacts):** The design process offers considerable opportunities to reduce environmental impacts, through appropriate choice of materials, equipment and physical systems and features. For example, equipment and climate-control systems with the lowest associated greenhouse gas emissions (e.g., high-efficiency electric motors and lighting) shall be used during construction as much as possible so that the project inserts minimum of carbon footprint. A well-designed hydrological model set-up for 100 years may suggest the dimensions of the drainage passage to design. Incorporating such elements will help to maximize climate change mitigation as a feature of the project.

146. **Pre-construction phase (siting impacts):** The selection of a facility site has the potential to generate environmental impacts based on:

- (i) the physical characteristics of the site itself (e.g., topography, soils, drainage, exposure to natural hazards, past and present land uses);
- (ii) the proximity of the site to impact receptors (e.g., water bodies, sensitive habitats, residences, schools, hospitals, public spaces);

- (iii) the amount and type of work required to connect the facility to transport networks and service infrastructure; and
- (iv) the distance between the facility and other facilities to which it is functionally linked.

147. **Pre-construction phase (procurement impacts):** Procurement decisions with negative impact potential during the construction and operation periods are related to both materials and service providers. Construction materials obtained from afar, especially those that are heavy and needed in very large quantities, can generally be expected to have a large carbon footprint due to increased emissions associated with their transport. Materials obtained from unsustainable sources contribute to environmental problems elsewhere. Use of construction and maintenance Contractors with a poor record of environmental and social safeguards compliance significantly increases the probability of all manner of negative impacts during the construction period, as well as the creation of problems whose effects will be felt far into the future. And hiring mainly or exclusively local workers accrues substantial project benefits to the local economy, while hiring workers from outside the project area may create social strife and requires establishment of construction camps, which typically have significant potential for negative environmental impacts.

148. **Construction phase impacts:** Impacts likely to arise during the construction phase relate to the physical activities that take place both at construction sites and at locations where related activity occurs, such as access roads, haul roads, and any borrow pits, quarries or spoil dumps established specifically to support construction of the site or sites in question. Although infrastructure construction is an inherently disruptive activity, many impacts of construction activity are well understood and amenable to minimization with appropriate construction site management.

149. **Operation phase impacts:** Impacts during use of infrastructure are generally of lesser magnitude and severity than construction impacts, and arise from regular O&M activity, but also from things that go wrong with these activities, such as accidents, fires, explosions and releases of harmful substances. Proper preparation and use of O&M manuals and protocols, as well as training of personnel and regular monitoring, are key means of preventing and minimizing operation phase impacts.

e. **Impact Mitigation and Enhancement**

150. **Objectives of mitigation:** The central goal of impact assessment is to determine how best to mitigate (make less serious, severe, or damaging) potential negative effects before they arise, and to identify opportunities for enhancing potential positive impacts, which may or may not be part of the project rationale. The IEE considers the specific activities that implementation will involve, from site selection through to operation, and defines the impacts that can be expected to arise in view of the particular features of the receiving environment. The analysis and discussion of impacts uses an integrated approach, in which environmental and social impacts are considered together in relation to each set of road development activities.

151. **Mitigation hierarchy:** Identification of an appropriate proactive approach for each expected impact in this IEE makes use of the standard mitigation hierarchy advocated by the ADB and other multilateral donors. In the mitigation hierarchy, top priority is given to measures that enable outright prevention or avoidance of impacts. Where prevention or avoidance is not possible, the next most preferred option is to minimize impacts to the greatest extent possible, within reasonable limits of feasibility. Finally, and only once it has been confirmed that there is no

feasible way to reduce an impact below a reasonable threshold of social acceptability, it will be appropriate to consider measures to compensate for the loss or damage caused to people and nature through reimbursement, replacement or some other means.

152. **Impact enhancement:** For positive impacts, there is no hierarchy as for mitigation, only one objective: to adopt measures to enhance or reinforce positive effects whenever possible, through thoughtful adaptation during site selection, design and implementation.

153. **Environmental Management Plan:** Measures will be prescribed for mitigation or enhancement of each predicted impact. Such prescriptions do not carry any weight unless they are made part of an obligatory implementation plan. The EMP translates the measures prescribed in this section of the IEE into costed action items assigned to specific actors and makes implementation of the action items subject to regular monitoring of compliance and effectiveness. The EMP is presented in Chapter 9 of this IEE report.

B. Findings of Impact Assessment: Pre-construction phase

1. Siting related impacts

154. Impacts related to siting of the infrastructure at the riverbanks are partly locked in by the established location of the already existing drains and roads owned by the respective polytechnics, which will be redeveloped with some expansion (i.e., widening). Some location-related impact areas are discussed below.

a. Climate change, sea level rise and water level

155. **Impacts:** As seen from Figure VI-2, the trend of precipitation in Goaplganj does not show any consistent trend in precipitation. The downscaling exercises and future climate change anomalies assessment through bias correction has been performed on Rainfall (precipitation) for two different SSPs of CMIP6 dataset in different time slices up to 2050. In accordance with IPCC practice, the base period for the climate change analysis was considered from 1981 to 2010. The change in rainfall and temperature for the Khulna and Madharipur stations are summarized in Table VI-2. The table suggests that in both Madaripur and Khulna station, the rainy season is going to shift towards post-monsoon (i.e., Sep-Oct) while winter and dry season is going to lose rainfall up to 12.2%. This implies that the usual high waters in the rivers might come later in the post monsoon, and a certain peak in high level water might exert more pressure on the riverbanks leading towards riverbanks erosion.

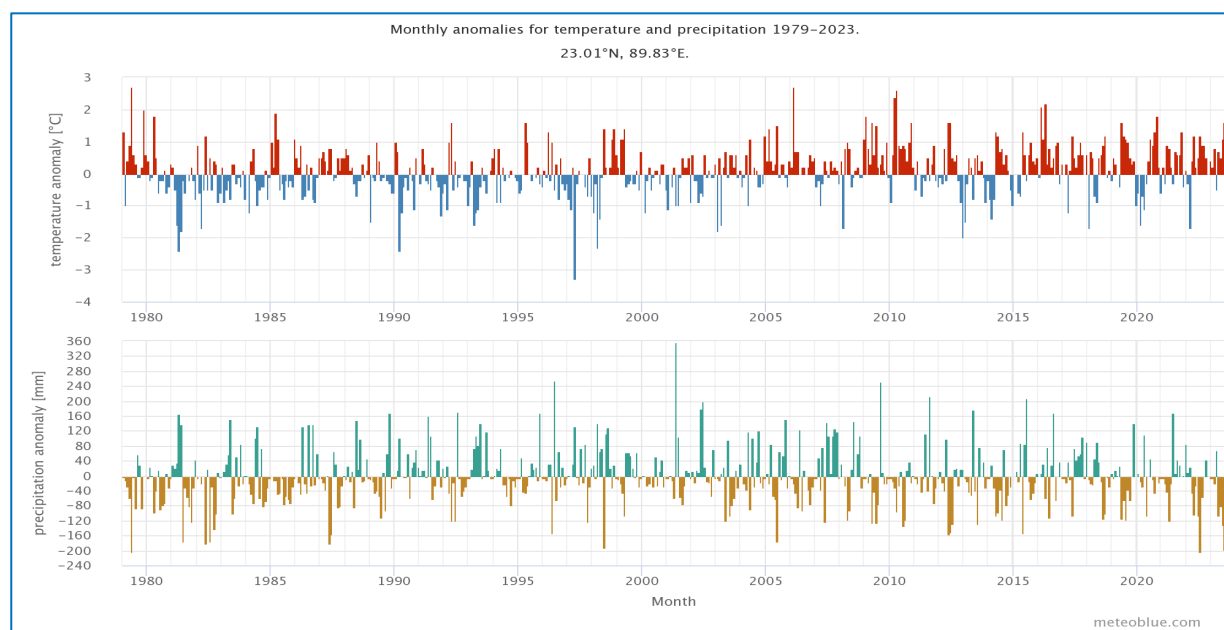


Figure VI-2 Current trend of temperature and precipitation anomalies at Gopalganj over the period of 1979 - 2023. data modeled by meteoblue.com.

Table VI-2 Change in rainfall in the study area by 2050s under SSP 3-7.0

Location	Monthly Change in Rainfall (%) under SSP3-7.0											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Khulna	0.7	-6.2	-11.2	2.8	-8.7	-6.6	-0.2	-0.1	9.8	4.8	-7.5	-8.0
Madaripur	-1.9	-5.3	-12.0	4.4	-4.5	-8.8	1.3	7.7	9.7	5.5	-7.4	-8.0

Source: TA consultants

156. In many infrastructure development scenarios, the siting of quarries and borrow pits is a key determinant of GHG emissions from construction. In this case, bulk materials are likely to be purchased on the open market, so siting will not be an important consideration in this regard. All the target construction sites (i.e., riverbank protection works) flood after heavy rains, when the catchment area overflows, since drainage systems are already clogged. Considering the climate change projections in Bangladesh predicting more and more intense rainfall over shorter period of time and shifting of monsoon demands the river protection works needs to adjust with the new reality. The projected intensifying rainfall over Bangladesh under climate change scenarios, specially under scenario SSP 1 -8.5, estimating river water level will play a crucial role in future development (Figure VI-3).

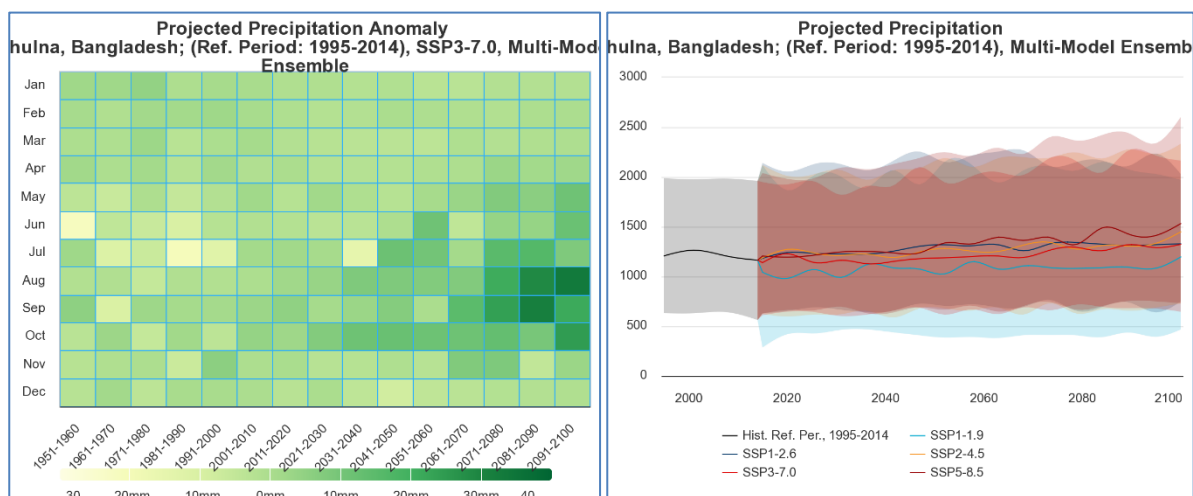


Figure VI-3 Projected rainfall under SSP 1-8.5 scenario in Khulna Region. Source: WB CCKP (<https://climateknowledgeportal.worldbank.org>)

157. Maximum sea level rise (SLR) as indicated in the BDP2100, is expected to be 1 meter or more by the year 2100. The Future projections of IPCC AR6, on sea level rise at Hiron point suggests 0.23-0.27 m rise by 2050s and 0.54-0.86 m rise by 2085s for the SSP1-2.6 and SSP5-8.5 scenario respectively. There is substantial uncertainty in the long-term projections of sea level rise according to IPCC with estimates ranging up to 1.75 m in some IPCC models near Bangladesh coast. The available regional model for the south-central and south-west region has been used to estimate the impact of sea level on the East Gopalganj area. Using 1D hydrodynamic and RR module of SOBEK modelling tool, SLR was projected for the intervention area (i.e., East Gopalganj Area) which are summarized in Table VI-3.

Table VI-3 Increase in river water level during dry season (Dec – Apr) by 2050s for different scenarios

Scenario	Increase in water level		
	Goaplganj Sadar	Tungipara	Kotalipara
SSP 1-1.5	0.09	0.10	0.09
SSP1-2.6	0.10	0.12	0.11
SSP2-4.5	0.12	0.14	0.13
SSP3-7.0	0.13	0.16	0.15
SSP5-8.5	0.16	0.20	0.19

Source: BWDB (2023) Final Report on Detailed Study for East Gopalganj Integrated Water Resources Management Project

158. **Mitigation:** Given the projection of higher precipitation in short period of time due to climate change, additional consideration of water levels is proposed for construction to remedy the erosion and flooding problems. It is assumed that after construction of the river protection works, the flooding problem will be resolved. However, during the design of the protection works, it needs to be considered that recent climate change projections suggest higher amount of rainfall in a small window of time in the future. The depth and length of the embankments need to be designed accordingly.

b. Flora and fauna

159. **Impacts.** The eroded areas, especially river bank lack vegetation cover. Hence, riverbank protection works will not involve removing any vegetation. Therefore, no impact is expected.

160. **Mitigation.** Although no impact is envisaged for the proposed construction interventions, plantation of deep-rooted vegetation along the shoulder of the embankments is recommended.

161. **Enhancement. NBS for riverbank protection.** At this current situation, the proposed 'hard engineering' or 'grey structures' are immediately required to protect riverbank erosion. However, it needs to be with additional proposals towards the commencement of a 'green solution' or NBS. The use of bundle structure (made of bamboo) along with thick deep rooted bushy vegetation proved to be effective in the past. Although the proposed sites seemed to be in deep scouring and water level seemed to be quite deep (survey report needed), the combination of bundle structure with vegetation can be effective, hence should be proposed with the 'grey structure' (current proposal). The NBS solution might be possible here, as BWDB can be inspired from a community led innovation of river protection that has taken place in Jinjiram river (Transboundary River) of Kurigram district. Compared to the proposed river, Jinjiram is smaller in size and flow, but severely flood and erosion prone due to the passage of flash flood from Assam (India). In the Jinjiram river, there are at least 50 sections of bandalling in the 60 km stretch of the river in Bangladesh, where it has a maximum width of 107 m. Bandalling are almost 15 feet deep in the river followed by thick natural vegetation (tall grass, deep rooted vegetation etc.) planted on the riverbank. Interestingly, local village communities decide where to put the bundalling structure, their length, size and depth followed by the local erosion resistant vegetation. This practice can follow in the proposed subproject areas, since WMOs and WMAs are involved in such decisive interventions. Possibilities of such NBS interventions led by communities should be assessed and if feasible, should be proposed as part of ADB commitment towards NBS in future.

2. Design related impacts

a. Climate change

162. **Impacts:** establishment of the temporary engineering camp, construction yard and labour camp for the construction project will unavoidably generate greenhouse gas emissions. Although it is not possible at this point in the design process to credibly calculate an impact in tons CO₂ equivalent, it is nevertheless useful to consider design elements that can make the facility's contribution to climate change greater or smaller. Certain materials have much higher embodied emissions than others; concrete is a particularly carbon-intensive material. Materials that are not available locally—particularly very heavy materials—also drive up the emissions associated with building. Installed equipment that is not modern and efficient represents a missed opportunity to lower carbon footprint of facilities, as does failure to integrate design measures that allow for natural cooling, natural light, and reduced water pumping needs.

163. **Mitigation:** Integration of GHG-mitigating design elements in the camp and construction yard facilities is an opportunity to enhance the facilities' contribution to climate change mitigation, relative to existing standards of construction for public infrastructure in Bangladesh. Key strategies for reducing emissions, and that should be considered for incorporation in proposed temporary infrastructures are outlined in Table VI-4. A number of the general design innovations

recommended are considered useful and feasible for at least some of the proposed camps and construction yards.

Table VI-4 Possible design phase measures for climate change mitigation

Climate change mitigation measure	Rationale
1. Substitute other materials for concrete where feasible	Concrete is among the most carbon-intensive of building materials
2. Use low-carbon concrete as much as possible	Using a lower proportion of cement (and longer cure time to compensate) can reduce the carbon intensity of concrete
3. Create designs that maximize use of building materials that are available locally	Reduced transport emissions
5. Integrate photovoltaic generation into the electrical plan	- Reduce reliance on coal-generated electricity - Reduce reliance on back-up diesel generator - Possibly reduce size of generator needed
6. Specify only high-efficiency electrical and mechanical equipment	- Reduce reliance on coal-generated electricity - Reduce reliance on back-up diesel generator - Possibly reduce size of generator needed
7. Specify most fuel-efficient backup generator available	Reduce diesel consumption
8. Maximize cross-ventilation by use of courtyards, openable windows and favorable building orientation	Reduce demand for air conditioning
9. Prioritize shade in the landscaping plan, with plentiful wide-crowned shade trees on all parts of site	
10. Incorporate hollow wall structures	
11. Use overhangs above large windows to prevent excessive solar penetration	
12. Maximize interior natural light by use of favorable building orientation and courtyards	Reduce use of electrical lighting during daytime
13. Specify water-saving toilets, faucets and showerheads	Reduce need for pumping and treating water
14. Design dedicated plumbing system for drinking and cooking water	Reduce volume of water requiring energy-intensive water treatment
15. Aim to meet all water heating needs with solar heaters	Eliminate use of electricity for heating water
16. Specify high-intensity, full-time lighting only where strictly necessary	Reduce consumption of energy for lighting spaces that don't need it (e.g., parking lots that are only used at peak times)
17. Specify solar-powered lighting for outdoor applications	Reduce energy used by lighting
18. Base landscape plan around drought-tolerant perennial native species	Reduce the need for pumping water
19. Design site layout and inspection process to minimize the length of time vehicles have their engines running during their passage on Love Road	Reduce direct greenhouse gas emissions
20. Incorporate green roofs wherever roof area is not needed for solar panels and solar water heaters	Reduce cooling needs

164. **Enhancement.** To enhance climate change mitigation through carbon sequestration, site designs should also incorporate as many trees as possible in fringe areas of the embankments.

The preliminary site designs indicate that all areas not occupied by structures, roadways or walkways are to be provided with ground cover, and sites for planting of trees are shown. Plantings should normally be included in the detailed site design drawings (landscaping plan) and Bill of Quantities to ensure that they actually get planted and maintained.

b. Public health and safety

165. **Impacts:** Construction sites and the rivers, in general, are used as local means of transportation of goods. During the time of construction, local transportation will be hampered, but in addition to that, if precautionary measures are not taken, accidents may happen due to collision with metal pipes, materials transporting vessels and entering in talweg areas where wave is high due to transportation activities.

166. With regards to public health, the coronavirus (COVID-19) pandemic has highlighted vulnerabilities related to human proximity that were previously under-appreciated. To the extent that public facilities such as commercial areas cause people to be packed closely together in indoor spaces, they facilitate the spread of communicable disease. Although the COVID-19 pandemic seems likely to have abated well before the new campus comes into service, it may just be a matter of time before another viral agent causes a similar crisis.

167. **Mitigation:** A River Traffic Management Plan (RTMP) as well as Road Traffic Management Plan (TMP) must be developed by the Contractor under the supervision of the Construction Supervision Consultants (CSC) and have to be approved by the local authority. If required, portions of the river should be restricted for vehicles to pass.

c. Waste management

168. **Impacts:** Increased commercial activities around the construction area are likely to pose the risk of waste being dumped into the nearby stream/river. Many of the local khals, even rivers were found as floating with plastic waste. This waste stream will grow over time, and if this is not anticipated in monitoring design (the drains should be easily accessible for complete cleaning), waste management problems such as ad-hoc dumping and on-site burning are sure to arise.

169. **Mitigation:** Waste management problems can be avoided entirely by correctly anticipating future waste streams and incorporating adequate design features to collect, sort, and dispose of each class of waste. Adequate segregated collection bins should be strategically placed at indoor and outdoor locations of the labour camps and construction yards where waste generation can be expected. The design of the drainage system also should include the access points where it can be cleaned. Drainage system should have some access points so that when extreme rainfall events occur, or waste dumping block the entire drainage system, cleaning can be done when needed.

3. Procurement related impacts

a. Contractor selection

170. **Impacts:** The success or failure of environmental mitigation in construction projects hinges to a significant degree on the primary Contractor's sense of environmental responsibility and commitment to compliance with prescribed safeguards measures. If Contractors with a poor track record of compliance are hired, it is more likely that environmental impacts that can be easily

prevented or minimized will become more serious than they reasonably should. It is expected that the investments at the construction interventions will be implemented through a contract, so the choice of primary Contractor is doubly critical.

171. **Mitigation:** Upon award of the contract, the Contractor will be required to prepare a detailed Contractor Environmental Management Plan (CEMP) to demonstrate how it will meet its obligations under the EMP in relation to the investment sites. The plan will be reviewed and approved by the CSC and the safeguards oversight unit (SOU) within the project implementation unit (PIU); this review process is a critical opportunity to ensure that the selected Contractor understands and is committed to full implementation of its safeguards' responsibilities. A sample outline of a CEMP is provided in Appendix 9.

172. Only Contractors with a demonstrated commitment to safeguards implementation - as can be confirmed by previous construction supervision consultants and monitoring reports from past projects - should be hired. Bidding documents should stress safeguards requirements, and the documentation provided by bidding firms should be carefully scrutinized, including by following up on references to recent works completed. All Contractors and sub-Contractors must be registered with the Ministry of Labor and Employment.

173. Contractor candidates should be required to provide details of the age and fuel efficiency of their equipment and vehicle fleets in bids, and this information should be scrutinized and weighed in the selection process as a means of helping to limit the greenhouse gas generation potential of the investments. Construction contracts should require the primary Contractor and all of its sub-Contractors to use only modern, fuel-efficient machinery, and the employer (most likely the PIU) should have the reserved right to require removal and replacement of machinery it deems unacceptable in this regard at any time during the construction phase.

b. Labour sourcing

174. **Impacts:** Procurement of labor has two main potential impacts, which can be either positive or negative, depending on where most workers come from. First, use of mostly or exclusively non-local labor means that a construction camp will be needed, and this has significant potential for environmental and social impacts, including water pollution of local surface waters with untreated sewage and grey water; social discord due to worker behavior off-site, cultural misunderstanding and resentment about jobs going to outsiders; spread of communicable diseases including sexually transmitted ones; and occupational health and safety risks due to contractor failure to provide decent facilities. Hiring all local workers, by contrast, may mean that the need for a construction camp is eliminated.

175. Second, hiring mostly non-local workers is a missed opportunity for the project to bring benefits to the local community. The people who live in nearby areas will bear the brunt of any negative impacts that arise during the construction and operation phases, and employment opportunities will go some way in compensating for inconveniences and discomforts experienced. When all the jobs go to workers from other regions, wages do not stay in the local community. It is not uncommon in Bangladesh for progress on project works to be frustrated by deliberate actions of local factions angered by the use of non-local labor.

176. **Mitigation and enhancement:** To minimize and prevent construction camp impacts and maximize the project's benefits to the local community, the primary Contractor and all of its sub-Contractors should be contractually required to hire mostly or exclusively local residents for unskilled job. Otherwise, for specialized construction works, only skillful and highly qualified

workers will be hired regardless of locality. This should be stipulated in the bidding documents and contracts.

c. **Material sourcing**

177. **Impacts:** Generally speaking, materials that come from afar - especially very heavy materials - will have more significant environmental impacts associated with them, because of the extra energy used in transport. Transport often accounts for the greatest proportion of GHG emissions embedded in earthworks. Materials sourced from suppliers who obtain their wares by illegal and unsustainable means, such as hill-cutting, coercive farmland mining or riverbed mining (all notable problems in Bangladesh) effectively expand the environmental footprint of the infrastructure that is built with them.

178. **Mitigation:** Contractors should be required to prioritize proximity in sourcing materials such as gravel, sand and cement, provided that proximate sources are also not illegally or unsustainably obtained. The supplier is required under national law to furnish a Certificate of No Objection from the District Commissioner or Local Upazila Nirbahi Officer (UNO); Contractors should be contractually prohibited from purchasing materials from any supplier who is unable to show such a certificate and should be required to secure copies of the certificate for inspection by the construction supervision consultant.

C. **Findings of Impact Assessment: construction phase**

1. **Biophysical impacts**

a. **Water quality**

179. **Impacts.** Construction materials, demolished debris, fuel both from transportation vessel and construction machineries (piling machine, pump etc.) may degrade the soil and water quality. The construction workers will generate domestic solid waste and wastewater including sewage. The amount of domestic wastewater generated by the construction workers is assumed to be equal to the amount of water usage. Oily water, waste oils, oily rags and other similar wastes will be generated from workshop. The stores and warehouse will generate solid waste such as empty cement bags, cardboards and wooden crates. Improper disposal of these waste streams can potentially contaminate the soils and water resources of the area. Soil and water contamination can potentially have negative impacts on the local community, natural vegetation, agriculture and biological resources of the area including aquatic flora and fauna.

180. Borrowing material from the riverbanks may potentially cause increased turbidity in the rivers. Furthermore, release of effluents, soil and/or sand in water bodies may increase water turbidity, which would prevent sunlight to enter into the water that is necessary for promoting photosynthesis of aquatic plants.

181. **Mitigation.** An Emergency Response Plan encompassing spill response should be a required element of the CEMP. Appropriate contents of an Emergency Response Plan are listed on the sample outline of a CEMP provided in Appendix 9.

182. Surface water pollution from construction camps can be effectively controlled by requiring the responsible Contractor to install appropriately sized septic systems to accommodate effluent from all on-site toilets, and to maintain them properly. This should be one set of specifications in

a broader Construction Camp Management Plan (CCMP), which the primary Contractor should be contractually required to produce. The primary Contractor should be held responsible for ensuring the plan is effectively implemented, even if the camp is occupied exclusively by workers hired by one or more sub-contractors. A sample outline of a CCMP is provided in Appendix 11.

183. Runoff from active construction sites should be of sufficient quality to prevent violation of minimum water quality standards in the receiving water body, as specified in the ECR, 2023.

184. The following measures are to be implemented by contractor to address the above concerns:

- (i) Contractor will prepare and implement site-specific pollution control plan and a Standard operation plan and procedures for handling pollution spills, and management of fuels and hazardous wastes for implementation upon approval by the Design, construction and supervision Consultant and PMO;
- (ii) Construction yards will have oil separators/sumps to avoid release of oily water;
- (iii) Avoid repairing of vehicles and machinery in the field;
- (iv) Use plastic sheet or gravel in the workshop and equipment yard to prevent soil and water contamination;
- (v) Dispose contaminated soil appropriately ensuring that it does not contaminate water bodies or affect drinking water sources;
- (vi) The Contractor will ensure that there is no leakage, spillage or release of fuel, oil or any other affluent/waste on the ground or in the water from its construction machinery, vehicles, boats, launches, and barges. Contractor will regularly monitor the condition of its fleet;
- (vii) Material borrowing from the river banks will be carried out sufficiently away from the water line, minimizing the possibility of loose soil to wash away in the river;
- (viii) Contractor will locate camps far away from communities and drinking water sources;
- (ix) Prepare and implement camp waste management plan (septic tanks, proper solid waste disposal);
- (x) Release untreated wastes on ground or in water;
- (xi) Recycle spoil and excavated material where possible;
- (xii) Dispose spoil at designated areas with community consent; and
- (xiii) Construction material, demolished debris and excavated soil/silt will not be allowed to enter the water bodies.

b. Sedimentation

185. **Impacts.** Borrowing material from the riverbanks may potentially cause increased sediments in the rivers. Similarly, excavation of water channels if carried out in water can potentially increase their sediment load. Excavated material from the channels, if left along their banks may again enter the water thus increasing their sediment load. In addition, construction material, loose earth/soil, demolition debris, and other materials may enter the river or other water bodies causing increased sediments. Run off from construction sites, camps, and other temporary facilities may enter water bodies increasing their sediment load.

186. **Mitigation.** The following mitigation measures are to be implemented to address the above concerns:

- (i) Contractor will protect untreated embankment slopes;
- (ii) Contractor will excavate channels after dewatering them in case of manual excavation;
- (iii) Contractor will not leave excavated earth and silt on channel banks;
- (iv) Contractor will implement measures to protect channels from run-off from working areas and camps; and
- (v) The contractor will obtain borrowing material from riverbanks in such a manner so that there is no increase of siltation in rivers and will not leave loose soil after excavation.

c. Fisheries

187. **Impacts.** Only during the construction operation, fish migration may be disturbed within the construction and transportation operation area. This impact may be very limited due to adoption of the EMP during the construction period. However, construction activities may also cause migration of some bottom feeder fish species from the construction operation zone. On the other hand, increased turbidity in water columns may attract some fish species for food sourcing. In general, there may be a minor change in fish composition only during construction, but it would not affect the local fish diversity.

188. **Mitigation.** During construction operations, it is quite it is not possible to avoid the impact on the fisheries. However, the impacts are not permanent. After construction, the river will be deeper to host a variety of fishes at different layers. Moreover, some fish sanctuaries can be developed after construction at the lower stretch of the river. In such cases, the WMAs and WMGs can take the lead.

d. Benthic fauna

189. **Impacts:** Benthic communities play an important role in food chain not only for lentic (standing water) but also for lotic (flowing) water bodies. Construction activities including re-excavation can potentially impact the benthic communities of the water bodies. Most of the construction activities will be implemented during dry season, when the benthic fauna would be more vulnerable.

190. **Mitigation:** The following mitigation measures are to be implemented to address the above concerns:

- (i) The Contractor will prepare site-specific plans for pollution control and for standard operation and procedures for handling pollution spills to be implemented upon approval by the Design, construction and Supervision Consultant and PMO

e. Public nuisance (air and noise pollution)

191. **Impacts:** Emission of greenhouse gases carbon dioxide and nitrogen oxides may be emitted from combustion of the petroleum products in project related vehicles, machinery, generators, and vessels/barges etc. during construction period. Their impact on air quality will not be significant as the pollutant emission activities (point and area sources) will be limited within the project boundary and the activities will be short term (only for preparation and construction

periods). However, this impact may further be minimized by adopting the Environmental Management Plan.

192. Impact on ambient noise operation of different machineries and equipment for hauling, running of heavy load traffic for construction materials transportation, and regular traffic movement may generate noise during construction period. The produced noise may have impact on existing acoustic environment of rural category defined in ECR, 2023. Local inhabitants may feel disturbed due to noise from line sources (traffic movement). However, it is very unlikely that the local people will be affected by the noise which might be produced from vehicular movements as the nearest village is located more than 2 km away from the construction sources.

193. Given the proximity of few residential areas, the noise generated by the construction vessels may cause a level of auditory discomfort, especially at night, which is difficult to evaluate in the absence of any noise measurements for construction operations. However, given the very short-term nature of the construction works, it is not expected that these sounds would be intolerable.

194. **Mitigation:** Although emissions impacts are expected to be negligible, all motorized construction equipment, as a matter of good practice, be maintained to a high standard, most particularly their fuel and exhaust systems. Emissions from motorized machinery used in construction should meet the standard indicated in ECR 2023.

195. To minimize noise and vibration impacts for residents living within earshot of the vicinity of construction site, construction activity should be strictly limited to daylight hours. To avoid adding to the traffic noise for roadside residents, all haul trucks must be kept in good repair, and fitted with functional mufflers. Proper maintenance of machinery and trucks shall be done not to cause extra vibration. Emissions of noise from the project construction sites should not be of a level sufficient to cause an exceedance of maximum ambient noise levels as specified in the ECR 2023. Emissions from individual pieces of machinery and vehicles used in embankment construction should not be allowed to exceed the maximum acceptable levels indicated in Noise Pollution Control Rules 2022.

2. Socioeconomic impacts

a. Employment and Livelihood

196. **Impacts.** There will be twofold impacts: affected people (indirect: fishermen) may lose their income opportunity; on the other hand, locals to be employed by the project will get income opportunity. If local people get access to project employment, then the income level of the locals will increase.

197. **Mitigation.** A social study is underway (i.e., livelihoods) to address the issue. Fishermen likely to be affected by the intervention will be identified and compensated. Later on, the fishermen will be trained to use special designated areas of the river for fishing purposes.

b. Occupational health and safety

198. **Impacts:** Construction activity and labour camp sites carry inherent risks for workers. These risks include falls, contact with moving machinery, flying and falling objects, dust, burns, cuts, exposure to intense light from arc welding, electric shock and electrocution, and crushing

from collapsing earth walls, amongst other things. Where construction is conducted in public rights-of-way, there are also dangers associated with vehicles moving past the work site.

199. The recent COVID-19 pandemic has heightened concern about workplaces as transmission points for viral illnesses. Although much construction work is conducted in the open air and thus can be considered relatively low risk, this is not always the case, especially as the construction process advances and construction materials are dumped. Whether it is COVID-19 or the next serious viral threat to come along, construction and labour camp sites are potential trouble spots.

200. Worker camps are problematic in terms of occupational health and safety because Contractors tend to invest as little as possible in their construction of camp, operation and upkeep, partly on the assumption that camps are by nature temporary, and also based on a characterization of construction workers as rough people accustomed to rough living conditions. This lack of investment in camps usually results in crowded and unsanitary living conditions, inadequate toilets and washing facilities, low-quality water supplied for drinking, cooking and bathing, and various dangers such as single exit sleeping sheds, lack of fire extinguishers, and exposed wires. The health risks for residents of construction camps are heightened dramatically when viral illnesses are circulating in the general population, as has been the case in 2020/2021 with COVID-19. In Bangladesh, it is not uncommon for construction workers to sleep in rows in poorly ventilated sheds, with less than 1 m between them and less than 2 m² space per person overall; workers also often gather to eat in the same sheds, for lack of dedicated mess halls or other eating space.

201. **Mitigation.** Risks to worker safety on the job site can be successfully minimized through proper worker training, and by strict use of task-appropriate personal protective equipment (PPE). All workers and site supervisors should be provided workplace safety training prior to the start of construction, and at regular intervals thereafter. Training should be repeated whenever new crews are brought on to the site, and whenever monitoring by the primary Contractor or construction supervision consultant reveals declining standards of practice on the site. The primary Contractor should ensure that all workers are provided with adequate PPE suited to any task they may be given, and also strictly enforce its use at all times.

202. In order to limit the spread of COVID-19 or other future viral threats on the project sites, preventive measures must become standard practice. All workers must undergo temperature checks at least once per day. Suitable face masks must be supplied to all workers and replaced daily; use of masks should be required at all times except when using other types of masks required for particular work activities, or when eating, bathing and sleeping. Hand washing and sanitizing stations should be positioned at any site location where workers may eat or drink, including at canteens, camp kitchens and eating spaces, and also near toilets. Data on temperature checks, mask provision and re-stocking of sanitizing soaps and sprays should be collected by the Contractor and reported in monthly compliance reporting to the supervision consultant.

203. Risks to workers from poor conditions in worker camps can be greatly minimized by full implementation of a site-specific CCMP for each camp that will be established. The Worker CCMP will be appended to the CEMP. The CCMP should specify, at minimum,

- (i) dormitories with good cross-ventilation at least 4 m² living space per person;

- (ii) two or more working exits and at least one high-capacity fire extinguisher maintained in good working order for all residential structures;
- (iii) indoor eating space separate from sleeping areas;
- (iv) kitchens with off-floor food storage, raised working surfaces of a material that can be easily sanitized, and a ready supply of clean water;
- (v) toilet facilities with at least one functional toilet (protected from the elements and affording full visual privacy to the user) per ten resident workers, with a ready water source for washing;
- (vi) roofed and partitioned wash-up areas with floors and proper drainage;
- (vii) physical separation between sleeping spaces on the one hand, and kitchens and storerooms on the other;
- (viii) wiring that meets the requirements of the Bangladesh National Building Code; and
- (ix) provision of unlimited drinking water that meets the standards indicated in the ECR 2023.

c. Public health and safety

204. **Impacts.** Public safety risks associated with construction activity are primarily related to proximity; works carried out in densely populated localities offer many more opportunities for members of the public to come into contact with heavy machinery, fall into holes, and get injured by unstable stockpiles of materials. All the sites will offer heightened risk in this regard, given the high density of residents nearby. During heavy hauling periods, safety risks may be slightly elevated for people using the two road corridors serving sites, although construction traffic will represent a small incremental increase relative to the steady flow of trucks heading to and from the outer construction area.

205. Public safety - especially the safety of women and girls - can also be threatened by operation of construction camps in proximity to local settlements, especially when camps house many non-local workers who may feel unencumbered by the norms and mores of their faraway home communities. Camps may become a locus for prostitution, and the violence that often accompanies it. Sometimes, local resentment over the hiring of non-local workers, perhaps exacerbated by cultural misunderstanding or racial and religious animus, can lead to violent conflict between resident workers and local people.

206. Public health is most often affected by construction activity when dust levels are very high for long periods, and also when poorly managed construction camps are situated near existing settlements. Especially when camps house large numbers of workers from other regions, their presence near communities may lead to elevated incidence and spread of communicable diseases, particularly sexually transmitted ones, in the local population. This is especially true if the camp is allowed to become a hub for prostitution.

207. **Mitigation.** The construction sites must be adequately fenced, and security should be provided at all times to keep curious people from entering. The construction site at the Tejgaon site should be planned in such a way that protected means of access are provided for users and staff of the existing facilities even as new ones are under construction. A low-speed limit should be imposed on haul trucks.

208. The best means of limiting construction camp-related public safety impacts is to avoid the need for camps at all, by hiring only local workers; given the high local unemployment rate and workforce accustomed to heavy work in the stone-crushing works around the area, it seems likely

it will be feasible to hire mostly local workers. If a camp must be established, resident workers should be given awareness training, and subject to strict controls on off-site travel and behavior. The Contractor responsible for the camp should work proactively with local community leaders - including women leaders - to monitor interaction between the resident worker population and the local public, and promptly address emerging problems such as prostitution and bad worker behavior off-site. These measures should be included in the CCMP, which will be appended to the CEMP (see Appendix 9).

209. Elevated dust levels can be effectively mitigated with regular light spraying of dust-generating surfaces with water, as noted above in relation to air quality impacts. Again, it should be emphasized that impacts from construction camps can be most effectively prevented by hiring only local workers. If this is not feasible, the Contractor in charge of the camp should provide regular sexually transmitted disease awareness training, and also work with local community leaders to proactively curb development of prostitution at and around the camp. These and other measures for managing construction camp impacts should be specified in the CCMP, appended to the CEMP.

d. Livelihoods

210. **Impacts.** Construction activity typically affects livelihoods in a few ways. On the negative side, poor management of the construction site can lead to property damage in adjacent areas. In particular, crops in nearby areas may get trampled or damaged by operation and parking of machinery without regard to the site boundary, or by materials stockpiles spreading across the property line. Careless management of the construction process can also sometimes impair access to nearby businesses, leading to loss of revenue; this is also not expected to be relevant at either site. In addition to such negative impacts, construction activity can also have a strong positive impact for local communities, especially if all or most workers are hired from amongst the local population.

211. **Mitigation.** To prevent damage to adjacent properties, all construction site boundaries should be fenced, and no construction-related activity of any kind allowed to damage the fence or overflow onto adjacent land. Workers should be prohibited from crossing the fence for any reason, including lounging and relieving themselves. If the boundary fence is inadvertently breached, the responsible Contractor should immediately remedy the situation and compensate the landowner, even if no formal grievance is filed.

212. **Enhancement.** To maximize the positive impact of the construction process for the local community, the primary Contractor and all sub-Contractors should be contractually obliged to give local workers first priority in hiring. Bringing in crews from other areas should only be permitted once the contractor has demonstrated that the local labor pool cannot supply sufficient numbers of appropriately skilled workers.

3. Waste management related impacts

a. Worker Camp and construction waste

213. **Impacts.** Waste generated during construction will consist mainly of packaging, from both construction materials and food products consumed by workers. The volume of waste produced is likely to be relatively small but can easily get strewn and blown across the landscape and end up in local water bodies, if not appropriately managed.

214. **Mitigation.** Suitable receptacles should be positioned at strategic locations around the work sites to facilitate containment and collection of solid waste. Construction waste should be sorted to segregate recyclables, and regular pickup of these by a local recycling business should be arranged. Non-recyclable waste should be transported to the nearest legal landfill site, and never burned, buried or dumped on the site. Waste oil and other noxious fluids and associated used containers should be recycled through a reputable business providing this service. The primary Contractor should be required to specify all waste management arrangements - including the identity of recycling enterprises and legal landfill operators able to accept expected wastes - in a site-specific Waste Management Plan embedded within the CEMP. Appropriate contents of a Waste Management Plan are specified in the sample CEMP outline provided in Appendix 9.

D. Findings of Impact Assessment: operation phase

1. Biophysical impacts

a. River Morphology

215. **Impacts.** Due to river protection works, sediment increase rate will be higher. In certain points, through different mechanisms or paths, whether natural or artificial, part of the scoured sediment leaves the riverine system. The balance between sand contribution and losses that the different physiographic units that make up the river border are what determines the trend towards erosion, progression or balance in the evolution of each one of them. The usual sedimentation sources are fluvial beds of a continuous or intermittent regime such as rivers, torrents, etc., and other calcareous elements, materials in suspension dragged by the wind, artificially produced by regeneration works, quarries, and etc.

216. **Mitigation.** The protected area needs to be under continuous surveillance. Maintenance repair works will be required to maintain the protective cover intact, especially the concrete blocks and geo-bags. Hence a solid planning and budget needs to be available for maintenance works.

217. **Mitigation.** Facility operations should be monitored, and any emerging public safety issues should be addressed as needed.

b. Aquatic flora and fauna

218. **Impacts.** Due to repair works, existing aquatic flora and fauna including benthic communities will be removed temporarily from the protective works alignment. Therefore, during the post-construction period, there will be little aquatic flora and fauna that will impact on the ecosystem that is dependent on aquatic flora and fauna. However, this impact is considered temporary as floating aquatic flora and fauna will be returned to the area over time as all the targeted rivers are tidal in nature.

219. **Mitigation.** The rivers will return to their original state with time if undisturbed. Hence, BWDB needs to ensure the rivers do not get polluted after the construction is done. During project implementation, a monitoring mechanism can be established which can be operated from any gauge station established by BWDB nearby.

E. Cumulative Impact Assessment

220. The river protection works are one of the many interventions planned under the CRISP-WM. 50 Nos of beels covering 140 sqm are identified that are connected with the khals in the study area. These areas lie beneath the water for almost 8 months every year. Rainfall during the monsoon is the primary cause of inundation because floodwater cannot pass through the polder's boundary. Hence, the construction is interrelated with many of the interventions like sluice gate construction and inlet-outlet construction. River protection works will offer the rivers to be stable at the banks. It is envisaged that the protective works will improve the erosion in the entire area, reducing the risk of flooding. The river, with a higher carrying capacity, will be able to maintain water in the beel system to keep it wet and productive. Hence, the protective works is expected to bring beneficial impacts to the whole project boundary.

F. Summary of Impact Assessment

221. This section of the IEE analyzes the negative and positive impacts that are likely to arise from construction activities, based on preliminary details of the construction plan and knowledge gathered on the physical, environmental and social characteristics of the site. All potential impacts during the construction phase are considered amenable to substantial mitigation with measures that are both available and feasible. Similarly, many operation-phase impacts can be avoided or greatly minimized by sensible design decisions.

222. Some impacts, such as emissions, noise and turbidity of water that will keep increasing through the construction period despite some mitigation will have residual impacts for which mitigation will inevitably be less than fully satisfactory. These residual impacts will be significantly compensated for by positive impacts such as increased river capacity, increased livelihoods opportunity for the fishermen and business opportunities in the form of river transport, as well as enhanced integration in the regional economy after implementation of the project.

223. The greatest concern facing the environment in the vicinity of the proposed site that the density of the dumping of waste materials. Dumping waste materials into wrong places may create havoc in the vicinity in terms of both social, economic and environmental. but this issue can be easily resolved by implementing the EMP at site.

224. Taking into the account all of the foregoing, it is considered that the impacts expected from this component of the Investment Project do not rise to a level of magnitude, severity or complexity that would justify further detailed study and development of novel or specialized mitigation strategies. The investments at this location are appropriately assigned to Category B for the Environment.

G. Summary Impact Matrix

Given the assessed level of impacts for the riverbank protection interventions discussed in the earlier sections, the following Tables give a summary assessment based on the method explained in Table VI-3.

Table VI-5 Summary Impact assessment matrix of riverbank protection works

KEY: +/-: positive/negative impact; D/C/B/A: none/minor/major/severe; Loc/Wid: localized/widespread; Tem/Per: temporary/persistent; Int/con: intermittent/continuous; Dir/Ind: direct/indirect; Iso/Cum: isolated/cumulative. Please refer to Table VI-1 for detailed methodology.

Components of the Environment		Ratings (when not mitigated)						Discussions											
		construction phase												Post- construction phase					
		Magnitude	Spatial extent	Duration	Timing	Nature	Relationship							Magnitude	Spatial extent	Duration	Timing	Nature	Relationship
1	Ecology	B-	Loc	Tem	Con	Dir	Iso	D	-	-	-	-	-	Riverbank protection works and construction can hamper river ecology. Disturbance of bottom sediment will impact the benthic communities as well as disturbances in water will drive fish away from the construction sites. The impacts are temporary though. The fish and benthic community will return to the river as the river is tidal and connected to the vast network of rivers.					
2	Aquatic flora and fauna	B-	Loc	Tem	Con	Dir	Iso	D	-	-	-	-	-	Disturbance of aquatic organisms in the riverbed during construction time.					
3	Water quality	B-	Loc	Tem	Con	Dir	Iso	D	-	-	-	-	-	Contamination of the water body by chemical, biological components and materials in suspension. Contamination of the surface water by greases, oils and floating bodies					
4	Air and noise	C-	Loc	Tem	Con	Dir	Iso	D	-	-	-	-	-	Emission of greenhouse gases, carbon dioxide and nitrogen oxides may be emitted from combustion of the petroleum products in project related transportation vehicles					
5	Navigation	D	Lo	Te	Co	Dir	Iso	D	-	-	-	-	-	During construction, navigation will be hampered. EMP needs to be followed.					
6	Occupational health and safety	B-	Loc	Tem	Int	Dir	Iso	D	-	-	-	-	-	Construction activity and labour camp sites carry inherent risks for workers. These risks include falls, contact with moving machinery, flying and falling objects, dust, burns, cuts, exposure to intense light from arc welding, electric shock and electrocution, and crushing from collapsing earth walls, amongst other things.					
7	Public health and safety	C-	Loc	Tem	Int	Dir	Iso	D	-	-	-	-	-	Public safety risks associated with construction activity are primarily related to proximity; works carried out in the target rivers, which are busy transport area. Due to construction activities, vehicular collisions are possible, accidents may happen to small country boats due to wave actions and scouring of river.					
8	Cultural heritage	D	-	-	-	-	-	D	-	-	-	-	-	No impact envisaged.					
9	Ecosystem	B-	Loc	Tem	Con	Dir	Iso	B+	Loc	Tem	Con	Dir	Iso	During construction, impacts on aquatic ecosystem is eminent. Most of the effects are unavoidable, however EMP to be followed to avoid long lasting effect. However, the ecosystem is expected to have a full recovery after construction works.					
10	Surface hydrology	B-	Loc	Tem	Con	Dir	Iso	B+	Loc	Per	Con	Dir	Cum	In certain points, through different mechanisms or paths, whether natural or artificial, part of the sediments leaves the riverine system. The balance between sand contribution or losses that the different physiographic units that make up the river border are what determines the trend towards erosion, progression or balance in the evolution of each one of them.					
11	Topography and Geology	C-	Loc	Tem	Con	Dir	Iso	D	-	-	-	-	-	In the construction area the bathymetry will change until finding a desired depth. Thereafter, nature will again raise the bottom due to the natural sedimentation process, to again carry out construction activities, until finding another solution to maintain the bottom stable.					

Components of the Environment		Ratings (when not mitigated)						Discussions											
		construction phase													Post- construction phase				
		Magnitude	Spatial extent	Duration	Timing	Nature	Relationship								Magnitude	Spatial extent	Duration	Timing	Nature
12	Land acquisition	D	-	-	-	-	-	D	-	-	-	-	-	No land acquisition is required.					
13	Disturbance to livelihoods	C-	Loc	Tem	Con	Dir	Iso	B+	Loc	Tem	Con	Dir	Cum	There will be twofold impacts: affected people (indirect: fishermen) may lose their income opportunity; on the other hand, locals to be employed by the project will get income opportunity. However, after construction, the fishermen will be benefited from higher fish catch, along with economic benefits.					
14	Disturbance to Ethnic Minority Groups and Indigenous People	D	-	-	-	-	-	D	-	-	-	-	-	No impact envisaged.					
15	Gender	D	-	-	-	-	-	D	-	-	-	-	-	No specific impact envisaged.					
16	Children's Rights	D	-	-	-	-	-	D	-	-	-	-	-	No specific impact envisaged.					
17	Infectious Diseases	B-	Loc	Tem	Int	Dir	Iso	D	-	-	-	-	-	In order to limit the spread of COVID-19 or other future viral threats on the project sites, preventive measures must become standard practice.					

VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Rationale and Requirements for Disclosure and Consultation

225. It is considered necessary and useful for the interests and concerns of the people and institutions who will be affected by the interventions (stakeholders) to be taken into account in planning and design from the earliest stages. Effective communication between the proponents of a project and the people whose lives will be affected by it (i) helps to ensure that positive impacts of the investment program are maximized while negative ones are prevented or minimized; (ii) honors basic democratic principles; and (iii) aids in forestalling development of social and political conflict surrounding allocation of public resources.

226. Consultation and information disclosure require that stakeholders of all kinds both have an opportunity to learn about infrastructure proposals and are given an effective means of providing their knowledge and voicing their concerns as inputs to project planning and implementation. The SPS mandates timely disclosure of project information and consultation with people and institutions that stand to be affected by their implementation throughout the project cycle.

227. **Disclosure.** The SPS requires that project information is made publicly available at key stages of project development and implementation. At a minimum, basic details of the project rationale, objectives, preliminary construction proposals and operation-phase activity need to be disseminated as part of consultations during the project preparatory phase, and the IEE needs to be disclosed on ADB's website.

228. **Consultation.** The SPS mandates that consultations should be carried out, at a depth commensurate with the significance of the expected impacts of the construction, as an integral part of the environmental and social assessment process. The particular form that consultation may take is appropriately tailored to the cultural and social context, as well as the types of infrastructure and project activities that are proposed. Consultations often involve some combination of interviews with key informants, public meetings, and focus group discussions.

B. Stakeholder Identification

229. Given the nature of the intervention, construction will take place within the river boundary. The stakeholders identified for the proposed construction activity include officials from BWDB, and local communities living on the banks of the target rivers who might be affected—positively or negatively—by implementation of the investments. Project stakeholders were initially identified on a theoretical level through a series of scoping discussions amongst the multi-disciplinary Technical Assistance study team, encompassing such matters as physical proximity, land use, resource flows, traffic composition, local employment, and business. The understanding of stakeholder groups was further refined in cooperation with the locally stationed BWDB officer who understands the project very well and is aware of the local socio-economic and environmental setting.

C. Stakeholder consultation history

1. Consultation with officials of the BWDB

230. Consultations with the BWDB took place over June – July 2023 in Faridpur local BWDB office. During the consultation, the Institutional Strengthening and Project Management Consultant (ISPMC) were also consulted. The BWDB officials and ISPMC explained the need for interventions and accompanied the TA consultants on field visits.

2. Consultation with the local community

231. During the time of field visits to the proposed intervention (June 2023 – July 2023) the TA consultants visited the local communities living on the banks of the target rivers and conducted both formal and informal discussions (Figure VII-1).



Figure VII-1 Consultation at locality during June – July 2023

232. Consultation records with BWD officials and community are provided in the following table (Table VII-1).

Table VII-1 Consultation records

Date	Type of Consultation	Place	Participant category	No. of Participant		
				Male	Female	Total
13 June 2023	Interview and informal discussions	Faridpur BWDB office	BWDB Officials	04	00	04
10 July 2023	Focused Group Discussion (FGD)	Chitulia village	Local community	08	02	10

Source: TA consultants

D. Outcomes of stakeholder consultation

233. **Meetings with BWDB and local communities.** The technical assistance (TA) team met the BWDB officials and the ISPMC several times during project preparation. Apart from the possibilities and process of implementation of the whole project, the points of discussions also included the need assessment of the proposed river protection works and excavation of other

canals within the project boundary. This IEE extracted the river protection works related activities and environmental concerns from all the discussions. The summary of the discussions is presented in the following Table VII-1.

Table VII-2 Summary of the point of discussions with government officials, ISPMC and local communities

Environment-related questions	Summary of salient points of discussion
Is there any environmental problem within the region?	Our region is suffering from heavy river erosion, drainage congestion and navigational problems. During rains, high water often leads to flooding and waterlogging.
Our natural surroundings (air, water, trees and other plant life, land, open space) generally affect the quality of our lives, including our ability to make a living. How do you feel about the current quality of the local environment?	Within the region, the riverbanks have some thick vegetation and agricultural lands. The region is not that noisy except the bazar areas.
Are you aware of any problems having to do with natural resources (air, water, farmland, trees, animals, open space) in this area?	Due to drainage congestion, cropping in the area has been restricted for a long time. Also, river erosion is threatening our homesteads.
Thinking about the construction work that may happen here under the project, how do you think this will affect the quality of the local environment, or your quality of life?	The river protection works will prevent river erosion in the area, which will be beneficial for homesteads and croplands.
River Traffic may increase as a result of this project, once construction has been completed. How do you think this will affect the local environment, or the quality of life in the community?	It will increase the economic benefit in the locality.

E. Future Stakeholder Engagement and disclosure

234. **Disclosure.** Once the IEE has been approved, ADB will, in accordance with its Public Information Policy, disclose the document on its website, from where it can be accessed and downloaded by any interested person at no cost. This should be repeated in the event that significant site or design changes require the formal updating of the IEE and EMP. As the approved project's implementation proceeds, details of key implementation stages—most notably the start of construction—should be publicly disclosed in advance by the proponent. Monitoring reports submitted by the proponent on a twice-yearly basis to ADB will be disclosed on the ADB website.

235. **Consultations.** The SPS 2009 indicates that consultation should be understood as an ongoing and iterative process that takes place throughout the project cycle. Consultations are considered especially necessary and appropriate at key inflection points after the project preparatory phase, including (i) following any major design changes, up-scaling or site changes introduced during the detailed design phase, especially ones that may change the nature, scale or severity of potential environmental and social impacts; (ii) prior to the start of construction, with a special focus on safety and quality of life impacts during the construction phase; (iii) prior to the start of facility operations; and (iv) following any significant emergency or accident involving

construction site. Additional rounds of consultations in all of the contexts mentioned above should be organized and conducted by the BWDB, with the support and guidance of the SOU within the PMO.

236. The EAs/IAs will send a written endorsement to ADB for disclosing these documents on the ADB website. The PIUs will provide relevant safeguards information in a timely manner, in an accessible place and in a form and language understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used. Disclosure will follow ADB's Public Communication Policy, 2011.¹⁸

¹⁸ <https://www.adb.org/sites/default/files/institutional-document/32904/files/pcp-2011.pdf>

VIII. GRIEVANCE REDRESS MECHANISM

A. Grievance Redress Mechanism

237. The grievance redress process includes three levels:

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

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

240. **Third level of GRM:** Should the grievance remain unresolved, the PIU's focal person will activate the third level of the GRM by referring the issue (with written documentation) to a Grievance Redress Committee (GRC), which will, based on review of the grievances, address them in consultation with the PIU, Contractor, ISPMC, and affected persons. The GRC will consist of project director, chairperson, representative of the executing agency or implementing agency, camp-in-charge, and other relevant stakeholders. A meeting will be called with the GRC, if necessary, where the affected person can present his/her concern and issues. The process will promote conflict resolution through mediation. The GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The functions of the GRC are as follows: (i) to provide support to affected persons on problems arising from environmental or social disruption, asset acquisition (where required), and eligibility for entitlements, compensation, and assistance; (ii) to record grievances of affected persons, categorize and prioritize them, and provide solutions within 15 days; and (iii) to report to the aggrieved parties' developments regarding their grievances and decisions of the GRC. The safeguards focal person of the executing agency or implementing agency will be responsible for

processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued, and the decisions carried out.

241. Safeguard monitoring reports will include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third levels), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as affected person, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e. open, closed, pending). All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by the executing agency or implementing agency.

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

243. **Court of Law.** 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.

244. The grievance redress mechanism and procedure are depicted in Figure VIII-1.

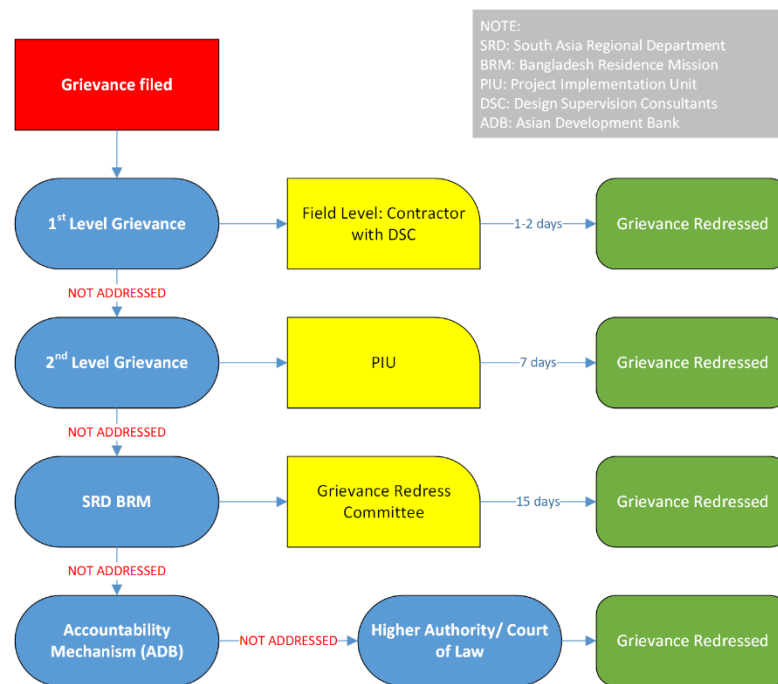


Figure VIII-1 Grievance Redress Mechanism (GRM) adopted for CRISP-WRM

B. Administration of Grievance Redress Mechanism

245. The SOU shall be responsible for making the public aware of the GRM in all project locations, explaining how it works and how to use it, and maintaining its accessibility and operability for the full duration of the construction phase and the defects period. Public awareness campaigns should be carried out at the local level in advance of the start of civil works. Contact information, including for written, telephone and in-person filing of grievances, shall be firmly established at the GRM's inception, and kept up to date and publicly available through the end of the defects period.

246. Records of grievances received, corrective actions taken, and their outcomes will be properly maintained by the SOU in a central grievance redress database. Grievances and resolutions will be included in the executing agencies' quarterly progress reports and the semi-annual environmental monitoring reports submitted to ADB. Any fatal accidents involving the project's implementation or project sites should be reported to the GRC and ADB immediately. The costs of operating the GRM will be very modest, and will be covered by the operating budget of the SOU.

C. Grievance Redress Mechanism for Workers

247. An additional mechanism shall be set up by the SOU to accept and address complaints from workers employed in the construction works, concerning working conditions, living conditions in construction camps, safety and health issues, labor rights violations, mistreatment, or any other matter. All laborers, skilled workers, and site engineers employed on site by the primary Contractor or by any of its sub-Contractors shall have access to the mechanism. All workers will

receive an orientation to the workers' GRM during pre-construction induction training. Workers will be able to lodge grievances with on-site personnel of the CSC, who will record the complainant's name, position, employer, and contact information, as well as a description of the complaint and the time, date and place at which the complaint was reported. The CSC will inform the SOU, which will record the grievance in a grievance register. The CSC will convene a meeting of the complainant or complainants, the sub-Contractor involved, the Primary Contractor, and any labor syndicate to which the complainant(s) may belong, in an effort to decide on an appropriate resolution of the complaint. The CSC will work with the relevant BWDB's ESFP and on-site Environment, Health and Safety Officer (EHSO) to monitor implementation of the proposed resolution and confirm absence of retaliation on the part of the Contractor involved. If the complaint cannot be resolved to the satisfaction of the complainant(s), the CSC will provide the complainant(s) with the necessary contact information to file a complaint with MOLE. The CSC will compile a complete record of the grievance, including measures taken for resolution and follow-up checks by the ESFP and EHSO, as well as any referral to MOLE and subsequent evolution of the case, and provide the record to the SOU for preservation in its grievance register.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives of The Environmental Management Plan

248. This environmental management plan (EMP) has been prepared for the ADB supported project in accordance with the ADB SPS (2009). Specific measures are developed in relation to the design and construction operation, to address the physical, biological, cultural and socio-economic impacts identified and discussed in the chapter on Anticipated Impacts and Mitigation Measures of the Initial Environment Examination (IEE) report.

249. The EMP for the project defines mitigation and monitoring measures and identifies the institutions, responsibilities and mechanisms that will ensure their implementation. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during the pre-construction, construction, and operation phases of the project, in order to manage adverse impacts.

250. The EMP's purpose is served by fulfilment of several key objectives:

- (i) To present a comprehensive and systematic list of measures for mitigating and enhancing anticipated environmental and social impacts, as discussed and prescribed in Chapter 6 of the IEE.
- (ii) To define and specify institutional arrangements to support implementation of the prescribed measures.
- (iii) To clearly assign responsibility for implementation of each prescribed measure.
- (iv) To clearly assign responsibility for systematic monitoring of implementation of the prescribed measures and overseeing corrective action as needed.
- (v) To establish a system for regular reporting on EMP implementation.
- (vi) To identify training and capacity-building needed to enable effective implementation of the EMP; and
- (vii) To provide sound estimates of the costs that will have to be budgeted by various entities to enable full and effective implementation of all prescribed measures to address likely impacts.

B. Roles and Responsibilities in EMP Implementation

251. Effective implementation of the EMP relies on inputs from multiple entities, spanning the pre-construction, construction and operation phases of the project. Specific tasks are identified and assigned in the next section of the EMP, but the roles and responsibilities are explained in general terms below, beginning with an outline of the entities that are to be involved.

1. Key Institutional Entities

a. Project Management Office (PMO)

252. Under the central setup, a PMO will be established in Gopalganj with a liaison office in Dhaka. A Superintending Engineer/Addl. Chief Engineer having multidisciplinary experience will head the PMO as full-time project director (PD). The PMO will (i) manage an overall implementation plan, annual work plans and budgets; (ii) liaise with BWDB, WARPO and other line agencies for technical backstopping, IWMP clearance (by WARPO), managerial support, and

other central-level activities; (iii) prepare IWMPs of additional FCD/I systems with the support of the relevant SMOs; (iv) liaise with, monitor, and supervise SMOs for subproject implementation; (v) manage financial accounts; and (vi) prepare periodic reports on implementation progress, with the support of the ISPMs consultants. The PMO will be responsible for: (i) overall coordination of the environmental safeguards; (ii) coordinate with and monitor the inputs of environment, health and safety specialist under ISPMC; (iii) review regular environmental monitoring report from environment, health and safety specialist and submit to ADB; and (iv) discuss with ADB and environmental, health and safety specialist regarding any environmental issues that might occur in future.

b. Subproject Management Office (SMO)

253. Two SMOs will be established at the project level, both under the control of the PMO. These SMOs will be responsible for overseeing the implementation of the five subprojects. One SMO will be the existing BWDB's O&M division located in Gopalganj. The other SMO will be managed by a 'Specialized Division,' which will be formed solely for the purpose of the project. Each SMO will be headed by a Executive Engineer with participatory experience to be appointed as subproject manager. The SMO is responsible for day-to-day implementation activities. It will (i) support the PMO planning unit to prepare IWMPs; (ii) manage the overall subproject implementation plans, annual work plans, and budgets; (iii) prepare and implement SIPs with proper recording and reporting to the PMO; and (iv) coordinate with line departments, LGIs, and NGOs. The SMO will be responsible for: (i) hosting the Environmental, Health and Safety Specialist; and (ii) monitoring environmental issues of the project and reporting back to PMO.

c. Safeguards Oversight Unit (SOU)

254. A central safeguards implementation function is considered critical to effective implementation of the EMP, including monitoring of compliance with all safeguard's requirements of the ADB and national government at multiple locations, most of which will see infrastructure development activities carried out by the PMO at BWDB. The central SOU will be established under the PMO, and the location specific SOUs will be established at the SMOs. While the central PMO should be staffed by at least one senior environmental professional known as the ESFP, the SMOs should be staffed with at least 2 environmental professionals, one for overall coordination at site and one specially dedicated to day-to-days site supervision known as the EHSO. In line with this, all the Subdivisional Engineers/ Assistant Engineers of the SMOs will monitor the implementation of the environmental and social safeguards as EHSO and one personnel from the PMO will be assigned as the ESFP.

d. Environmental Safeguards Focal Persons

255. The BWDB PMO will have a designated ESFP, whose role will be to oversee the safeguards compliance process for all Investment Project sites under the PMO's control, heading the central SOU and liaising with the SMOs while supported by EHSOs working in the field. The ESFP may appropriately be a Deputy Project Director (DPD), or other senior managers, or engineers within the PMO and will answer directly to the Project Director. The ESFP will work closely with the PMO, DOE and ADB Safeguards team to ensure that safeguards requirements are included and effectively addressed as part of Project implementation at this location.

e. Environment, Health and Safety Officers

256. Each SMO will designate EHSOs, answering to and supporting the ESFP as well as the designated coordinator from the local BWDB, to oversee EMP implementation at the construction site. The EHSOs may appropriately be subdivisional engineers/ assistant engineers with other duties in the case of SMOs with only small investments under the Investment Project, but where this is the case, it is critical that adequate time and resource allocations for their EHS responsibilities are firmly established in their job descriptions. In most cases, it will be preferable for the EHSOs to be dedicated staff positions or consultants. A proposed term of reference for the EHSO positions is presented in Appendix 16. EHSOs may be appointed to cover more than one location, where this is deemed feasible in view of proximity and the scale of works in each location.

f. Construction Supervision Consultants

257. The ISPMC will be engaged by the PMO to monitor, guide and support the work of construction Contractors carrying out the works under the Investment Project. The ISPMC will have environment, health and safety specialist to assist PMO with environmental matters and ensure strong environmental compliance. The ISPMC should be required to maintain a site office at each investment location, to enable its inspectors and site engineers to maintain a daily presence at each active construction site.

g. Contractors

258. The planned works are to be packaged and tendered as contracts. Primary Contractors will be required to develop a CEMP covering the construction works under their control, including work carried out by their sub-Contractors. Each primary construction works Contractor will designate an EHS Representative, who will oversee the implementation of the CEMP at all sites under the Contractor's control, including regular monitoring of site conditions and effective implementation of prescribed mitigation measures by both the primary Contractor and all sub-Contractors.

h. Department of Environment

259. As a key regulator of industry, the DOE is mandated to review and approve construction proposals based on consideration of possible environmental effects. The agency remains involved throughout a project's life cycle, during which environmental clearances must be annually renewed, with environmental monitoring results being a key reference point in renewal decisions.

i. ADB

260. As the financing institution, ADB will exercise its due diligence and oversight functions, and maintain strong interaction with the PSC, PMO and SMO.

2. Responsibilities in EMP Implementation

261. Each of the entities identified above has multiple responsibilities, the fulfilment of which is required for full and effective implementation of the EMP. These responsibilities are detailed in Table IX-1 below.

Table IX-1 EMP implementation responsibilities

Entity	Responsibilities in EMP Implementation
Project Management Office (PMO)	• Prepare operations and maintenance procedures for facilities under construction, ensuring their compliance with the EMP. • Work with the SOU to train facility personnel on EHS aspects of facility operation in advance of commissioning, to ensure effective EMP implementation during the operation period
Subproject Management Office (SMO)	• Ensure that EMP implementation is recognized as a critical element of overall project implementation. • Enable and adequately staff SOU. • Oversee rigorous review of bids and prioritize selection of Contractors with strong environmental compliance track records. • Coordinate with PMO as needed to ensure smooth implementation of EMP
Safeguards Oversight Unit (SOU) under PMO	• Ensure EMP provisions are fully reflected in civil works bid documents. • Advise and support SMO on Contractor selection and other procurement decisions. • Guide and support ESFP and EHSOs to ensure timely and competent execution of site-level oversight activity. • Collect and collate progress reports and environmental monitoring reports for each location to assemble comprehensive quarterly monitoring reports for submission to ADB. • Work with CSCs and primary Contractors to develop and deliver periodic EHS training for sub-Contractors and their workers. • Work with CSCs to train facility managers or their EHS personnel in advance of commissioning, to ensure effective EMP implementation during the operation period. • Administer the GRM • Support PMO in obtaining environmental clearances and renewals
Environmental Safeguards Focal Person (ESFP) under PMO	• Oversee the safeguards compliance process for all Investment Project sites under the PMO's control, liaising with the SMO-appointed Project Manager and with support from SOU and EHSOs • Prepare and submit quarterly progress reports for the sites owned by their home agencies to the SMO and SOU • Chair LGRC when needed to address Level 2 grievances regarding project implementation activities
Environmental coordinator/manager at SMO	• Oversee the safeguards compliance process for the investment sites for the designated intervention areas • Liaison with the ESFP for monthly report and day to day update • Supervise the EHSO
Environment, Health and Safety Officers (EHSOs)	• Conduct regular monitoring of conditions on site, including compliance with prescribed mitigation strategies, and submit EHS monitoring reports on a monthly basis to the Environmental Coordinator at SMO • Identify worker training needs and support SOU and CSC in development and delivery of training
Construction Supervision Consultants (CSC)	• Review and approve CEMPs and quarterly environmental monitoring reports submitted by Contractors. • Guide and assist PMO, through ESFPs, in monitoring of CEMP implementation and site conditions, including preparation of quarterly progress reports for submission to SOU. • Direct and supervise corrective action by Contractors as needed. • Collaborate with SOU on development of safeguards training for sub-Contractors and workers
Contractors	• Prepare and implement CEMP for each site, based on EMP prescriptions and international best practices. • Conduct quarterly EHS monitoring on all sites under their control and submit quarterly monitoring reports to CSC for review. • Implement corrective actions as directed by CSC and/or ESFP

Entity	Responsibilities in EMP Implementation
Department of Environment (DOE)	- Review environmental clearance applications, including IEE and EMP - Review annual environmental monitoring reports submitted by SOU during construction phase. - Review applications for environmental clearance renewals
ADB	- Review and approve IEE and EMP - Publicly disclose IEE on ADB website - Review quarterly environmental monitoring reports prepared by PMU and publicly disclose them on ADB website

262. The intersecting roles and responsibilities in EMP implementation during the construction phase - including monitoring of implementation - are further illuminated in Figure IX-1 below. During the operation phase, EMP implementation is simplified considerably, as the temporary entities formed or engaged to carry out and oversee the construction process are wound down or move on to other projects, and permanent entities assume responsibility for ensuring that the EMP continues to guide infrastructure operations and maintenance. Responsibilities for EMP implementation in the operation phase are also shown in Figure IX-1.

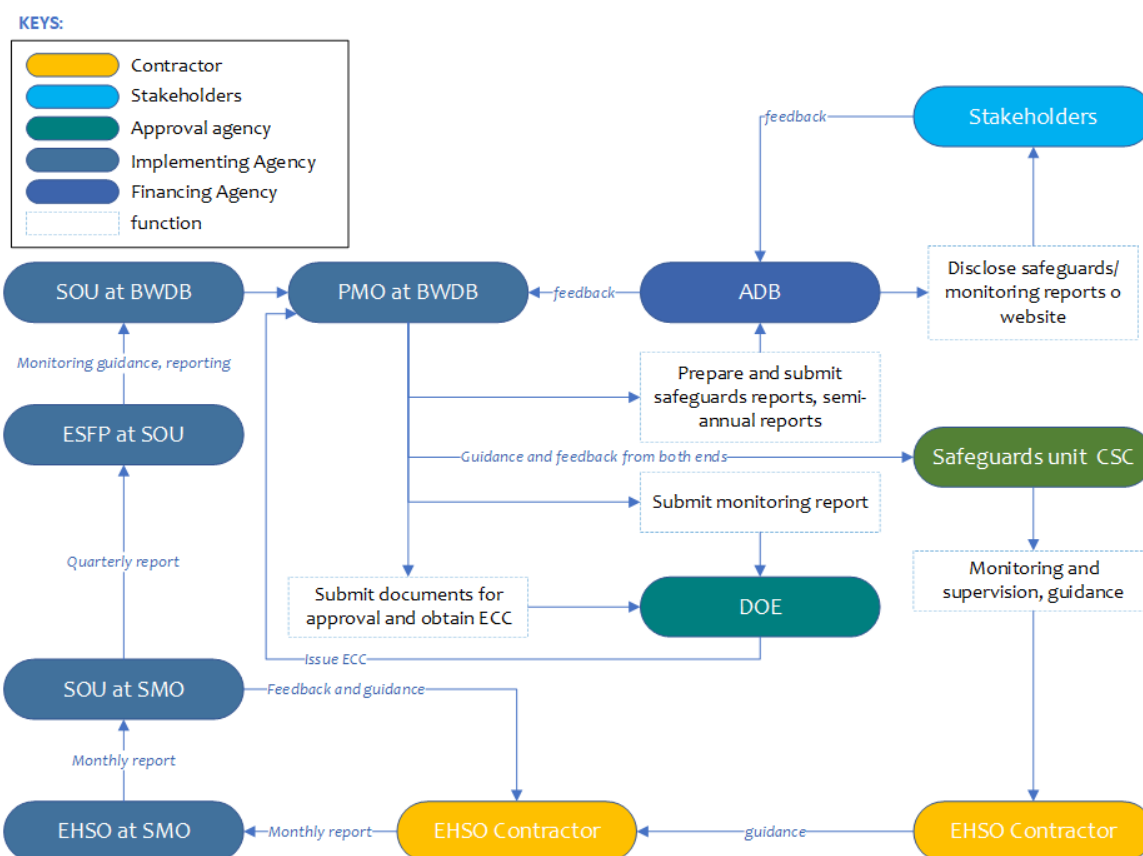


Figure IX-1 EMP implementation responsibilities during construction phase adopted for CRISP-WRM

3. Assessment of Project Readiness

263. Before construction, the PMO will assess the project's readiness in terms of environmental management based on a set of indicators (Table IX-2) and report it to the ADB and the PMO. This assessment will verify that environmental commitments are being carried out and environmental management systems are in place before construction starts, or if this is not the case, propose corrective actions to ensure that all requirements are met.

Table IX-2 Indicators of project readiness in relation to environmental management

Indicator	Criteria	Assessment	
DoE approval	DoE approves the IEE and ECC is being obtained	Yes	No
EMP update	The EMP is updated after detailed designs are approved, and approved by ADB and DoE	Yes	No
Compliance with loan covenants	The borrower complies with loan covenants related to project design and environmental management planning	Yes	No
Public involvement effectiveness	- Meaningful consultation completed. - GRM established at entry point	Yes	No
Environmental supervision in place	PIU supervision in place	Yes	No
Bidding documents and contracts with environmental safeguards	- Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances. - Bidding documents and contracts incorporating the impact mitigation and environmental management provisions of the EMP	Yes	No
Contractor readiness	- Contractor EMPs (CEMPs) have been prepared and approved by PIU and PMU - Environmental, Health and Safety Management Plans (EHSMP) established for construction sites. - Environment, Health and Safety Officers appointed. - Assessment of potential disruption to utilities services conducted. - Stakeholder interviews conducted to confirm issues if services are disrupted	Yes	No
EMP financial support	Required funds have been set aside to support the EMP implementation according to the financial plan	Yes	No

C. Environmental Impacts and Prescribed Mitigation and Enhancement Measures

264. The findings of the environmental impact analysis are presented in Section VI of the IEE report. The potential impacts and corresponding measures that are prescribed in order to mitigate the negative impacts or enhance positive ones are collected in Table IX-3 below. The measures prescribed apply to the pre-construction, construction and post-construction phases of the project. All measures listed in Table IX-3 are requirements, based on the investment plan as proposed at the time of preparation. All measures assigned to Contractors should be reflected in bidding documents, and serve as the basis for the CEMPs, which must be prepared to cover all sites at this investment location.

Table IX-3 Prescribed environmental mitigation and enhancement measures.

KEYS: ADB: Asian Development Bank; CSC: Construction Supervision Consultant; Con: Contractor; DOE: Department of Environment; EHSO: Environment, Health and Safety Officer; ESFP: Environmental Safeguards Focal Person; NQC: No Quantifiable Cost; SOU: Safeguards Oversight Unit; BWDB: Bangladesh Water Development Board; EMP: Environmental Management Plan, EMoP: Environmental Monitoring Plan; PMO: Project Management Office; SMO: Subproject management Office.

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
A. PRE- CONSTRUCTION PHASE						
(i) IMPLEMENTATION READINESS						
1. IEE and EMP update	Impacts not accounted for due to post-approval modifications in alignment, design or local conditions	- Review IEE and EMP to ensure any post-approval changes are properly accounted for and addressed, by addition of mitigation measures if necessary. - EMP copied in the bid document and part of legal contract of the contractor	SOU	PMO/ SMO	- IEE and EMP confirmed still fully applicable. - New measures added to EMP if needed to cover any changes in alignment, design or local conditions	NQC (Included in PMO budget)
2. Confirmation of NOCs from local agencies and authorities	Project works will not be granted clearances by DOE if NOCs are not obtained from relevant national and local authorities	- Confirm NOC has been obtained from local authority. - Declare site clearance from BWDB itself/ or concerned authority so that no conflict occurs in future, and DOE has legal documents that the site is owned by GOB (presentation of relevant policy will be sufficient)	SOU	PMO/ SMO	- NOCs granted by local authorities. - Relevant policies presented by the BWDB (see policy section in this IEE)	NQC (Included in PMO budget)
3. Verification of environmental clearances	Project works will not be in compliance with national environmental laws if clearances are not obtained prior to site clearing	Confirm Site Clearance Certificate (SCC) and Environmental Clearance Certificate (ECC) have been granted, and that any conditions imposed by DOE on approval have been reflected in EMP and EMoP, as well as CEMP as applicable	SOU	PMO	- SCC and ECC granted. - New measures added to EMP, EMoP and CEMP if needed to meet any condition of approval specified by DOE	NQC (Included in PMO budget)
4. CEMP verification	Mitigation will be inadequate if the CEMP is not fully specified	Review CEMP to ensure all primary Contractor responsibilities are fully reflected, including monitoring and reporting	SOU CSC	PMO	- Any necessary changes requested and made by Contractor. - CEMP confirmed adequate by reviewers	NQC (Included in PO budget and CSC amount)
5. Specialized plans verification	Mitigation will be inadequate if specialized plans have not been formulated to manage key impacts	Confirm that the following specialized plans have been prepared by the Contractor: - site-specific Construction Camp Management Plan(s) - site-specific Waste Management Plans (embedded within CEMP)	SOU CSC	PMO	All required specialized plans prepared to adequate standard and approved by relevant authority (as required in some cases)	NQC (Included in PMO budget and CSC amount)

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
		• site-specific Emergency Response Plans (embedded within CEMP) • Construction Traffic Management Plan (worker camp) • Occupational Health and Safety Plan (including COVID-19 measures stipulated by ADB and Government of Bangladesh Guidance for Social and Institutional Containment and Prevention) • Soil erosion management plan • Water pollution management plan				
6. Grievance Redress Mechanisms	Members of the public and workers require a fair and transparent means of getting resolution to complaints about some aspect of the project's implementation	• Confirm that a central GRM and workers' GRM have been established and publicized	PMO	SOU	• Central GRM established and publicized • Workers' GRM established and explained to workers before the start of construction	NQC (Included in PMO budget)
(ii) DESIGN CONSIDERATION						
7. Climate change mitigation	Generation of GHG from construction contributes to global climate change problem	• Integrate GHG-limiting measures into facility designs, including: • substitute other materials for concrete where feasible • use low-carbon concrete as much as possible • maximize use of construction materials available locally • integrate photovoltaic generation into the electrical plan for engineer's camp and construction camp • specify only high-efficiency electrical and mechanical equipment. • specify most fuel-efficient backup generator available • maximize cross-ventilation by use of courtyards, openable windows and favorable building orientation in engineer's camp and construction yard • incorporate hollow wall structures where feasible • Use overhangs above large windows to prevent excessive solar penetration	CSC Con	SOU ESFP BWDB	• All feasible GHG-reduction design measures incorporated in facility detailed designs	NQC (included in CSC + Con costs)

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
		- Prioritize shade in the landscaping plan, with plentiful wide-crowned shade trees on all parts of site - Maximize interior natural light by use of favorable building orientation and courtyards - Specify water-saving toilets, faucets and showerheads. - Design dedicated plumbing system for drinking and cooking water - Aim to meet all water heating needs with solar heaters - Specify high-intensity, full-time lighting only where strictly necessary				
8. Climate change adaptation	construction use limitations, damage, and environmental hazards due to changing conditions	- Design facilities so that critical components (including heavy machineries, backup generator and fuel tanks) are well above maximum flood level foreseen under climate change projections specified in Climate Risk and Adaptation Assessment (CRA) report and detailed hydrological study. - Excavate only the amount needed. Detailed hydrological and bathy study will be essential in this account.	CSC Con	SOU ESFP BWDB ESFP SMO	- All critical facility components above maximum expected flood level - Detailed hydrological study, bathy study and construction plan presented.	NQC (included in CSC + Con costs)
(iii) PROCUREMENT						
9. Selection of CSC and Contractor	Contractors with low commitment to safeguards compliance limit success of EMP implementation	- Prioritize selection of Contractor with strong compliance track record, as verified by references from previous CSCs. - Select only Contractors registered with MOLE	PMO	SOU	Selected CSC and Contractor has verified track record of good performance on safeguards compliance	NQC (Included in PMO costs)
10. Evaluation of contractors	Contractors that use fuel-inefficient equipment and vehicles generate more emissions than is necessary	- Require prospective Contractors to provide information on the age, condition and fuel-efficiency of their machinery and vehicle fleets in their bids and consider this in the selection process. - Include provision in contract giving the employer the right to require removal of equipment and vehicles it deems to be unacceptably polluting from work sites at any time during construction, even if these are the property of sub-Contractors	PMO	SOU	- Detailed machinery and fleet information required in bids. - Emissions potential of fleets considered in Contractor selection. - Provision included in contract giving the employer the right to require removal of equipment and vehicles it deems to be unacceptably polluting from work sites at any time during construction,	NQC (Included in PMO costs)

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
					even if these are the property of sub-Contractors	
11. Labor sourcing	Use of non-local labor reduces positive impact of project on local livelihoods and triggers social conflict	- Hire laborer specialized at block construction regardless of locality. - Hire exclusively or mostly local workers for unskilled works	Con	ESFP PMO ESFP-SMO	Unskilled workers from outside the region represent less than 10% of total workforce	NQC (Included in Con costs)
12. Materials sourcing	Undue GHG emissions from transport of materials sourced far from point of use	Prioritize bulk materials suppliers using less distant sources	Con	ESFP PMO ESFP-SMO	Materials sourced from within reasonable distance	NQC (Included in Con costs)
13. Materials Sourcing	Knock-on environmental effects of sourcing from unsustainable suppliers	Select suppliers with strong green credentials (verified by review of certifications received)	Con	ESFP PMO ESFP-SMO	International suppliers of materials have favorable environmental certifications	NQC (Included in Con costs)
B. CONSTRUCTION PHASE						
(i) BIO-PHYSICAL IMPACTS						
14. Aquatic Flora including Benthos	Disturbance to riverbed and benthos. Loss of aquatic communities especially benthic biota;	- Do not release untreated waste on soil or in water. - Carry out protection works in segment thus minimizing impacts on benthic fauna.	Con	ESFP PMO ESFP-SMO	- everyday monitoring report from ESFP-SMO - quarterly monitoring report on aquatic life by specialist appointed by BWDB	NQC (Included in Con costs) + PMO cost for specialist
15. Aquatic Fauna	Impacts on Feeding and Spawning Ground of Fish Habitat	- Earth work should be conducted during the dry season (December- January) - A sequence of work at the bank side of the rivers will be carefully planned to minimize impacts on spawning and subsequently nursery ground of fish. - Contractor will maintain liaison with experienced fishermen in the locality	Con	ESFP PMO ESFP-SMO	- everyday monitoring report from ESFP-SMO - quarterly monitoring report on aquatic life by specialist appointed by BWDB	NQC (Included in Con costs) + PMO cost for specialist
16. Fisheries	Disturbance of fish and damage of aquatic vegetation.	- No mitigation is required. - Enhance culture and capture fishery in planned manner.	Con	ESFP PMO ESFP-SMO	- everyday monitoring report from ESFP-SMO - quarterly monitoring report on aquatic life by specialist appointed by BWDB	NQC (Included in Con costs) + PMO cost for specialist
17. Fisheries habitat	The proposed location generally contains vegetation covers (Chon, Nol, Kaisa, Mutha, Binna, Durba etc.). Fish and	Vegetation clearance should be done as low as possible only covering the footprint of the embankment.	Con	ESFP PMO ESFP-SMO	- everyday monitoring report from ESFP-SMO - quarterly monitoring report on aquatic life by specialist appointed by BWDB	NQC (Included in Con costs) + PMO cost for specialist

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
	prawn species (major carps, i.e., rui, catla, mrigel etc., big and small catfishes, Golda, gura chingri etc.) use this habitat as spawning, grazing and refuge grounds during the inundation of habitat in the monsoon flood season (June to September). Temporary damage would occur in the seasonal fish habitat in the target rivers due to either clearance of vegetation cover or draped by the filling earth during earth work for the fish species of marginal vegetation feeder.	Habitat is supposed to be restored after construction if the target areas left undisturbed by vessels and other human interferences				
18. Fish Migration	Lateral migration occurs through flooding water. Larvae and juveniles migrate from the river to the adjacent before feeding and growth during the dry season (December to March). Both the Longitudinal and lateral migration for fish will be temporarily disturbed.	Dry season (December-March) is proposed for construction works, especially construction related dredging and earthworks	Con	ESFP PMO ESFP-SMO	- everyday monitoring report from ESFP-SMO - quarterly monitoring report on aquatic life by specialist appointed by BWDB	NQC (Included in Con costs) + PMO cost for specialist
19. Geo-morphology and Bathymetry	Erosion and accretion of the riverbank.	Ensure adequate measure through proper design and construction of training works	Con	ESFP PMO ESFP-SMO	Plan prepared to prevent river erosion	NQC (Included in Con costs)
20. Sediment Dispersal	Settlement of suspended solids; Attenuation of light in	Small scale Tidal River Management (TRM) will be implemented where appropriate;	Con	ESFP PMO ESFP-	everyday monitoring report from ESFP-SMO	NQC (Included in Con costs)

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
	water column; Dispersion of contaminated sediments; Degradation of pelagic habitat	- Contractor will protect untreated embankment slopes; - Contractor will excavate channels after dewatering them. - Contractor will not leave excavated earth and silt on channel banks. - Contractor will implement measures to protect channels from run-off from working areas and camps; and - Contractor will obtain borrowing material from riverbanks in such a manner so that there is no increase of siltation in rivers and will not leave loose soil after excavation.		SMO		
21. Drainage Congestion	Drainage might be disturbed around construction yard, engineering camp and work camp	- Deploy silt screens in front of drainage pipes to prevent sedimentation on surrounding lands of the disposal areas. - Do not exceed DoE turbidity standards. - Apply measures to minimize sediment dispersion.	Con	ESFP PMO ESFP-SMO	everyday monitoring report from ESFP-SMO	NQC (Included in Con costs)
22. River Traffic	Obstruction to river traffic. Hindrance of other transportation traffic.	- Adequate precautionary measures, prior announcement and proper workmanship. - Coordinate location of construction activity with vessel operators and BWDB to reduce river transportation delays.	Con	ESFP PMO ESFP-SMO	everyday monitoring report from ESFP-SMO	NQC (Included in Con costs)
(II) LAND CHANGE, TOPOGRAPHY AND DRAINAGE						
23. Drainage Congestion	Drainage congestion problems might occur as water may be entrapped in the area due to the construction of new embankment. Low impact may be generated as the conveyance capacity of internal rivers and lakes will be stressed, resulting in drainage congestion problems.	Design drainage channel as per requirement and as per hydrological analysis.	Con	ESFP PMO ESFP-SMO	everyday monitoring report from ESFP-SMO	NQC (Included in Con costs)
24. Erosion	(BENEFICIAL IMPACT) Massive impact on the livelihood of the local	no mitigation measure suggested	Con	ESFP PMO ESFP-	end project report by consultants	NQC (Included in Con costs)

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
	people. Due to the bank protection works a huge number of agricultural lands and settlements will be saved. Communication facilities will be re-established			SMO		
25. Surface Water Quality and Hydrology	Deterioration of water quality. Increase of turbidity of water. Change in salinity level of water.	- Ensure proper site management and good monitoring. - Ensure proper monitoring.	Con	ESFP PMO ESFP-SMO	everyday monitoring report from ESFP-SMO	NQC (Included in Con costs)
26. land use change	(BENEFICIAL IMPACT) Minimization of riverbank erosion so that at least 30% of the NCA is impacted positively	The community organizations should be formed (i.e., WMOs) and strengthening through orientation on embankment management, smooth functioning of regulators, improve of the drainage system of the project, integrated water management, on farm development etc.	BWDB	PMO	- WMOs formed and oriented about the embankment management - WMOs sit regularly on embankment issues and updates. - Reports of WMOs meeting, meetings records	NQC (included in PMO cost)
(III) SOCIO-ECONOMIC IMPACTS						
27. Air Pollution	Impact due to operation of the transport vessels, trucks, tugboats, generators, and other associated machineries and equipment. Minor amount of dust may be generated during excavating and dumping of earth materials, surface leveling with dumping machine and vehicular movements.	- Control rampant movement of vehicle and equipment - Water to be sprinkled on regular intervals, as and where required	Con	ESFP PMO ESFP-SMO	everyday monitoring report from ESFP-SMO	NQC (Included in Con costs)
28. Noise Pollution	Increased ambient noise level from construction, camp management, stockpile yards. Low impacts would be caused during excavation	- Proper site management and construction plans shall be in place. - Ensure that the site is kept orderly and tidy. - Noise levels due to vehicular movement, excavation and dredging activities are to be kept within permissible limit.	Con	ESFP PMO ESFP-SMO	- everyday monitoring report from ESFP-SMO - CEMP is prepared by contractor and approved by SMO and PMO	NQC (Included in Con costs)

Parameter	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost in BDT
	and dredging of soil and vehicular movements.					
29. Employment and Livelihood	Damage to fishing gear; unemployment for fishermen – due to disturbance during construction	• Apply to minimize sediment dispersion. • Advise local residents before commencement of construction works. • Prepare list of affected fishermen and pay compensation	Con PMO SMO	ESFP PMO ESFP-SMO	• records of community consultation, update EMP, prepared affected fishermen list, paid compensation and records of payment	PMO cost
30. Occupational health & safety	Construction activity and labour camp sites carry inherent risks for workers. These risks include falls, contact with moving machinery, flying and falling objects, dust, burns, cuts, exposure to intense light from arc welding, electric shock and electrocution, and crushing from collapsing earth walls, amongst other things.	• Conduct monthly checks to review PSE compliance. • Random check of 10% of the labor force, and check that laborers have contract letters and check age, working conditions and documentation. • Provide sufficient training for pollution control safety measures, first aid, and firefighting. Establish effective onsite safety procedures and control systems	Con PMO SMO	ESFP PMO ESFP-SMO	• everyday monitoring report from ESFP-SMO • CEMP is prepared by contractor and approved by SMO and PMO	NQC (Included in Con costs)
C. POST-CONSTRUCTION PHASE						
31. River Morphology	Erosion and accretion of the river.	• Ensure adequate measure through proper design and construction of training works.	Con PMO SMO	ESFP PMO ESFP-SMO	• Post construction plan prepared by BWDB	PMO cost

D. Environmental Monitoring and Reporting

265. The purpose of environmental monitoring is to ensure that the EMP is fully and competently implemented across all phases of the project's development, and to provide a basis for appropriate and timely corrective action when it is found not to be. The environmental monitoring process should be understood not only as a means of supervision and enforcement, but also as a vehicle for organizational learning and progress towards mainstream international best practice in construction site and facility management. Effective monitoring can also be a vital tool in forestalling conflict with the communities most likely to suffer the consequences of negative environmental impacts, as problems can be identified and corrected in a timely manner, before they grow to nuisance or dangerous levels.

266. Environmental monitoring consists of assessing both the degree to which Contractors and facility operators are fulfilling their responsibilities to implement measures specified in the EMP to manage impacts (compliance monitoring), and the degree to which their impact management efforts are successful in preventing harmful environmental conditions from arising (effects monitoring). Compliance monitoring typically makes use of checklists to confirm or disconfirm that prescribed measures are being properly implemented, while effects monitoring involves quantitative and/or qualitative sampling at designated locations. Both types of monitoring need to be conducted on a regular and consistent basis, to ensure the comparability of results across monitoring periods. Monitoring should begin before site clearing, so an environmental baseline (i.e., pre-project conditions) can be established for key environmental parameters.

267. Monitoring parameters for each prescribed mitigation and enhancement measure are identified in Table IX-3 above. Specific monitoring responsibilities, including the monitoring and reporting timetable for each, are detailed in Table IX-4.

Table IX-4 Environmental Monitoring Plan

KEYS: ADB: Asian Development Bank; CSC: Construction Supervision Consultant; Con: Contractor; DOE: Department of Environment; EHSO: Environment, Health and Safety Officer; ESFP: Environmental Safeguards Focal Person; NQC: No Quantifiable Cost; SOU: Safeguards Oversight Unit; BWDB: Bangladesh Water Development Board; EMP: Environmental Management Plan, EMoP: Environmental Monitoring Plan; PMO: Project Management Office; SMO: Subproject management Office.

Parameter type	Prescribed measures	Monitoring entity	Monitoring parameters	When to monitor	Estimated monitoring cost in BDT
A. PRE-CONSTRUCTION PHASE					
(i) IMPLEMENTATION READINESS					
1. Environmental baseline	Collect and analyze samples for key environmental parameters to establish a pre-project environmental baseline for development site	ESFP PMO	- Ambient air quality (PM_{2.5}, PM₁₀, SO₂, CO, NO₂); compared to the Environment Conservation Rules, 2023 (minimum 8 hr sampling period) – 1 sample from each site = 4 sites all total, 4 samples - Adjacent surface waters (pH, BOD₅, COD, DO, SS, total coliform, Total P, Total N, turbidity); compared to the Environment Conservation Rules, 2023 – 1 sample from each site = 4 sites all total, 4 samples - Ambient noise (dBA daytime, dBA night); compared to the Environment Conservation Rules, 2023– 1 sample from each site = 4 sites all total, 4 samples.	One sample prior to start construction. Sampling locations: to be set by the environmental specialist employed by CSC and PMO SOU	BDT 300,000 for sampling and laboratory analysis
2. IEE and EMP update	Review IEE and EMP to ensure any post-approval changes are properly accounted for and addressed, by addition of mitigation measures if necessary	ESFP PMO	- IEE and EMP confirmed still fully applicable. - New measures added to EMP if needed to cover any changes in alignment, design or local conditions	Once before start of procurement	NQC (Included in PIU budget)
3. Verification of environmental clearances	Confirm Site Clearance Certificate (SCC) and Environmental Clearance Certificate (ECC) have been granted, and that any conditions imposed by DOE on approval have been reflected in EMP and EMoP, as well as CEMP as applicable	SOU PMO	- SCC and ECC granted. - New measures added to EMP, EMoP and CEMP if needed to meet any condition of approval specified by DOE	Once before start of procurement	NQC (Included in PIU budget)
4. CEMP verification	Review CEMP to ensure all primary Contractor responsibilities are fully reflected, including monitoring and reporting	CSC	- Any necessary changes requested, and made by Con - CEMP confirmed adequate by reviewers	Once before start of construction	NQC (Included in CSC amount)
5. Specialized plans verification	- Confirm that the following specialized plans have been prepared by the Contractor: - site-specific Construction Camp Management Plan(s) - site-specific Waste Management Plans (embedded within CEMP)	CSC	All required specialized plans prepared to adequate standard and approved by relevant authority (as required in some cases)	Once before start of construction	NQC (Included in CSC amount)

Parameter type	Prescribed measures	Monitoring entity	Monitoring parameters	When to monitor	Estimated monitoring cost in BDT
	- site-specific Emergency Response Plans (embedded within CEMP) - Soil Erosion Prevention Plan - Site Reinstatement Plan - Occupational Health and Safety Plan (including COVID-19 measures stipulated by ADB and Government of Bangladesh Guidance for Social and Institutional Containment and Prevention) - Water pollution prevention plan				
6. Grievance Redress Mechanisms	Confirm that a central GRM and workers' GRM have been established and publicized	SOU	- Central GRM established and publicized - Workers' GRM established and explained to workers before the start of construction	Once before start of construction	NQC (Included in PMO budget)
(ii) DESIGN					
9. Climate change mitigation	- Integrate GHG-limiting measures into facility designs, including: - maximize use of excavated materials available locally - integrate photovoltaic generation into the work camp management plan - specify only high-efficiency electrical and mechanical equipment. - specify most fuel-efficient backup generator available. - Specify water-saving toilets, faucets and showerheads at work camp	SOU ESFP PMO ESFP SMO	All feasible GHG-reduction design measures incorporated in facility designs.	Once before approval of detailed designs	NQC (included in SMO and PMO budgets)
10. Climate change adaptation	Design facilities so that critical components (including construction vehicles, backup generator and fuel tanks) are well above maximum flood level foreseen under climate change projections specified in Climate Risk and Adaptation Assessment (CRA) report and detailed hydrological study	SOU ESFP PMO ESFP SMO	All critical facility components above maximum expected flood level	Once before approval of detailed designs	NQC (included in SMO and PMO budgets)
(iii) PROCUREMENT					
11. Selection of Contractor	- Prioritize selection of Contractor with strong compliance track record, as verified by references from previous CSCs - Select only Contractors registered with MOLE - Ensure that contractor has professional EHSO	SOU ESFPs	Selected Contractor has verified track record of good performance on safeguards compliance	Once during procurement	NQC (Included in PMO and SMO costs)
12. Labor	Hire exclusively or mostly local workers for unskilled works	CSC ESFPs	Workers from region given first priority in hiring for construction jobs	Once prior to start of construction	NQC

Parameter type	Prescribed measures	Monitoring entity	Monitoring parameters	When to monitor	Estimated monitoring cost in BDT
					(Included in CSC and PMO costs)
13. Materials sourcing	- Obtain valid Certificate of BSTI from suppliers of bulk materials. - Prioritize bulk materials suppliers using less distant sources - Select suppliers with strong green credentials (verified by review of certifications received)	CSC ESFPs	Certificate of BSTI obtained and filed for each purchase of bulk materials	Prior to approval of each purchase order	NQC (Included in CSC and PMO costs)
B. CONSTRUCTION PHASE					
(i) BIOPHYSICAL ENVIRONMENT					
14. Aquatic Flora including Benthos	- As part of the daily/weekly inspection, examine the benthic communities and examine the level of turbidity in excavation area and also in the outlet of the disposal area. - Confirm turbidity is not exceeding the DoE guideline.	Con CSC ESFPs at SMO	Checklist to be provided monthly (benthos, turbidity, BOD, oil/grease etc.)	Take samples every three months from the construction area	BDT 300,000 (LS)
15. Aquatic Fauna	As part of the daily/weekly inspection, observe large fisheries near to the construction areas and confirm works are stopped working if sighted	Con CSC ESFPs at SMO	Checklist to be provided monthly (benthos, turbidity etc.)	Daily throughout the construction period	Covered by item no. 14.
16. Geo-morphology and Bathymetry	Avoid the formation of sand banks	Con CSC ESFPs at SMO	Checklist to be provided monthly (benthos, turbidity etc.)	Daily throughout the construction period	Covered by item no. 14.
17. Sediment Dispersal	Ensure powerful suction pumps on the dredgers/earthwork machines are able to suck up suspended sediment out of the water column	Con CSC ESFPs at SMO	Checklist to be provided monthly	Daily throughout the construction period	Covered by item no. 14.
18. Drainage Congestion	Confirm the drainage outlets in the disposal area are functional and adequate to discharge water as of DoE standards	Con CSC ESFPs at SMO	Turbidity test results	Take three samples for turbidity testing at different reach of the river, every three months. Assuming 18 month of construction, 18 samples should be collected and analyzed	BDT 100,000 (LS)
19. River Traffic	Make sure river traffic has not been disturbed due to construction activities or prepare a detour plan if necessary	Con CSC ESFPs at SMO	Checklist to be provided monthly	Daily throughout the construction period	Covered by item no. 14.

Parameter type	Prescribed measures	Monitoring entity	Monitoring parameters	When to monitor	Estimated monitoring cost in BDT
(ii) SPILLAGE, LEAKAGE AND ACCIDENTS					
20. Deliberate Spillage/drops	personnel must be trained to perform optimum work in the river vessels, and must have the required contingency equipment	Con CSC ESFPs at SMO	Checklist to be provided monthly	Daily throughout the construction period	Covered by item no. 14.
21. Accidental Spillage	Regular inspection is necessary to check all equipment and machineries	Con CSC ESFPs at SMO	Checklist to be provided monthly	Daily throughout the construction period	Covered by item no. 14.
22. Surface Water Quality	- Deterioration of water quality. - Increase of turbidity of water. - Change in salinity level of water.	Con CSC ESFPs at SMO	- Ensure proper site management and good monitoring. - Ensure proper monitoring. - Test results (refer to item no. 14)	Daily throughout the construction period	Covered by item no. 14.
(iii) SOCIO-ECONOMIC IMPACT					
23. Air Pollution	Air quality test results	Con CSC ESFPs at SMO	- Control rampant movement of vehicles and equipment. - Ambient air quality (PM_{2.5}, PM₁₀, SO₂, CO, NO₂); compared to the Environment Conservation Rules, 2023 (minimum 8 hr sampling period) – 1 sample from each site = 4 sites all total, 4 samples, quarterly report – assuming 18-month period of construction 4*6 = 24 samples	Quarterly	BDT 720,000 (LS)
24. Noise Pollution	Noise quality test results	Con CSC ESFPs at SMO	Ambient noise quality measures and reports – 1 sample from each site = 4 sites all total, 4 samples, quarterly report – assuming 18-month period of construction 4*6 = 24 samples.	Quarterly	BDT 24,000 (LS)
25. Employment and Livelihood	- Damage to fishing gear - Compensation for fishermen	PMO SMO	Records of compensation	Monthly	PMO cost
C. POST-DERDGING PHASE					
26. River Morphology	Ensure adequate measure through proper design and construction of training works.	Con BWDB	Checklist and report	Monthly	PMO cost
27. Aquatic Flora and Fauna	- Enhance culture and capture fishery in planned way. - Creation of sanctuary at suitable location.	Con BWDB	Checklist and report	Monthly	PMO cost

268. As will be noted from the preceding table and figures, several entities are expected to submit regular monitoring reports as a fundamental contribution to effective implementation of the EMP. These reporting processes are summarized in Table IX-5 for clarity. A sample outline of a semi-annual monitoring report as must be prepared by the SOU for submission to ADB (which can also be adapted for quarterly monitoring reports as must be prepared for DOE) is provided in Appendix 17.

Table IX-5 Monitoring reporting requirements

Report type	Prepared by	Submitted to	Frequency
Construction phase			
Contractor EHS monitoring reports	Contractor	ESFP	Monthly
Site EHS monitoring reports	EHSO	ESFP	Monthly
Progress reports (safeguards sections)	ESFP	SMO/SOU	Quarterly
Environmental monitoring reports	SOU	DOE	Quarterly
Environmental monitoring reports	SOU	ADB	Semi-annually
Operation phase			
Environmental monitoring reports	SMO units and PMO	DOE	Quarterly

E. Institutional strengthening and training requirements

269. Implementation of environmental safeguards on infrastructure projects in Bangladesh has tended to be weak, as is often evident even to the casual observer passing by poorly fenced construction sites where few workers can be seen using appropriate personal protective equipment. Incomplete EMP compliance is largely a function of two factors: (i) inadequate capacity in institutions charged with oversight; and (ii) a low level of awareness and knowledge on the part of local subcontractors and their workers.

1. Institutional capacity

270. **Project Management Systems.** To ensure the quality of its output, the Project will operate participatory management and quality control systems through the PMO and scheme-level SMOs, with the support of the ISPMC consultants. To ensure participatory implementation and O&M sustainability, JMCs will be set up following the NWP and BWDB Act 2000. The JMCs will comprise representatives of WMAs, LGIs, BWDB, LGED, and line agencies, along with their subunit-level subcommittees. JMCs and their subcommittees will be trained to make subproject decisions at the scheme and the subunit levels, respectively, including project program delivery and annual O&M, based on which specific works will be undertaken by the responsible organizations, with monitoring by the WMAs. Within this framework, the Project's quality control system ensures (i) due recording and reporting at SMOs on institutional, physical, financial progress against the specified targets and schedules in IWMPs and SIPs; and (ii) regular SMO-PMO review meetings to be operated as part of the internal audit mechanism.

271. **Institutions Strengthened through Training and Advisory Support.** The Project will provide training to strengthen project institutions, including operating staff and trainers, with a distinct output target to create a pool of professional staff who institutionalize the participatory and integrated business processes embodied in the NWP and Rules of Participatory Water Management, with progressively reducing consultancy support that is provided with a clear exit strategy and performance targets for relevant staff positions. Project training will enhance skills for participatory IWMP preparation; socially inclusive WMA development and management; management of diverse stakeholder interests; resettlement; design and construction

management; environmental management; agriculture, fishery, and livelihood enhancement; sustainable O&M; and quality control.

272. Under the Participatory Water Management Rules (2014), the Office of Chief Water Management of BWDB will be responsible for registration and performance (technical, institutional, financial) auditing of WMOs. This is a new activity to BWDB and requires careful planning and implementation. The project will strengthen the department through training, planning support and logistic provisions.

2. Training needs

273. **Contractors.** International construction contractors working in Bangladesh are well aware of safeguards requirements, and knowledgeable on global best practices in impact mitigation and site management. Effective oversight and enforcement, not training, is needed to ensure strong EMP performance from these firms. However, the local firms acting as contractor or sub-contractors, which will undertake most of the physical work of infrastructure development, can in most cases be expected to be less aware and less experienced regarding safeguards requirements, and minimally concerned with international standards of practice. Local firms will benefit from training to strengthen their knowledge and awareness and help ensure strong compliance on this project and other projects in the future.

274. Training for contractors/sub-contractors should be developed by the SOU in collaboration with the CSCs and be delivered by the CSC prior to the start of construction, and whenever weak compliance warrants refresher training. Training for contractors/sub-contractors should cover the following topics:

- (i) rationale for safeguards requirements in development interventions;
- (ii) ADB safeguards requirements;
- (iii) national safeguards requirements;
- (iv) primary contractors' legal and contractual responsibilities with respect to compliance with national environmental and labor rules;
- (v) sub-contractors' legal and contractual responsibilities with respect to compliance with national environmental and labor rules;
- (vi) environmental monitoring processes and enforcement;
- (vii) best practices in construction site management and environmental mitigation; and
- (viii) emergency response plans and their implementation.

275. **Workers.** Primary contractors and their sub-contractors should provide adequate training to workers in their employ to ensure safe and sanitary workplaces and full compliance with all prescriptions of the EMP, but often fall short in this regard. It is therefore usually necessary and appropriate for the SMO to implement supplemental worker training. Such training should be designed by the SOU in collaboration with the CSC and implemented by the SOU through the site-level EHSOs. Worker training should be provided prior to the start of construction, and whenever new sub-contractors and crews of workers are brought on-stream; refresher training should be given any time site monitoring reveals recurrent patterns of non-compliance that can be attributed to lack of worker knowledge or awareness.

276. Training for workers should encompass the following topics:

- (i) rationale for EHS requirements on construction sites;

- (ii) workplace safety practices, including, but not limited to, proper use of task-appropriate personal protective equipment;
- (iii) safe handling of noxious substances used in construction;
- (iv) proper procedure for avoiding spills during refueling and equipment maintenance;
- (v) fire safety, including fire prevention and use of fire extinguishers;
- (vi) reporting observed spills, leaks, physical hazards and other potentially urgent matters to site managers;
- (vii) proper solid waste management practices;
- (viii) sanitation and personal cleanliness in toilets, cooking and eating areas, wash-up facilities and employer-provided accommodations; and
- (ix) existence and use of the Grievance Redress Mechanism.

277. **Facility managers.** During the operation phase, ongoing mitigation of potential impacts is subsumed within regular facility operations, guided by operations and maintenance manuals, as well as protocols for workplace safety, emergency response and routine monitoring of buildings and equipment. Work carried out at operational facilities by external maintenance contractors also needs to be monitored for compliance with the EMP by the facilities' regular personnel. Accordingly, it is appropriate for facility managers, their designated EHS personnel, and other staff to receive training to allow them to undertake such work with confidence.

278. Training for facility operators should address the following:

- (i) the EMP and its relevance to operations;
- (ii) linkages between the EMP and operations and maintenance manuals;
- (iii) best EHS practices in facility management;
- (iv) emergency response plans and their implementation;
- (v) monitoring maintenance contractors; and
- (vi) EMP reporting requirements.

279. Facility personnel should be given training prior to the end of construction, as soon as operations and maintenance manuals and emergency response plans have been finalized and approved by the SOU and CSC. Training should be designed by the CSC and organized and delivered by the new PMO and SMO EHS units. Periodic refresher training may be appropriate throughout the operation phase, especially following turnover of key personnel positions or if monitoring carried out by the PMO and SMO EHS units indicates recurrent compliance issues.

280. **Institutional strengthening.** The PMU will lead the implementation of the EMP assisted by the consultants, with responsibility for such key tasks as ensuring project readiness; reviewing and approving designs and plans; ensuring that environmental information in bid documents and environmental clauses in construction contracts are on target; providing training on environmental mitigation measures; supervising and directing environmental monitoring; and providing guidance on environmental matters whenever needed. The work and leadership of the environmental consultants will strengthen environmental management and supervision capacity of the BWDB, PMO and contractors, and ensure the project's full compliance with the ADB's SPS.

281. In addition to the activity of the environmental consultants, the project's environmental management and supervision will be enhanced by engagement of a licensed laboratory to undertake quarterly site monitoring, including quantitative measurement of air quality and noise levels at all active construction sites; this importation of technical monitoring expertise will ensure adherence to DoE standards. Finally, all contractors will be required to hire an EHSO for each

site under their control and empower that officer to manage the implementation of an Environment, Health and Safety Management Plan (EHSMP) for the site. With the guidance, support and supervision of the environmental consultants, the EHSOs will play a key role in ensuring sound implementation of environmental mitigation measures prescribed by the EMP. It is believed that these institutional strengthening measures will enable competent and efficient environmental management of the project. The institutional strengthening plan is summarized in Table IX-6.

Table IX-6 Institutional Strengthening Measures

Target Agencies	Institutional strengthening measures	Timing
BWDB	Define institutional arrangements for environmental management, monitoring and supervision. Define positions and responsibilities	During project preparation
PMO	Recruit and contract one national environmental consultant for environmental management, environmental training, EMP compliance review, and reporting	At start of pre-construction phase
SMO	Recruit and contract licensed laboratory for quarterly environmental monitoring before and during construction phase	Prior to start of construction
Contractors	Hire Environment, Health and Safety Officers for each construction site	Prior to start of construction
Contractor / Workers	Work Health and Safety training on periodic basis	Before start of the construction and quarterly until end of construction

282. **Training.** Selected personnel of the BWDB, PMO and SMO and contractors will receive training in environmental management, environmental monitoring and supervision, mitigation planning, emergency response, public consultation and use of the GRM, occupational and community health and safety, and other environmental management topics. The topics, methods, and estimated costs of the training are outlined in Table IX-7. Training sessions will use a workshop format. Training will be developed and provided by the environmental consultants with the support of other experts engaged under the grant implementation consultant services.

Table IX-7 Training requirements and estimated cost

Training target	Developed by	Delivered by	Timing	Estimated cost for this location
Contractor	SOU/CSC	SOU/EHSO	Once before start of construction, periodically during construction on quarterly basis	BDT 30,000 per session
Workers	SOU/CSC	SOU/EHSO	Once before start of construction, periodically during construction on quarterly basis	BDT 50,000 per session
Facility managers	SOU	BWDB EHS Unit	Before start of operations	BDT 100,000

Training Topics.

EMP Implementation: Roles and Responsibilities, Monitoring, Supervision and Reporting Procedures
 Grievance Redress Mechanism: Roles and Responsibilities, Procedures, Occupational and Community Health and Safety, Emergency Preparedness and Response, Pollution Control and Environmental Monitoring, Inspection and Reporting, Public Consultation, Contractor Engagement and Management, including EMP Enforcement, Operation-Phase Environmental Management and Monitoring

F. EMP Implementation cost

283. Cost estimates for mitigation measures, environmental monitoring, public consultations, and capacity building are summarized in Table IX-8. Contractors will bear the direct costs of all mitigation measures during construction, which will be included in the tender and contract documents; this includes features built into facility designs in order to prevent environmental impacts from arising. The PMO and SMO will bear the costs related to mitigation measures during operation. Costs related to environmental supervision during construction will be borne by the PMO (for hiring a licensed laboratory to conduct quarterly monitoring), the PMO (for the activities of the environmental consultants) and by the contractors (for monitoring work carried out by the EHSOs). During the operation phase and monitoring costs will be borne by the PMO and SMO (for regular monitoring activity of their site EHSOs).

Table IX-8 EMP implementation cost

Sl. No	Description of activity	Unit cost (BDT)	Calculation	Cost (BDT)
1	Recruit and appoint EHSO at site for 18 months by the contractor	BDT 50,000 per month	BDT 50,000 x 18 months X 4 sites	3,600,000
2	Debris disposal and waste management on camp sites. Temporary camp site waste disposal facility improvement 2 nos (1 no of organic waste and 1 no of inorganic waste disposal facility) Site cleaning, Removal and disposal activities	lump sum	BDT 50,000 x 4 sites	2,00,000
3	Medical supplies (First Aid box), other medical requirements, note, equipment, kits, dress etc.	lump sum	BDT 50,000	50,000
4	Waste collection facilities with collection bins, scheduled disposal, carry to designated places, waste separation process etc.	lump sum	BDT 40,000	40,000
5	Health safety warning signs and log maintenance, infectious diseases response as identified in the EMP	lump sum	BDT 50,000	50,000
6	Personal Protection equipment, EMP implementation training on site	lump sum	BDT 40,000 x 4 sites	1,60,000
7	Conduct environmental baseline: - Ambient air quality (PM_{2.5}, PM₁₀, SO₂, CO, NO₂); compared to the Environment Conservation Rules, 2023 (minimum 8 hr sampling period) – 1 sample from each site = 4 sites all total, 4 samples. - Adjacent surface waters (pH, BOD₅, COD, DO, SS, total coliform, Total P, Total N, turbidity); compared to the Environment Conservation Rules, 2023 – 1 sample from each site = 4 sites all total, 4 samples. - Ambient noise (dBA daytime, dBA night); compared to the Environment Conservation Rules, 2023– 1 sample from each site = 4 sites all total, 4 samples.	Lump sum	BDT 300,000	300,000
8	Monitoring: - Ambient air quality (PM_{2.5}, PM₁₀, SO₂, CO, NO₂); compared to the Environment Conservation Rules, 2023 (minimum 8 hr sampling period) – 1 sample from each site = 4 sites all total, 4 samples, quarterly report – assuming 18-month period of construction 4*6 = 24 samples - Ambient noise quality measures and reports – 1 sample from each site = 4 sites all total, 4 samples, quarterly report – assuming 18-month period of construction 4*6 = 24 samples.	Lump sum	BDT 720,000 + BDT 24,000	744,000
9	Construction of gender differentiated toilets (adequate quantities as per satisfaction of the ESFP)	Lump sum	BDT 50,000 x 4 sites	200,000
10	Worker shed	Lump sum	BDT 100,000 x 4 sites	400,000
11	Training cost (as described in Table IX-7)	Lump sum		180,000

Sl. No	Description of activity	Unit cost (BDT)	Calculation	Cost (BDT)
12	PMO Environmental Specialist	Included in the PMO cost (see EARF for details)		-
Cost				5,624,000
Overhead + Miscellaneous (10%)				562,400
Total cost				6,186,400

X. CONCLUSION AND RECOMMENDATION

A. Conclusion

284. This IEE report on investments planned for river protection works in Gopalganj has been prepared based on desktop study, field reconnaissance of the planned building site and surrounding areas, and consultations with institutional stakeholders and members of the public in the projected area of influence. The report comprises a comprehensive consideration of the environmental, health and safety impacts that can be anticipated to arise from the project. The EMP has been prepared in line with the ADB SPS and DoE environmental assessment requirements, and the mitigation strategies prescribed within it reflect current international best practices, as exemplified by the World Bank Group's Environment, Health and Safety Guidelines.

285. Minor negative impacts of the project will be felt during the construction phases which may involve minor sand erosion, water and waste pollution. The major significant impacts can come from disrupting local hydrological system and waste pollution. The impacts of noise and increase in river traffic are expected to be within the existing level experienced by the local people. The contractor will be under specific orders for providing PPE to the workers engaged in the job. Strict site and labour camp health and safety regulation will be forced as per government and ADB guidelines. The IEE is indicative of the suggestions that should guide the topographic surveys, construction spoils management plan and detail designs. Site specific EMPs will be developed after detail design is developed and this IEE should be updated as well.

286. The monitoring plan, if properly implemented during the pre-construction, construction and post-construction and operation phases will ensure corrective measures. The proposed project will have no residual adverse impact on the environment or the eco-system if mitigation measures are properly followed. BWDB is required to take clearance from the DoE for implementing the transmission line and other ancillary works. The IEE report has been prepared with this end in view.

B. Recommendations

287. While residual negative impacts have been identified, it is also acknowledged that the investments are expected to have significant positive economic impacts for local communities, and these are to be weighed against the residual negative impacts. Generally, very positive perceptions and expectations were expressed about the planned investments during consultations carried out as part of IEE preparation, and while the local communities are clearly concerned about the riverbank erosion and crop damage, they expect that some minor problems can be faced by the local communities for the greater good. It seems clear that local community leaders see the investment as a potential benefit for them.

288. The major recommendations made in the IEE are as follows:

- (i) Some medium negative impacts like increased noise level, air and water pollution at the pre-construction and construction phases should be taken care of by taking proper mitigation measures as suggested in the EMP section of this IEE.
- (ii) This IEE is indicative of suggestions to develop detail design. Once detailed design is done, the site specific EMPs must be developed, and this IEE should be updated accordingly. The Site specific EMPs should be verified by the BWDB/ADB appointed Environmental Specialist.
- (iii) The EMP and EMP cost must be included in the bid documents prepared by BWDB.

- (iv) The contractor needs to prepare the site-specific CEMP prior construction works start. The CEMP must be approved by PMO and ADB.
- (v) BWDB should get clearance from DoE before the start of the construction. This IEE is prepared with the view that this document belongs to BWDB and should be used for obtaining ECC from DoE. Any further instruction conveyed from DoE prior obtaining the ECC, BWDB is responsible to update this IEE accordingly. An Environmental Specialist should be appointed by BWDB prior construction works to develop and update the EMPs.
- (vi) The project will require interventions wise IEEs as per requirement of the SPS 2009. This IEE was prepared by a consultant appointed by the ADB as part of project preparation. The next intervention wise IEEs as per categorization and guideline suggested in the EARF will be prepared by the PMO appointed environmental specialist with the support of SMO in the field. The IEEs will be reviewed by ADB and approved IEEs will be disclosed on ADB website in due process. For the new interventions, PMO's environment specialist along with SMO will ensure consultation under the guidance of PD and ADB's Environment Officer.

APPENDICES

- APPENDIX 1 – Relevant National Environmental Standards
- APPENDIX 2 – Environmental Categorization
- APPENDIX 3 – REA Checklist
- APPENDIX 4 – Sample Traffic Management Plan (TMP) for worker camp
- APPENDIX 5 – COVID-19 Health and Safety Guidance for the Construction Workforce
- APPENDIX 6 – Emergency response team
- APPENDIX 7 – Sample EHS Monitoring and reporting template
- APPENDIX 8 – Sample Outline of Compensatory Tree Planting Plan
- APPENDIX 9 – Sample Outline of Contractor Environmental Management Plan
- APPENDIX 10 – Sample Outline of Soil Erosion Prevention Plan
- APPENDIX 11 – Sample Outline of Construction Camp Management Plan
- APPENDIX 12 – Sample Outline of Site Reinstatement Plan
- APPENDIX 13 – Sample Outline of Occupational Health and Safety Plan
- APPENDIX 14 - Sample Outline of Spill Prevention and Response Plan
- APPENDIX 15 – Consultation Records
- APPENDIX 16 – Proposed Terms of Reference for Environment, Health and Safety Officers
- APPENDIX 17 – Outline of Semi-Annual Environmental Monitoring Report
- APPENDIX 18 – List of Fisheries found in the project area
- APPENDIX 19 – List of Flora and Fauna (including avians) found in the project area
- APPENDIX 20 – Sample outline of dredged material management plan

Appendix 1 – Relevant National Environmental Standards

Bangladesh Ambient Air Quality Standard as adopted in 2022.

Pollutant	Objective	Average
CO	05 mg/m ³	8 hours ^a
	20 mg/m ³	1 hour ^a
Pb	0.25 µg/m ³	Annual ^b
	0.50 µg/m ³	24 hours ^a
NOx	40 µg/m ³	Annual ^b
	80 µg/m ³	24 hours ^a
PM ₁₀	50 µg/m ³	Annual ^b
	150 µg/m ³	24 hours ^a
PM _{2.5}	35 µg/m ³	Annual ^b
	65 µg/m ³	24 hours ^a
O ₃	180 µg/m ³	1 hour ^a
	100 µg/m ³	8 hours ^a
SO ₂	250 µg/m ³	1 hour ^a
	80 µg/m ³	24 hours ^a
NH ₃	100 µg/m ³	Annual ^b
	400 µg/m ³	24 hours ^a

Notes:

(a) Not to be exceeded more than once per year

(b) The objective is attained when the annual arithmetic mean is within the standard

Standard for Water

(A) Standard for inland surface water

Best Practice based classification	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 or more	200 or less
c. Source of drinking water for supply after conventional treatment:	6.5-8.5	6 or less	6 or more	5000 or less
d. Water usable by fisheries:	6.5-8.5	6 or 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 by various process and cooling industries:	6.5-8.5	10 or less	5 or more	1000 or less

Notes:

1. In water used for pisciculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2. Electrical conductivity for irrigation water -2250 µmhoms/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

(B) Standard for drinking water

Sl. No.	Parameter	Unit	Standards
1	2	3	4
1	Ammonia (NH ₃)	Mg/l	0.2
2	Arsenic	"	0.05
3	BOD ₅ 20°C	"	0.2
4	Chloride	"	150-600
5	COD	"	4
6	Coliform (fecal)	n/100 ml	0
7	Coliform (total)	n/100 ml	0
8	Color	Hazen	15
9	DO	Mg/l	0.2
10	Iron	"	0.3-1.0
11	Lead	"	0.05
12	Manganese	"	0.1
13	Oil and grease	"	0.01
14	pH	---	6.5-8.5
15	Total dissolved solids	Mg/l	1000

SCHEDULE - 4
Standard for Sound
(as adopted 2006)

Sl. No.	Category of areas	Standards determined at dBa unit	
		Day	Night
a.	Silent zone	50	40
b.	Residential area	55	45
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:

The time from 6 a.m. to 9 p.m. is counted as daytime.

The time from 9 p.m. to 6 a.m. is counted as nighttime.

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.

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 Vehicles	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.

* All the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows: -

- (a) Diesel engine – maximum rotating speed
- (b) Gasoline engine – at two thirds of its maximum rotating speed and without any load.
- (c) 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.

Standard for Emission from Motor Vehicles

Parameter	Unit	Standard Unit
Black Smoke	Hartridge Smoke Unit (HSU)	65
Carbon Monoxide	gm/km Percent area	24 04
Hydrocarbon	gm/km ppm	02 180
Oxides of Nitrogen	gm/km ppm	02 600

* As measured at two thirds of maximum rotating speed.

Appendix 2 – ENVIRONMENTAL CATEGORIZATION

Date: 30.8.2023

A. Instructions (i) The project team completes and submits the form to the Safeguards Division (SDSS) for endorsement by SDSS Director, and for approval by the Chief Compliance Officer (CCO). OM F1/OP on <i>Safeguard Review Procedures</i> (paras. 4–7) provides the requirements on environment categorization. (ii) The classification of a project is a continuing process. If there is a change in the project components or/and site that may result in category change, the Sector Division submits a new form and requests for recategorization, and endorsement by SDSS Director and by the CCO. The old form is attached for reference. (iii) In addition, the project team may propose in the comments section that the project is highly complex and sensitive (HCS), for approval by the CCO. HCS projects are a subset of Category A projects that ADB deems to be highly risky or contentious or involve serious and multidimensional and generally interrelated potential social and/or environmental impacts.	
B. Project Data Country/Project No./Project Title : <u>BAN: Climate Resilient Integrated Southwest Project – Water Resources</u> Department/ Division : <u>SG-AFNRD</u> Processing Stage : <u>Concept Stage</u> Modality : _____ [x] Project Loan [] Program Loan [] Financial Intermediary [] General Corporate Finance [] Sector Loan [] MFF [] Emergency Assistance [] Grant [] Results-based lending ¹⁹ [] Other financing modalities	
C. Environment Category [please tick one category based on the set of criteria in OMF1 (paras. 6–7)] [x] New [] Recategorization — Previous Category [] ☐ Category A ☒ Category B ☐ Category C ☐ Category FI	
D. Basis for Categorization/ Recategorization (please, attach supporting documents): [x] REA Checklists [x] Project and/or Site Description [x] Other: Asbestos checklist	
E. Comments	
Project Team Comments The project will support sustainable water resource management for improving agricultural and fisheries production, livelihood support, and disaster and climate resilience in the southwestern part of Bangladesh. It will improve the drainage congestion in the <i>beel</i> area of Tungipara and Kotalipara <i>upazillas</i> by establishing improved water management systems for each flood control, drainage, and irrigation (FCD/I) scheme. The water management structures to be constructed under the project are (i) regulator/boat pass (rehab and new); (ii) canal re-excavation; (iii) embankment construction, re-sectioning and protection work; (iv) check structures, bridge and culvert, (v) river dredging; (vi) construction of office building and training center; (vii) arsenic free tube-well, etc. The environmental impacts are site-specific,	OSPT Comments

¹⁹ For Results-Based Lending (RBL) modality, please refer to the [Staff Instruction on Business Processes for RBL for Programs](#) issued on 17 March 2021. The [supplemental checklist](#) needs to be submitted to SDSS for confirmation of eligible activities under the RBL program by the CCO.

short-term, temporary and are expected to occur mostly during construction phase. Mitigating measures can be readily designed and the incremental adverse impacts are foreseen to be insignificant. Two sample IEEs and an EARF are under preparation to guide the selection of subprojects, identification and mitigation of environmental impacts. The Bangladesh Water Development Board and Water Resources Planning Organization (for technical backstopping) in collaboration with LGED and other line departments will implement the project that has prior experience to implement similar projects with ADB.			
F. Approval			
Proposed by: Pushkar Srivastava Project Management Specialist, SG		Reviewed by:	
Project Safeguard Team Specialist / Officer, Farhat Jahan Chowdhury Sr. Project Officer (Environment) SARD, BRM		Environment Specialist, OSPT/OSFG	
Date:	30.08.2023	Date:	
Endorsed by:		Approved by:	
Yasmin S. Siddiqi		☐ Highly Complex and Sensitive Project	
Director, SG-AFNRD		Bruce Dunn, Director, OSPT/OSFG	
Date:		Date:	

Appendix 3 – REA Checklist

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST FOR EMBANKMENTS AND EXCAVATION

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Safeguards Division (SDSS) for endorsement by Director, SDSS and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's: (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

BAN: Climate Resilient Integrated Southwest Project – Water Resources Management (CRISP-WRM)

Sector Division:

SG-AFNRD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		X	
▪ Legally protected Area (core zone or buffer zone)		X	
▪ Wetland	X		The proposed project area is <i>beel</i> or wetland where FCD/I structures will be constructed for better drainage and crop production. <i>Beel</i> will not be completely drained out. The core area of the <i>beel</i> will have water for fisheries, birds and other aquatic wildlife.
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	Although the project sites are not designated as special areas for protecting biodiversity, the area is rich with aquatic biodiversity. Hence, proposed interventions will be screened carefully to avoid any damage to wildlife and biodiversity.
B. Potential Environmental Impacts Will the Project cause...			
▪ impairment of historical/cultural areas; disfiguration of landscape or potential loss/damage to physical cultural resources?			

Screening Questions	Yes	No	Remarks
▪ Disturbance to precious ecology (e.g., sensitive or protected areas)?		X	Not likely. The area is a wetland system which is a sensitive ecology, but the proposed interventions will take place only at the rivers and canal systems outside the beel area.
▪ alteration of surface water hydrology of waterways resulting in increased sediment in streams affected by increased soil erosion at construction site?		X	Embankment structures are proposed to protect riverbank from scouring and erosion and dredging is proposed for improving drainage in the river/canal and the vicinity. Hence no sedimentation and pollution from the proposed interventions is expected.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		X	No harmful chemical will be used for riverbank protection works or dredging. Work camps will be placed at least 500m away from the riverbanks and no waste will be permitted to throw in any waterbody
▪ increased air pollution due to project construction and operation?	X		Increase in air pollution due to dredging operation is expected. However, the pollution will be for a short period of time and impact is reversible. EMP to be followed.
▪ noise and vibration due to project construction or operation?	X		Expected during construction. Impact is temporary and some impacts are negotiable through EMP. EMP to be followed.
▪ involuntary resettlement of people? (Physical displacement and/or economic displacement)		X	No dislocation is expected
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	The proposed interventions will benefit all equally.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STIs and HIV/AIDS) from workers to local populations?	X		Poor sanitation and waste management in work camps are expected. EMP to be followed.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		X	No likely from the proposed interventions.
▪ social conflicts if workers from other regions or countries are hired?		X	Mostly local workers will be hired.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	Mostly local workers will be hired. The peak number of workers could be 20-25 at best.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	X		There are some risks of occupational health and safety during construction. EMP to be followed.
▪ 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?		X	Construction materials will be transported through rivers and canals. Hence there is no risk to community health and safety.

Screening Questions	Yes	No	Remarks
▪ 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?		X	Construction materials will be transported through rivers and canals. Community access will be restricted during construction. Hence there is no risk to community health and safety.
▪ generation of solid waste and/or hazardous waste?	X		EMP to be followed.
▪ use of chemicals?		X	Not likely.
▪ generation of wastewater during construction or operation?		X	

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST FOR BRIDGES AND CULVERTS SUBPROJECTS

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Safeguards Division (SDSS) for endorsement by Director, SDSS and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's: (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

BAN: Climate Resilient Integrated Southwest Project – Water Resources Management (CRISP-WRM)

Sector Division:

SG-AFNRD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		X	
▪ Protected Area		X	
▪ Wetland	X		The proposed project area is beel or wetland where FCD/I structures will be constructed for better drainage, as the beel system (i.e., wetland) shows drainage congestion during post monsoon
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	Although the project sites are not designated as special areas for protecting biodiversity, the area is rich in biodiversity. Hence, all the activities should be screened against a checklist whether the interventions will threat the local biodiversity
B. Potential Environmental Impacts Will the Project cause...			
▪ impairment of historical/cultural areas; disfiguration of landscape or potential loss/damage to physical cultural resources?		X	Not likely. No historic or cultural areas were found in the project area. The entire project area is <i>beel</i> , hence loss of cultural resources due to project implementation is unlikely.

Screening Questions	Yes	No	Remarks
▪ Disturbance to precious ecology (e.g., sensitive or protected areas)?		X	Not likely. The area is a wetland system which is sensitive ecology, but the proposed interventions will take place only on the embankment roads outside of the beel areas
▪ alteration of surface water hydrology of waterways resulting in increased sediment in streams affected by increased soil erosion at construction site?		X	The culverts proposed will increase flow water within the beel system, hence will not impact the surface hydrology.
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		X	The bridges and culverts will be constructed on the existing roads, hence will not affect the surface water hydrology.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		X	No harmful chemical will be used for riverbank protection works or dredging. Work camps will be placed at least 500m away from the riverbanks and no waste will be permitted to throw in any waterbody
▪ increased air pollution due to project construction and operation?	X		Local air pollution is expected to increase. However, given the small size of the bridges and culverts, construction led air pollution is expected to be minimal and managed by implementation of EMP
▪ noise and vibration due to project construction or operation?	X		Expected during construction. Impact is temporary and some impacts are negotiable through EMP. EMP to be followed.
▪ involuntary resettlement of people? (Physical displacement and/or economic displacement)		X	No dislocation is expected
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	The proposed interventions will benefit all equally.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STIs and HIV/AIDS) from workers to local populations?	X		Poor sanitation and waste management in work camps are expected. EMP to be followed.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		X	No likely from the proposed interventions.
▪ social conflicts if workers from other regions or countries are hired?		X	Mostly local workers will be hired.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	Mostly local workers will be hired. The peak number of workers could be 20-25 at best.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	X		There are some risks of occupational health and safety during construction. EMP to be followed.
▪ 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?	X		Likely. EMP to be followed. A TMP will be also developed to avoid such situations.

Screening Questions	Yes	No	Remarks
▪ 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?	X		
▪ generation of solid waste and/or hazardous waste?	X		EMP to be followed.
▪ use of chemicals?		X	Not likely.
▪ generation of wastewater during construction or operation?		X	

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST FOR FCD/I STRUCTURES

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Safeguards Division (SDSS) for endorsement by Director, SDSS and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's: (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

BAN: Climate Resilient Integrated Southwest Project – Water Resources Management (CRISP-WRM)

Sector Division:

SG-AFNRD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		X	
▪ Legally protected Area (core zone or buffer zone)		X	
▪ Wetland	X		The proposed project area is beel or wetland where FCD/I structures will be constructed for better drainage, as the beel system (i.e., wetland) shows drainage congestion during post monsoon
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	Although the project sites are not designated as special areas for protecting biodiversity, the area is rich with biodiversity. Hence, all the activities should be screened against a checklist whether the interventions will threaten the local biodiversity
B. Potential Environmental Impacts Will the Project cause...			
▪ impairment of historical/cultural areas; disfiguration of landscape or potential loss/damage to physical cultural resources?		X	Not likely. The area is a wetland system, and the proposed interventions will take place only at the edge of the beel system (i.e., embankments)
▪ disturbance to precious ecology (e.g. sensitive or protected areas)?	X		If the FCD/I structures are not operated and maintained well, the structural interventions might interact with the precious ecological system of the beels

Screening Questions	Yes	No	Remarks
▪ alteration of surface water hydrology of waterways resulting in increased sediment in streams affected by increased soil erosion at construction site?		X	In fact, the proposed intervention is to reduce drainage congestion. Hence these interventions are expected to provide positive impacts.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	X		Improper siting of workcamps and unregulated waste dumping may lead to possible water pollution. EMP to be followed.
▪ involuntary resettlement of people? (physical displacement and/or economic displacement)		X	No dislocation is expected.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	The beneficial impacts are open for all groups of people.
▪ noise and vibration due to project construction or operation?	X		Some limited construction noise is expected. EMP to be followed.
▪ increased air pollution due to project construction and operation?	X		Dust generation is expected but limited. EMP to be followed.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STIs and HIV/AIDS) from workers to local populations?	X		Improper siting of work camp and lack of proper waste management may lead to transmission of communicable diseases. Contractor must prepare a CEMP and get approved by BWDB and ADB and follow the plan. EMP to be followed in general.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?	X		Temporary creation of waterlogging due to construction activities may lead to breeding of mosquitoes and other rodents. But the expected time for sustaining such an environment is very short and by following EMP can be avoided.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	The proposed interventions do not envisage large populations outside of the region. Construction works may require 20-25 people at its peak time. The workers are likely to come from the locality.
▪ social conflicts if workers from other regions or countries are hired?		X	Construction workers will be hired from local areas.
▪ 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?	X		Road transportation of construction materials may cause some traffic congestion and accidents due to narrow roads and population density. However, most of the construction materials will come by river/canals. So, risks are minimum. EMP will be followed.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., irrigation dams) 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?		X	Unlikely
▪ generation of solid waste and/or hazardous waste?	X		Generation of solid waste is likely during construction. EMP to be followed.
▪ use of chemicals?	X		Chemicals are likely to be used during drilling. EMP to be followed.

Screening Questions	Yes	No	Remarks
▪ generation of wastewater during construction or operation?	X		Generation of wastewater is likely during construction. EMP to be followed.

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST FOR WATER SUPPLY SUBPROJECT(S)

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Safeguards Division (SDSS) for endorsement by Director, SDSS and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's: (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

BAN: Climate Resilient Integrated Southwest Project – Water Resources Management (CRISP-WRM)

Sector Division:

SG-AFNRD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area....			
▪ Densely populated?		X	
▪ Heavy with development activities?		X	
▪ Adjacent to or within any environmentally sensitive areas?		X	Project sites are located in Beel area, where no development activity is ongoing
▪ Cultural heritage site		X	
▪ Protected Area		X	
▪ Wetland	X		The proposed project area is beel or wetland where FCD/I structures will be constructed for better drainage, as the beel system (i.e., wetland) shows drainage congestion during post monsoon
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	Although the project sites are not designated as special areas for protecting biodiversity, the area is rich with biodiversity. Hence, all the activities should be screened against a checklist whether the interventions will threat the local biodiversity
▪ Bay		X	
B. Potential Environmental Impacts Will the Project cause...			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		X	

Screening Questions	Yes	No	Remarks
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		X	Sites are located within the highlands of the <i>bee/</i> area. The possibility of historical artifacts/monuments are unlikely.
▪ hazard of land subsidence caused by excessive ground water pumping?	X		The beel area (i.e., project site) is already located in a depression area where arsenic in groundwater is common. Excessive ground water pumping may accelerate land subsidence. However, only handpumps will be installed to provide arsenic free potable water for the adjacent communities. Hence, the possibility of land subsidence from excess groundwater pumping is unlikely.
▪ social conflicts arising from displacement of communities?		X	No dislocation is expected.
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		X	No conflict is expected. The area suffers from arsenic contaminated groundwater. Hence arsenic free tube wells will be beneficial to all.
▪ unsatisfactory raw water supply (e.g., excessive pathogens or mineral constituents)?		X	Every tube well water will be tested for potential pathogens and contaminants during sinking. Hence, unsatisfactory raw water supply is unexpected.
▪ delivery of unsafe water to distribution system?		X	Unlikely.
▪ inadequate protection of intake works or wells, leading to pollution of water supply?	X		The tube wells will be operated and maintained by the local community led Water Management Groups (WMGs) and Water Management Organizations (WMOs). Any water pollution or other hazard will be addressed by the communities.
▪ over pumping of ground water, leading to salinization and ground subsidence?	X		Hand pumps (tube wells) will be provided. Hence the extraction of ground water is not expected to be of industrial level. Hence salinization and ground subsidence from ground water pumping is not expected. However, given the number of proposed tube wells in the region (304 nos. to date), there is a concern of large cone of depression leading to arsenic intrusion in deeper layers. A hydrological study is proposed to investigate the possibility of such problems and possible remedies.
▪ excessive algal growth in storage reservoir?		X	No storage reservoir is proposed.
▪ increase in production of sewage beyond capabilities of community facilities?		X	Not expected.
▪ inadequate disposal of sludge from water treatment plants?		X	Not relevant
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		X	Hand pumps (tube wells) are proposed in common areas away from households and close to internal roads. Hence, noise of pumping is not expected to reach homestead to create nuisance.
▪ impairments associated with transmission lines and access roads?		X	Not relevant

Screening Questions	Yes	No	Remarks
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		X	
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?		X	
▪ dislocation or involuntary resettlement of people?		X	No dislocation is expected.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples, or other vulnerable groups?		X	The tube wells will be beneficial to all.
▪ noise and dust from construction activities?		X	Noise and dust is expected during construction period for a short period of time. EMP will be followed.
▪ increased road traffic due to interference of construction activities?		X	Not expected.
▪ continuing soil erosion/silt runoff from construction operations?		X	Not expected.
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	X		O&M will be done by the local WMGs and WMOs. They will act as needed.
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		X	Not relevant
▪ accidental leakage of chlorine gas?		X	
▪ excessive abstraction of water affecting downstream water users?		X	
▪ competing uses of water?		X	Not expected. An adequate number of tube wells will be provided in the region.
▪ increased sewage flow due to increased water supply?		X	Not relevant
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant?		X	Not relevant
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	Tube well sinking need only 10-15 people at best who usually work as groups. Local groups will be hired. Usually, they do not use heavy machinery which may create threat to community health and safety. Minor injuries to workers may happen. Health and safety management rules will be applied.
▪ social conflicts if workers from other regions or countries are hired?		X	
▪ 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 operation and construction?		X	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST FOR POTENTIAL INTERVENTION IN FISHERIES

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Safeguards Division (SDSS) for endorsement by Director, SDSS and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's: (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: BAN: Climate Resilient Integrated Southwest Project – Water Resources Management (CRISP-WRM)

Sector Division: SG-AFNRD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		X	
▪ Protected Area		X	
▪ Wetland	X		The entire project is located at a wetland system which is rich in fisheries and aquatic ecosystem.
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	
B. Potential Environmental Impacts Will the Project cause...			
▪ overexploitation of fish stocks and long-term degradation of resource base?	X		The proposed project aimed improve command area for cultivation without affecting the main fisheries habitat. Overexploitation of fisheries resources is possible if not managed properly. The Department of Fisheries will train the locals on fish culture techniques and monitor fisheries reproduction and stocks.
▪ capture of non-target species and habitat damage through use of destructive fishing methods and gears?	X		Capture of non-target species is possible. possible. However, the Department of Fisheries will train the local fishermen in using proper gears for fishing and BWDB WMOs will arrange awareness trainings an discussions among themselves.

Screening Questions	Yes	No	Remarks
▪ accidental damage to coral reefs by divers and fishing vessel anchors?		X	
▪ pollution from oil and fuel spills and bilge flushing?		X	
▪ ecological degradation resulting from clearing for conversion of coastal wetlands to fishponds?		X	Activities will be restricted within the deeper part of the beel and no conversion of wetland to pond will be allowed.
▪ social problems arising from conflicts with other site uses?		X	
▪ downstream water pollution from discharge of pond effluents with drain water?		X	Fisheries activities will be restricted within deeper part of the beel areas
▪ reduction of water supplies for competing uses (e.g., irrigation or domestic)?		X	
▪ restriction of water circulation, obstruction to navigation by fish pens/cages, and reduction of stream capacity from siltation?	X		Due to siltation fish migration within the beels and fish reproduction areas have been decreased. Some dredging activities will be carried out within the beel areas to restore depth so that fish reproduction can be increased.
▪ dislocation or involuntary resettlement of people?		X	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ social problems due to land tenure and use conflicts?		X	
▪ soil erosion and siltation during construction?		X	
▪ noise and dust from construction?	X		No construction is planned. Most air pollution and dust generation will come from dredging activities, which will be temporary. EMP to be followed.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?		X	
▪ reduction of water available to downstream users during peak seasons?		X	Activities are restricted within the deeper part of the natural beel areas.
▪ pollution of nearby aquatic environments by pond drainage water and inadequate farm management?		X	
▪ depletion of local fish populations by stocking of wild fry/fingerlings in ponds?		X	
▪ spread of diseases and parasites from exotic cultured species or escape of pond fish to the wild?		X	
▪ large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	
▪ social conflicts if workers from other regions or countries are hired?		X	
▪ increased community health risks due to the increased incidence or introduction of waterborne or water-related diseases?		X	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials likely to create physical, chemical and biological hazards during construction and operation?		X	

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST FOR BUILDING

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Safeguards Division (SDSS) for endorsement by Director, SDSS and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's: (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

BAN: Climate Resilient Integrated Southwest Project – Water Resources Management (CRISP-WRM)

Sector Division:

SG-AFNRD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following areas:			
▪ Underground utilities		X	
▪ Cultural heritage site		X	
▪ Protected Area		X	
▪ Wetland	X		The proposed project area is beel or wetland where FCD/I structures will be constructed for better drainage, as the beel system (i.e., wetland) shows drainage congestion during post monsoon.
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	Although the project sits are not designated as special area for protecting biodiversity, the area is rich with biodiversity. Hence, all the activities should be screened against a checklist whether the interventions will threat the local biodiversity
▪ Bay		X	
B. Potential Environmental Impacts Will the Project cause...			
▪ Encroachment on historical/cultural areas?		X	

Screening Questions	Yes	No	Remarks
▪ Encroachment on precious ecology (e.g. sensitive or protected areas)?		X	The beel system is sensitive due to high biodiversity and complex hydrological system, the proposed interventions are to take place only on riverbanks and edge of the beel area. Hence the interventions will not interact with the ecology of the beel system.
▪ Impacts on the sustainability of associated sanitation and solid waste disposal systems?	X		If not well managed during civil works, sanitation and solid waste disposal might create soil and water pollution. EMPs stipulated within the IEEs need to be followed.
▪ Dislocation or involuntary resettlement of people?		X	No dislocation is expected.
▪ Disproportionate impacts on the poor, women and children, Indigenous Peoples, or other vulnerable groups?		X	The project ensures that the benefit of this program offers equal opportunities for all communities.
▪ Accident risks associated with increased vehicular traffic, leading to loss of life?	X		During construction increased traffic volume and associated impacts are expected, thus EMP needs to be followed
▪ Increased noise and air pollution resulting from increased traffic volume?	X		Expected at construction sites, but limited to the premises and the impacts are expected to be temporary. EMP to be followed.
▪ Occupational and community health and safety risks?	X		Expected during construction. EMP to be followed.
▪ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	X		Some risks are expected during construction, however during operation no risk is envisaged since the operation of the civil structures are simple. EMP to be followed.
▪ Generation of dust in sensitive areas during construction?	X		Dust generation is expected during construction. Impacts are envisaged to be minor and temporary. EMP to be followed.
▪ Requirements for disposal of fill, excavation, and/or spoil materials?		X	Not expected.
▪ Noise and vibration due to blasting and other civil works?		X	Noise and vibration during construction is expected during construction. Impacts are envisaged to be minor and temporary. EMP to be followed.
▪ Long-term impacts on groundwater flows as result of needing to drain the project site prior to construction?		X	Not envisaged.
▪ Long-term impacts on local hydrology because of building hard surfaces in or near the building?		X	Impact areas are expected to be limited and limited within the soils of construction footprint.
▪ Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	The proposed civil works for building are small in nature. So, no large population flux is expected.
▪ Social conflicts if workers from other regions or countries are hired?	X		At least 90% of the skilled and unskilled workers will be hired from a locality.
▪ Risks to community safety caused by fire, electric shock, or failure of the building's safety features during operation?		X	Civil structures are proposed in very low population density areas. Hence threats on community safety are not expected
▪ Risks to community health and safety caused by management and disposal of waste?	X		It is a possibility if waste disposal is not managed properly. EMP to be followed.

Screening Questions	Yes	No	Remarks
Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	Most of the civil structures are proposed for BWDB and WMOs. Hence community safety risks are not expected.
Use of chemicals?	X		Drilling fluids will be used for pile driving. Use of water resistant and saline resistant chemicals during construction is also envisaged. Generators, excavators, drilling machines will use oil.
generation of wastewater during construction or operation?	X		Generation of construction wastewater is expected. During operation, a small amount of domestic wastewater from labor camp is also expected.

ASBESTOS SCREENING TOOL

Screening Questions	Yes*	Maybe*	No	Remarks *For those with answers of YES and MAYBE , document the potential likelihood of asbestos being encountered.
Does the proposed project involve, or potentially involve, any of the following activities that are commonly associated with asbestos use:				
Construction/commissioning of a new asset?	X			BWDB guest house and some WMO training centers will be built. Use of asbestos with construction materials will be avoided. Procurement plans will be prepared to avoid any asbestos contents.
Refurbishment / demolition of an existing asset?			X	
Post-disaster response, involving reconstruction, repair, or removal of damaged asset?			X	
Maritime activities?			X	
Water supply, water sanitation, wastewater, sewerage, or water hygiene initiatives?			X	
Earthworks, remedial activities, or solid waste management?			X	
Power, telecommunications, or energy supply infrastructure?			X	
Maintenance, demolition, transportation, or disposal of wastes associated with the above activities?			X	

Note: If you answered YES or MAYBE to the above questions, assume that the project is likely to encounter asbestos as a direct or indirect result of project-related activities and proceed to the [TOOLKIT FOR SCREENING ASBESTOS RISKS IN NEW ADB-SUPPORTED PROJECTS PART B – SCREENING TOOLS AND CHECKLISTS](#)

Appendix 4 – Sample Traffic Management Plan (TMP) for worker camp

A. Principles

One of the prime objectives of the Contractor's **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 travelling 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

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.

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

Figure A1 to Figure A6 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

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

- a) Approval from the ULB/CMC/Public Works Department (PWD) to use the local streets as detours;
- b) 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;
- c) Determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
- d) Determining if additional traffic control or temporary improvements are needed along the detour route;
- e) Considering how access will be provided to the worksite;

- f) Contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- g) 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.

If full road-closure of certain roads within the area is not possible, due to inadequate capacity of the detour arrangements, the full closure can be restricted to weekends with the construction commencing on Thursday night and ending on Sunday morning prior to the morning peak period.

The traffic management guidelines are as follows:

- Review construction schedule and methods;
- Identify initial traffic recirculation and control policy;
- Identify routes for traffic diversions;
- Analyze adverse impact & mitigation at the detours;
- Begin community consultation for consensus;
- Finalize or determine alternate detours;
- Identify temporary parking (on and off -street);
- Discuss with CMC, owner, community for use;
- Coordinate with the Traffic Police to enforce traffic and diversions;
- Install traffic control devices (traffic cones, signs, lightings, etc);
- Conduct campaigns, publicity, and notify public about street closure; and
- Develop a mechanism to address public grievances regarding disruptors of traffic, utilities, etc.

D. Public Awareness and Notifications

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.

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.

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

- a) Traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
- b) defensive driving behavior along the work zones; and
- c) Reduced speeds enforced at the work zones and traffic diversions.

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

- a) Explain why the brochure was prepared, along with a brief description of the project;
- b) Advise the public to expect the unexpected;
- c) Educate the public about the various traffic control devices and safety measures adopted at the work zones;
- d) Educate the public about the safe road user behavior to emulate at the work zones;
- e) 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
- f) Indicate the office hours of relevant offices.

E. Install Traffic Control Devices at the Work Zones and Traffic Diversion Routes

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:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

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").

The Contractor would need to consider such Traffic Management situations for these typical arrangements and others that may occur during road construction works. The Contractor would need to coordinate closely with the road management and road police authorities and submit their Traffic Management proposals, with not less than a month's prior notice, to the PIU for obtaining prior approval, before any closure of roads are considered.

- Work on Shoulder or Parking Area;
- Work with Land Closure: Low Traffic;
- Work on Lane Closure With Yield Sign on Two Lane: Low Volume;
- Work on Lane Closure With Single Flag Operator on Two Lane : Low Volume;
- Lane Closure: Two Flag Operators on Two Lane Road; and
- Street Closure with Detour.

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.

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.

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.

Appendix 5 – COVID-19 Health and Safety Guidance for the Construction Workforce

COVID-19 Health and Safety Guidance for the Construction Workforce

INSTRUCTIONS

Contractors are required to ensure health and safety of the workers and employees in accordance with environmental health and safety (EHS) provisions of the contract which is in line with ADB SPS 2009 and Bangladesh Labor Law 2006 (Chapter VIII). A supplementary EHS guidelines was prepared to ensure that workers and employees are safe from Pandemic COVID-19 infection while working at the construction sites. This guideline should be used as a supplement to the project's Environmental Health and Safety (EHS) guidelines for the workers. Contractors are encouraged to prepare a site-specific Environmental Health and Safety (EHS) guidelines for reopening the sites and mobilizing labor and resources and get it approved by Executing Agency. The EHS guidelines and COVID-19 EHS guidelines should be available at worksite all the time with no exception.

Prerequisites for Reopening Worksite

1. Consider reopening at limited scale by identifying and engaging essential labor force
2. Avoid worker intensive works as much as possible; encourage use of equipment
3. Engage fulltime EHS professional to oversee the implementation of EHS guidelines
4. Engage a medical professional to prepare health record of the workers and daily health checkup
5. Ensure overall Personal Protective Equipment (PPE) for medical professional
6. Prepare a list of equipment and vehicles to be used frequently and ensure routine disinfection
7. Make available thermometer, soap, hand sanitizer, disinfectant, and PPE (mask, gloves, boot) at worksite and camp
8. Place adequate number of washbasins, disinfectant tub, dispenser for sanitizer
9. Establish electronic payment system (e.g., BKash, Nagad, Rocket) to pay the daily wage
10. Follow the guidance as provided below.



Locate the closest medical facility equipped with COVID -19 and contact them.



Place washbasins and disinfectant tub for shoes.



Engage EHS professional. Engage Medical professional (fulltime/ part-time).



Place a few COVID-19 signed covered trash bin for disposal of used PPEs.



Supply soap and sanitizer to labor and staff for after office for disinfection.

Worksite Entrance Protocol



Everyone entering the worksite must wear a mask and gloves.



During worksite entry que, maintain physical distance of minimum 1m (3ft).



Every personnel should wash their hands with soap for 20 seconds. Display hand washing protocol at entrance.



Spray bottom of shoes of every personnel entering worksite/campsite with disinfectant. Disinfect all vehicles entering site.



use thermometer gun to check temperature. If body temperature found $> 37^{\circ}\text{C}$ send to the designated medical facility.

Worksite Management



Frequently clean and disinfect highly used tools, machineries and surfaces (e.g. tables, toilets) by workers.



Mandatory morning briefing on COVID awareness at site maintaining physical distance.



Use alcohol-based wipe to clean tools, equipment, vehicle before and after use.



Discourage gathering at site. Discourage unnecessary entrance and exit at site.

Camp Management

1. Provide soap, sanitizer, washing facility and safe water at the workers' dwelling. Encourage frequent hand washing.
2. Ensure separate covered bin for disposal of used PPEs.
3. Protect against heat, cold, damp, noise, fire, and disease-carrying animals.
4. Maintain good housekeeping and social distancing in kitchens, meal rooms, canteens.
5. Ensure personal distance at least 1 meter (3 feet), preferably 2m (6ft) during lunch, dinner and prayer.
6. Ensure ample ventilation at the camp.



Place covered waste bins at worksite
Do not forget to dispose your used PPEs in the bins!!

Work at Site Awareness



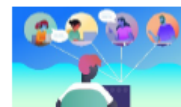
Inform the designated ESH/Medical personnel immediately if any person starts showing the symptoms of COVID-19.



Encourage respiratory etiquette, including covering coughs and sneezes. Don't touch nose/eye/mouth if not washed recently, do not spit.



Encourage the workers at camp to go out for supplies not more than once a week.



Shorten toolbox meetings. Initiate remote meeting protocol to avoid physical contact.



Stay informed. Get news from WHO and Government news outlets. Ask your EAs. Ask ADB.

Appendix 6 – Emergency response team

EMERGENCY/CRISIS RESPONSE TEAM (Roles and Responsibilities)

A. Overview

An integrated approach to emergency response involves a range of stakeholders, including the primary responder (i.e. the contractor), supervision consultants, the secondary responder (i.e. EA/IAs) and the tertiary responder (i.e. Donor agencies (e.g. ADB)) along with the local authorities, regulatory agencies and the general public. Such a system therefore requires robust processes regarding information dissemination, training, and designation of responsibility, management actions, monitoring, control, and corrective actions. The Emergency/Crisis Response Team therefore needs to be fully equipped and well communicated.

B. Organization chart of crisis response team

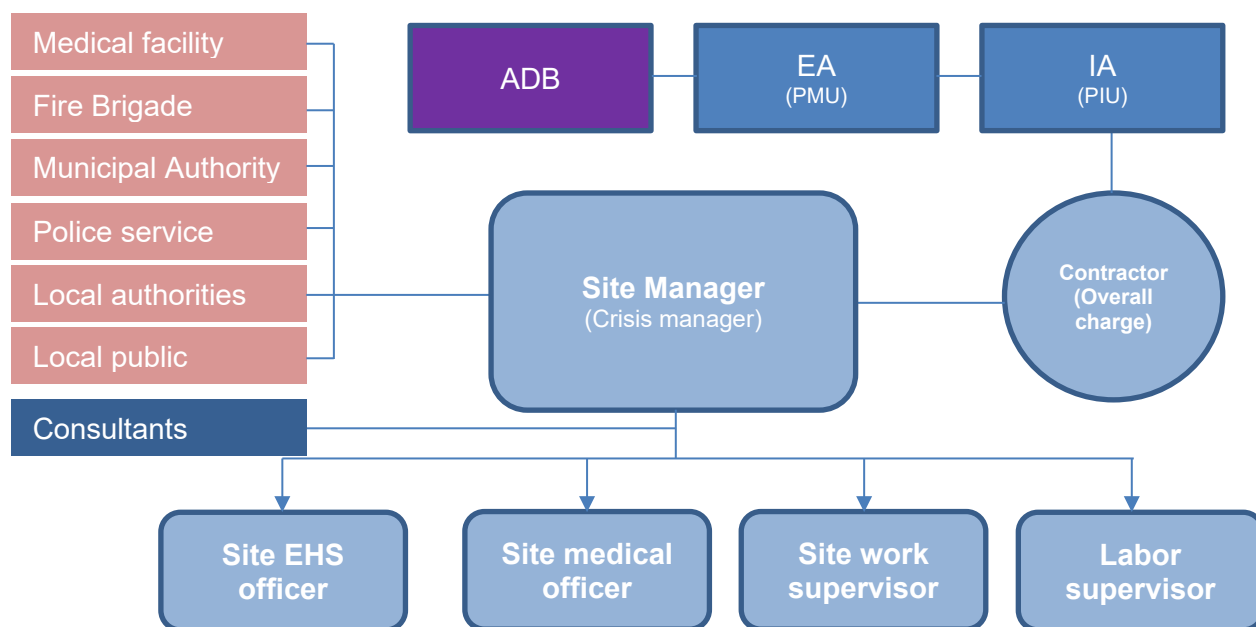


Figure: Organization chart of the crisis management team

Explanation of color code:

Work site body
Executive body
Donor body
External services team
Consultants

Appendix 7 – Sample EHS Monitoring and reporting template

Monitoring and Reporting Template

Environmental Health and Safety Monitoring

A. Environmental Health and Safety Checklist

Sl no.	Item	Exist in the worksite?		Recommendation And/ or Remarks	Time frame to comply
		Yes ☐	No ☐		
1	Site readiness (e.g. is worksite fenced and can be distinguished from general establishment? Is the an EHS professional at site? Has he/she been fulltime professional? Has he/she been present at site every day?)				
2	Site access (e.g., is site access road wide and easily accessible?)				
3	Signboard with safety warnings (e.g. with general EHS safety signboards, are COVID 19 response signboards visible at every corner of worksite?)				
4	Lighting (e.g. is every corner of the worksite is well lit?)				
5	Appropriate PPEs (Helmet, Safety Shoe, Vest, Ear plug, Musk etc.) e.g. Is every person in site is wearing appropriate PPEs?				
6	Fall protection measures (e.g. is the fall protection measures at worksite appropriate and adequate?)				
7	Fire extinguishers (e.g. are they at site? How many? Are they placed at vulnerable/most accessible places?)				
8	House keeping (e.g. are all workers health records kept? Is the EMP and EHS manual at site? Has the morning briefing on EHS conducted? Is there any vehicle record/material register/attendance register/complain register kept?)				
9	Garbage bins (e.g. are there garbage bins at site? Are the numbers adequate? Is waste thrown to bins? Are the bins well places?)				
10	Drinking water supply (e.g. safe drinking water for worksite been supplied? Is drinking water adequate?)				
11	Sanitation facilities (e.g. is there separate male and female toilets established? Are they adequate? Hand wash materials and water being provided at toilets? Are those toilets sanitary?)				
12	Dust protection measures (e.g. is mask provided for worksite personnel? Is water sprayed frequently as needed to suppress dust? Are sand class materials covered with plastic sheets?)				
13	Noise barrier and reduction equipment (e.g. how much noise is generated by site? Does it exceed maximum human exposure limit? Are workers provided with noise reduction gears such as ear mufflers?)				
14	Shelter (e.g. is there a site office or shelter good enough to take shelter during rain or storm event?)				
15	First aid box (e.g. is there a first aid box at site? Are the contents of the first aid box adequate for primary treatment? Is the first aid box handled by at EHS/medical professional)				

Sl no.	Item	Exist in the worksite?		Recommendation And/ or Remarks	Time frame to comply
		Yes ☐	No ☐		
16	Toolbox meetings (e.g. are toolbox meeting regularly arranged? Are records kept?)				
17	Others (many other checklists can be formulated by the EHS professional on board)				
COVID -19 protocols on top of usual EHS checklist (this applied to campsite also)					
18	COVID-19 posters/signboards (e.g. are COVID-19 awareness/protocol posters are showing all visible corners of the site?)				
19	Entrance protocol (e.g. Is the COVID-19 worksite entrance protocol been followed as stipulated in the COVID -19 response guidance? Are adequate soaps, water has been kept at site entry? Are workers at entrance que using mask, hand gloves and hard shoes? Are disinfectant spray kept at site entry to disinfect underneath the boots of entering persons?)				
20	Vehicle entry protocol (e.g. has the vehicle disinfection protocol has been initiated?)				
21	Social distancing (e.g. are the workers maintaining social distancing all the time?)				
22	Sharing tools/machineries (e.g. are the tools and machineries are wiped to disinfect before sharing/working?)				
23	Disinfecting work area (e.g. is the worksite/ common surfaces, toilets etc. are disinfected before worksite opened in the morning? Has record being kept? Has the worksite been disinfected yesterday after closing for the day?)				
24	Restriction on worksite entry and exit (e.g. has workers being discouraged to travel frequently out of worksite or entering? Has records being kept?)				
25	Stock of disinfectant (e.g. is the stock of disinfectants, soap, PPEs are adequate at worksite?)				

*Attach photos

**Enter additional criteria as required for site specific measures

Reported by (ESC)	Checked by (TL)	Approved by (EA/IA)
Name Designation Signature Date	Name Designation Signature Date	Name Designation Signature Date
Received and agreed to comply by the representative of the contractor	Name Designation Signature Date	

B. Accident/ Incident Investigation Report

Class of Incident		Reported	
☐ Injure	☐ Property/ Plant Damage	Yes ☐ No ☐ Details:	
☐ Near Miss	☐ Environmental	Further Action Required	
		☐ Report to Authorities ☐ Other	
Details of Incident			
Date of Incident		Time of Incident	am ☐ pm ☐
Witness Name		Witness Contact	
Nature of Incident			
Location of Incident			
Description of Incident			
Details of damage to equipment/property			
Injured Person/s (if applicable)			
Name			
Address			
Date of Birth			
Occupation		Employer	
Referred/transferred to			
Recommended Preventive Action			
Details			
Completed by			
Name		Position	
Signature		Date	

C. Safety patrol/inspection report form

SITE SAFETY PATROL REPORT AND INSTRUCTION						
Date						
Inspector						
No	Location	Comment/instruction	Photo	Corrective action	Deadline	Responsible person

Reported by (ESC)	Checked by (TL)	Approved by (EA/IA)
Name Designation Signature Date	Name Designation Signature Date	Name Designation Signature Date
Received and agreed to comply by the representative of the contractor	Name Designation Signature Date	

Appendix 8 – Sample Outline of Compensatory Tree Planting Plan

COMPENSATORY TREE PLANTING PLAN

Note: The purpose of the planting plan is to fully assess the existing tree resources on the development site and specify an implementable strategy for ensuring that the net medium-term effect of the site's development on local arboreal resources is at least neutral relative to existing conditions. The planting plan is to be developed by the design-build contractor and approved by the Forest Department and local Union Parishad authorities prior to issuance of the Site Clearance Certificate.

1. Plan Rationale and Requirements

- Objective of plan
- Brief description of planned development producing need for plan
- Forest Department requirements for compensatory planting plans
- Roles and responsibilities for plan development and implementation
- Required approvals

2. Baseline Profile of Tree Resources on the Development Site

A. General description of tree cover

- Proportion of site covered
- Historical trends of tree cover and surrounding areas
- Hydrological, soil and site use factors influencing distribution of tree cover on site
- Notable species assemblages
- Ecological functions of existing trees and groups of trees
- Micro-climatic functions of existing trees and groups of trees
- Existing uses of on-site trees
- Values associated with on-site trees by local people

B. Inventory of existing trees on site

- Full inventory of all trees over 2 m height, tabulated by species and size (height, crown width) and native/introduced status
- List of identified significant specimens (trees that are highly valued for any reason, e.g., religious or spiritual; very large size; serve as a social meeting place; historically high yield of fruits, nuts or other products; medicinal importance; use by popular wildlife)

3. Trees Designated for Preservation, Removal and Planting

A. Inventory of trees to be preserved, based on site master plan

- List of trees by species and location
- Map of preserved trees
- Planned method of protecting trees during site clearing and construction

B. Inventory of trees to be removed, based on site master plan

- List of trees by species and location
- Map of clearance areas
- Planned method of removing trees and disbursing timber

C. Inventory of spaces for compensatory planting

- Number of trees to be planted, based on anticipated removals
- List and description of suitable on-site areas, including soil and moisture constraints

- List and description of possibly suitable off-site areas, including soil, moisture and land use constraints
- Map of potentially suitable on-site and off-site planting areas

4. Report on Consultation with Local Stakeholders

A. Stakeholders

- List of institutional stakeholders
- List of existing users of trees on site
- List of residents in the vicinity of the site

B. Summary of consultation events and formats

C. Findings of consultations

- Non-monetary values attached to site trees by stakeholders
- Monetary values of existing tree uses
- Location preferences for compensatory planting
- Species preferences for compensatory planting

5. Compensatory Planting Plan

A. Constraints and opportunities

- Survey of suitable sapling sources (saplings at least 2 m tall, in sufficient number to have at least two trees planted for each tree removed)
- Estimation of sapling costs by species
- Seasonal factors affecting planting
- Minimum and optimal spacing requirements for different species

B. Selected species and locations

- Identification of priority species based on site conditions and consultation findings
- Identification of priority planting locations based on site conditions and consultation findings
- Master planting plan map

C. Planting strategy

- Timing of planting activity
- Procurement of saplings, soil amendments and mulches
- Procurement of labor for planting
- Stakeholder participation in planting

D. Plantation maintenance strategy

- Identification of maintenance needs by species and location (watering, mulching, fertilization, trimming, weeding)
- Maintenance schedule
- Arrangement of labor and responsibility for on-site plantation maintenance
- Arrangement of labor and responsibility for off-site plantation maintenance
- Procurement of tools for plantation maintenance

6. Cost Estimates

- Estimated initial costs for planting
- Estimated recurring costs for plantation maintenance

7. Monitoring of Implementation

- monitoring parameters (e.g., tree survival rate, maintenance performance)
- method and frequency of monitoring
- public participation in monitoring plantations
- definition of feasible corrective actions in the case of poor performance

Appendix 9 – Sample Outline of Contractor Environmental Management Plan

CONTRACTOR ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

1. Purpose of the Plan

- Objectives
- Relationship to subproject/component EMP
- Relationship to specialized mitigation plans
- Performance indicators

2. Roles and Responsibilities in Plan Implementation

- Contractor's Environment, Health and Safety Representative
- Site engineers
- Emergency response focal persons
- Skilled workers
- Laborers

3. Legal Requirements

- Laws and regulations pertinent to the works
- Licenses and permits required

4. Special Contextual Issues

- Environmental (if any)
- Social (if any)
- Cultural (if any)

5. Scope of Works

- Description of infrastructure plan
- List of work locations and sites
- Applicable standards

6. Work Plan

- Resources (facilities, equipment, human resources)
- Coordination and phasing
- Timetable

7. Environmental Method Statements

- Boundary establishment and site clearing
- Soil protection and erosion prevention
- Runoff management
- Sediment control
- Dust prevention and suppression
- Noise and vibration impact management
- Storage of fuels, lubricants, coolants and other fluids
 - maintenance yard
 - construction sites
- Refueling and servicing equipment at the job site
- Monitoring of equipment condition
- Construction site safety management
- Materials stockpiles at the job site
- Chance Find Procedure for physical cultural resources

8. Waste Management

- Classes of waste produced by type of site
 - work sites
 - maintenance yards
 - construction camp
- Solid waste collection
 - collection methodology
 - collection frequency
 - responsibility for collection
- Solid waste recycling
 - recyclable materials
 - entities capable of accepting recyclable materials
 - recycling plan
- Solid waste disposal
 - composition of non-recyclable waste stream
 - legal and available disposal options in local area
 - disposal plan
- Waste oil and other hazardous wastes
 - types of hazardous liquids
 - methods of storage
 - collection methodology
 - collection frequency
 - legal and feasible treatment and disposal options
 - entities capable of accepting waste oil and other hazardous fluids and their containers
 - waste oil disposal plan

9. Emergency Response Plan

- Characterization of possible emergency situations for sites
 - spills and accidental releases
 - fires and explosions
 - serious accidents
 - other foreseeable situations
- Key actors (including names and contact information, to be updated regularly)
- Chain of command and process steps in emergency situations
- Documentation and reporting of incidents

10. Monitoring and Reporting Framework

- Purpose of monitoring
- Compliance monitoring parameters and methods
- Effects monitoring parameters and methods
- Responsibilities in monitoring
- Mechanism for corrective actions
- Monitoring schedule
- Reporting requirements

11. Training Needs and Plans

- Training needs assessment
- Training targets and content
- Training plan

Appendix 10 – Outline of Soil Erosion Prevention Plan

SOIL EROSION PREVENTION PLAN

1. Plan Rationale and Requirements

- Objective of plan
- Description of work sites and earthworks
- Roles and responsibilities for plan development, approval, implementation and supervision

2. Identification of Erosion Risks Specific to Site and Materials

- Erodibility of natural site soils
- Erodibility of fill materials
- Erodibility of stockpiled building materials
- Erosion by rainfall
- Erosion by running water (site runoff, flash floods, fluvial flooding)
- Erosion by wind
- Types of erosion (e.g., sheet, rill, gully, mass)

3. Method Statements

- Timing of earthworks to limit erosion risk (seasonal and weather-related)
- Mulching
- Temporary ground covers (e.g., jute mats)
- Permanent slope protection measures (e.g., terracing, geocells)
- Temporary drainage arrangements to avoid concentration of flow
- Check dams and sediment traps
- Temporary armored runoff channels
- Runoff infiltration swales
- Stockpile covers (tarpaulins)
- Stockpile containment dams

4. Monitoring and Correction

- Method of site monitoring for active erosion and erosion risk
- Frequency of site monitoring for active erosion and erosion risk
- Practices for correcting different types of erosion

Follow-up to corrective actions

Appendix 11 – Sample Outline of Construction Camp Management Plan

CONSTRUCTION CAMP MANAGEMENT PLAN

1. Purpose of the Plan

- Objectives
- Relationship to subproject EMP
- Performance indicators

2. Environmental and Social Context of Construction Camp

- Location
- Road access and distance to road sites
- Service infrastructure
- Local topography
- Prevailing wind
- Drainage
- Nearby water bodies
- Surrounding land use
- Local communities
 - proximity
 - population
 - ethnic makeup
 - employment and livelihoods

3. Camp Capacity and Resident Profile

- Projected number of resident workers during different phases of work
- Expected number of accompanying family members
- Expected number of support staff living on site
- Expected ethnic makeup of camp residents

4. Camp Infrastructure

- Kitchens
- Eating facilities
- Toilets and septic system(s)
- Wash-up facilities
- Accommodations
- Storage
- Water supply and water heating
- Electricity
- Cooking fuel
- Backup generators
- Firefighting equipment
- Parking
- Fencing
- Site layout
- Camp construction schedule

5. Cleaning and Maintenance Plan

- Cleaning and sanitation
 - responsibilities
 - methods
 - schedule
- Facility inspection and maintenance
 - responsibilities
 - inspection methodology
 - inspection schedule
 - maintenance schedule

6. Wastes and Waste Management

- Solid waste
 - expected composition of solid waste stream
 - collection and management of recyclables
 - collection and management of non-recyclables
 - collection and composting of organic waste
- Liquid waste
 - expected composition of liquid waste stream
 - management of gray water
 - management of sewage

7. Rules Governing Resident Behavior

- Rules for conduct when in camp
- Rules for conduct outside camp
- Family members policy
- Visitor policy
- Rules regarding alcohol and illegal drugs
- Procedure for adjudicating disputes among residents

8. Training

- good practices for disease prevention
- camp safety and fire suppression

9. Monitoring and Reporting

- Purpose of monitoring
- Monitoring responsibilities
- Monitoring methodology
- Monitoring frequency
- Reporting schedule

10. Camp decommissioning

- Responsibility for decommissioning
- Procedure for decommissioning
- Timing of decommissioning

Appendix 12 – Sample Outline of Site Reinstatement Plan

SITE REINSTATEMENT PLAN

1. Plan Rationale and Requirements

- Objective of plan
- Description of work sites and earthworks
- Roles and responsibilities for plan development, approval, implementation and supervision

2. Schedule of works

- Construction schedule by building and area
- 'Reinstatement-ready' schedule by site area
- Seasonal constraints on vegetation establishment
- Reinstatement and planting schedule by site area
- Post-planting monitoring and maintenance schedule (through end of defects period)

3. Vegetation specifications

- New tree plantings indicated in detailed design (landscaping plan)
 - number
 - preferred species
 - planting locations
- New tree plantings required under Compensatory Tree Planting Plan
 - number
 - preferred species
 - planting locations
- Ground cover specified for infiltration areas
 - total planting area
 - locations of infiltration areas
 - preferred species
- Ground cover specified for recreational use areas
 - total planting area
 - locations of recreational use areas
 - preferred species
- Ground cover specified for ornamental displays
 - total planting area
 - locations of ornamental displays
 - preferred species

4. Sourcing of key materials

- Saplings
- Root stock
- Seed
- Soil amendments
- Mulches and other protective materials (e.g., jute mats)

5. Method statements

- Removal, storage and replacement of topsoil
- Slopes (maximum slope and stabilizing measures)
- Pre-planting soil suitability assessment and soil amendment
- Tree planting
- Bare root planting
- Seeding

- Use of mulches and other protective materials
- Watering (by vegetation type)
- Fertilization (by vegetation type)
- Weeding, thinning and trimming (by vegetation type)

6. Monitoring and Follow-up

- Metrics and methods for measurement of vegetation establishment success (e.g., vigor, survival rate by time period, density, coverage)
- Frequency of site monitoring
- Documentation and reporting of vegetation monitoring results
- Criteria for replanting and infill planting

Appendix 13 – Sample Outline of Occupational Health and Safety Plan

OCCUPATIONAL HEALTH AND SAFETY PLAN

1. Plan Rationale and Requirements

- Objective of plan
- Description of work sites and major work activities
- Roles and responsibilities for plan development, approval, implementation and supervision

2. Identification of Health and Safety Risks Specific to Site and Activities

- Inventory of hazards inherent to work site
- Inventory of dangerous activities
- Inventory of hazardous materials used and stored on site
- Inventory of health risks for workers

3. Method Statements for Risk Reduction Practices

- Task-appropriate PPE and its proper use
- Operating heavy machinery
- Working in proximity to mobile heavy machinery
- Working at height
- Working in trenches and holes
- Working in underground enclosed spaces
- Electrical work
- Handling hazardous materials
- Handling and storing explosive and flammable materials
- Use of cranes
- Lifting
- Arc welding
- Power cutting and grinding
- Dust suppression
- Spill prevention and response
- Fire suppression
- Personal hygiene on the work site

4. Work Site Setup and Maintenance Specifications

- Provision and placement of fire suppression equipment
- Provision and placement of spill containment and cleanup supplies
- Safe storage spaces for hazardous, flammable and explosive materials
- Barriers and fencing
- Provision of adequate toilets based on worker population
- Provision of adequate wash-up facilities based on worker population
- Provision of unlimited drinking water meeting national standard for drinking water
- Provision of shaded break areas
- Food preparation and eating facilities

5. COVID-19 Containment and Prevention

- Practices as specified in ADB and GOB's Technical Guidance for Social and Institutional Containment and Prevention

6. Emergency Response Plan

- Designation of focal persons and 24/7 contact details
- Definition of chain of command

- Flowchart of response actions
- Identification, placement, labeling and upkeep of emergency response equipment
- Materials for use in training
- Emergency drill procedure and schedule

7. Training

- Induction training (content and timing)
- Refresher training (content and timing)
- Health and safety meetings
- Specialized tasks training (e.g., for heavy equipment operators and at-height workers)
- Emergency response training

8. Monitoring

- Site health and safety audits (methods, parameters, frequency, documentation)
- Spot check system
- Framework for follow-up and corrective action

Appendix 14 – Sample Outline of Spill Prevention and Response Plan

SPILL PREVENTION AND RESPONSE PLAN

1. Plan Rationale and Requirements

- Objective of plan
- Description of land port storage spaces and transshipment activity
- Roles and responsibilities for plan development, approval, implementation and supervision

2. Characterization of Hazardous and Noxious Cargo Risks

- Fuels
- Oils
- Bagged chemical substances
- Containerized dry chemicals
- Containerized liquid chemicals
- Bulk dry chemicals
- Bulk liquid chemicals
- Flammable materials
- Explosive materials
- Non-compatibility between classes of substances

3. Scoping of Spill Scenarios

- Truck rollovers and collisions on site
- Leaks from cargo on trucks
- Leaks from stored materials (in warehouses)
- Leaks from stored materials (outside)
- Spills during transshipment handling
- Explosions
- Fires
- Penetration of storage arrangements by flash flood

3. Method Statements for Spill Prevention

- System for identification of potentially hazardous and noxious incoming cargos
- Characterization of spill risk at time of entry
- Hazardous and noxious cargos registry
- Safe handling and transfer procedures (for each class of hazardous and noxious materials)
- Safe indoor storage requirements (for each class of material, taking account of non-compatibilities)
- Raised platforms for outdoor storage
- Temporary canopies for outdoor storage
- Collision and rollover prevention

4. Spill Response and Cleanup Plan

- Designation of point persons for response, including 24/7 contact details
- Definition of chain of command for response
- Flowchart of spill response actions
- Method statement: containment
- Method statement: cleanup
- Method statement: treatment and disposal
- Placement and upkeep of spill response and cleanup equipment and supplies
- Materials for use in training
- Notification protocols (people on site, authorities and public)

- Protocol for when to seek guidance from DOE or other agencies

5. Training

- Training for spill response leaders (content, frequency, outside expertise needed)
- Training for other site personnel (content, frequency)
- Training for laborers involved in transshipment activity (content, frequency)

Appendix 15 – Consultation Records

List of participants in Focus Group Discussion

Sp: Salta-
Venue: Bagda. Vil: Chitulia

Date: 13.8.2023

Sl. No.	Name of Respondent	Address	Mobile no	Signature
০১.	রাবেয়া বেগম ০১ নং আমতলী ২. নং. ছোয়াব্যান	আমতলী	০১৭৩২৬২০ ১২৭	
০২.	সুজিতা মাহা মহিষ	০১৭২৩৩১৭৪৭৩ svj0y5ek@26100@gmail.com	০১৭২৩৩১৭৪৭৩	
০৩.	মন্মোহন চৌধুরী	আমতলী	০১৭৪৯০৯০০৯৬	সাত্তা
০৪.	আবুনাঈদ হোসেন	গাঙ্গাড়া	০১৭২৪৪৭০৪১১	আবুনাঈদ
০৫.	রাবেয়া বেগম	"		রাবেয়া
০৬.	ছদ্মি মিয়া	"	০১৭০৪২৫২২১৪	ছদ্মি
০৭.	মামুন বিদ্যায়	আমতলী	০১৭৪৩২৪২০১৭	মামুন
০৮.	হালদান কবির	"	০১৪৬৬৭৫৬৫৬	হালদান
০৯.	আ. হাকিম মিয়া	"	০১৭১৬৩৭২৭৭৭	আ. হাকিম
১০.	হাবিব মোল্লা	গাঙ্গাড়া	০১ ৭৭৫২৭৭৫৪৪	হাবিব মোল্লা

Signature of the Interviewer:

Date:

Appendix 16 – Proposed Terms of Reference for Environment, Health and Safety Officers

The Environment, Health and Safety Officers (EHSOs) are critical to the timely and effective implementation of the EMP/EMoP, as they will be responsible for executing all compliance activities pertaining to works and operations of the EA. The EHSOs will answer to the Environmental Safeguards Focal Person (ESFP). The responsibilities of each EHSO are as follows:

- (i) Prepare site-specific monitoring checklists for assigned investment sites under the control of the EA, based on the contents of the EMP/EMoP, to assess site-level compliance with prescribed mitigation measures and effectiveness in meeting relevant national standards for key environmental parameters;
- (ii) Conduct compliance and effects monitoring on at least a monthly basis (including both regular inspections and spot checks) at all assigned investment sites under the control of the EA, and compile monitoring results in quarterly monitoring reports to the EA's ESFP;
- (iii) Support and collaborate with any outside entities contracted to conduct sampling, testing and analysis of environmental parameters, as identified in the EMP/EMoP, and incorporate their results into quarterly monitoring reports;
- (iv) Engage directly with site engineers to propose and ensure effective implementation of corrective actions needed to address emerging and recurrent problems, including both compliance issues and environmental effects that violate relevant national standards;
- (v) Design and orchestrate training for workers and site engineers as may be needed to forestall, correct or lessen emerging and recurrent problems with compliance and deleterious environmental effects derived from site activity;
- (vi) Facilitate and participate in any site visits conducted by officials of DOE, DIFE or other relevant regulatory agencies;
- (vii) Assist the ESFP with preparation of the EA's environmental reporting, including but not limited to its submissions to the PIU and/or SOU; and
- (viii) Prepare a Notification of Environmental Harm for immediate submission to DOE in the event of any serious release or other deleterious event occurring on any site under the EA's control, ensure rapid appropriate action by the Contractor, and coordinate follow-up with DOE as needed.

Appendix 17 – Outline of Semi-Annual Environmental Monitoring Report

The Program Steering Committee is required to submit semi-annual environmental monitoring reports to ADB, for review and public disclosure on the ADB website. The semi-annual reports will be produced by the Safeguards Oversight Unit. A sample report outline, which can be adapted as necessary, is provided below.

1. Introduction

- Report purpose
- Overview of subproject components and sites subject to monitoring
- Summary of project implementation progress

2. Review and Verification of Clearance History

- Clearances required and obtained
- Clearances due for renewal in upcoming monitoring period
- Clearance lapses and plans for reinstatement

3. Review of Contractor Environmental Monitoring Reports (CEMRs)

- Reports submitted/outstanding
- Quality of reports received and comments issued
- Issues of note from CEMRs, and contractor follow-up

4. Summary of Works and Prescribed Mitigation

- Major work activities by site
- Mitigation measures prescribed
- Ongoing corrective actions from previous monitoring period

5. Summary of Monitoring Activity

- number and dates of site visits
- monitoring methodology used

6. Monitoring Results

- instances of non-compliance
- violations of standards and observed negative environmental effects
- on-site communication with contractor personnel
- photographs

7. Corrective Action Required

- description and explanation of non-compliance or concerns noted
- required actions with timeframe and responsibility
- corrective actions undertaken in the current period
- corrective actions to continue into the next period

8. Attachments

- Notices of Non-Compliance issued
- Additional photographs

Appendix 18 – List of Fisheries found in the project area

Source: BWDB (2022) EIA for Integrated Water Resources Management for Improvement of Drainage Congestion in Tungipara & Kotalipara Upazila Under Gopalganj District

SL	Common group	Family	Local Name	Scientific Name	Present status	Remarks
1	Carps	Cyprinidae	Rui	<i>Labeo rohita</i>	Common	
2			Catla	<i>Catla catla</i>	Common	
3			Mrigal	<i>Cirrhinus mrigala</i>	Common	
4			Kalibaus	<i>Labeo calbasu</i>	rare	Due to hamper the migration route
5			Bata	<i>Labeo bata</i>	rare	do
6			Raek/ Tatkini	<i>Cirrhinus reba</i>	Very rare	do
7			Gonia	<i>Labeo gonius</i>	Very rare	do
8			Nandina	<i>Labeo nandina</i>	Very rare	do
9			Elanga	<i>Bengla elanga</i>	Rare	
10	Indian river shad	Clupeidae	Chapila	<i>Gudusia chapra</i>	Common	
11		Clupeidae	Kachki	<i>Corica soborna</i>	Common	
12	Barbs and Minnows	Cyprinidae	Mola	<i>Amblypharyngodon mola</i>	Very common	
13			Lamba chela	<i>Chela bacaila</i>	Common	
14			Phutani punti	<i>Puntius phutunio</i>	Very common	
15			Jatputi	<i>Puntius sophore</i>	Very common	
16			Titputi	<i>Puntius ticto</i>	Very common	
17			Sharpunti	<i>Puntius sarana</i>	Very Rare	Due to breeding & rearing problems
18			Darkina	<i>Esomus danricus</i>	Common	

SL	Common group	Family	Local Name	Scientific Name	Present status	Remarks
19			Piali	<i>Aspdoparia morar</i>	Very rare	Interrupt the linkage between river & floodplain
20			Chap chela	<i>Danio deverio</i>	commom	
21		Scilbeidae	Bash pata	<i>Ailia punctata</i>	Very rare	Unavailability of riverine species & water in time
22	Catfishes	Bagridae	Tengra	<i>Mystus vittatus</i>	Common	
23			Bujuritengra	<i>Mystus tengra</i>	Common	
24			Aor	<i>Mystus aor</i>	Very rare	Unavailability of riverine species
25		Siluridae	Pabda	<i>Ompok pabda</i>	Very rare	do
26			Boal	<i>Wallago attu</i>	Common	
27		Clariidae	Magur	<i>Clarius batrachus</i>	Very common	
28		Heteropneustidae	Shing	<i>Heteropneustes fossilis</i>	Very common	
29	Blue Panchax	Aplocheilidae	Khanpona	<i>Aplocheilus panchax</i>	Common	
30	Snakeheads	Channidae	Taki	<i>Channa punctatus</i>	Very common	
31			Cheng	<i>Channa orientalis</i>	Common	
32			Shol	<i>Channa striatus</i>	Very common	
33			Gojar	<i>Channa marulius</i>	Common	
34	Eels	Mastacembelidae	Tara baim	<i>Macrognathus aculeatus</i>	Common	
35			Guchibaim	<i>Mastacembezus pancalus</i>	Very common	
36		Centropomidae	Kuchia	<i>Cuchia cuchia</i>	Common	
37			Nama chanda	<i>Chanda nama</i>	Common	
38			Lal chanda	<i>Chanda ranga</i>	Common	
39		Sciaenidae	Poa	<i>Pama pama</i>	Very rare	
40	Perches	Anabantidae	Koi	<i>Anabas testudineus</i>	Very common	
41			Khalisha	<i>Colisafasciatus</i>	Very common	
42		Badidae	Napit koi	<i>Badis badis</i>	Common	
43		Nandidae	Veda	<i>Nandus nandus</i>	Very common	
44	Feather backs	Notopteridae	Foli	<i>Notopterus notopterus</i>	common	
45			Chitol	<i>Chitala chitala</i>	Rare	
46	Loaches	Cobitidae	Gutum	<i>Lepidocephalus guntea</i>	Very common	
47			Rani	<i>Botia dario</i>	Very rare	Lack of riverine species & water in time
48	Tank Goby	Gobiidae	Bailla	<i>Glossogobious giuris</i>	Common	
49		Trypauchenidae	Lal chew	<i>Trypauchen vagina</i>	Rare	
50			Sada chew	<i>Gobiades rubicundus</i>	Rare	
51	Freshwater gar fish	Belontiidae	Kakila	<i>Xenentodon cancila</i>	Common	
52	Fresh water globe fish	Tetraodontidae	Patca	<i>Tetraodon cutcutia</i>	Rare	
53			Potca	<i>Tetraodon patka</i>	Very rare	Destruct the habitat

Appendix 19 – List of Flora and Fauna (including avians) found in the project area

Source: BWDB (2022) EIA for Integrated Water Resources Management for Improvement of Drainage Congestion in Tungipara & Kotalipara Upazila Under Gopalganj District

Fruit and Timber Tree Species		
Local Name	Scientific Name	Availability
Mehogani	<i>Swietenia mahagoni</i>	Common
Babla	<i>Acacia auriculiformis</i>	Fairly Common
Akashmoni	<i>Acacia moniliformis</i>	Common
Hargozakata	<i>Acanthus illicifolius</i>	Common
Bel	<i>Aegle marmelos</i>	Common
Koroi	<i>Albizia procera</i>	Common
Sirish	<i>Albizia lebbek</i>	Fairly Common
Debdaru	<i>Polyalthia longifolia</i>	Fairly Common
Grajan	<i>Dipterocarpus turbinatus</i>	Common
Supari	<i>Areca catechu</i>	Common
Kanthal	<i>Arlocarpus heterophyllus</i>	Common
Barta, Bankatal	<i>Artocarpus lacucha</i>	Fairly Common
Nim	<i>Azadirachta indica</i>	Common
Jowa bans	<i>Bambusa tulda</i>	Fairly Common
Dumur	<i>Ficus hispida</i>	Fairly Common
Jhau	<i>Casuarina littoria</i>	Fairly Common
Shimul	<i>Bombax ceiba</i>	Common
Tal	<i>Borassus flabellifer</i>	Common
Bet	<i>Calamus viminalis</i>	Fairly Common
Akanda	<i>Calotropis gigantia</i>	Rare
Swetakand	<i>Calotropis procera</i>	Fairly Common
Ghoranim	<i>Melia semparvirens</i>	Fairly Common
Pepe	<i>Carica papaya</i>	Fairly Common
Bandarlathi, Sonali	<i>Cassia fistula</i>	Common
Kalkasunde	<i>Cassia sophora</i>	Rare
Chandanbeto	<i>Chenopodium ambrosioides</i>	Rare
Chorekanta	<i>Chrysopogonaciculatus</i>	Rare
Jarul	<i>Lagerstroemia speciosa</i>	Fairly Common
Patipata	<i>Clyngedichotoma</i>	Fairly Common
Narikel, Dab	<i>Cocos nucifera</i>	Rare
Patabahar	<i>Codiaeum variegatum</i>	Common
Bilati gab	<i>Diospyros discolor</i>	Common
Kalokoroi	<i>Albizia lebbek</i>	Fairly Common
Sishoo	<i>Dalbergia sisoo</i>	Fairly Common
Krishnachura	<i>Delonix regia</i>	Fairly Common
Karanja	<i>Derris indica</i>	Common
Gab	<i>Diospyros peregrina</i>	Fairly Common
Mandar	<i>Rythrina variegata</i>	Fairly Common
Eucalyptus	<i>Eucalyptus citriodora</i>	Fairly Common
Segun	<i>Tectona grandis</i>	Fairly Common
Swetkerui	<i>Euphorbia thymifolia</i>	Common
Bot	<i>Ficus altissima</i>	Fairly Common
Hizal	<i>Barringtonia acutanaula</i>	Fairly Common
Am	<i>Mangifera indica</i>	Common
Amlaki	<i>Embelica officinalis</i>	Common
Gamari	<i>Gmelina arborea</i>	Common
Bichi kola	<i>Musa sapientum</i>	Common
Dalim	<i>Punica granatum</i>	Fairly Common
Khajur	<i>Phoenix sylvestris</i>	Common
Debdaru, Saralgoch	<i>Polyalthia longifolia</i>	Common
Karanja, Karamcha	<i>Pongamia pinnata</i>	Fairly Common
Peyara	<i>Psidium guajava</i>	Common
Veranda	<i>Ricinus communis</i>	Fairly Common
Nalkhagra	<i>Saccharum spontaneum</i>	Common
Raintree	<i>Samanea saman</i>	Common
Jam	<i>Syzygium grandis</i>	Common
Tetul	<i>Tamarindus indicus</i>	Common

BIRDS		
Local Name	Scientific Name	Availability
Bhubancheel	<i>Milvus migrans</i>	Rare
Sadacheel	<i>Elanus caeruleus</i>	Rare
Mala gugu	<i>Streptopelia decaocto</i>	Fairly Common
Teya	<i>Psittacula krameri</i>	Common
Kokil	<i>Eudynamis scolopacea</i>	Common
Suichora	<i>Merops schenaulti</i>	Fairly Common
Bulbul	<i>Pycnonotus jocosus</i>	Fairly Common
Doyal	<i>Copsychus saularis</i>	Common
Tuntune	<i>Orthotomus sutorius</i>	Common
Finga	<i>Dicrurus macrocercus</i>	Fairly Common
Patikak	<i>Cervinus splendens</i>	Common
Darkak	<i>Corvus macrorhynchos</i>	Common
Bhatsalik	<i>Acridotheres tristis</i>	Common
Go salik	<i>Stumus contra</i>	Common
Jhutisalik	<i>Acridotheres fuscus</i>	Common
Chorui	<i>Passer domesticus</i>	Common
Pancowri	<i>Phalacrocorax carbo</i>	Rare
Borobok	<i>Bubulcus ibis</i>	Common
Sadabok	<i>Egretta garzetta</i>	Common
Kani bok	<i>Ixobrychus flavicollis</i>	Common
Lal bok	<i>Ixobrychus cinnamomeus</i>	Fairly Common
Kali bok	<i>Ardeola grayii</i>	Fairly Common
Shonkhocheel	<i>Haliastur indus</i>	Rare
Balihas	<i>Dendrocygna javanica</i>	Fairly Common
Chokha	<i>Tadorna ferruginea</i>	Common
Dahuk	<i>Gallinago cinerea</i>	Common
Pecha	<i>Athya brama</i>	Common
Kath thokra	<i>Dinopium javanese</i>	Rare
Lokkhi Pecha	<i>Tyto alba</i>	Fairly Common
Machranga	<i>Halcyon pileata</i>	Common

Appendix 20 – Sample outline of dredged material management plan

1.0 PURPOSE - The purpose of the Dredged Material Management Plan (DMMP)

2.0 DESCRIPTION OF EXISTING RIVER - Channel Dimensions

3.0 GEOTECHNICAL INVESTIGATIONS

3.1 Regional and site geology – description of river and regional geology

3.2 Field explorations and laboratory testing

3.3 Design considerations

3.3.1 Selection of primary dredging parameters - The geotechnical design parameters are used to develop the features presented in the feasibility study or geotechnical investigations. They are varied and range from the traditional geotechnical parameters for shear strength and consolidation to hydraulic dredging parameters for bulking, retention, and shrinkage. These preliminary design parameters are to be developed from a variety of sources. These sources include contractor works, recent inhouse experience of BWDB with the construction of hydraulic levees, historic in-house data associated with dredged material placement, and local knowledge based on the historic performance of foundation soils at specific placement areas.

3.3.2 Shoaling rate

3.3.3 Bulking factor

3.3.4 Retention factor

3.3.5 Shrinkage factor

3.3.6 Shear strength

3.4 SLOPE STABILITY AND FOUNDATION CONCERNS

3.4.1 Upland placement area - the design of the final perimeter levee heights for the next 50 years will be guided by the results of the slope stability analyses.

3.4.2 Beneficial use features – will come from community consultation.

3.5 CONSTRUCTION ISSUES

3.5.1 Excavatability

3.5.2 Dredging - Channel deepening of the inshore reaches would require the use of pipeline dredges of sufficient size and power to pump the new work materials to the areas indicated.

3.5.3 Placement Areas – will come from community consultation.

3.5.4 Beneficial Use Features

4.0 DREDGED MATERIAL QUANTITIES

4.1 ALLOWABLE OVERDEPTH – aside calculation of dredged material and dredging depths an additional depth outside the required template is permitted to allow for inaccuracies in the dredging process. This additional dredging allowance is referred to as dredging tolerance, or allowable overdepth (AO).

4.2 NONPAY DREDGING - Nonpay dredging is dredging outside the paid AO that may occur due to such factors as unanticipated variations in substrate, incidental removal of submerged obstructions, or wind or wave conditions.

4.3 NON-FEDERAL DREDGING - The Non-Federal dredging quantity is defined as a percentage of the channel shoaling by section

4.4 ADVANCE MAINTENANCE - Advance maintenance consists of dredging deeper than the authorized channel dimensions so as to provide for the accumulation and storage of sediment. In critical and fast-shoaling areas, it is required to avoid frequent redredging and to ensure reliability and least overall cost for operating and maintaining the project authorized dimensions.

4.5 DREDGING FREQUENCY

4.6 PREDICTED SHOALING RATES

4.7 MAINTENANCE MATERIAL QUANTITIES

5.0 BORROW AND DISPOSAL

5.1 PLANNING CONSIDERATIONS

5.2 UPLAND PLACEMENT AREA DESCRIPTIONS

5.3 BENEFICIAL USE FEATURES

5.4 OFFSHORE PLACEMENT AREAS

6.0 ADDITIONAL BORINGS AND LABORATORY TESTING PROGRAM

6.1 SUBSURFACE INVESTIGATIONS

6.2 LABORATORY TESTING

6.3 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE EVALUATION

7.0 CONSTRUCTION

7.1 CONTRACT SCHEDULE

7.2 CONSTRUCTION METHOD

7.3 MATERIAL SOURCES AND MATERIAL INVESTIGATIONS