Chittagong Port Authority
People's Republic of Bangladesh

Preliminary Environmental and Social Impact Assessment (ESIA) Report of Bay Terminal

National Document

Chattogram Port Authority (CPA), Chattogram

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CHITTAGONG PORT AUTHORITY

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ABBREVIATIONS AND ACRONYMS

CHA	Critical Habitat Assessment
CHS	Community Health and Safety
CIA	Cumulative Impact Assessment
CPA	Chattogram Port Authority
DIA	Direct Impact Area
DoE	Department of Environment
DWT	dead weight tonnage
ECC	Environmental Clearance Certificate
EHS	Environment, Health, and Safety
EIA	Environmental Impact Assessment
ERG	Emergency Response Group
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESMoP	Environmental and Social Monitoring Plan
ESS	Environmental and Social Standards
E&S	Environmental and Social
ESOHS	Environmental Social Occupational Health and Safety
FD	Forest Department
FGD	Focus Group Discussion
GBV	Gender Based Violence
GIIP	Good International Industry Practice
GIS	Geographical Information System
GoB	Government of Bangladesh
GRM	Grievance Redress Mechanism
H&S	Health and Safety
HIV/AIDS	Human Immunodeficiency Virus / Acquired immunodeficiency syndrome
IIA	Indirect Impact Area
IMT	Incident Management Team
IPF	Investment Project Financing
IRT	Incident Response Team
MoEFCC	Ministry of Environment, Forest and Climate Change
MoL	Ministry of Land
MoLE	Ministry of Labour and Employment
MoWR	Ministry of Water Resources
NGO	Non-Governmental Organization
NOC	No Objection Certificate
OHS	Occupational Health and Safety
PAPs	Project Affected Persons
PPE	Personal Protective Equipment
SEA	Sexual Exploitation and Abuse
SH	Sexual Harassment
SIA	Social Impact Assessment
TMP	Traffic Management Plan
WB	World Bank
WBG	World Bank Group

Executive Summary

Project Background

The Bay Terminal has been proposed in the Bay of Bengal, off the coast of Patenga, in the city's Halishahar Ananda Bazar area. It is near the existing Chattogram Port and Chattogram Export Processing Zone. The proposed Bay Terminal will address the capacity limits of Chattogram Port. The maximum draft of the existing Chattogram Port is only 9.2 meters, requiring smaller ships to be used to transport cargo to and from large freighters that are anchored in the bay.

The present-day situation calls for changes in the Chattogram Port's current performance through improvement in the current hinterland connections of the port together with the different intermodal connections and links. The vital role of Chattogram Port for Bangladesh underlines the necessity of investigating how best it should be developed to meet future challenges. Toward enhancing the existing handling capacity and future demand, the **Chattogram Port Authority (CPA)** plans for one of the largest and most ambitious projects – **the Bay Terminal** – the future Chattogram Port.

After completion, the Bay Terminal is expected to significantly contribute to the port's containerized cargo handling capability. It is also expected to significantly improve turnaround time, draft, dead weight tonnage (DWT), container carrying capacity, berthing facilities, etc. vessels, calling at the port with their connectivity, fuel oil unloading, etc., which will meet present and future demand.

The Bay Terminal Project will involve the (a) construction and operation of the port terminal, including auxiliaries such as road networks, rail networks, power, and water supplies; (b) construction of the breakwater fronting the terminal; and (c) capital and maintenance dredging of the channel. Supporting the operation of the port terminal, structures such as road and rail links and drainage outlets will also be part of the Bay Terminal Project. These project components and activities will be the subject of this **preliminary Environmental and Social Impact Assessment (ESIA)**.

Purpose of the Preliminary Environmental and Social Impact Assessment (ESIA)

The objective of this preliminary ESIA for the proposed Bay Terminal Project, which followed the guidelines of the approved Environmental Impact Assessment (EIA) Terms of Reference (ToR) prescribed by the Department of Environment (DOE, vide its Memo No. DoE/Clearance/5645/2016/380, dated September 8, 2016), World Bank'S Environmental and Social Framework (ESF), and the World Bank Group's Environmental, Health, and Safety (EHS) Guidelines specific for Ports, Harbors, and Terminals, included the following:

- Assess the environmental and social profile of the project area and its surrounding areas;
- Preliminarily assess the environmental and social impacts of the project on the established environmental and social baseline;
- Identify, assess, and specify initial measures and standards to be included in the detailed design, construction, and operation of the proposed project that are necessary to mitigate these environmental and social impacts and reduce them to acceptable levels; and,
- Prepare an initial Environmental and Social Management Plan (ESMP) and the appropriate monitoring plan which will be updated during detailed engineering phase.

This preliminary ESIA along with the ESMP will be updated and finalized during detailed engineering with additional field surveys, stakeholder consultation, necessary modeling, analysis and interpretation of other study findings, design consideration and analyzing the impact. The updating and finalization will include:(a) ascertain the impact areas based on quantitative result of sediment transport modeling; (b) update and present more detailed information on the design and operational features of the entire project; (c) identify all other associated facilities that must be included in the ESIA using the WB's definition of associated facilities; (d) include other environmental and social baseline information derived from other ongoing and completed studies including results of other consultations; and (e) incorporate results of related E&S documents such as RAP, SEP and CIA.

Policy, Legal, and Administrative Frameworks

The Government of Bangladesh (GoB) Ministry of Environment, Forestry, and Climate Change (MoEFCC) is the apex body with the mandate for matters relating to the state of the environment in Bangladesh. Realizing the ever-increasing importance of environmental issues, the MoEFCC was established in 1989 and is a permanent member of the Executive Committee of the National Economic Council (ECNEC), the decision-making body for economic policy, and is also responsible for approving public investment projects. Under the MoEFCC, the following agencies undertake specific tasks within the framework of the MoEFCC's mandate: Department of Environment (DoE), Forest Department (FD), Ministry of Land (MoL), Ministry of Labour and Employment (MoLE), Ministry of Water Resources (MoWR), and Chattogram Port Authority (CPA).

The GoB environmental, labor, health and safety, gender, and social legislation will govern the implementation of various proposed Bay Terminal Project components.

The proposed Bay Terminal Project falls under the Red Category according to the Bangladesh Environment Conservation Rules ECR-2023 (update from ECR-1997). Under this category, it is mandatory to carry out EIA, including the Environment Social Management Plan (ESMP), and, where necessary, develop a Resettlement Action Plan (RAP) for getting an Environmental Clearance Certificate (ECC) from the DoE.

Under the GoB environmental regulations, studies needed for the proposed Bay Terminal Project are the Initial Environmental Examination (IEE), EIA, and EMP, including the Environmental Monitoring Plan (EMoP). The studies are related to the types of development interventions and impacts on environmental components (physical, biological, and socio-economic) at different implementation stages (pre-construction, construction, and operation). Environmental studies are conducted based on primary data collected during site visits, from socio-economic, hydrological, topographic, geotechnical, and engineering surveys, data collected from public consultation meetings, and secondary data.

International conventions, treaties, and protocols (ICTPs) on the environment, pollution control, biodiversity conservation, and climate change ratified by the GoB will also govern the implementation of the proposed Bay Terminal Project.

The proposed Bay Terminal Project has been identified as a high-risk category because of its potential environmental and social impacts on WB's ESS. The salient parameters include significant E&S and OHS risks, low regulatory and institutional capacity, and low technical capacity.

Project Description

The CPA is the Implementing Agency (IA) of the proposed Bay Terminal Project. The site yard for the Chittagong Bay Terminal is demarcated by coordinates at four corners: the northeast corner at 22°21'1.4398"N, 91°45'35.8652"E; the southeast corner at 22°17'27.8106"N, 91°46'14.3496"E; the southwest corner at 22°17'22.0798"N, 91°45'31.7613"E; and the northwest corner at 22°20'56.4023"N, 91°44'58.435"E. The breakwater extends from north to south, starting at 22°21'3.2964"N, 91°44'5.249"E, and ending at 22°17'22.0798"N, 91°45'31.7613"E. The project is located under North Halishahar, Ward No. 37; Middle/South Halishahar, Ward No. 38; and South Kattoli, Ward Nos. 11 and 26. The landside portion of the project site is situated in the Halishahar region of Chattogram, west of the existing Chattogram Port and north of the Chattogram Export Processing Zone (CEPZ). Access to the project site is provided by the Port Link Road and coastal roads to the east and the Bay of Bengal to the west.

The project site will have a total land area of approximately 2,500 acres, of which 1,620 acres are reclaimed from the sea, 500.695 acres are khas land, 188.89 acres are khas land acquisition, 124.085 acres are forest land, and 66.85 acres are private land.

The major components that are supported by the World Bank are the construction of ~5 km of breakwater on existing sandbar and capital and maintenance dredging along ~13 km of the access channel. Other proposed support facilities are the container terminals 1 and 2, a multipurpose terminal, a jetty, buildings, and a terminal gate; terminal access roads and bay bridges; a railway terminal with railway access facilities; community drainage facilities with a small fishing boat landing station; container and general cargo handling facilities; and an electrical substation.

The water requirement will be sourced from groundwater during regular operations. During the monsoon period, rainwater and surface water will be utilized along with the groundwater and will be treated at a water treatment plant (WTP) to produce potable water. The power requirement will be sourced from the national grid.

A sewage treatment plant (STP) will be installed to treat the domestic wastewater generated during the port operation. A wastewater treatment plant (WWTP) will also be installed to treat the bilge water.

The project encompasses a design phase of approximately 9 months, followed by a construction phase for 36 months (for Phase-1, which includes Container Terminal-1, Multipurpose Container Terminal, Breakwater, Access Dredging and other necessary facilities). The Phase-2 includes Container Terminal-2 and construction duration is estimated 24 months and will start after the Phase-1. An initial investment of US$4.768 billion is required, with an additional investment of US$5.7 billion distributed over a year 2024 to 2070.

Summary of Natural and Socio-Economic Features of the Project Area

In order to analyze environmental factors such as the physical, biological, and socioeconomic status of the project area, the direct impact area is initially defined as being within 1 km of the project boundary and the indirect impact area as being within 5 km of the direct impact, with the exception of the ecological survey, which has been expanded up to 18.52 km or more due to the nature of impacts. This impact area delineation will be re-assessed during detailed engineering when the results of the sediment transport modeling has quantitatively established the impact zone within the coastal area.

The physical environment consists of terrain, land, soil, meteorology, air, water, noise, and so on, whereas the biological environment consists of flora and fauna. Demography, ethnicity, religion, education and job opportunities, occupation, income, poverty, social relations, and so on are all part of the studied area's socioeconomic environment.

The baseline environmental conditions are based on data gathered from numerous field surveys, associated agencies, and secondary documents obtained from published sources and websites. In addition, baseline data (water quality, air quality, noise level, traffic, biodiversity, etc.) from the previous EIA study have been re-evaluated as part of the preparation of this preliminary ESIA study. Moreover, additional studies have been conducted: (i) urban drainage discharge modeling for drainage capacity calculation; (ii) noise modeling to identify the potential cumulative impact; (iii) test boring for evaluation of groundwater quantity and quality; (iv) socio-economic baseline survey; (v) farm survey; and (vi) the focus group discussion (community and technical institution).

Analysis of Alternatives

Two alternative developments for the breakwater structures were considered taking into account the bearing capacity of the underlying soils, marine environment, etc. The capacity resistance of the cofferdam breakwater is significantly higher than that of the rubble mound breakwater. However, the service life of the rubble mound structure is longer than the cofferdam breakwater, and less maintenance is required for the rubble mound. The rubble mound breakwater requires a lot of stone for its construction. The optimum option is not yet decided at this stage of the study.

For the port terminal, three site alternatives were considered. First, the Laldia area between the river and the airport road will require the relocation of the illegal settlers, which raises social and political concerns. The second is the left bank of the Karnaphuli River at the estuary between the river's mouth and the KAFCO jetty. The area is currently overlapping with the Bangabandhu Sheikh Mujibor Rahman Tunnel. Third is the Bay Terminal area north of the Karnaphuli River estuary and west of the Port Link Road. The area can handle larger vessels and has a stable natural sandbar. Alternative 3 is chosen considering future demand, economic, environmental, social, and operational requirements.

Assessment of Environmental and Social Risks and Impacts and Mitigation Measures

The magnitude of each identified impact is assessed based on five parameters: (i) the duration of the impact (temporal aspect); (ii) the spatial extent of the potential impact; (iii) the reversibility of the impact; (iv) the likelihood of occurring; and (v) compliance with national and international standard.

Cumulative Impact Assessment

A rapid cumulative impact assessment (CIA) has been undertaken concurrently with this preliminary ESIA, focusing on identified valued environmental and social components (VESCs). The specific subtasks for the CIA following the IFC Guidelines on Cumulative Impact Assessment and Management (2013) are: (i) Preliminary identification of VESCs, (ii) Site visits and consultations to prioritize VESCs, (iii) Determining the spatial and temporal boundaries of the CIA, (iv) Determining the scope and scale of past, existing or planned developments and other activities in addition to the project, (v) Identification of natural stressors and other factors that may affect condition of VESCs, (vi) Assessment of cumulative impacts on VESCs (vii) Determining significance of predicted cumulative impacts, (viii) Identification of potential mitigation and management measures, and (ix) Suggesting informed adaptive management strategies to manage uncertainties using adaptive management approaches.

Stakeholders' Engagement

The stakeholders' engagement was conducted following the regulatory process per ECR-1997 of the DoE to inform them about the project interventions and the impacts of project activities and to gather their suggestions for mitigating the project's negative impact.

A total of 12 focus group discussions (FGDs) were held by the ESIA team with the stakeholders within and around the project area. About 120 people participated in the FGDs, including members of vulnerable groups (poor, women, children, and people with disabilities), fishermen, and stakeholders engaged in aquaculture and cattle farming inside the project site.

Three public consultation meetings were held with a total of 203 people at the initial stage of the project planning: (1) on April 1, 2017, at 10:30 a.m. in Munshipara, Munir Nagar (Ward 37, Chattogram City Corporation) with 24 participants; (2) on April 1, 2017 at 5:30 p.m. in South Kattuli (Ward 11, Chattogram, City Corporation), with 27 participants; (3) on September 21, 2022, in CPA Shaheed Md. Fazlur Rahman Munsi Auditorium, with 152 participants.

In addition, nine face-to-face consultation meetings were held with the Chattogram Development Authority (CDA), Chattogram City Corporation, Chattogram WASA, Bangladesh Water Development Board (Chattogram), and neighborhood residents to gather stakeholder feedback for identifying the affected area and improving the project drainage plan.

The concerns raised during the meetings are (i) the impact of the project on the city drainage, (ii) traffic congestion on coastal roads, (iii) land acquisition payment, (iv) loss of livelihood and limited alternative sources for support and survival, (v) land reclamation issues, and (vi) detailed activity of port operation. Additional consultants will be carried out in coming months.

Grievance Redress Mechanism (GRM)

CPA will establish a GRM for the proposed Bay Terminal Project to address complaints and grievances throughout the project's lifecycle, considering the overall need for the entire project period. The GRM is intended to address issues and complaints efficiently, timely, and cost-effectively. Separate grievance mechanisms will be established for labor-related issues between contractors and subcontractors and gender-based violence/Sexual Exploitation and Abuses/Sexual Harassment (SEA/SH). Project-affected people and any other stakeholder may submit comments or complaints at any time using the project's GRM.

Environmental and Social Management Plan (ESMP)

This Preliminary ESIA includes generic Environmental and Social Management Plan (ESMP) that will be considered into the project design for the project's sustainable development. The ESMP will be updated for pre-construction, construction and operational phase of the different component of the project at the detailed phase phase. The matrix of the environmental and social management plan (ESMP) is presented in the table.

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
Pre-construction and Construction Phase		
ESS1 and ESS3		
Deterioration of Soil and Sediment Quality ▪ Site development (reclamation, leveling, and compaction) ▪ Accidental spillage of fuel from storage areas, machines, transport vehicles, diesel generators, dredgers, and vessels ▪ Storage and disposal of construction and demolition (C&D) debris and municipal solid waste (MSW) ▪ Accidental spillage of hazardous waste from the storage area	▪ Allocation of the protected sections or premises from external factors impacting the temporary disposal of waste. ▪ Hazardous wastes should be packed properly and have the relevant labels. ▪ Hazardous waste management should be undertaken by the contractor having the relevant permit for such activity and following good international practices and applicable local and international regulations. ▪ Strict control of the waste management process. To maintain the special logbook for the purpose of recording the quantity of the generated wastes, types, and further management processes; ▪ All rubbish, waste materials, and debris shall be systematically cleared from working areas as they accumulate; all such materials should be cleared at the end of each working day. ▪ If the removal of waste materials at the end of the working day is not possible, the materials should be covered with tarpaulin or something similar. ▪ Waste materials not removed directly from the site shall be temporarily stored at designated points and covered, pending removal from the site. ▪ Fuels will be stored in dedicated storage area having secondary containment.	EHS Team of Contractor
Changes in the Coastal Morphology ▪ Capital dredging and reclamation ▪ Disposal of unsuitable soil at an offshore disposal site ▪ Dredging of sand from other sand extraction area and discharge in the reclamation area	▪ Implement a dredging technology that has the least impact on coastal morphology. ▪ Unsuitable soil from the reclamation area will be disposed of at the designated disposal site. ▪ Limit sand extraction to avoid the creation of scattered deep holes in the area.	EHS Team of Contractor
Deterioration of Surface Water Quality ▪ Capital dredging and reclamation ▪ Disposal of unsuitable soil at an offshore disposal site	▪ The fueling equipment should be equipped with breakaway" hose connections that provide emergency shutdown of flow in case of connection failure. ▪ International standards for refueling dredgers should be followed.	EHS Team of Contractor

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
▪ Dredging of sand from other sand extraction area and discharge in the reclamation area ▪ Accidental spillage of fuel from dredgers and vessels used for transportation of dredge and construction materials. ▪ Contaminated surface runoff from a land-based construction area ▪ Discharge of untreated sewage from the construction area and untreated bilge and ballast water	▪ Absorbents should be present at places of refueling. ▪ Make bilge water pumping a requirement for all dredgers and vessels for internal transfers and transfers to the shore reception facility. Waste and bilge water from dredgers and vessels should be collected and further discharged at a designated discharge point. Collect the oily sludge for safe disposal or treatment using the existing established facilities at Chattogram Port. ▪ A thorough dredge management plan, including EHS components, that complies with international standards must be submitted by dredging contractors before the dredging is started and must be acknowledged and authorized by the CPA consultant team. Throughout the dredging, the dredging contractors must adhere to the authorized dredging plan. ▪ Accidental spills will be managed through the preparation and implementation of an emergency response plan to be prepared by the contractors as part of the OHS Plan. ▪ Monitoring of the implementation of the environmental and social management plan should be done by engaging monitoring mechanisms. ▪ Implement a dredging technology that has the least impact on surface water quality. ▪ Unsuitable soil from the reclamation area will be disposed of at the designated disposal site. ▪ All sewage generated from the construction area will be treated.	
Deterioration of Ambient Air Quality ▪ Fugitive dust emissions from site development activities like grading and leveling, construction activities like earthwork for the foundation of buildings and civil infrastructure, and the handling of construction materials like sand, cement, and aggregate.	▪ Vehicle speed restrictions (e.g., 20 km/h) must be enforced to control dust generation. ▪ Construction materials must be covered to protect them from wind action. ▪ Spray water regularly to suppress fugitive dust. ▪ Provide pollution control devices in equipment and machinery emission stacks.	EHS Team of Contractor

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
▪ Emission during transport of construction materials, equipment, and manpower and operation of heavy equipment and standby diesel generator sets.	▪ Ensure proper and regular maintenance of engine-driven construction equipment. ▪ Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards. ▪ Conduct regular maintenance on dredgers.	
Increase in Ambient Noise Level ▪ Site development activities, construction activities, and handling of construction materials (site clearing and preparation, excavation and concrete placement, erection of structures, concrete mixing and aggregate production systems, construction camps and ancillary facilities, drilling of bored pile activities, and haulage and general vehicle movements.) ▪ Piling activity ▪ Transport of construction materials, equipment, and manpower and operation of heavy equipment and standby diesel generator sets (mostly vehicles involved in construction activities such as engine running, hydraulic horns, and loading and unloading activities).	▪ Equipment modifications or redesigns of a particular piece of equipment to achieve quieter noise levels. ▪ Sound aprons or a canopy are useful when the shielding must be frequently removed or if only partial covering is possible. ▪ Enclosures for stationary work may be constructed of wood or any other suitable sound-dampened material and typically surround the specific operation area and equipment. ▪ The use of electrically powered equipment is typically quieter than diesel, and hydraulically powered equipment is quieter than pneumatic power. ▪ Using vehicles and equipment in good conditions ▪ Monitor sound levels during piling activity to ensure that they do not exceed the DoE, WB, or any other internationally recognized criteria. ▪ Incorporate the use of clear “ramp-up” (i.e., “soft-start”) procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause a significant behavioral impact on marine mammals to the full output necessary for the completion of the activity. ▪ Implement measures to attenuate the sound when sound pressure levels exceed the DoE, WB, or any other internationally recognized criteria. Methods to reduce sound pressure levels include, but are not limited to: ▪ Incorporate the use of fully enclosing or confined, encircling absorptive barriers (e.g., isolation casings) or other demonstrably effective noise reduction methods at the immediate works site in order to	EHS Team of Contractor

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
	reduce underwater sound propagation from on-site operations. Studies have shown that such methods can provide a significant reduction in sound input to the wider aquatic environment in the order of 10–30 dB. ▪ The force of the hammer blow can be controlled with hydraulic hammers, and reducing the impact force will reduce the intensity of the resulting sound. ▪ Soft start, where piling starts at a low level and progressively builds in intensity through a piling session. There are concerns that the use of this method results in sensitive fauna still being present when piling noise increases in intensity and thus may still be exposed to high noise levels.	
ESS2		
Potential Increase of Income/Employment Opportunity ▪ Sourcing of manpower for construction activity ▪ Sourcing of construction materials from local suppliers ▪ Opportunity for local enterprises	▪ Unskilled workers will be sourced locally. ▪ Follow existing labor laws including the standard labor code, which mentions all issues relating to labor deployment, wages, occupational health and safety following the World Bank guidelines, international labor organization (ILO) conventions, and GOB laws, laborers ▪ Source the construction materials from local suppliers	Human Resources of CPA
Increased Risks on Occupational Health and Safety including SEA/SH/GBV ▪ Site development activities, construction activities, handling of construction materials, and operation of heavy equipment. ▪ Changes in environmental quality from emissions to air, water and noise from construction activities and different hazards in the workplace	▪ Prepare and implement an occupational health and safety management plan (OHSMP) following the hierarchy of hazard controls, prior to commencing work. This plan will include working methods, construction sequence and safety arrangements. ▪ Permit to work system will be established to ensure only authorized persons will work at site. ▪ Increase workers' awareness on the anticipated health hazards during the construction phase. ▪ Provide personal protective equipment (PPE) to protect workers from any incidents at the work site. ▪ Ensure water, sanitation, and hygiene (WASH) at the work site. Construction	CPA/EHS Team of Contractor

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
	▪ Ensure women's occupational health safety and women's decent gender friendly working environment at all levels during project activities. ▪ Set-up grievance redress mechanism (GRM) for the workers. The GRM will have a mechanism to address SEA/SH related complaints and able to handle the case sensitively. ▪ A code of conduct for contractors and workers – specifying appropriate roles and responsibilities, including specifying examples and risks of SEA/SH, will be signed and understood by them. ▪ Train project-related staff on behavioral obligations and consequences ▪ Disseminate CoCs with employees and community	
ESS4		
Increased Risk on Community Health and Safety including SEA/SH/GBV ▪ Fugitive dust, air emissions, and increased noise levels from site development activities, construction activities, handling of construction materials, transport of materials, equipment, and manpower, and operation of heavy equipment and standby generator sets. ▪ Traffic movement during the transport of construction materials, equipment, and manpower ▪ Influx of non-resident workers to the area.	▪ Use low-sound and low-polluting construction equipment. ▪ Set up a workstation at a designated place. ▪ Traffic management plan will be prepared to identify, evaluate, manage, and monitor traffic and road safety risks to workers and affected communities. ▪ Set up the construction site at a location away from the settlement. ▪ Set up a grievance redress committee involving community leaders, able to address SEA/SH issues. ▪ Carryout information and awareness campaign to raise awareness about SEA/SH ▪ Spraying water around the construction site ▪ Regular meetings with local people and community leaders ▪ Adopt mitigation measures proposed against noise, air quality, waste, etc.	EHS Team of Contractor
Hindrance and Impact to Local Fishing Activities ▪ Capital dredging and reclamation ▪ Discharge of dredging material in the reclamation area	▪ Preparation of a plan to safeguard the fishermen. The plan will be effective and restricted for the period of project implementation for all registered fishermen.	Community Relations of CPA/ PIU (ESOHS)

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
▪ Piling activity and vessel transport of construction materials and equipment		
Increased Road and Vessel Traffic and Transport ▪ Road and vessel transport of construction materials, equipment, and manpower	▪ Provide induction/training to all drivers for safe driving. ▪ Avoid road transport during rush hours.	EHS Team of Contractor
ESS5		
Land Acquisition and Involuntary Resettlement ▪ Land acquisition of private land/ Restrictions on land use	▪ Prepare a land acquisition plan (LAP) and resettlement action plan (RAP)/livelihood restoration plan (LRP) following ARIPA 2017 and the World Bank ESF.Implement the RAP/LRP plan for the affected people, especially vulnerable groups.	Land Acquisition and Involuntary Resettlement Specialist CPA/ PIU (ESOHS)
ESS6	▪	
Terrestrial and Marine Ecology ▪ Capital dredging and reclamation ▪ Disposal of unsuitable soil at an offshore disposal site ▪ Dredging of sand from other sand extraction area and discharge in the reclamation area ▪ Accidental spillage of fuel from dredgers and vessels used for transportation of dredge and construction materials. ▪ Contaminated surface runoff from a land-based construction area ▪ Discharge of untreated sewage from the construction area and untreated bilge and ballast water ▪ Piling activity and vessel transport of construction materials and equipment	▪ Keep conducting continuous inspections for leaks. ▪ Gradually ramp up the sound levels (pile diving) to scare marine life away before piling commences. Use pingers to chase away fish and other cetaceans. Monitor the area for these creatures to ensure they are well away from the piling site; scare them away if they are too close to the site using pingers. ▪ Lighting must be limited to the minimum area required to be lit. ▪ Make passages and waterways for aquatic animals away from navigation routes. ▪ Construction site runoff and drainage should be prevented or minimized in ▪ accordance with international best practices and standards. Sand/silt retaining ▪ Facilities such as traps and sediment basins should be provided to limit the runoff. ▪ Exposed slope or soil surface, dredged material in particular, should be covered to reduce the potential runoff. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of rain. ▪ Implement a dredging technology that has the least impact on marine ecology.	EHS Team of Contractor

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
	▪ Erect temporary fences or other barriers that encourage migrants to fly at some height over passing the project site	
ESS8		
Impact on Archaeological and Cultural Sites ▪ Transport of construction materials, equipment, and manpower	▪ Control the movement of traffic at Bay Terminal during the holy ritual day to ensure the traffic safety of the participating Hindu purnrathi (pilgrims). ▪ Consultation meeting with Snan Ghat ritual management team members before the holy ritual day of each year. ▪ Remove barrier to access to the Cultural Heritage site during all period of operation	Cultural Heritage Specialist of PIU (ESOHS)
ESS10	▪	
Stakeholders Engagement (including the disadvantaged and the vulnerable) ▪ Exclusion of vulnerable groups from stakeholder engagement and project benefits	▪ Implement an effective Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) to address complaints and grievances throughout the project's lifecycle to address issues and complaints efficiently, timely, and cost-effectively. ▪ Toll-free telephone hotline/Short Message Service (SMS) line, E-mail, Letter to Grievance focal points at local facilities. Walk-ins may register a complaint in a grievance logbook at a project site/facility or use the Complaint/Suggestion box at the project site.	Stakeholder Engagement of CPA/ PIU(ESOHS)
Operation Phase		
ESS1 and ESS3		
Deterioration of Surface Water Quality ▪ Discharge of operational wastewater ▪ Accidental spillage of fuel from dredgers and vessels ▪ Discharge of untreated sewage ▪ Maintenance dredging	▪ Use of sediment settling ponds: Dredging material can be deposited into sediment settling ponds, where the sediment can settle, and the clearer water can be returned to the ocean. ▪ Implementation of best management practices that can be used during dredging operations to minimize the release of sediment into the water, such as using turbidity curtains and silt screens. ▪ Dredging activities can be scheduled during times when water currents and tides are less likely to cause sediment to be dispersed.	EHS Team of CPA

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
	▪ Regular monitoring of water quality, including turbidity levels, should be conducted after dredging activities to assess their impact and identify areas for improvement. ▪ Strict enforcement of regulations related to dredging and water quality can help to ensure that dredging contractors are following best practices to minimize the impact of dredging on the environment. ▪ The dredging contractors have to submit a dredging management plan before commencing the dredging work, which must be followed according to best management practices based on international standards. ▪ A sewage treatment plant (STP) with a capacity of 1,000 m3/day is required for the treatment of sewage from the port operations office, canteen, and ship. ▪ STP should comply with Department of Environment guidelines. ▪ STP-treated water quality parameters are monitored quarterly to check compliance with DoE guidelines. ▪ Make bilge water pumping a requirement for all vessels arriving at a shore receiving facility such as a WWTP. Collect the oily sludge for safe disposal or treatment at the planned Bay Terminal's established facilities. ▪ For the treatment of bilge water or oily wastewater generated from the ship, establish a Wastewater Treatment Plant (WWTP) with a capacity of 1000 m3/day and sludge handling facilities. ▪ WWTP should comply with Department of Environment guidelines. ▪ WWTP-treated water quality parameters are monitored quarterly to check compliance with DoE guidelines.	
Deterioration of Ambient Air Quality ▪ Fugitive dust emission and cargo vapor emission from the operation of the terminal	▪ Regular maintenance of port operation machinery, vehicles, and standby diesel generator sets in accordance with the manufacturer's specifications.	EHS Team of CPA

Potential Impact /Activities	**Proposed Mitigating Measures**	**Responsibility**
▪ Emissions from the transportation of container and operation of standby diesel generator sets	▪ Provide pollution control devices in equipment and machinery emission stacks. ▪ Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards. ▪ Conduct regular maintenance on dredgers.	
Increased of Noise Level ▪ Container handling activities ▪ Transportation of container ▪ Operation of standby diesel generator sets and other machinery and equipment.	▪ Equipment modifications or redesigns of a particular piece of equipment to achieve quieter noise levels. ▪ Sound aprons or a canopy are useful when the shielding must be frequently removed or if only partial covering is possible. ▪ Enclosures for stationary work may be constructed of wood or any other suitable sound-dampened material and typically surround the specific operation area and equipment. ▪ The use of electrically powered equipment is typically quieter than diesel, and hydraulic-powered equipment is quieter than pneumatic power. ▪ Using vehicles and equipment in good conditions ▪ Incorporate the use of clear "ramp-up" (i.e., "soft-start") procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause a significant behavioral impact on marine mammals to the full output necessary for the completion of the activity. ▪ Implement measures to attenuate the sound when sound pressure levels exceed the DoE, WB, or any other internationally recognized criteria. Methods to reduce sound pressure levels include, but are not limited to: ▪ Incorporate the use of fully enclosing or confined, encircling absorptive barriers (e.g., isolation casings) or other demonstrably effective noise reduction methods at the immediate works site in order to reduce underwater sound propagation from on-site operations. Studies have shown that such methods can provide a significant reduction in sound input to	EHS Team of CPA

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
	the wider aquatic environment in the order of 10–30 dB. ▪ Ships, when in port, stop their engines and derive their power supply from a direct connection to the local electricity grid from the port. This reduces emissions and noise emanating from the ships themselves while in port.	
ESS2		
Potential Increase of Income/Employment Opportunity ▪ Sourcing of manpower for operations ▪ Opportunity for local enterprises	▪ Unskilled workers will be sourced locally. ▪ Follow existing labor laws including the standard labor code, which mentions all issues relating to labor deployment, wages, occupational health and safety following the World Bank guidelines, international labor organization (ILO) conventions, and GOB laws, laborers	Human Resources of CPA
ESS4		
Increased Risks on Community Health and Safety including SEA/SH/GBV ▪ Increased noise level due to the operation of machinery and equipment and container handling activities ▪ Traffic movement during the transport of the container ▪ Influx of non-resident workers to the area	▪ Set up labor camps close to the work site and minimize hiring vacant accommodations in the neighborhood. ▪ Transportation of containers outside rush hours to minimize pressure on roads ▪ Set up a grievance redress committee involving community leaders able to address SEA/SH issues. ▪ Regular meetings with local people and community leaders ▪ Adopt the mitigation measures proposed against noise.	Community Relations of CPA
ESS6		
Negative Impact on Marine Ecology ▪ Discharge of operational wastewater and untreated sewage ▪ Accidental spillage of fuel from dredgers and vessels ▪ Maintenance dredging ▪ Vessel movement	▪ The vessel must be refueled off-site, where possible. ▪ Fueling of vessels must be undertaken in bunded areas, and all fueling equipment must be regularly (yearly) inspected and serviced. ▪ Implementation of best management practices that can be used during dredging operations to minimize the release of sediment into the water, such as using turbidity curtains and silt screens.	EHS Team of CPA

Potential Impact /Activities	Proposed Mitigating Measures	Responsibility
	▪ Treatment of sewage and bilge water and ensuring that STP and WWTP comply with Department of Environment guidelines.	

An environmental and social monitoring plan (ESMoP) will be required at all project stages to ensure that the commitments made are implemented, to verify the effectiveness of the proposed mitigation measures in reducing impacts, and to allow the mitigation measures to be refined or developed as needed to address the actual effects. This plan will be prepared at the ESIA updating and finalization.

Conclusions and Recommendations

The proposed Bay Terminal Project is projected to considerably expand the Chattogram Port's ability to handle containerized cargo. Furthermore, it is expected to greatly improve the turnaround time, draft, dead weight tonnage (DWT), container carrying capacity, berthing facilities, and connection of vessels calling at the port. All environmental and social issues that arise during the construction and operation of the port will be managed by the implementation of the measures mentioned in the ESMP. It is recommended to conduct environmental compliance monitoring activities during construction and operation to determine the compliance of the measures identified in the ESMP. The detail plan/framework of the compliance monitoring will be prepared during the updating and finalization of the ESIA.

1. Introduction

1.1. Project Background

1. The Chattogram Port is the principal seaport of Bangladesh, handling about 92% of the country's import-export trade and providing a significant gateway for the country's trade with the outside world. The present-day Chattogram Port, with its significant load of activities and competency, is a river port situated 16 km upstream of the Bay of Bengal. It is located by the estuary of the Karnaphuli River at Patenga. This seaport has been in operation since the 4th century B.C. Since its formal commissioning under the Port Commissioners Act of 1887 under British Rule of the Indian Sub-continent and, going through various stages of subsequent historical events, e.g., the partition of the sub-continent in 1947, creation of the Chattogram Port Trust (1960) and renaming of the Trust as the Chattogram Port Authority (1976), the Great 1971 War of Liberation of Bangladesh and subsequent periods till date, it has been performing as one of the significantly busy seaports of the world. The port ranked as the world's 86th busiest container-handling port in 2014.

2. In 2021-2022, Chattogram Port handled over 118.17 million metric tons of cargo, including 30.5 million tons of containerized cargo and 3.25 million twenty-foot equivalent unit (TEU) containers. The gross domestic project (GDP) growth of Bangladesh's economy is around 6-7% per year, while the container traffic growth of Chattogram Port is approximately 14% per year, double the GDP rate. Based on the expected economic development and the past container handling growth, the total container handling in Bangladesh is expected to increase from 3.26 million TEUs in 2021 to 5.31 million TEUs in 2030, 7.45 million TEUs in 2040, and 13.85 million TEUs in 2070. The Chattogram Port's contribution to the national economy is remarkable. Chattogram Port has undertaken many ambitious projects to enhance its capacity, improve efficiency and quality of services, and develop adequate facilities to turn itself into a world-class regional port to meet the challenges of globalization and the liberalization of world trade and economy.

3. The present-day situation calls for changes in the port's current performance through improvement in the current hinterland connections of the port together with the different intermodal connections and links. The vital role of Chattogram Port for Bangladesh underlines the necessity of investigating how best it should be developed to meet future challenges. Toward enhancing the existing handling capacity and future demand, the **Chattogram Port Authority (CPA)** plans for one of the largest and most ambitious projects – **the Bay Terminal** – the future Chattogram Port.

4. After completion, the Bay Terminal is expected to significantly contribute to the port's containerized cargo handling capability. It is also expected to significantly improve turnaround time, draft, dead weight tonnage (DWT), container carrying capacity, berthing facilities, etc. vessels, calling at the port with their connectivity, fuel oil unloading, etc., which will meet present and future demand.

5. The Bay Terminal has been proposed in the Bay of Bengal off the coast of Patenga in the city's Halishahar Ananda Bazar area. It is near the existing Chattogram Port and Chattogram Export Processing Zone. The Bay Terminal will address the capacity limits near Chattogram Port. The maximum draft of Chattogram Port is 9.2 meters, requiring smaller ships to be used to transport cargo to and from large freighters that are anchored in the bay.

6. The Bay Terminal Project will involve the (a) construction and operation of the port terminals including auxiliaries such as road networks, rail networks, power and water supplies, (b) construction of the breakwater fronting the terminal, and (c) capital and maintenance dredging of the channel. To support the operation of the port terminal, structures such as road and rail links and drainage outlets will also be part of the Bay Terminal Project. These project components and activities will be the subject of this **preliminary Environmental and Social Impact Assessment (ESIA)**.

1.1.1. Rationale of the Project

7. It is a fact that efficient international trade is among the prerequisites and a crucial prime mover of GDP and, hence, of the overall economic development of Bangladesh. As a result of growth, port activity has attained a significant pace over the years. Further growth and future development strategy of Bangladesh will depend on future trade growth, with the sectors, specifically, the Ready-Made Garment (RMG) sector and other sectors comprising those of various conventional and non-conventional Items playing the role of key players. Trade growth necessitates an efficient, reliable, and competitive transport system vis-à-vis the effective operation system of seaports. Over the years, the port has been undergoing improvements in its facilities and is currently enhancing its performance through several development projects.

8. The existing Chattogram Port extends some 16 nautical miles (30 km) upstream from the estuary end of the river. A number of water-side limitations are inherent in this current location of the port. Several identified restrictions in the port hinterland capacity pose a potential hindrance to increasing trade volumes. Moreover, a shallow bar at the entrance, including various point bars, strong tidal streams, unfavorable circumstances, and conditions associated with periods of heavy rainfall, and strong freshet currents prevent big vessels carrying various kinds of cargo berthing at port jetties. As a result, such vessels are forced to stay at the outer anchorage and wait to unload their goods through lighter vessels with high transportation costs. These impediments and other unfavorable conditions are significant deterrents to the port's efficiency and performance.

9. Above mentioned circumstances could be cited as the rationale for undertaking the project on the Bay Terminal of the Chattogram Port. The proposed Bay Terminal will be free of restrictions currently posing a potential hindrance to increasing trade volumes and future expansion of services and activities of the Chattogram Port when commissioned. It will be Chattogram's future seaport and significantly contribute to its containerized cargo handling capacity. It will also tremendously improve calling-in vessels' turnabout time, draft, dead weight tonnage (DWT), container carrying capacity, berthing facilities, connectivity, etc.

1.1.2. National Requirements and World Bank's Environmental and Social Framework

10. This Preliminary ESIA prepared for the Bay Terminal Project also followed guidelines of the approved Environmental and Social Impact Assessment (ESIA) Terms of Reference (ToR) prescribed by the Department of Environment (DOE – vide its Memo No. DoE/Clearance/5645/2016/380, dated 08/09/2016), World Bank's Environmental and Social Framework (ESF) and the World Bank Group's Environmental, Health, and Safety (EHS) Guidelines specific for Port, Harbors & Terminals.

11. The main objectives of this preliminary ESIA include the following:

- Assess the environmental and social profile of the project area and its surrounding areas;
- Preliminarily assess environmental and social impacts from the project on the established environmental and social baseline;
- Identify, assesses, and specify measures and standards to be included in the detailed design, construction, and operation of the proposed project which are necessary to mitigate these environmental and social impacts and reduce them to acceptable levels; and
- Prepare a preliminary Environmental and Social Management Plan (ESMP) and the appropriate monitoring plan which will be updated during detailed engineering design.

12. The construction of the breakwater and dredging of the port access channel of the Bay Terminal Project is likely to be funded by the World Bank (WB). Other components will be

funded from other sources identified by the Government of Bangladesh (GoB). According to the World Bank's Environmental and Social Framework (ESF), other components of the Bay Terminal Project will be considered as **associated facilities**[1]. Associated Facilities will also meet the requirements of the Environmental and social Standards (ESSs), to the extent that the Borrower has control or influence over such facilities. As such, the entire Bay Terminal Project must be consistent with the requirements of the ESF including the relevant environmental and social standards (ESS). The ESF sets out the requirements for the borrowers to identify and assess environmental and social risks and impacts associated with the project. The ESSs support the borrowers in achieving good international practice relating to environmental and social sustainability, assisting them in fulfilling their national and international environmental and social obligations, enhancing transparency and accountability, and ensuring sustainable development through ongoing stakeholder engagement.

1.2. Scope of the ESIA

13. The Preliminary ESIA has been prepared with limited field data collection and parallel to several ongoing studies. The feasibility study of the breakwater and dredging of the access roads are ongoing and the preliminary ESIA does not have detailed information on these two components. The master plan and other feasibility study reports were received after the draft final preliminary report submission.

14. The exact impacts of the proposed activities and their respective mitigation measures and ESMPs will be updated at the detailed design phase before initiating the contracting processes. This preliminary ESIA study includes generic ESMP, and a more detailed ESIA including ESMP will be carried out when the detailed design of the components is ready. A ToR for updating the preliminary ESIA is attached in Annex 1.

15. The preparation of this preliminary Environmental and Social Impact Assessment (ESIA) is guided by the requirements of the Government of Bangladesh (GoB) as defined in the Bangladesh Environment Conservation Act of 1995, the Bangladesh Environment Conservation Rules of 2023 (an update from ECR-1997), the World Bank (WB) Environmental and Social Framework (ESF) guidelines, and other relevant sector-specific guidelines and international best practices. According to the Environment Conservation Rules-2023 of the GoB, the proposed Bay Terminal Project falls within the projects listed under the 'Red Category.' It requires undertaking an Initial Environmental Examination (IEE), followed by a full-length Environmental & Social Impact Assessment (ESIA). The ESIA report of the proposed Project includes the Environmental and Social Management Plan (ESMP) for environmental and social impact, a disaster preparedness plan, relocation and rehabilitation of project-affected people, and a risk assessment and management plan. As per World Bank's ESF project risk categorization, this project is considered a high-risk project. In addition, the requirement of the ESF will apply to the entrie project. Therefore, WB ESF guidelines are considered for the preparation of the ESIA, along with the ECR-2023 standard.

[1] *The term associated facilities means facilities or activities that are not funded by the World Bank as part of the project but are: (a) directly and significantly related to the project; (b) carried out or planned to be carried out contemporaneously with the project; and (c) necessary for the project to be viable and would not have been constructed, expanded, or conducted if the project did not exist. All three criteria must be met for facilities or activities to be associated facilities.*

16. This preliminary ESIA reports the initial evaluation of the proposed Bay Terminal location's physical, biological, and social environment. The initial ESMP was prepared to minimize the potential impacts of project activities during construction and operation.

17. The scope of the preliminary ESIA, or study area, was defined as the extent to which the project has a direct and indirect impact. The area to be developed to establish the Bay Terminal Project, or the project footprint, is considered the direct impact area (DIA). The DIA will include the ancillary facilities needed for the project, such as a workers' camp, a spoil disposal area, etc. The DIA is further defined as being within 1 km of the project current boundary to anticipate further changes in the location. The area within 5 km of the direct impact of the Bay Terminal Project is considered the indirect impact area (IIA), with the exception of the ecological survey, which has been expanded up to 10 nautical miles (18.52 km) or more due to the nature of the impacts. As such, environmental and social risks will be assessed and analyzed in both the DIA and IIA. The project delineation and the study area are shown in **Figure 1-1**. The preliminary ESIA analyzed potential impacts and recommend mitigation measures for all project phases, including: (a) capital dredging and construction of the breakwater; (b) construction of the port facility; and (c) operations and maintenance works at the port, including maintenance channel dredging.

18. Shown in the map are the proposed locations of the components of the Bay Terminal Project—Port Terminal and the breakwater, including some buffer zones still considered part of the project footprint. The total length of the coastal area that will be part of the project is 6.15 km.

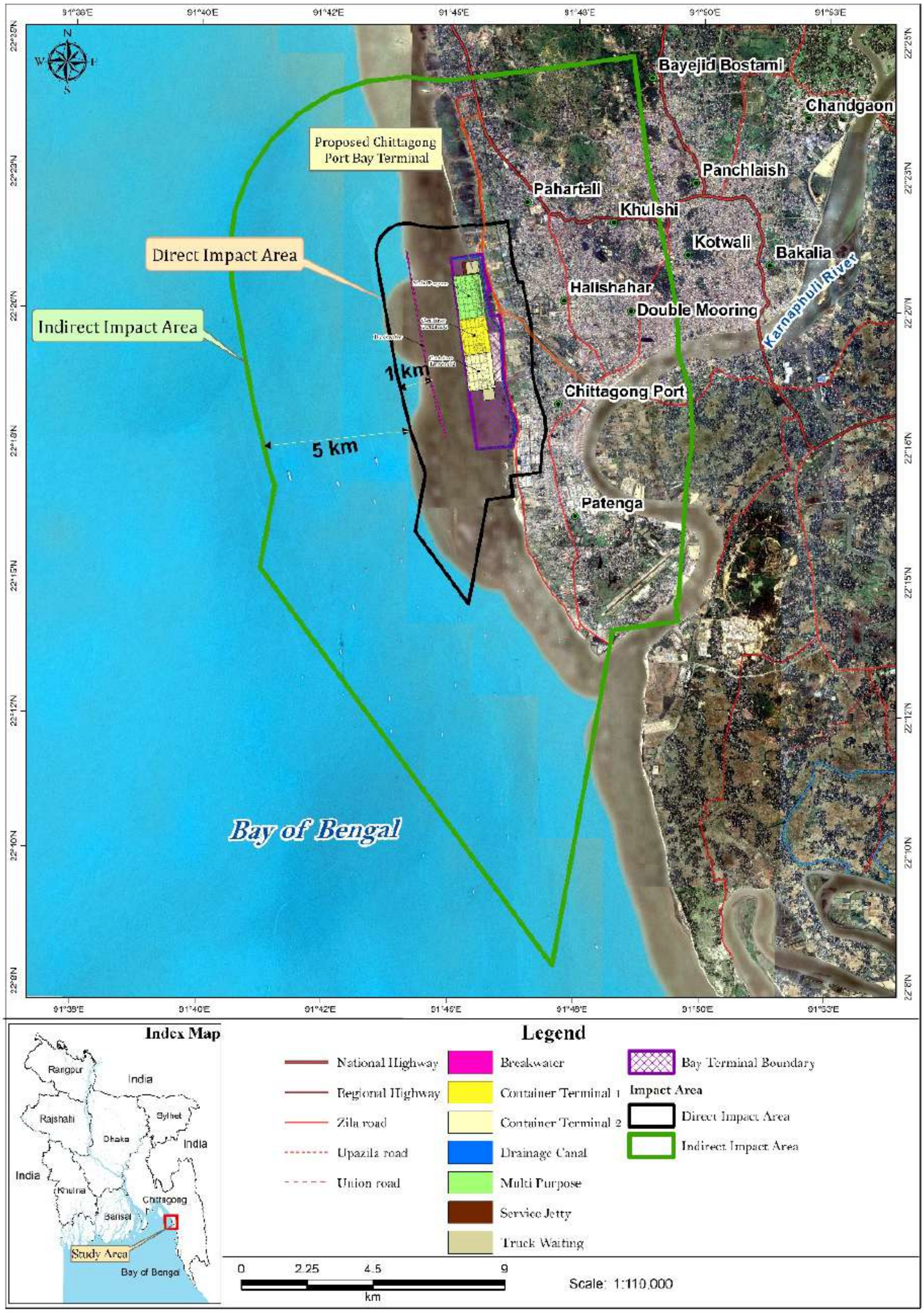


Figure 1-1: The Study Area and the Proposed Location of the Bay Terminal Project

19. The specific tasks done as part of this preliminary ESIA included the following:

- Review of existing literature and local legislation (ECR of 1997 and relevant), applicable WB ESSs, WB EHS Guidelines for ports and harbors, and international best practices related to the project;
- Consolidation of the environmental baseline conditions of the project area, including environmental quality, water, soil condition, land, ecology, agriculture, fisheries, socio-economics, etc.;
- Selection of important environmental and social components likely to be impacted by the proposed project activities;
- Conduct several focus group discussions (FGDs) and stakeholder consultation meetings;
- Analysis of potential impacts on the natural environment, surrounding sensitive receptors, cultural heritages, labor and working conditions, indigenous people, and land acquisition;
- Prepare the initial ESMP with appropriate mitigation measures to minimize the negative effects and enhance the benefit of the positive impacts; compensation measures for negative impacts that cannot be mitigated; and
- Prepare an initial monitoring plan for the project to indicate the location and frequency of data collection on selected indicators, considering pre-construction, construction, and post-construction phases of the project.

20. This preliminary ESIA along with the ESMP will be updated and finalized during detailed engineering with additional field surveys, stakeholder consultation, necessary modeling, analysis and interpretation of other study findings, design consideration and analyzing the impact. The updating and finalization will include:(a) ascertain the impact areas based on quantitative result of sediment transport modeling; (b) update and present more detailed information on the design and operational features of the entire project; (c) identify all other associated facilities that must be included in the ESIA using the WB's definition of associated facilities; (d) include other environmental and social baseline information derived from other ongoing and completed studies including results of other consultations; and (e) incorporate results of related E&S documents such as RAP, SEP and CIA.

1.3. Approach and Methodology

1.3.1. ESIA Process

21. The overall ESIA process for the proposed project is shown schematically in **Figure 1-2**.

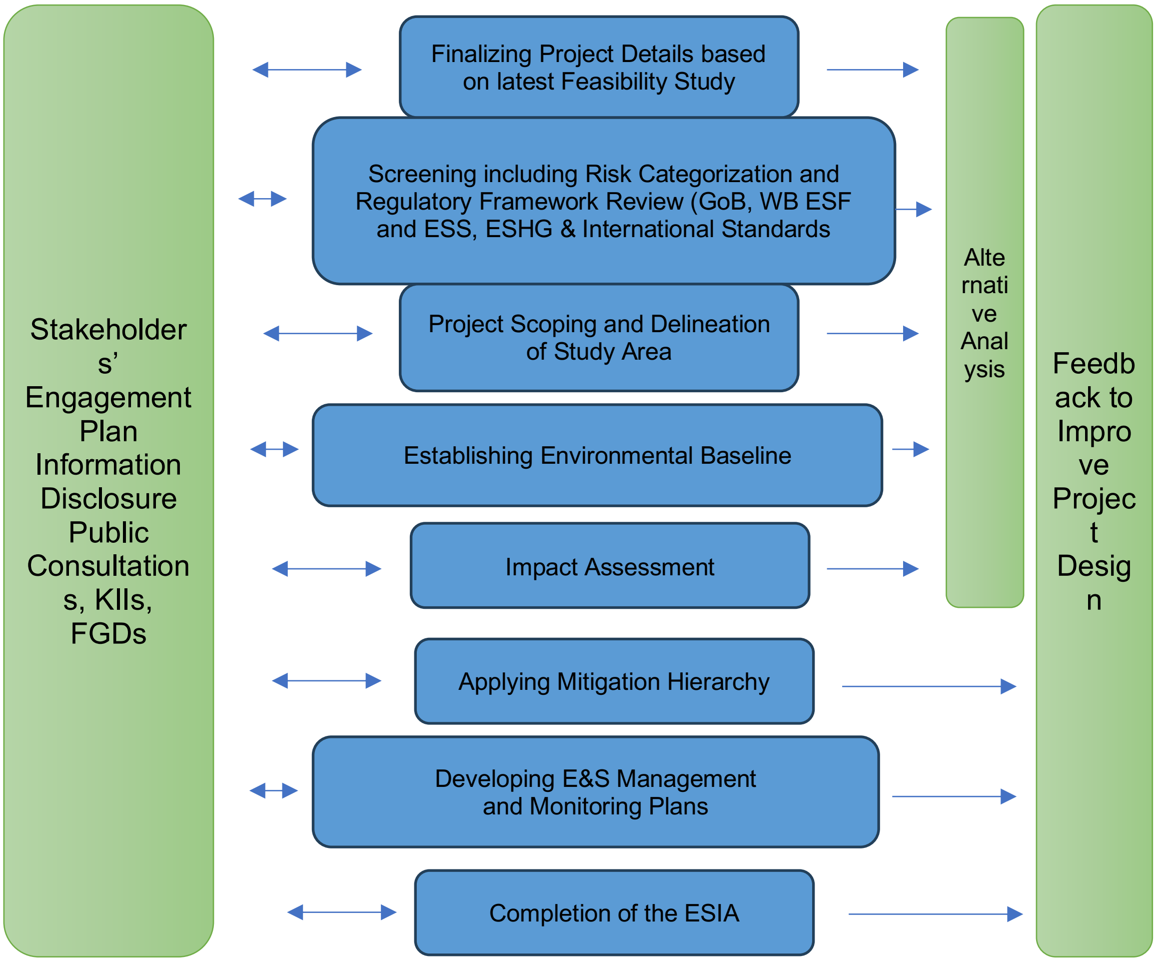


Figure 1-2: Environmental Impact Assessment Process

22. The relevant legal and policy frameworks were reviewed in light of field findings to concentrate on the significant impacts of the IESCs. Project compliance with the relevant international standards was also considered.

23. The IESCs were selected through a scoping process in consultation with the local people to investigate the likely impact of the proposed interventions. The area likely to be impacted by the proposed project was delineated in consultation with the project implementation agency, and feedback was received from the local people during community scoping sessions.

1.3.2. Conduct of Environmental and Social Baseline Data Collection

1.3.2.1. Physical Environment

24. **Physiography, Geology, and Seismicity**: The general physiographical and geological features and the seismicity of the project and its surrounding areas were collected from secondary data sources. The earthquake zone and any active faults in and around the project area were analyzed.

25. **Climate and Meteorology**: Meteorological data such as rainfall, evapotranspiration, temperature, sunshine hours, humidity, and wind pattern were collected from the Bangladesh Meteorological Department (BMD) station within the nearest proximity of the project site and analyzed to assess the local climate that is directly related to the project.

26. **Water Resources**: Water resources data of river/wetland in terms of hydrology, drainage pattern, flooding history, groundwater reserve, and water use was collected from secondary sources and analyzed. Flood inundation extent and flood depth maps were produced using

Geographic Information System (GIS) technology considering present and future climate change scenarios. Relevant water quality parameters were tested following both ex-situ and in-situ methods.

27. **Land Resources**: The agro-ecological region of the study area was identified using secondary sources (Bangladesh Agricultural Research Council (BARC), Food Agriculture Organization (FAO)/United Nations Development Programme (UNDP) GIS Project/BGD/1995/2006). Soil data were also collected from the Upazila Land and Soil Resources Utilization Guide (Upazila Nirdeshika/Guide) of the Soil Resources Development Institute (SRDI).

28. **Air quality**: Air quality data in terms of fine particulate matter ($PM_{2.5}$), respirable dust content (PM_{10}), suspended particulate matter (SPM), sulfur dioxide (SO_2), Nitrogen Oxide (NO_x), carbon monoxide (CO), ozone (O_3) were collected to establish the baseline situation.

29. **Noise**: Noise levels were measured twice daily (day and night) within the project study area. Each time, the noise level was recorded for five minutes at 30-second intervals using a portable noise level meter. The noise meter was set up and calibrated each time depending on the site condition and acoustic environment.

1.3.2.2. Biological Environment

30. **Fisheries Resources**: Fisheries resources (both capture and culture fishery) data and information on different parameters at various seasons such as available fish species, catch and effort data, production of fish, and loss of fish habitat were collected. Primary data were collected through a questionnaire survey and FGD. Secondary data were collected from the concerned Upazila Fisheries Office (UFO) and reviewed by the Fisheries Resources Survey System (FRSS) of the Department of Fisheries (DoF). Fisheries' habitat (water bodies) was identified using satellite images.

31. **Flora and Fauna Resources**: The International Union for Conservation of Nature (IUCN) and Bangladesh Forest Department collected information on bio-ecological zone and their characteristics. The field activities in the study area included the collection of ecosystem information, sensitive habitat identification, and identifying ecological changes and potential ecological impact. Field investigation methods included physical observation, transect walk, and consultation with local people. The land use information on the different ecosystems (terrestrial and aquatic ecosystems) was generated by analyzing archived satellite images/google images. An inventory of common flora and fauna within the study area was made based on a field survey and the IUCN database.

32. A Critical Habitat Assessment (CHA) was also conducted following the ESS6 guidelines. The summary of the CHA was presented in the environmental baseline.

1.3.2.3. Socio-economic Environment

33. Socio-economic baseline information, including demography, occupation, literacy rate, public utilities (drinking water, electricity facilities), etc., were collected from secondary sources, i.e., Bangladesh Bureau of Statistics (BBS) and other relevant literature. Data on income, expenditure, social overhead capital, quality of life, livelihood pattern, communication system, proposed project impact on socio-economic status, and cultural and heritage features of the project area were collected mainly from primary sources through questionnaire surveys and FGDs with relevant agencies and surrounding stakeholders. The social questionnaire survey and FGDs will be conducted to identify the actual social condition of the project impact area, which will include members of vulnerable populations (women, children, and people with disabilities, for example), as well as individuals working in fishing and those engaged in aquaculture and cattle farming within the project area, among others. The outcome of the FGD and the social questionnaire survey will be incorporated into the project development process.

34. As part of the social assessment, secondary livestock data like population, feed, fodder shortage, and diseases were collected from the Department of Livestock Services (DLS).

35. Agricultural resources data regarding farming practices, crop production constraints, existing cropping patterns, crop variety, crop yield, crop damage, and agricultural inputs were collected from primary and secondary sources. Primary agriculture data were collected through questionnaires, key informant interviews, and focused group discussions. Secondary data were collected from the Upazila Agricultural Office of the Department of Agricultural Extension (DAE).

1.3.3. Impact Assessment

36. Once an impact was identified, it was further evaluated based on its significance. The degree of significance of an impact defined by a five-point Likert scale was assessed by its magnitude and sensitivity. Thus, an approach of qualitative quantification was followed to evaluate the impact.

37. **Assessing the Magnitude of an Impact.** The magnitude of each identified impact was assessed based on five parameters: (i) the duration of the impact; (ii) the spatial extent of the potential impact; (iii) the reversibility of the impact; (iv) the likelihood of occurring; and (v) compliance with national and international standards.

38. A scoring technique of qualitative assessment was adopted to assign the magnitude of an impact assessing these five parameters. A Likert scale was developed to assess the degree of each parameter. A word scenario was also developed to guide the quantification of each parameter. Once the assessment of each parameter is complete for an impact, a composite score for each impact was calculated, summing scores of all five parameters. Depending on the combined score, the magnitude of the impact was assessed.

39. **Assessing Sensitivity of a Receptor.** The receptor's sensitivity for each impact was assessed based on the receptors' capacity or features (including proximity/numbers/vulnerability etc.) to handle or tackle an impact. A four-level qualitative scale defining the sensitivity as "low", "medium", "high", and "very high" was developed to assess the sensitivity.

40. **Assessing Significance of an Impact.** The significance of an impact was assessed by its magnitude and sensitivity. A cross-tabular matrix was developed to assess the magnitude qualitatively. The significance of an impact was evaluated following a five-level scale (Critical, Major, Moderate, Minor, and Minimal) which was determined by a cross-tabular matrix between magnitude and sensitivity.

41. **Mitigation Hierarchy Approach.** The ESIA will apply a mitigation hierarchy consistent with WB ESF guidelines shown in **Figure 1-3**. The project will anticipate and avoid risks and impacts brought about by the construction and operation activities. Where avoidance is not possible, measures must be implemented to minimize or reduce risks and impacts to acceptable levels compared to existing GoB and EHSG guidelines (usually following whichever is more stringent). Once risks and impacts have been minimized or reduced by appropriate measures, then the project must mitigate, and where significant residual impacts remain, compensate for or offset the impacts, where technically and financially feasible.

Figure 1-3: Impact Mitigation Hierarchy

1.3.4. Stakeholders' Engagement

42. A stakeholders' engagement plan was developed for the project which identified the potential stakeholders and identified strategies for continuous and meaningful interactions among the stakeholders by the CPA.

43. Across all activities in the ESIA process, the stakeholders were consulted. As a requirement both by the GoB and the WB ESF, public consultation meetings (PCMs) were conducted to ensure people's participation in the proposed project. Formal and informal consultations including focus group discussions (FGDs) and key informant interviews (KIIs) with fisherfolks and fish landing groups, business establishment owners, among others were conducted at each step of the study. It helped to understand people's perception of the project, potential impacts (both positive and negative), and mitigation measures.

1.4. ESIA Study Team

44. The Chattogram Port Authority engaged several technical, environmental, and social consultants to develop this Preliminary ESIA. **Table 1-1** presents the ESIA study team reporting to CPA.

Table 1-1: ESIA Study Core Team

No.	Name of Professional	Area of Expertise	Position Assigned
01	Mohammad Hasanuzzaman B.Sc Engineering (Civil) M.Sc Env. Engineering (Denmark)	Environmental and Social Management Framework & Wastewater Treatment Expert	Environment & Safety, Wastewater Expert,
02	Dr. Md. Kamrul Hasan	Ecology, Biodiversity, and Environment	Biodiversity Expert
03	Dr. Anirban Sarker	Fish Ecology & Taxonomy Fish Evolution Marine Biology	Marine Biology/ Fisheries
04	Dr. Salma Akther	Social & Gender	Gender & Social Expert
05	Mustafizur Rahman	Land Resettelement, Social & Cultural Heritage	Land Resettelement, Social & Cultural Heritage
06	A.B.M S. Zaman B.Arch	Land Use, Planning, and Architecture	Urban Planner

2. Policy, Legal and Administrative Frameworks

2.1. GoB Policy, Legal, and Administrative Frameworks

2.1.1. GoB Environmental and Social Institutional Frameworks

45. The Ministry of Environment, Forest and Climate Change (MoEFCC) is the apex body with the mandate for matters state of the environment in the country. Realizing the ever-increasing importance of environmental issues, the MoEFCC was established in 1989 and is a permanent member of the Executive Committee of the National Economic Council (ECNEC), the decision-making body for economic policy, and is also responsible for approving public investment projects. Under the MoEFCC, the following agencies undertake specific tasks within the framework of the MoEFCC's mandate.

46. **Department of Environment (DoE)**. The DoE was established in 1989 under the jurisdiction of the MoEFCC. The DoE is the executing agency for planning and implementing environmental issues, including, but not limited to, the following activities:

- Reviewing environmental impact assessments and issuing environmental clearance Where appropriate;
- Implementing environmental monitoring programs and enforcement measures;
- Developing and maintaining environmental databases, and
- Coordinating international events with the MoEFCC (e.g., representing Bangladesh in the meetings of various multi-lateral environmental agreements, international seminars, workshops, etc.).

47. **Forest Department (FD)**. The FD is under the MoEFCC and is responsible for protecting and managing the country's reserve forests, national parks, and sanctuaries. The department manpower extends to union levels in areas where reserve forests exist. Officers of the FD are responsible for the protection of wildlife in these forest areas.

48. In addition to the MoEFCC, the following ministries and departments are also relevant to the project activities.

49. **Ministry of Land (MoL)**. The MoL manages revenue generation for government-owned land (called khas), excluding agency-owned lands controlled by the Bangladesh Water Development Board (BWDB), roads & highways, etc. The MoL controls open water bodies (rivers, beels, and haors) above a specified size, except those transferred to the Ministry of Fisheries and Livestock (MoFL) under the public water bodies (Jalmohal) Management Policy, 2009. The MoL must approve the process where the government acquires private land on behalf of a private development program.

50. **Ministry of Labour and Employment (MoLE)**. The vision of the MoLE is to reduce unemployment & poverty through productive employment & human resource development by maintaining good industrial relations & relation development between workers & employers.

51. **Ministry of Water Resources (MoWR)**. The MoWR is responsible for the water management program of the country. It includes preparing and implementing water master plans, flood control measures, surface and groundwater hydrology data-collection, modeling, monitoring, and planning of irrigation and drainage projects. BWDB is the executing agency of MoWR.

52. **Chattogram Port Authority (CPA)**. The CPA, the implementing agency for the Bay Terminal Project, is under the Ports Division of the Ministry of Shipping (MoS). CPA is committed to protecting the health and safety of everybody involved with their activities, the people who come into contact with their operations, and the physical and natural

environments in which they work. CPA is also committed to the implementation of Environmental Health & Safety Management Systems (EHSMS) in the operations (related to the requirements of health, safety, and environmental standards) of the proposed Bay Terminal and strives to:

- Ensure that all operations comply with applicable health, safety, and environmental laws and regulations;
- Implement controls to protect all personnel involved in activities to prevent pollution and to protect biodiversity;
- Provide health, safety, and environmental training to employees and actively promote awareness of health, safety, and environmental issues;
- Ensure that contractors are aware of their policies and standards and, where necessary, work with their contractors to raise their standards to meet them. Foster a culture where accidents, incidents, and near misses are reported and investigated, and the lessons learned are shared throughout the organization;
- Monitor performance and conduct regular audits to ensure controls are effective and that health, safety, and environmental aspirations are being achieved;
- Set objectives and targets for improving health, safety, and environmental performance and monitor and report openly on performance;
- Work with Government and regulatory bodies in the formulation or improvement of laws, policies, regulations, and procedures aimed at protecting health, safety, and the environment;
- Consult with and respond to the concerns of other stakeholders on health, safety, and environmental performance;

53. CPA needs to ensure that the appropriate occupational health and safety (OHS) provisions have been included in the bidding documents and are being implemented by the contractor.

2.1.2. Relevant National Environmental Legislations

54. The GoB environmental and land related acts, rules, policies, and regulations will govern the implementation of various proposed project components. **Table 2-1** summarizes the project's relevant national environmental legislation.

Table 2-1: Relevant National Environmental Legislation

Legislation	Responsible Agency	Relevance to the Project
Environment Conservation Act of 1995 and subsequent amendments in 2000, 2002 and 2010	Ministry of Environment, Forest and Climate Change (MoEFCC) Department of Environment (DoE)	The provisions of the act apply to all the components of proposed project in the construction and operation stages
Environment Conservation Rules of 2023 (updated from ECR-1997)	Ministry of Environment, Forest and Climate Change (MoEFCC) Department of Environment (DoE)	The proposed project will be classified as Red. All required clearances from the DoE shall be obtained prior to the commencement of civil works on the ground.
Environment Court Act of 2010	Judicial Court Ministry of Environment, Forest and Climate Change (MoEFCC)	Provision for the establishment of an environmental court and amends the prevailing act to accelerate punishment of environment-related crime.
Forest Act of 1927 and subsequent amendments in 1982 and 1989	Ministry of Environment, Forest and Climate Change (MoEFCC)	Various components of proposed multilane tunnel interventions will be in line for the conservation and protection of forests.

Legislation	Responsible Agency	Relevance to the Project
Wildlife (Conservation and Security) Act, 2012	Ministry of Environment, Forest and Climate Change (MoEFCC)	An Act to provide for the conservation and safety of biodiversity, forest, and wildlife of the country by repealing the existing law relating to conservation and management of wildlife of Bangladesh which is incorporated in the various components of the project selection criteria
Biodiversity Act 2017	Ministry of Environment, Forest and Climate Change (MoEFCC)	To ensure conservation of biodiversity, the sustainable use of its components and fair and equitable sharing of benefits arising out of the utilization of genetic resources which is incorporated in the various components of the project selection criteria.
Water Supply and Sanitation Act 1996	Ministry of Local Government, Rural Development and Cooperatives	Regulate the management and control of water supply and sanitation in urban areas
Bangladesh Water Act, 2013	Ministry of Water Resources & Ministry of Environment, Forest and Climate Change (MoEFCC)	Provides for the right to water when it is used for the purposes of drinking, sanitation and sewage disposal, water control, protection and conservation of water resources which is incorporated in the various components of the project selection criteria.
Protection and Conservation of Fish Act of 1950 and subsequent amendments in 1982	Department of Fishery	Water source selection will be in line with the conservation and Protection of fish in surface water bodies;
The Marine Fisheries Act, 2020	Department of Fishery	Legislation for conservation and sustainable management of fisheries in Bangladesh which is incorporated in the various components of the project selection criteria.
National 3R (Reduce, reuse, recycle) Strategy for Waste Management of 2010	Department of Environment (DoE) Ministry of Environment, Forest and Climate Change (MoEFCC)	Construction-related waste management for all civil works
The Land Acquisition Act of 1894 and The Acquisition and Requisition of Immovable Property Ordinance of 1982 and subsequent amendments in 1994, 1995, 2004 & 2017	Ministry of Land	Incorporated in the various components of the Bay Terminal project selection criteria
Antiquities Act of 1968	Department of Archaeology	Various components of proposed project interventions will be in line for the preservation of cultural heritage, historical monuments, and protected sites

2.1.3. National Laborers, Health and Safety, Gender, and Social Legislations

55. During the construction and operation, the project will comply with the labour laws and occupational and health-related rules summarized in **Table 2-2**.

Table 2-2: Relevant Laborers, Health and Safety, Gender, and Other Social Legislations

Title	Overview
Bangladesh Labour Act of 2006 Labour Rules of 2015	Provides for the safety of the workforce during the construction period. The act provides guidance on the employer's extent of responsibility and the workmen's right to compensation in case of injury caused by an accident while working.
Bangladesh National Building Code (BNBC) of 2020/BNBC Gazetted 2021	The Bangladesh National Building Code (BNBC) was first published in 1993 to regulate the construction of buildings and maintain and uphold them to specific standards. Before the code, the only law pertaining to construction was the Building Construction Act, enacted way back in 1952, during the Pakistan era. The need for the BNBC arose with sudden growth and development in the country, which led to a massive real estate boom starting in the early 90s. The first version was published in 1993. Building Codes are rules meant to stipulate the minimum standards that must be followed when a building is being constructed. They must follow these codes to gain permission for planning and construction from the authorities. The main purpose of a building code is to secure the health, safety, and overall well-being of its occupants by ensuring proper standards in the construction and design of buildings.
Water Supply and Sewerage Authority Act of 1996	The act calls for ensuring water supply and sewerage system to the public, preservation of the system, and other related health and environmental facilities for the community.
Labour Relations under Labour Laws of 1996 (Revisions to scattered Acts and Ordinances to formulate a unified code)	General concerns during the project implementation state that the project manager must recognize labor unions.
Public Health Emergency Provisions Ordinance of 1994	Calls for special provisions with regard to public health. In case of emergency, it is necessary to make special provisions for preventing the spread of disease, safeguarding public health, and providing adequate medical services, and other services essential to the health of respective communities and workers during construction-related work.
The Employees State Insurance Act of 1948	Health, injury, and sickness benefit should be paid.
The Employer's Liability Act of 1938	Covers accidents, risks, and damages with respect to employment injuries
Maternity Benefit Act of 1950	Framed rules for female employees, who are entitled to various benefits for maternity.
Bangladesh Factory Act of 1979	Workplaces provisions: these Acts and Labor Laws require medical facilities, first aid, accident, and emergency arrangements, and childcare services to be provided to the workers at the workplace.
The Penal Code, 1860	The Penal Code specifies punishments for offences related to kidnapping, abduction or compelling a woman into marriage, slavery or forced labour. However, these are seldom, if ever, invoked as they overlap with subsequent Acts that criminalize these offences.
Nari O Shishu Nirjatan Daman Ain (Women and Children Repression Prevention Act), 2000	The Women and Children Repression Prevention Act (WCRPA) is the cardinal legislation that criminalizes and introduces harsh punishments for various forms of violence against women in Bangladesh. These include trafficking, kidnapping, rape, sexual assault, and dowry violence.
National Women Development Policy 2011	The policy provides distinct guidelines on prevention of child marriage, removal of discrimination against disabled girls and their protection, secured and standard

Title	Overview
	recreational, cultural and sports facility for the female child, and removal of mental and physical abuse of women, rape, dowry, family abuse and acid throwing.
The Rights and Protection of Persons with Disabilities Act (RPPD), 2013	Affirms the rights of persons with disabilities. Section 16 of the Act enshrines their right to equal legal recognition and access to justice, as well as the right to be employed in public and private establishments
Road Transport Act 2018	Provides road transport security for any civil crimes committed under the motor vehicle ordinance act, 1983.
Source: Bangladesh Government Rules and Regulations	

2.1.4. GoB Environmental and Social Requirements for the Project

56. The legislation relevant to environmental assessment for the proposed project is the Environment Conservation Act (ECA) of 1995 and the Environment Conservation Rules (ECR) of 1997. DoE, under the MoEFCC, is the regulatory body responsible for enforcing the ECA 1995 and ECR- 2023(updated from ECR-1997) update under Bangladesh Gazette, Extra, March 5, 2023). According to ECR-2023, Rule 5 (1) (Update from ECR 1997), for issuing of Environmental Clearance Certificate (ECC), every industrial unit or project, in consideration of their site and impact on the environment, will be classified into four categories. They are Category I (green), Category II (Yellow), Category III (Orange), and Category IV (Red).

57. The proposed project falls under the **Red Category** of projects according to the Bangladesh ECR 2023, as mentioned in Schedule-1's list of various categories of industrial establishments and projects [Sub-rule (2) of rule 5, clauses of sub-rule (2) of rule 5, sub-rule (4) of rule 12, and sub-rule (3) of rule 13 Note], classifying industrial establishments or projects in Serial no: 42 Construction of ports and harbors (cargo facilities with a capacity of over 30 million tons per annum). The Environmental Clearance Committee shall review other reports submitted in terms of environmental impact assessment, such as social impact assessment, disaster preparedness plan, relocation and rehabilitation of victims, risk assessment and management plan along with EIA & EMP.

2.1.4.1. Environmental Clearance Certificate (ECC)

58. ECC must be obtained by the respective implementing agency from the DoE. The ECC procedure for Red Category projects can be summarized as follows: The steps to be followed for obtaining ECC (under Red Category) from DoE are shown in **Figure 2-1**.

59. The No Objection Certificate (NOC) is mandatory to obtain Site Clearance from the DoE. Usually, DoE indicates the name of the agencies from whom NOC would be required. DoE requires that the proponent obtain NOCs from affected agencies or local/regional administrations, which essentially sign off on the project. A NOC letter contains the description of the project, including location, justification to obtain NOC from that agency, and proposed measures under the project.

60. Public participation or consultation is not a condition in the ECR 1997/2023 or EIA Guidelines. However, DoE prefers the proponent to engage in public participation and provide site clearance during the approval of the EIA ToR.

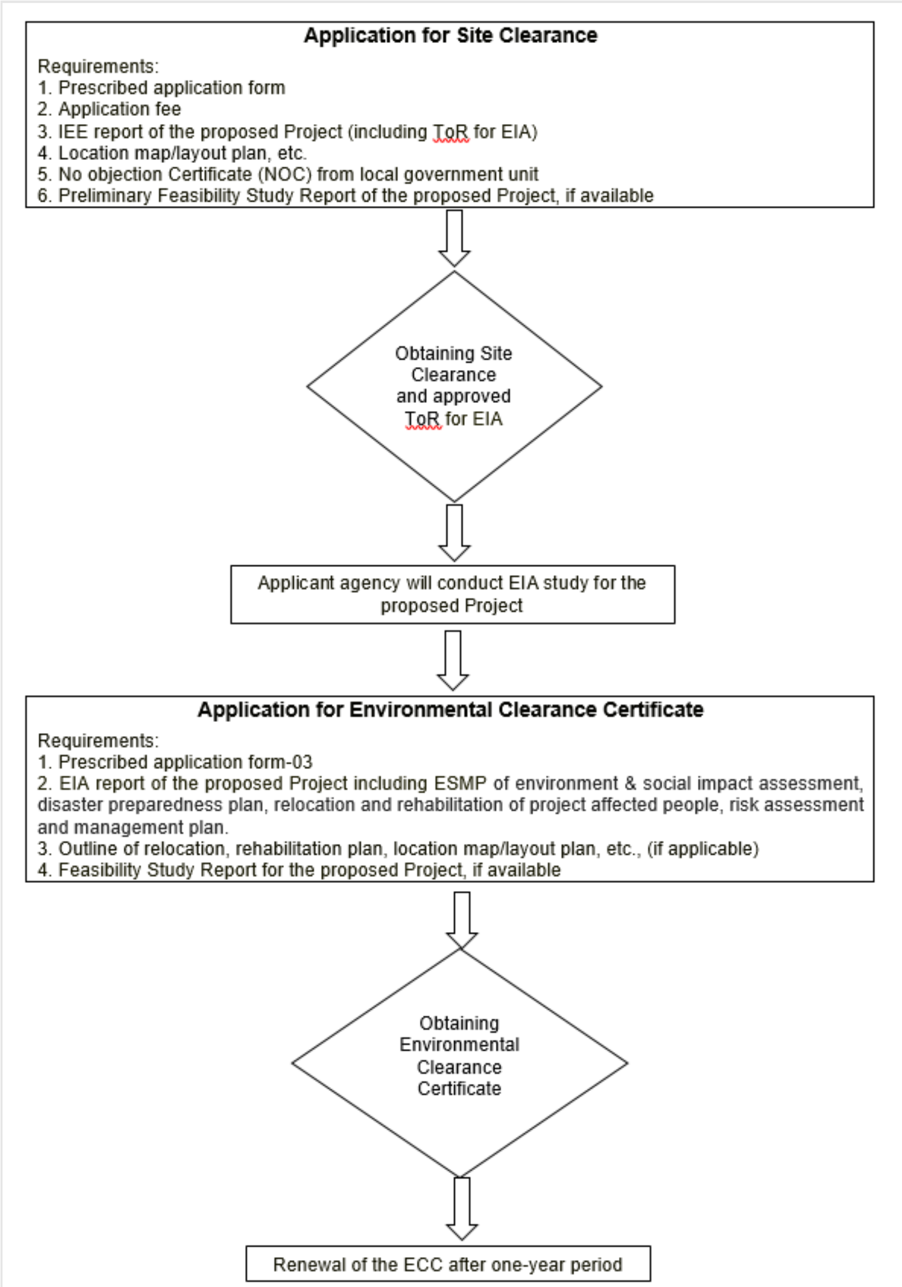


Figure 2-1: As per ECR-2023 Process of Obtaining Environmental Clearance Certificate from DoE

2.1.4.2. Environmental and Social Studies Needed for the Project

61. Under the GoB environmental regulations, studies needed for the proposed project are the IEE, EIA, EMP, including EMoP. The studies are related to the types of development interventions and impacts on environmental components (physical, biological, and socio-economic) at different implementation stages (pre-construction, construction, and operation). Environmental studies are conducted based on primary data collected during site visits, from the socio-economic, hydrological, topographic, geotechnical, and engineering surveys, data collected from public consultation meetings, and secondary data.

62. The preparation of IEE and EIA during the feasibility and detailed design stages is obligatory under Bangladesh's environmental legislation and rules. An ECC from DoE is required for initiating project implementation activities. The study needed is based on the degree of project impacts on decision-making and planning, acts as a legal document for the implementing agency, and as a management tool to stakeholders and guidelines for the

Contractor during project implementation stages. **Table 2-3** lists the environmental and social studies required for different project stages.

Table 2-3: Environmental and Social Studies Needed for the Project

Project Stages	Overview
Feasibility Study	Preparation of Initial Environmental Examination (IEE), obtaining Site Clearance, and preparation and finalization of Terms of References (ToR)
Detailed Engineering Design	Completion of Environmental Impact Assessment (EIA) and obtaining Environmental Clearance Certificate (ECC).
Preparation of Development Project Proposal (DPP)	Inclusion of recommendations from EIA in the DPP
Approval and Construction of project	Implementation of Environmental Management Plan (EMP) during construction stage
Operational Stage	Implementation of Environmental Monitoring Plan (EMoP) set by EMP during operational stage

2.1.4.3. Other Clearance/Permits Required for the Project

63. **Table 2-4** lists the other clearance/permits required for the project.

Table 2-4: Clearances and Permits Required for the Project

Clearances and Permits	Government Agency
A. Pre-Construction stage	
Approval of EIA prior to the construction stage	Ministry of Environment, Forest and Climate Change (MoEFCC)/Department of Environment (DoE)
Permission for tree felling	Forest Department (FD)
Navigation clearance	Bangladesh Inland Water Transport Authority (BIWTA)
B. Construction Stage	
Consent to establish and consent to operate construction camp sites	Department of Environment (DoE)
Permissions for sourcing of water for construction activities (surface and groundwater)	Ministry of Water Resources (MoWR) Bangladesh Water Development Board (BWDB)
Labor license	Ministry of Labour and Employment (MoLE)
Extraction of sand by dredging	Deputy Commissioner

2.1.5. International Conventions, Treaties and Protocols (ICTPs) Ratified by the GoB

64. GoB has been a signatory and party to most of the international treaties, conventions, and protocols on the environment, pollution control, biodiversity conservation, and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversity conservation and the Kyoto Protocol on climate change. GoB also complies with the International Ship and Port Facility Security (ISPS) Code, an essential maritime regulation for the safety and security of ships, ports, cargo, and crew. An overview of the relevant international treaties and conventions signed by GoB is summarized in **Table 2-5** and **Table 2-6**.

Table 2-5: Relevant International Conventions, Treaties and Protocols (ICTPs)

Treaty/Convention / Protocol	Year Created	Year Bangladesh Signed	Focus	Relevant Agency/Ministry
Ecosystem / Biodiversity				
On Protection of Birds, Paris	1950	March 19, 1976	Protection of birds in the wild state	Department of Environment/ Department of Fisheries
Ramsar Convention	1971	1992	Protection of wetlands	Department of Environment/ Department of Fisheries
Convention on International Trade in Endangered Species (CITES), Washington	1973	November 20, 1981	Ban and restrictions on international trade in endangered species of wild fauna and flora	Department of Environment/ Department of Fisheries
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	1979	November 1, 1983.	Provides a global platform for the conservation and sustainable use of migratory animals and their habitats.	Department of Environment/ Department of Fisheries
United Nations Convention on the Law of the Sea (UNCLOS)	1982	July 27, 2001	As a Law of the Sea Convention or the Law of the Sea Treaty, is an international agreement that establishes a legal framework for all marine and maritime activities.	Ministry of Shipping
Convention on Biological Diversity (CBD), Rio de Janeiro	1992	June 05, 1992	Conservation of biodiversity, sustainable use of its components and access to genetic resources	Department of Environment/ Ministry of Environment, Forest and Climate Change
Protocol on Biological Safety (Cartagena Protocol)	2000	October 30, 2013	Biological safety in the transport and use of various biological resources	Department of Environment/ Ministry of Environment, Forest and Climate Change
Pollution				
International Convention on Civil Liability for Oil Pollution Damage, Brussels	1969	March 19, 1976	Ensure that adequate compensation would be available where oil pollution damage was caused by maritime casualties involving oil tankers	Department of Environment/ Ministry of Shipping
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION 1969)	1969	1992	Affirms the right of a coastal State to "take such measures on the high seas as may be necessary to prevent, mitigate or eliminate grave and imminent danger to their coastline or related interests from pollution or threat of pollution of the sea by oil, following upon a maritime casualty or acts related to	Department of Environment/ Ministry of Shipping

Treaty/Convention / Protocol	Year Created	Year Bangladesh Signed	Focus	Relevant Agency/Ministry
			such a casualty	
The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78)	1973; 1978	October 2, 1983	Preventing ship contamination of the maritime environment due to operational or unintentional reasons.	Ministry of Shipping
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), London	1990	September 25, 1991	Legal framework and preparedness for control of oil pollution	Department of Environment/ Ministry of Shipping
Climate Change				
Vienna Convention	1985	August 2, 1990	Protection of Ozone Layer	Department of Environment/ Ministry of Environment, Forest and Climate Change
London Protocol	1990	2004 and later amended it in 2014	Control of Global Emissions that Deplete Ozone Layer	Department of Environment/ Ministry of Environment, Forest and Climate Change
United Nations Framework Convention on Climate Change (UNFCCC), Rio de Janeiro	1992	June 09, 1992 and ratified on April 15, 1994	Regulation of Greenhouse Gases Emissions	Department of Environment/ Ministry of Environment, Forest and Climate Change
International Convention on Climate Change (Kyoto Protocol)	1997	October 22, 2001	International treaty on climate change and emission of greenhouse gases	Department of Environment/ Ministry of Environment, Forest and Climate Change
Labor, Health and Safety, Gender				
Convention on the International Regulations for Preventing Collisions at Sea (COLREGs)	1972	October 5, 1978	Prevent collisions between two or more vessels	Ministry of Shipping
Prevention and Control of Occupational Hazards (Geneva)	1974	2015	Protect workers against occupational exposure to carcinogenic substances and agents	Ministry of Health and Family Welfare
Occupational hazards due to air pollution, noise & vibration (Geneva)	1977	2015	Protect workers against occupational hazards in the working environment	Ministry of Health and Family Welfare
Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)	1979	May 2015	Relates to discrimination against women in employment and emphasized that equality in employment can be seriously impaired when women are subjected to	Ministry of Labor / Ministry of Women and Children Affairs

Treaty/Convention / Protocol	Year Created	Year Bangladesh Signed	Focus	Relevant Agency/Ministry
			gender-specific violence, such as sexual harassment in the workplace.	
Occupational safety and health in working environment (Geneva)	1981	2013	Prevent accidents and injury to health by minimizing hazards in the working environment	Ministry of Health and Family Welfare
Occupational Health Services (Geneva)	1985	March 10, 2022	Promote a safe and healthy working environment	Ministry of Health and Family Welfare
International Convention on Maritime Search and Rescue (SAR)	1985	August 8, 2011	Ensure agreed, standardized procedures for SAR around the world	Ministry of Shipping/ Bangladesh Coast Guard
UN Declaration on the Elimination of Violence Against Women (DEVAW)	1993	December 9, 1993	Strengthen state commitments to global participation and policy formation regarding violence against women	Ministry of Labor / Ministry of Women and Children Affairs
Maritime Labour Convention (MLC), ILO	2006	2014	Provide a broad perspective to the seafarer's rights and fortification at work	Ministry of Labor
Heritage				
World Cultural and Natural Heritage (Paris)	1972	March 11, 1983	Protection of major cultural and natural monuments	Department of Archaeology

Table 2-6: IMO Conventions/Protocols Accepted / Acceded by Bangladesh as of January 9, 2018

SL No	Name of the Convention/Protocol	Date of entry into force	Date of Signature or Deposit of Instrument by Bangladesh	Date of the entry into force for Bangladesh	Remarks
01	Convention on the International Maritime Organization, 1948	17.03.1958		27.05.1976	Acceded
02	The convention on the International Regulations for Prevention Collisions at Sea, 1972	15.07.1977	10.05.1978	10.05.1978	Acceded
03	The International Convention on Load Lines, 1966	21.07.1977	10.05.1978	10.08.1978	Acceded
04	The Special Trade Passenger Ships Agreement, 1971	02.01.1974		10.11.1978	Acceded
05	The Protocol on Space Requirements for Special Trade Passenger Ships, 1973	02.06.1977	10.11.1978	10.02.1979	Acceded
06	The International Convention for the Safety	25.05.1980	06.11.1981	06.02.1982	Acceded

SL No	Name of the Convention/Protocol	Date of entry into force	Date of Signature or Deposit of Instrument by Bangladesh	Date of the entry into force for Bangladesh	Remarks
	of Life at Sea (SOLAS), 1974				
07	The International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969	06.05.1975	06.11.1981	04.02.1982	Acceded
08	The International Convention on Tonnage Measurement of Ships, 1969	18.07.1982	06.11.1981	18.07.1982	Acceded
09	Operating Agreement on the International Maritime Satellite Organization (INMARSAT),1976	16.07.1979		-	Acceded
10	The International Convention on Standards of Training, Certifications and Watchkeeping for Seafarers, 1978 as amended in 1995	28.04.1984	06.11.1981	28.04.1984	Accepded
11	Convention on the International Mobile Satellite Organization (IMSO)	16.07.1979	17.09.1993	17.09.1993	Acceded
12	Convention on Facilitation of International Maritime Traffic, 1965	05.03.1967	21.09.2000	28.10.2000	Acceded
13	Protocol of 1988 relating to the International Convention for the Safety of Life at Sea (SOLAS), 1974	03.02.2002	18.12.2002	04.11.2002	Acceded
14	Protocol of 1988 relating to the International Convention on the Load Line,1966	01.01.2015		-	Acceded
15	The International Convention for the Preventing of Pollution from the Ships, 1973, as modified by the Protocol of 1978 relating thereto {(MARPOL 73/78)-Annes I/II}	02.10.1983	18.12.2002	04.11.2002	Acceded
16	The International Convention for the Preventing of Pollution from the Ships, 1973, as modified by the Protocol of 1978 relating thereto {(MARPOL 73/78)-Annex III	01.07.1992	18.12.2002	04.11.2002	Acceded
17	The International Convention for the	27.09.2002	18.12.2002	04.11.2002	Acceded

SL No	Name of the Convention/Protocol	Date of entry into force	Date of Signature or Deposit of Instrument by Bangladesh	Date of the entry into force for Bangladesh	Remarks
	Preventing of Pollution from the Ships, 1973, as modified by the Protocol of 1978 relating thereto {(MARPOL 73/78)-Annex IV				
18	The International Convention for the Preventing of Pollution from the Ships, 1973, as modified by the Protocol of 1978 relating thereto {(MARPOL 73/78)-Annex V	31.12.1988	18.12.2002	04.11.2002	Acceded
19	The International Convention for the Preventing of Pollution from the Ships, 1973, as modified by the Protocol of 1978 relating thereto {(MARPOL 73/78)-Annex VI	19.05.2005	18.12.2002	04.11.2002	Acceded
20	International Conventional on Oil Pollution Preparedness, Response and Co-operation 1990(OPRC) 90	13.05.1995	23.10.2004	23.07.2004	Acceded
21	Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation (SUA),1988	01.03.1992	09.06.2005	07.09.2005	Acceded
22	Protocol for The Suppression of Unlawful Acts Against the Safety of Fixed Platforms Located on the Continental Shelf,1988	01.03.1992	09.06.2005	-	Acceded
23	International Convention on Maritime Search and Rescue, 1979	22.06.1985	08.08.2011	31.07.2011	Acceded
24	International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS 2001)	17.09.2008	11.04.2017	07.09.2018	Acceded
25	International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM 2004)	08.09.2017	11.04.2017	07.09.2018	Acceded

2.2. World Bank Frameworks, Policies, and Standards

2.2.1. World Bank Environmental and Social Framework (ESF)

65. The WB procedures for ESIA study cover the policies, guidelines, and good practices. The WB guidelines are consistent with the best practices for such work in Bangladesh.

66. The ESF supports globally accepted practices and interventions by which the borrowers can efficiently implement their development programs keeping the environmental and social impact of the people and landscapes minimal. The WB undertakes environmental and social risk screening of the proposed projects that are classified into one of four categories High Risk, Substantial Risk, Moderate Risk, and Low Risk depending on their type, location, sensitivity, the scale of the project, and the nature and magnitude of its potential environmental impacts and the capacity and commitment of the Borrower.

67. The proposed project has been identified as a **high-risk** category because of its potential environmental and social impacts on WB's ESS. The salient parameters include significant E&S and OHS risks, low regulatory and institutional capacity, and low technical capacity. However, many associated risks can be mitigated with proper and timely measures. The WB environment and social standards are as follows:

- ESS1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS2: Labor and Working Conditions
- ESS3: Resource Efficiency and Pollution Prevention and Management
- ESS4: Community Health and Safety
- ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities
- ESS8: Cultural Heritage
- ESS9: Financial Intermediaries
- ESS10: Stakeholder Engagement and Information Disclosure

2.2.2. World Bank Environmental, Health and Safety (EHS) Guidelines for Port Facilities

2.2.2.1. World Bank Group (WBG) EHS Guidelines of 2007

68. The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). They are referred to in the WB's ESF and International Finance Corporation (IFC's) Performance Standards. The WBG requires borrowers/clients to apply the appropriate levels or measures of the EHS Guidelines. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent.

69. The General EHS Guidelines contain the following information:

- Environmental (Air Emissions and Ambient Air Quality, Energy Conservation, Wastewater and Ambient Water Quality, Water Conservation, Hazardous Materials Management, Waste Management, Noise, Contaminated Land)
- Occupational Health and Safety (General Facility Design and Operation, Communication and Training, Physical Hazards, Chemical Hazards, Biological Hazards,

Radiological Hazards, Personal Protective Equipment, Special Hazard Environments, Monitoring)

- Community Health and Safety (Water Quality and Availability, Structural Safety of Project Infrastructure, Life and Fire Safety, Traffic Safety, Transport of Hazardous Materials, Disease Prevention, Emergency Preparedness and Response
- Construction and Decommissioning (Environment, Occupational Health and Safety, Community Health and Safety)

2.2.2.2. WBG EHS Guidelines for Port, Harbors, and Terminals

70. The WBG EHS has developed specific guidelines for the construction and operations of ports, harbors, and terminals. More specific issues and mitigating measures are discussed and proposed.

71. **Environment**. Environmental issues relevant to port and terminal construction and operation primarily include the following: terrestrial and marine habitat alteration and biodiversity; climate change resilience; water quality; air emissions; waste management; hazardous materials and oil management; noise and vibration (including underwater).

72. **Occupational Health and Safety**. Occupational health and safety issues relevant to port and terminal construction and operation primarily include the following: physical hazards; chemical hazards; confined spaces; exposure to organic and inorganic dust; and exposure to noise including the risk of SEA/SH at the workplace.

73. **Community Health and Safety**. Community health and safety issues during the construction of ports are common to those of the largest infrastructure or industrial facilities and are discussed in the General EHS Guidelines. These impacts include, among others, dust, noise, and vibration from construction vehicle transit and infectious diseases associated with the influx of temporary construction labor, workplace sexual harassment and abuse, and any interferences to the community related to sexual harassment and abuse. The following operational phase issues are specific to ports and are discussed in the EHS: port marine safety; port security; and visual impacts.

2.3. Gap Analysis between GoB and WB Policies (including measures to be taken to address those gaps)

74. The gaps between the relevant government laws and WB ESS and measures to address the gaps are presented in **Table 2-7**.

Table 2-7: Gaps Between GoB Laws/Regulations and WB ESS

World Bank ESS	Relevant GoB Laws/Regulations	Gaps	Measures to Address the Gaps
▪ **ESS 1 Assessment and Management of Environmental and Social Risks and Impact**	▪ ECA 1995 ▪ ECR-2023(Update from ECR 1997)	▪ The EIA screening and scoping study doesn't comprehensively cover all the WBs ESS in their analysis; ▪ (Stakeholder engagement is carried out during the EIA. However, the nature of stakeholder engagement could be more extensive in scope. The EIA report is also not publicly disclosed; and ▪ The EIA framework doesn't require the analysis of alternatives.	▪ Project components will be thoroughly screened to ensure that they are covered by and meet the requirements of ESS and Government laws and regulations; ▪ E&S risks and Impacts have been identified in the ESIA based on surveys and consultations with primary stakeholders, including communities and implementing agencies; ▪ Environmental and Social Management Plan (ESMP) will be prepared based on the screening outcome and impact assessment in the ESIA; and ▪ The ESIA will be disclosed both on the CPA and Bank's websites.
▪ **ESS 2 Labor and Working Conditions**	▪ Labor Act 2006 ▪ Public Procurement Rule 2008 ▪ Occupational Health and Safety Policy 2013	▪ The labor act does not make it mandatory for development interventions to be assessed and reviewed in terms of labor and working conditions, including OHS, before approval; and ▪ The labor act does not require development projects to prepare labor management plans/procedures or OHS Plans.	▪ The project will be hiring direct and contracted workers. The Contractor(s) might further engage multiple subcontractors; ▪ The influx of migrant for construction works is a norm and is likely to continue in this project; and ▪ A labor management procedure (LMP) will be prepared to regulate working conditions and management of workers' relations, including worker specific GRM, terms and conditions of employment, non-discrimination, equal opportunity, GBV/SEA/SH, protection of workforce, the prohibition of child/forced labor, and provision of OHS Plan for

World Bank ESS	Relevant GoB Laws/Regulations	Gaps	Measures to Address the Gaps
			contractors.
▪ **ESS 3 Resource Efficiency and Pollution Prevention and Management**	▪ ECA 1995 ▪ Sustainable and Renewable Energy Development Authority Act 2012 ▪ Road Transport Act 2018 <u>Water</u> ▪ The Ground Water Management ordinance, 1985 ▪ Water Supply and Sanitation Act, 1996 ▪ National Water Bodies Protection Act, 2000 ▪ The National Water Act, 2013 <u>Waste</u> ▪ National 3R Strategy for Waste Management, 2020 ▪ Hazardous Waste (E-Waste) Management Rules, 2021 <u>Air and Noise</u> ▪ The Brick Burning Control Act, 1989 (Amendment Act, 1992 and 2001) ▪ Noise Pollution (Control) Rules 2006 ▪ Draft Air Pollution Control Rules 2021	▪ The current regulations of BD do not require consideration of efficiency in energy, water and raw materials use in project design and planning. ▪ Projects are not required or encouraged through any policy to follow the hierarchy approach in addressing pollution issues as current regulations of BD. ▪ There is still no regulation or policy encouraging individual companies/projects to minimize GHG emission.	▪ The project preparation and the ESIA process will identify feasible measures for efficient (a) energy use; (b) water usage and management to minimize water usage during construction, conservation measures to offset total construction water demand and maintain balance for demand of water resources; and (c) raw materials use by exploring use of local materials, recycled aggregates, use of innovative technology so as to minimize project's footprints on finite natural resources. ▪ With respect to Pollution Management, the project will develop, as part of the ESIA process, prevention and management measures to offset risks and impacts of pollution from potential sources such as dust and emission from operation of hot-mix and batching plants, crushers, construction and haulage vehicles, material and spoil stockpile; effluents and wastewater from labor camps, construction camp; spillage or leakage during handling of chemical admixtures, hazardous materials like bitumen, high strength diesel, used oil, battery wastes etc.; and disposal of non-hazardous wastes (municipal wastes) generated during project implementation

World Bank ESS	Relevant GoB Laws/Regulations	Gaps	Measures to Address the Gaps
			period.
▪ **ESS 4 Community Health and Safety**	▪ ECA 1995, current update of ECR-2023 <u>Infrastructure and Equipment Design and Safety</u> ▪ Bangladesh Standards and Testing Institute Act 2003 ▪ National Building Code 2020 <u>Traffic and Road Safety</u> ▪ Roads and Highways Department Geometric Design Standards 2005 ▪ Road Transport Act 2018 <u>GBV/SEA</u> ▪ Women and Children Repression Prevention Act, 2010 ▪ National Women Policy, 2011 ▪ Rights & Protection of Persons with Disabilities Act, 2013 ▪ High-Court Directives on SEA/SH in public places Health ▪ Pesticide Act 2009 ▪ Food Safety Act 2013	▪ Although the ECA 1995 already gives the DoE the authority to decide on safe practices for the use, storage, and transportation of hazardous substances, the country lacks any policies or standards for dam safety, let alone for the safety of water infrastructure. Expectedly, except from those development projects that have historically been covered in the EIA with the DoE as the agency responsible, there are no specific standards or organizations in charge of safeguarding community health and safety throughout the planning phase. Almost all areas of community health and safety are seriously under-enforced, but the building code, laws governing food safety, and operational aspects of road safety (such as traffic laws, licensing, etc.) are perhaps the worst offenders.	▪ The ESMP contains measures that are appropriate for filling the gaps between GoB regulations and ESS 4. Additionally, contractors will be in charge of creating and carrying out the Contractor Environmental and Social Management Plan (C-ESMP) for community health and safety, which includes an OHS plan and a management plan for traffic and road safety, among other things.
▪ **ESS 5 Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement**	▪ National Land Use Policy, 2001 ▪ Acquisition and Requisition of Immovable Property Act (ARIPA) 2017	▪ Preparation of a Social Impact Assessment (SIA) and Resettlement Action Plan (RAP) is not required; ▪ Does not provide compensation or assistance to those who are none-title holders; ▪ Does not have provisions to include transitional allowances for the restoration of livelihoods for informal settlers;	▪ Important gaps between WB ESS and GoB regulation exist in the determination of compensation, identification of non-titleholders, cut-off dates for non-title holders, and valuation of structures with depreciation. These gaps and other short- and long-term measures will be included in the RAP.

World Bank ESS	Relevant GoB Laws/Regulations	Gaps	Measures to Address the Gaps
		▪ Focused on cash compensation which may be viewed as a short-term strategy. However, involuntary resettlement can cause long-term impacts. ARIPA does not include sustainable or inclusive developmental objectives. ▪ No special provisions for specific groups, such as the vulnerable groups of the population; and ▪ The valuation of lost assets is not based on the replacement cost principle.	
▪ **ESS 6 Biodiversity Conservation**	▪ Forest Act 1927 ▪ Protection and Conservation of Fish Act 1950 ▪ ▪ ECA Act 1995 ▪ National Integrated Pest Management Policy 2002 ▪ Disaster Management Act 2012 ▪ Wildlife Act 2012 ▪ Biodiversity Act 2017 ▪ The Marine Fisheries Act 2020	▪ Bangladesh's biodiversity regulations prioritize the identification of key habitat areas and their designation as protected areas. Development initiatives are normally not authorized in these places due to their protected status unless they are part of the area's conservation plan. As a result, there are no overarching rules or standards for controlling project impacts and influence in various domains, such as the hierarchy rule for implementing mitigation measures. However, the ECA 1995 imposes obligation on individuals/companies for harm inflicted to ecosystems and requires that compensation for the loss be established by an expert. ▪ It is important to keep in mind that most regulatory frameworks pertinent to the other WB ES Standards are not explicitly	▪ Although these strategies and acts cover bio-diversity conservation but does not directly cover issues such as eco-system services. This provision needs to be considered during the project's impact evaluation.

World Bank ESS	Relevant GoB Laws/Regulations	Gaps	Measures to Address the Gaps
		associated with the EIA.	
▪ **ESS 7: Indigenous People**	▪ Constitutional Rights of the Tribal People	▪ No equivalent requirements available in the national laws.	▪ This ESS will identify the measures to minimize disruption of the livelihoods due to the project development. Currently no Indigenous person has been identified.
▪ **ESS 8 Cultural Heritage**	▪ National Culture Policies ▪ Antiques Law 1968	▪ No clear strategy or requirement is defined to manage the effect of development interventions on cultural heritage.	▪ If they (antiques/cultural heritage) are found, they need to be relocated, and provisions must be made in the RAP; ▪ A chance find procedures will be incorporated in the ESMP, and chance find clauses will also be incorporated in work contracts requiring contractors to stop construction; and(iii) Although the current alignment does not have any heritage sites or archaeological sites, the project is likely to impose a negative externality on mosques, temples, churches, schools, colleges, madrasahs, etc. The WB mitigation hierarchy will be followed to address the gaps.
▪ **ESS 10 Stakeholder Engagement and Information Disclosure**	▪ Right to Information Act, 2009	▪ The EIA framework does not require consultation. The scope of consultation is very limited. ▪ However, the EIA guidelines issued by DoE and other agencies recommend public consultations during scoping and the preparation of the ESIA. There is also no provision for any stakeholder engagements during project implementation.	▪ The project will ensure that relevant stakeholders for the project are properly identified. ▪ Stakeholders have been consulted during the preparation of the stakeholders' engagement plan (SEP). ▪ The SEP has been prepared to follow during the implementation of the project.

3. Project Description

3.1. Project Context

75. Chittagong Port, located north of Karnaphuli River on the northeast curve of the Bay of Bengal, has historically been Bangladesh's largest and most significant seaport. The issue with Chittagong Port is that its maximum draft is just 9.2 meters, which is insufficient for many contemporary cargo ships. It necessitates a time-consuming and costly transfer procedure since smaller ships must convey goods to and from large ocean freighters anchored in the bay.

76. The project's goal is to expand the current capacity and facilities of the Chittagong Port to remove bottlenecks that prevent the effective delivery of services, as was previously thought to be necessary. Over the years, the need for such expansion has attained paramount importance and necessitated the immediate establishment of the proposed Bay Terminal. The proposed Bay Terminal will help remove the bottlenecks currently faced by the Chittagong Port, as stated above, through accommodating terminals offering berthing facilities to bigger vessels in large numbers and reducing their waiting time and, hence, help speed up the port activity.

3.2. Proposed Project

3.2.1. Project Implementing Agency

77. The Chittagong Port Authority (CPA) is the project's proponent. CPA is an autonomous entity within the Ministry of Shipping (MoS) of the Government of the People's Republic of Bangladesh.

3.2.2. Project Objectives

78. The objectives of the project are the following:

- To serve as a significant gateway for the country's trade with the rest of the globe;
- To overcome the primary issue of the limiting factor in accommodating larger vessel sizes in the Chittagong Port;
- To improve service quality, develop adequate facilities, and increase capacity of total Chittagong Port;
- To enhance the port's dynamism and efficiency, the CPA has taken short, mid, and long-term plans in line with the Sustainable Development Goals (SDGs) 2030 and 2041; and
- To increase the country's export competitiveness by lowering the prices of imported and exported commodities due to shorter shipping times and reduced shipping costs.

3.2.3. Project Location

79. The project site with geographic coordinates shown in **Figure 3-1** is under North Halishahar Ward No. 37, Middle/South Halishahar Ward No. 38, and South Kattoli Ward No. 11 and Ward No. 26. The landside portion of the project site is in the Halishahar region of Chittagong to the west of the existing Chittagong Port and several kilometers to the north of the Chittagong Export Processing Zone (CEPZ). The project site can be accessed by the Port Link Road and coastal roads to the east and the Bay of Bengal to the west. **Figure 3-2** shows the location map of the proposed Bay Terminal.

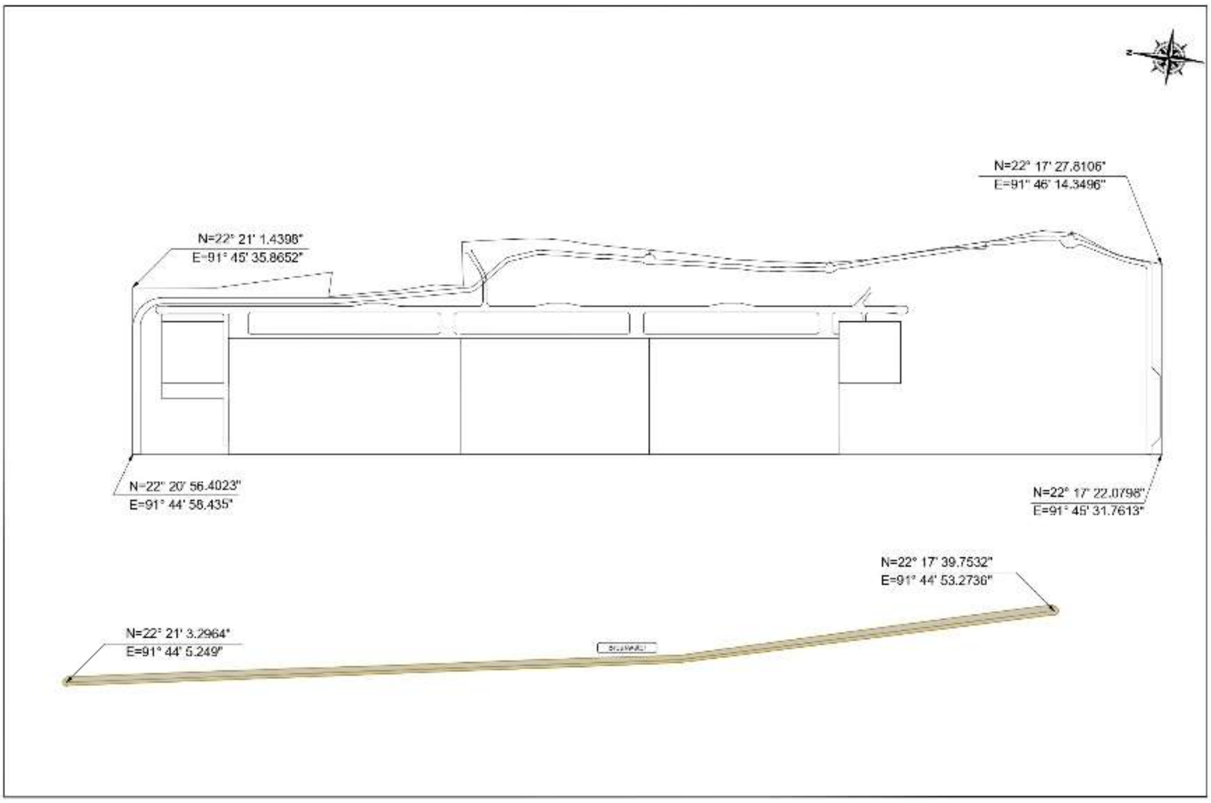


Figure 3-1: Map with Geographic Coordinates of the Proposed Bay Terminal

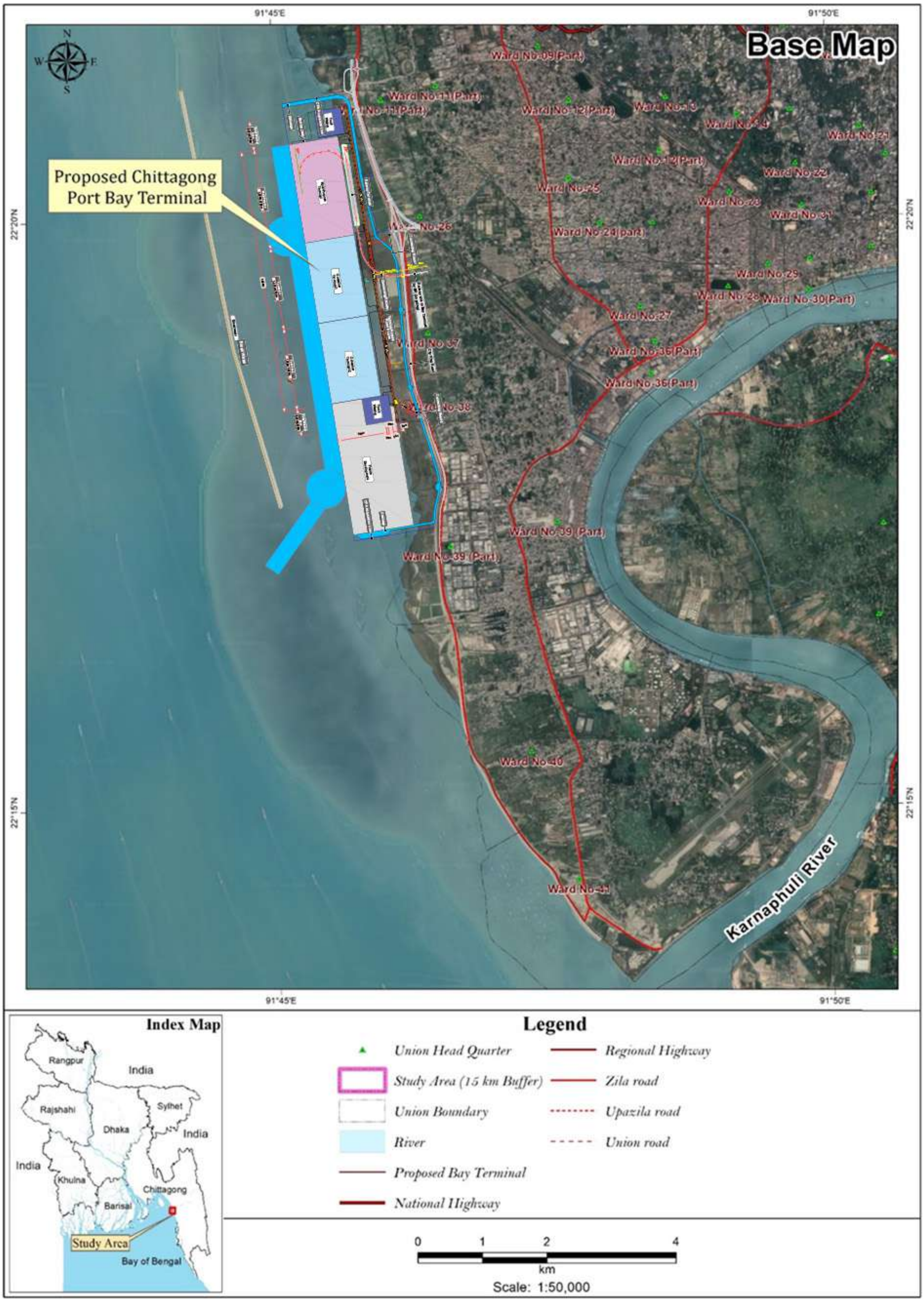


Figure 3-2: Location Map of the Proposed Bay Terminal

3.2.4. Project Site

81. The project site will have a total land area of approximately 2,500 acres, of which 1,620 acres are reclaimed from the sea, 500.695 acres are *khas already transferred to CPA*, 188.0711 acres are khas/litigation land under acquisition, 124.085 acres are forest land under process to be transferred, and 66.85 acres are private land already acquired. CPA has already sand-filled some of the land inside the project boundaries, totaling 138.11 acres. **Plate 3-1** shows the photographs of the project site.

Plate 3-1: Photographs of the Project Site

3.3. Project

82. The major interventions of the proposed Bay Terminal are the following:

- Container terminals 1 and 2
- Multipurpose terminal
- Breakwater on existing sandbar
- Capital and maintenance dredging along ~13 km stretch of the access channel
- Jetty, buildings and terminal gate
- Terminal access road and bay bridges
- Railway terminal with railway access facilities
- Community drainage facilities with small fishing boat landing station
- Container and General cargo handling facilities
- Electrical substation with necessary facilities.

83. **Figure 3-3** shows the layout plan of the proposed Bay Terminal.

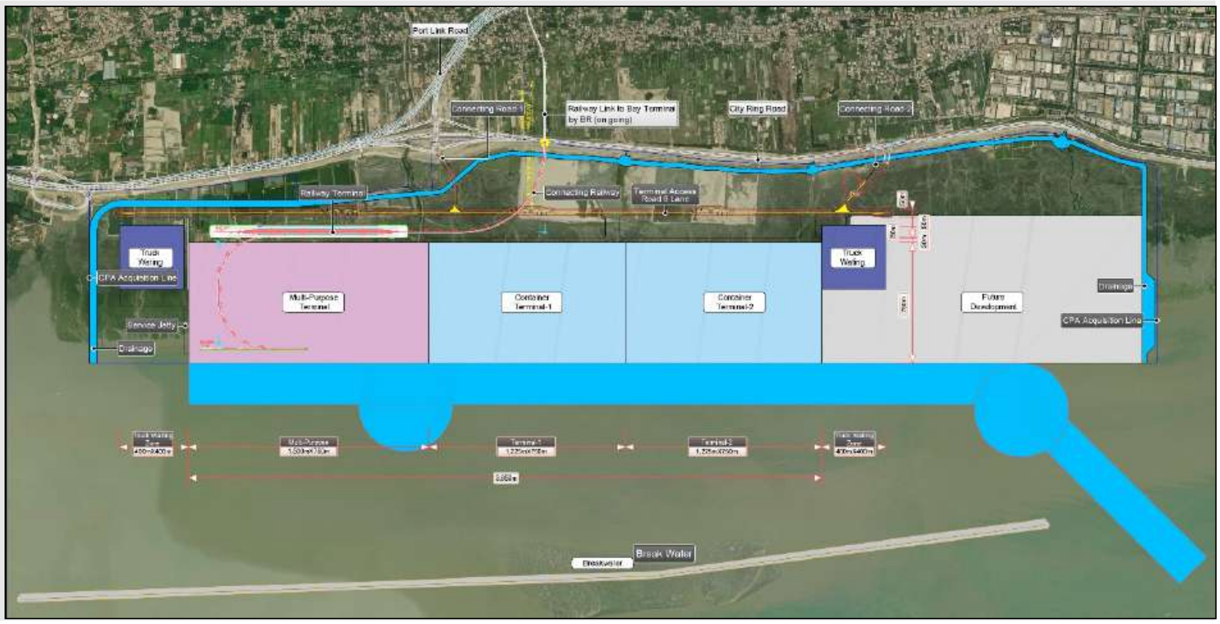


Figure 3-3: Layout Plan of the Proposed Bay Terminal

3.3.1. Breakwater

84. **Figure 3-4** shows the sandbar of about 1 km from the planned terminal location and an inner channel between the sandbar and the terminal. A breakwater will be constructed along the sandbar in front of the Bay Terminal.

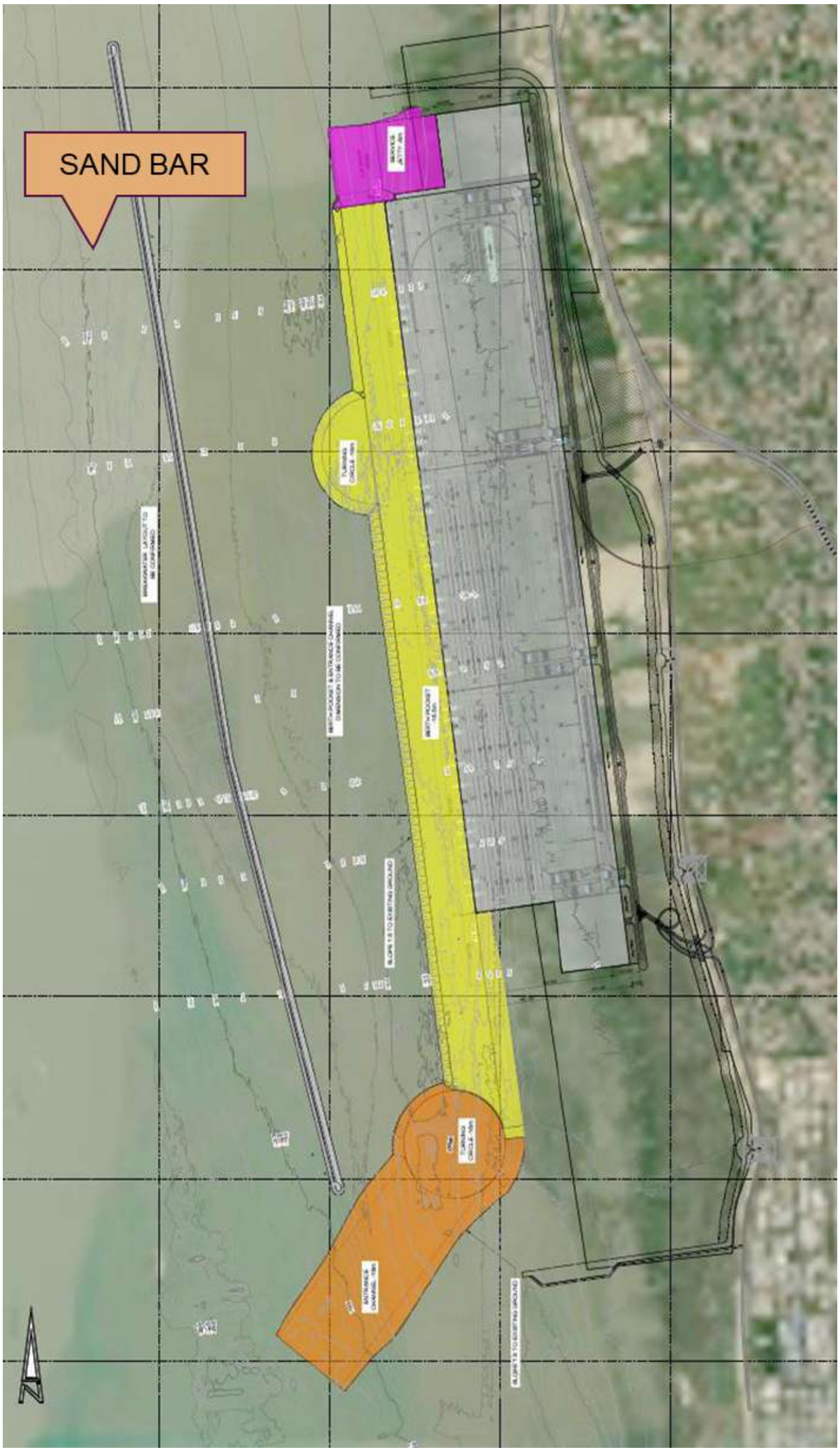


Figure 3-4: Location of Sandbar

3.3.2. Port Terminal and Container Yard

3.3.2.1. Port Terminal

85. The port terminal will be composed of two container terminals and multipurpose terminals. It will be used by cargo ships such as Panamax-class containers, bulk carriers, Ro-Ro ships, etc. It will have a total of 13 berths. The length of the total berth is 3,950 m. The length of one berth for the container is 300 m per 42,000 dead weight tonnage (DWT), and for cargo is 300 m per 50,000 DWT. The length of the berth is provided in **Table 3-1**. **Figure 3-5** shows the arrangement of the berth.

Table 3-1: Length of Berth

Terminal	Container Terminal - 1		Multipurpose Terminal		Container Terminal - 2	
	Berth, No.	Length, m	Berth, No.	Length, m	Berth, No.	Length, m
Container	4	1,225	-	-	4	1,225
Cargo	-	-	5	1,500	-	-
Source: Detailed Master Plan of Bay Terminal Project under CPA, Janary 2024						

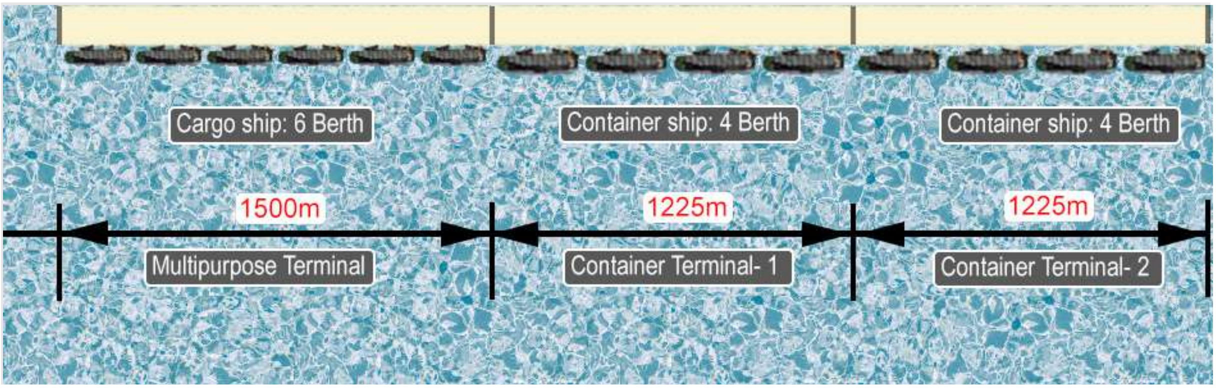


Figure 3-5: Arrangement of Berth

3.3.2.2. Container Yard

86. The container yard will be divided into two areas. Container-related facilities such as stacking, appropriate zones, container freight station (CFS), customs, workshop and gate will be concentrated in the front area adjacent to the jetty for quicker loading and unloading of containers. The rear areas will be planned for the delivery zone, empty container stack, dangerous & non-standard container stack, gate, etc. Around 18,260 of 20-foot container ground slots (TGS) will be installed in the Bay Terminal. **Table 3-2** presents the TGS for each terminal.

Table 3-2: Capacity of Container Stacking

Item	Container Terminal – 1, TGS	Container Terminal – 2, TGS	Total, TGS
Container Yard	9,130	9,130	18,260
Appraisal & Delivery Zone(m^2)	31,606	31,606	63,212
Note: TGS – Twenty Feet Container Ground Slots *Source: Detailed Master Plan of Bay Terminal Project under CPA, January 2024*			

87. There will be separate entrance and exit gates for CFS handling imported and exported LCL cargoes. Each gate will have three lanes to facilitate in and out of cargo. In addition, CFS will have facilities and parking lots for customs inspection. There will be two CFS buildings per terminal. The floor area of each CFS is 300,000 m^2 (300m × 100m). **Table 3-3** shows the size of CFS. **Figure 3-6** shows the CFS layout plan.

Table 3-3: Size of CFS

Item	Area, m^2		Number of CFS	Total, m^2
Container Terminal – 1	300,000	2 Floors	2	1,200,000
Container Terminal – 2	300,000	2 Floors	2	1,200,000
Total			**4**	**2,400,000**

Item	Area, m^2	Number of CFS	Total, m^2
Source: Detailed Master Plan of Bay Terminal Project under CPA, January 2024			

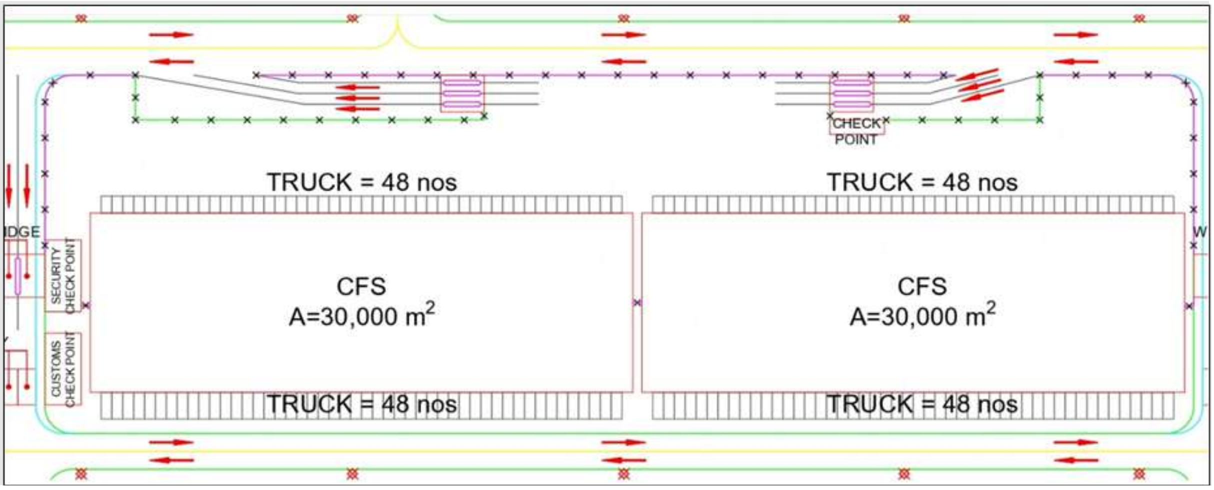


Figure 3-6: CFS Layout Plan

3.3.3. Multipurpose Yard

88. The Multipurpose Terminal will have an open yard, warehouse, and car parking. It will store and handle various cargoes. **Table 3-4** presents the yard and warehouse size of the multipurpose terminal.

Table 3-4: Yard and Warehouse Size of Multipurpose Terminal

Item	Area, m^2
Open Yard	414,570
Warehouse #1	13,530
Warehouse #1	13,530
Warehouse #1	13,530
Dangerous Warehouse	13,530
RCWH (Radiation Controlled Warehouse)	4,100
Car Parking Building (Ground Floor to 4th Floor)	10,600
Source: Detailed Master Plan of Bay Terminal Project under CPA, January 2024	

89. The total floor area of car parking will be 10,600 m^2, allowing 1,200 cars to be parked. A one-lane railway terminal for heavy cargo will be installed on the rear side of the jetty, as shown in **Figure 3-7**.

Figure 3-7: Quayside Railway Station on the Rear Side of the Jetty

3.3.4. Jetty

90. Due to the soil conditions, a structure with a deep foundation, such as a reinforced concrete suspended deck on piles, is the most practical/economical option. **Figure 3-8** shows the cross-section of the jetty.

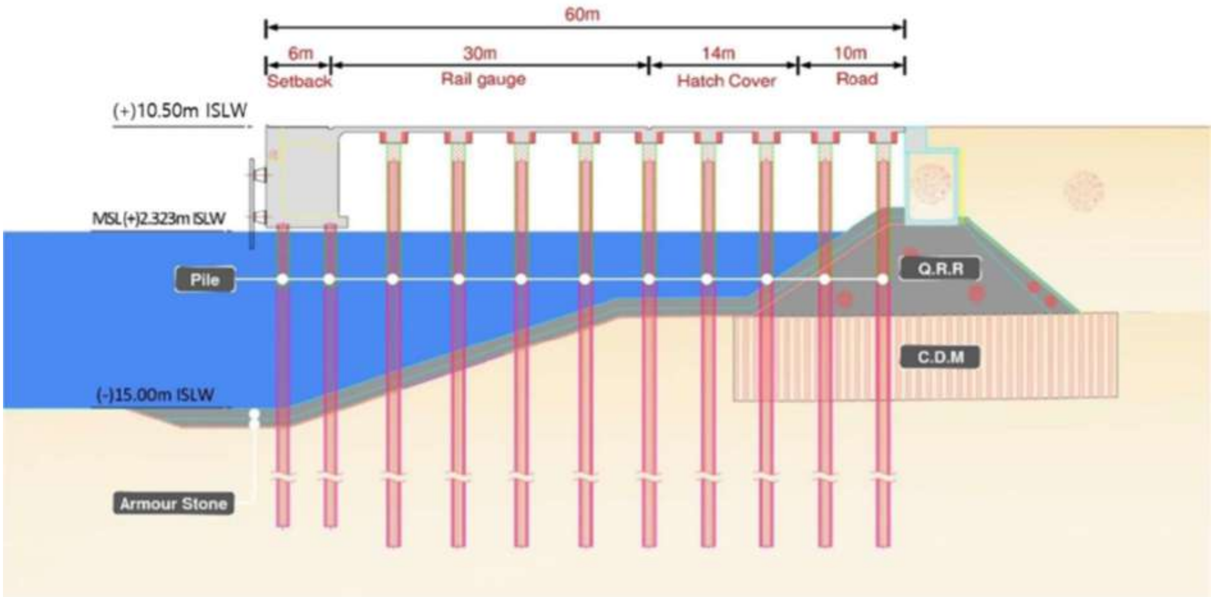


Figure 3-8: Cross Section of Jetty (Quay Wall)

91. The width of the Jetty is determined to be 60m considering the setback, quay gantry crane (QGC) rail width, hatch cover, and road. The length of the setback is planned to be 6m in consideration of the bollard, cable trench, power supply, etc. **Table 3-5** presents the dimensions of the jetty.

Table 3-5: Dimensions of Jetty

Setback	Crane rail span	Hatch cover	Road	Total
6.0 m	30.0 m	14.0 m	10.0 m	60.0 m
Source: Detailed Master Plan of Bay Terminal Project under CPA, January 2024				

3.3.5. Building and Other Infrastructure

92. The building and other infrastructure zones will be divided inside and outside the yard. The buildings and infrastructures inside the yard are essential for the yard's operation, such as the operating building, water reservoir, pump house, cafeteria, fuel station, driver/labor shed, workshop, overhead water tank, substation, etc. The buildings and infrastructures outside the yard include the administration building, guest house, cafeteria, fire station, medical center, etc. **Table 3-6** lists the buildings and infrastructures inside and outside the yard.

Table 3-6: Buildings and Other Infrastructures

Building and Infrastructure	Unit	Multipurpose Terminal	Container Terminal 1	Container Terminal 2
Operation Building				
Signal Tower (Top of Operation Building)	nos	1	0	0
Outer Gate Complex	nos	2	0	0
Inner Gate Complex	nos	2	1	1
CFS Gate Complex	nos	0	2	2
Weigh Bridge (Each lane of Inner Gate)	nos	40	20	20
Security Check Point	nos	4	3	3
Security Post	nos	6	4	4
Customs Building	nos	1	1	1
Customs Check Point	nos	2	1	1
CFS Shed (Including Custom Office)	nos	0	2	2
Sub-Station	nos	1	1	1
X-Ray Scanner	nos	0	4	4
Toilet and Resting Shed	nos	6	5	5

Building and Infrastructure	Unit	Multipurpose Terminal	Container Terminal 1	Container Terminal 2
Driver & Labour Shed	nos	2	2	2
Workshop	nos	2	2	2
Fuel Station	nos	1	1	1
Tool Storage	nos	2	2	2
Pump House	nos	1	1	1
OHWT (Over Head Water Tank)	nos	2	1	1
Warehouse	nos	3	0	0
DG Warehouse	nos	1	0	0
RCWH (Radiation Controlled Warehouse)	nos	1	1	1
RQD (Radio Quantity Detection)	nos	0	1	1
Service Jetty Office & Documentation Office	nos	1	0	0

Table 3-7: Building and Infrastructure Outside the Yard

Building and Infrastructure	Unit	Multipurpose Terminal	Container Terminal 1	Container Terminal 2
One Stop Building	nos	1	0	0
Security Building	nos	1	0	0
Fire Station	nos	1	0	0
Main Sub-Station	nos	1	0	0
Solid Waste Yard	nos	1	0	0

3.3.6. Terminal Connecting Road and Bridges

3.3.6.1. Connecting Road

93. Direct access from the Port Link Road[2] to Chittagong Bay Terminal will be provided. The considerations for the Bay Terminal access road will be the following:

- To provide smooth movability for freight traffic between the port and National Highway-1 (N1);
- To ensure traffic safety for local traffic and communities against cargo truck traffic;
- To mitigate community severance by the connecting road construction;
- To minimize natural and social environmental impact by the road construction; and
- To accommodate the future expandability of arterial road links into the Chittagong development area.

94. **Figure 3-9** shows the Bay Terminal Connecting Road from the Port Link Road.

[2] The Port Link Road has currently two lanes with a capacity of 16,000 vehicles per day. The Roads and Highways Department (RHD) is planning to widen the road to four lanes.

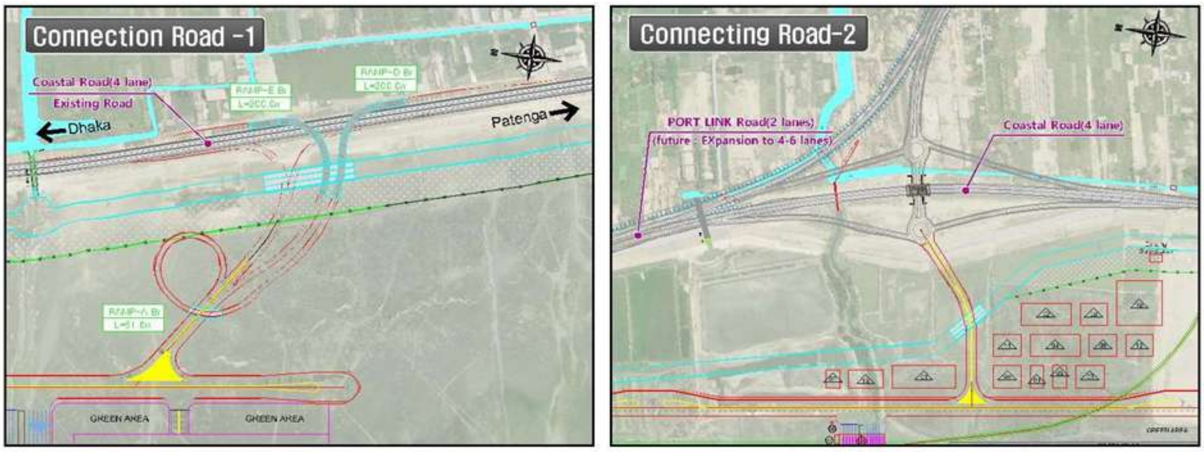
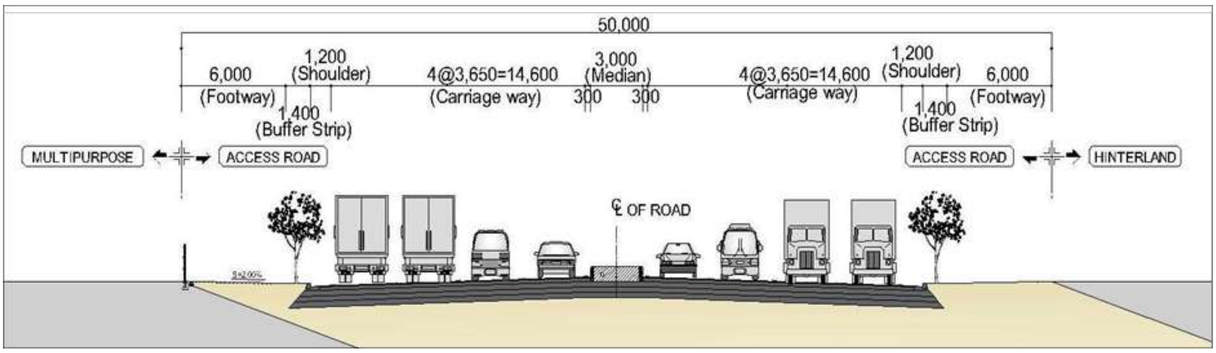


Figure 3-9: Bay Terminal Connecting Road

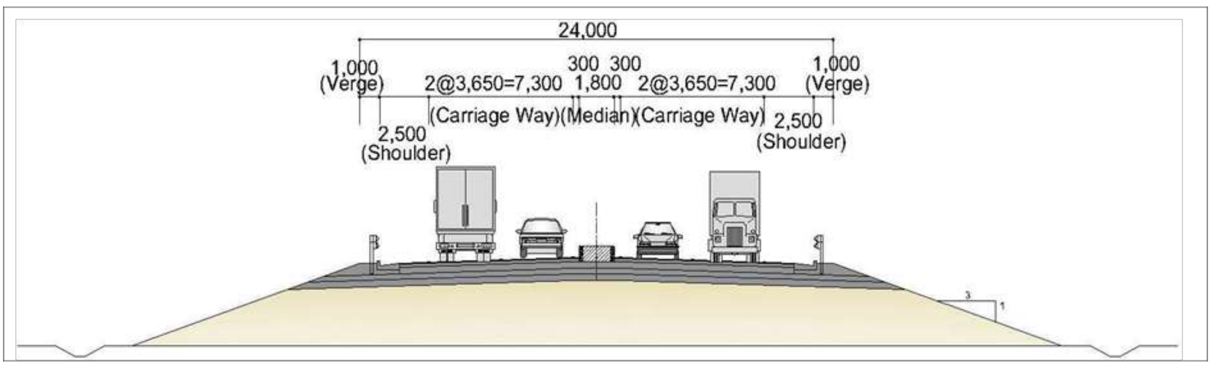
95. **Table 3-8** and **Figure 3-10** show the dimensions of the Bay Terminal connecting road cross-section.

Table 3-8: Dimensions of the Bay Terminal Connecting Road

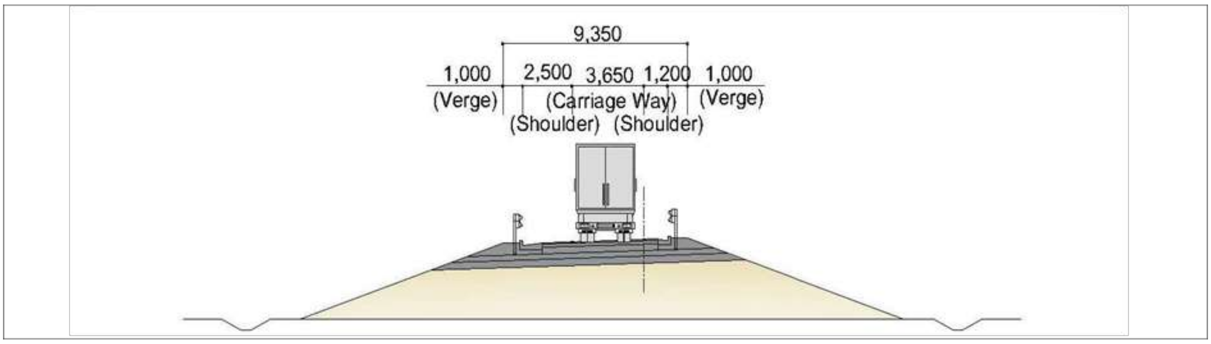
Description	Unit	Access Road	Connecting Road	
Number of Lane			2 lanes(dual)	**1 lane**
Crest Width	m	50.00	24.00	**9.35**
Carriageway	m	8@3.65=29.20	4@3.65=14.60	**3.65**
Median	m	3.00	1.80	-
Shoulder	m	1.20	2.50	2.50
Verge	m	1.00	1.00	1.00



(a) Access Road (8 Lanes)



(b) Connecting Road (4 Lanes)



(c) Connecting Road (Single 1 Lane)

Figure 3-10: Typical Cross Section Connecting Road

3.3.6.2. Bridges of the Connecting Road

96. **Table 3-9** lists the detailed specifications of the bridges. PSC BEAM, PSC BOX, and RCC BOX types of bridges are considered for economic feasibility. **Figure 3-11** shows the layout of the bridges.

Table 3-9: Detailed Specifications of the Bridges

Name	Type	Length, m	Width, m	Remark
Bay Bridge	PSC BEAM	8@40 =320	29.3 (6Lanes)	Crossing the Road
Ramp-A Bridge	PSC BEAM	43+55+43+8@15 =261.0m	10.8 (2Lanes)	Crossing the Road
Ramp-B Bridge	PSC BOX +RCC BOX	43+55+43+3@15 =186.0m	10.8 (2Lanes)	Crossing the Road
Ramp-C Bridge	RCC BOX	13@15 =195.0m	10.8 (2Lanes)	-
Ramp-D Bridge	PSC BEAM +PSC BOX +RCC BOX	35+3@40+20@15 =455.0m	10.8 (2Lanes)	Crossing the Road

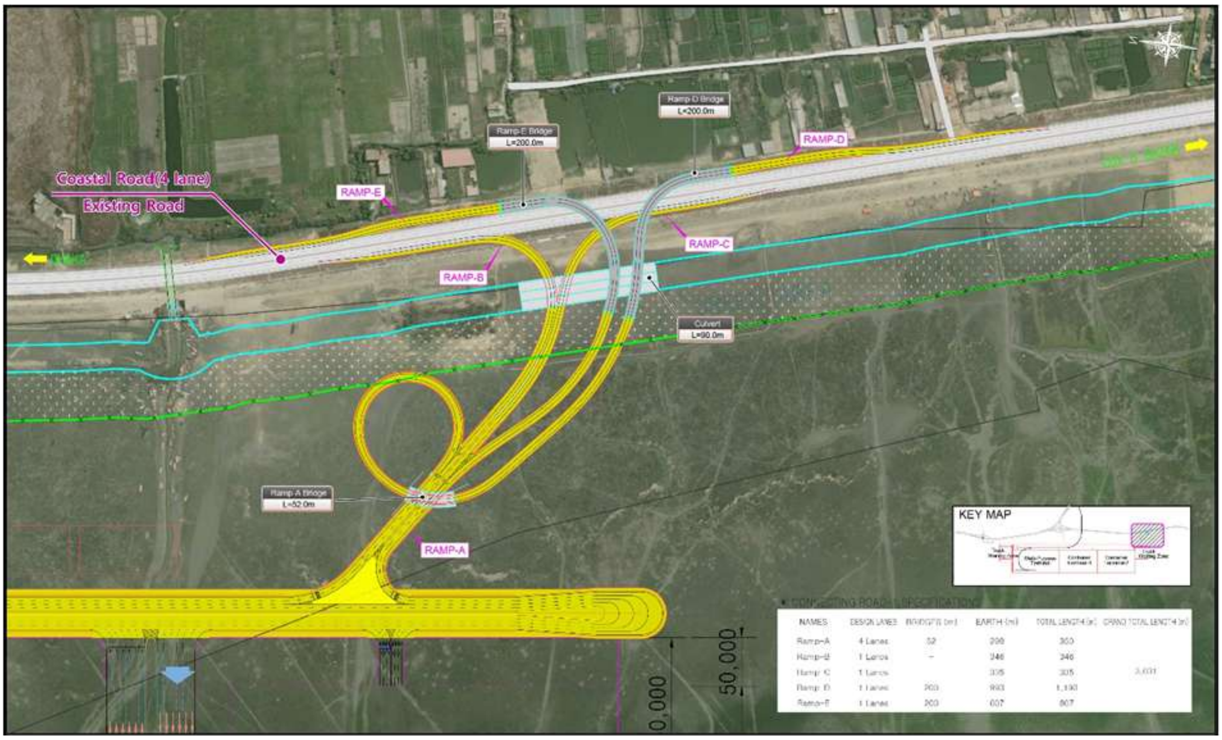


Figure 3-11: Layout of the Bridges

3.3.7. Railway Connections

97. The proposed Bay Terminal will be connected to Halishahar railway station through an access railway. The railway will carry a large number of containers at a time. It will reduce the issues created by transportation through container trucks, such as air and noise pollution, road congestion, and delayed delivery. The railway terminal will be constructed inside the multipurpose terminal. It will facilitate quick cargo transport from the Port site to the inland area. **Figure 3-12** shows the layout of the railway terminal.

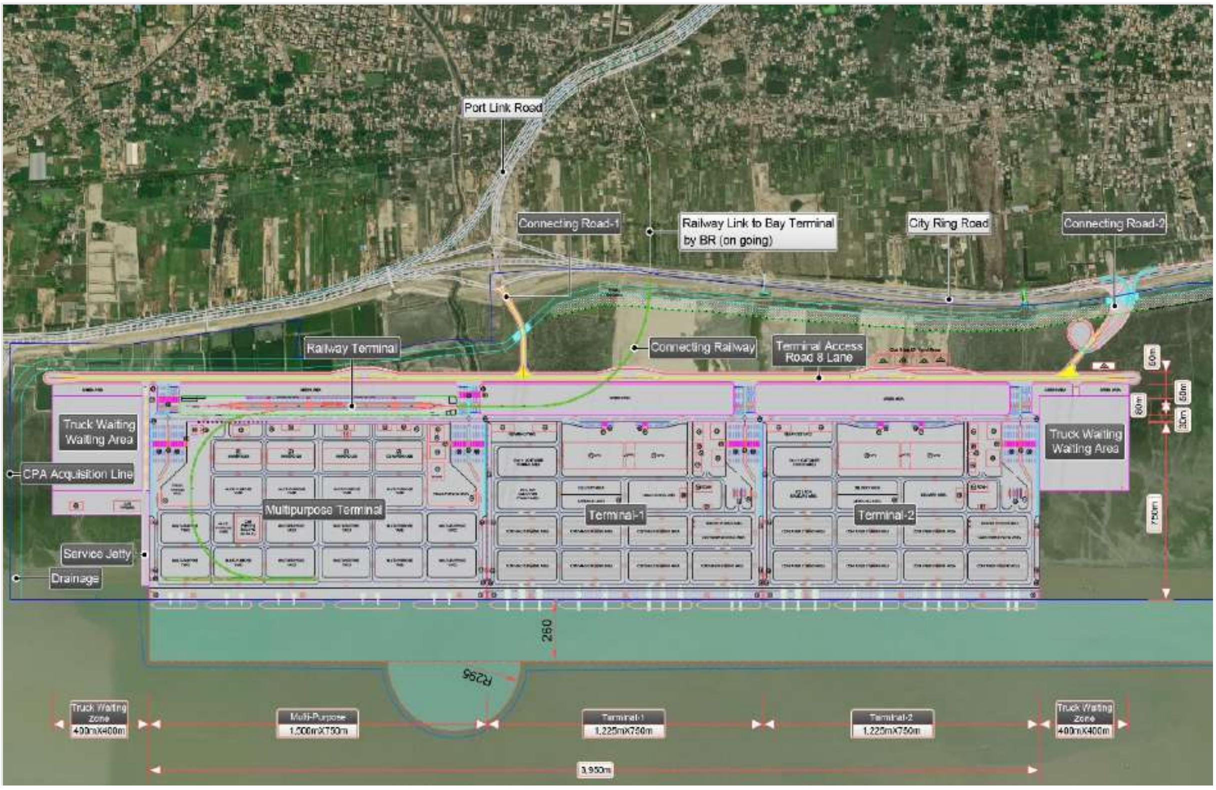


Figure 3-12: Layout of the Railway Terminal

98. In the future, the train will go directly from the railway terminal in Bay Terminal to Dhaka. The total alignment spans 4.258 km, comprising 2.397 km of access railway and 0.67 km of incoming railway. This measurement excludes the 1.225 km railway link designed by BR. Due to the limited land availability within the port area, a minimum radius curve of 300 meters has been adopted to accommodate the spatial constraints. **Figure 3-13** shows the railway horizontal alignment.

Figure 3-13: Railway Horizontal Alignment

3.4. Utility Requirements

3.4.1. Water Requirement and Sources (including rainwater harvesting)

3.4.1.1. Water Demand

99. The water requirement will be used for office operation, toilet flushing, office canteen, washing, etc. and berthing ship (ship purchase water from the port). **Table 3-10** list the estimated water demand of the three terminals.

Table 3-10: Water Demand of the Three Terminals

No.	Water Usage	Water Demand
01	Port Operation Manpower (MTP+CT-1+CT-2)	932x3x200 liter = 559,200 liter (559 m^3) Considering the demand of year 2053.
02	Port Visitor including Truck Divers	1000x3x200 liter = 600,000 liter (600 m^3) Considering the demand of year 2053.
03	Berthing ship (Three Terminal)	Crew: 24 Nos. x Water Consumption: 1,000 liter/voyage time: 30 days x No. of ship: 13 per day Daily Water Requirement by ship = 9,360 m^3/day Estimated Water Demand for Ship = 10,000 m^3/day (For Safety)
04	Others;	Considering the Other Water Demand = 840 m^3
Total Water Demand (Estimated)/day = 2,000m^3 (Port Operation) + 10,000 m^3 (Ship) = 12,000 m^3		
Source: Port engineering team & Pub; 7.I85 – The Management of Ship-Generated Waste On-board Ships		

3.4.1.2. Water Sources

100. The water sources are the following:

- Groundwater extracted by a deep tube well.
- Surface water collected from Karnaphuli River by a piping network.
- Rainwater harvesting.
- Sea water collected by a pipe network.

101. The groundwater source will be used during regular operation. During the monsoon period, rainwater and surface water from the Karnaphuli River will be utilized along with the groundwater. The blended water will be treated to an 800 m^3/h water treatment plant (WTP) to produce potable water.

102. To establish the concept of green in port operation, it is better to use other available sources, like surface water and rainwater, along with groundwater, which will reduce stress on groundwater sources. The temporary water storage capacity of rainwater is 292,789 m^2 with 4.5 m depth. The total rainwater volume that can be collected is 1,317,325 m^3.

3.4.2. Power Requirement and Sources

3.4.2.1. Electrical System

103. The electrical system will consider the following:

- The electrical system covers a total length of quay front of 3,950m.
- Installation of separate electrical incoming lines depending on the operating entity.
- Electrical load capacity is calculated by dividing it into three locations (Container Terminal 1, 2, and Multipurpose Terminal).

104. The national grid will source the electricity in accordance with International Electrotechnical Commission (IEC) standards. **Table 3-11** summarizes the electricity plan for the project.

Table 3-11: Electricity Plan for the Bay Terminal

Items	Contents
Bay Terminal Electrical Power Operation Plan	3 independent two parallel incoming lines are established and operated separately
Incoming Power Plan	Single-line service (1 Spare Type)
Voltage Ranges	132kV or 33kV – 11kV-400/230V

105. The equipment main load consumption of the STS crane, RTG, and Mobile Harbor Cranes will be distributed to three terminals. **Table 3-12** shows the estimated load consumption for buildings & yards.

Table 3-12: Overall Estimated Electrical Demand Load For CT-1, CT-2 And MPT

Item	Sum of Maximum Demand CT-1 (MVA)	Sum of Maximum Demand CT-2 (MVA)	Sum of Maximum Demand MPT (MVA)	Diversity Factor (Between Transformers)	CT-1 Demand (MVA)	CT-2 Demand (MVA)	MPT Demand (MVA)
Electrical Load for Equipment	24	24	7	1.3	18	18	5
Electrical Load for Building, Yard, and Parking Area	10	10	16	1.3	7	7	12
Shore-to-Ship Power Supply System CT – 5 MVA x 3 Sets, MPT	15	15	15	1.3	12	12	12

Item	Sum of Maximum Demand CT-1 (MVA)	Sum of Maximum Demand CT-2 (MVA)	Sum of Maximum Demand MPT (MVA)	Diversity Factor (Between Transformers)	CT-1 Demand (MVA)	CT-2 Demand (MVA)	MPT Demand (MVA)
– 5 MVA x 3 Sets							
Total (Include Ship Power)					37	37	29
Total (Not Include Ship Power)					26	26	18

106. The electrical design will consider the following:

- Three independent incoming lines will be established and operated separately, and the Multipurpose Terminal incoming line has been designed with two parallel lines (1- spare line)
- All solar power produced will be consumed in its terminal, and no storage battery will be installed.
- Photovoltaic (PV) panels will be installed on the roofs of all buildings with available locations.
- Shore-to-ship power supply facilities will not be installed.
- The power supply of the RF container will be supplied through a cross line from the normal transformer in the event of a power failure of the RF transformer. When both transformers are out of power, a generator will be used as an alternative power supply.

3.4.2.2. Solar System

107. There are two main categories of crystalline silicon modules, one of which is mono-crystalline modules, and the other is multi-crystalline modules. Mono-crystalline modules are currently best interms of performance, with an efficiency of 16 – 18%. They are also more expensive. The efficiencyof multi-crystalline modules is between 12 and 14%. They are more commonly used, especially inthe residential and service sectors.

108. Calculating a photovoltaic array, it is absolutely essential to take into account the location (geographic location, latitude, altitude, shade, etc.) and installation factors (direction faced, angle,etc.). Firstly, the approximate power output may be calculated based on the available surface area:10 m² = 1 KWp. **Table 3-13** shows the solar panel installation area.

Table 3-13: Solar Panel Installation Area (m^2)

Building Area (m^2)	Area (m^2)		Solar Panel (m^2)	
	MPT	CT	MPT	CT
Operation Building (area, m^2) 10FL x (80x140), 10 FL x (80 x 100) Load Capacity (kVa)	11,200	8,000	8,960	6,400
Substation (area, m^2) (60 m x 100 m), (60 m x 100 m) Load Capacity (kVa)	6,000	6,000	-	-
CFS (area, m^2) 2x (100 m x 300 m), (100 m x 300 m) Load Capacity (kVa)	60,000	30,000	48,000	24,000
Worker House, Workshop (area, m^2) (20x65), (20x70)/(30x65), (30x70) Load Capacity (kVa)	1,300 1,950	1,400 2,100	1,040	1,120
Cafeteria MPT-(0), CT-(60x55) (Area, m^2) Recreational MPT-(0), CT-(100x90) Load Capacity (kVa)	-	3,300 9,000	-	2,640 7,200
Security Check (20x40), (20x40) (area, m^2) Recreational MPT-(0), CT-(100x90) Load Capacity (kVa)	800 800	800 1,000	640 640	640 800
Warehouse (area, m^2) MPT-(70x75x2), (70x100), CT-(30x57) Load Capacity (kVa)	10,500 7,000	1,710	8,400 5,600	1,368
Custom Office MPT-(0), CT-(20x50x2) Shed, Fire (30x60, 30x60)/(0, 20x40), Fuel (20x40), (20x40)	- 2,600	2,000 3,400	- 2,080	1,600 2,720

Building Area (m^2)	Area (m^2)		Solar Panel (m^2)	
	MPT	CT	MPT	CT
Load Capacity (kVa)				
Truch Terminal (Tower Light 30 m) T/R Access Road (Pole 10 m) Load Capacity (kVa)			75,360	48,488
	0.87	0.83	65,186	40,245

109. The solar power generation capacity (1KW/10 m^2):

- Container Terminal 1 & 2 (same capacity): 4,000KW
- Multipurpose Terminal: 6,500KW

3.4.3. Other Support Facilities

3.4.3.1. Community Drainage Plan with Small Fishing Boat Landing Station

110. It is necessary to construct adequate drainage facilities in the eastern part, mainly ward number 10, 11 (detail), 26, 37, 38, 39, and 40 areas and the surrounding area. The area will be divided into four catchments for efficient management, sustainable drainage, and ensuring natural discharge. **Figure 3-14** shows the catchment area. **Table 3-14** presents the detailed assessment of drainage volume.

Figure 3-14: Boundary of Catchment Area

Table 3-14: Detailed Assessment of Drainage Volume

Name	Drainage area (ha)	Total Drainage Area (A) in ha	Rainfall Intensity (I) in mm	Runoff coefficient	Discharge from Rainfall (m^3/s)	Additional Drainage (m^3/s)	Climate change impact volume (23% of rainfall) in (m^3/s)	Total Discharge (m^3/s)
Cat-1	127.5	856.9	27	0.67	43.4	7.4	**9.98**	**60.78**
Cat-2	407.4							
Cat-3	228.1							
Cat-4	93.9							
	856.9							

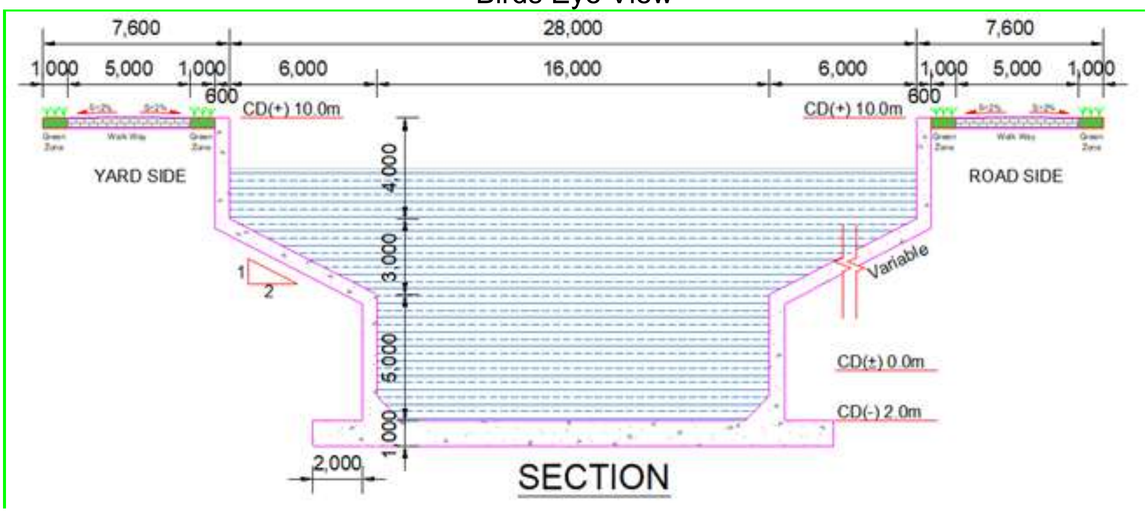
111. The drainage design considers the total drainage area, rainfall intensity, runoff coefficient, climate change impact, and the additional drainage by the Chittagong WASA and CEPZ. From these considerations, the drainage plan is summarized below:

- The bed width of the drainage channel will be 16 m at the bottom, and 26 m at the top with a single side opening, and the bed level will be (-) 1.5 to (-) 2.0 mPWD. It is recommended that the drainage channel be open at both ends to facilitate quick drainage and washout the siltation, considering the unusual hydrological event, sea level rise, changes in land use pattern, soil erosion, and siltation. It will also enhance the design capacity substantially.
- A silt trap with a proper collection and management system will be constructed downstream of the BWDB regulators.
- A couverture area will be provided inside the drainage channel to minimize the upstream water thrust for the sustainability of the channel structure as well as the backflows of the discharge water.
- A mechanical screening system will be provided on both sides of the channel to remove suspended solids from wastewater discharge from urban areas that will cause seawater quality degradation.
- Three vent regulators will replace the damaged pipe sluice with a size of 1.5 m x 1.8 m.
- It is recommended that the discharge of CWASA's STP be directly connected to the drainage channel (downstream side), and the level of discharged pipe should be kept above the high tide level. The regulator gate will be closed during high tide to prevent flooding in the city area.

112. **Figure 3-15** shows the layout and section of the drainage channel.

Top View

Birds Eye View



Sectional View

Figure 3-15: Layout and Section of Drainage Channel

3.4.3.2. Fire Safety System

113. **Figure 3-16** shows the fire hydrant lay plan of the Multipurpose Terminal. The fire safety system is necessary to prevent, detect, and extinguish fire within ports, terminals, and vessels.

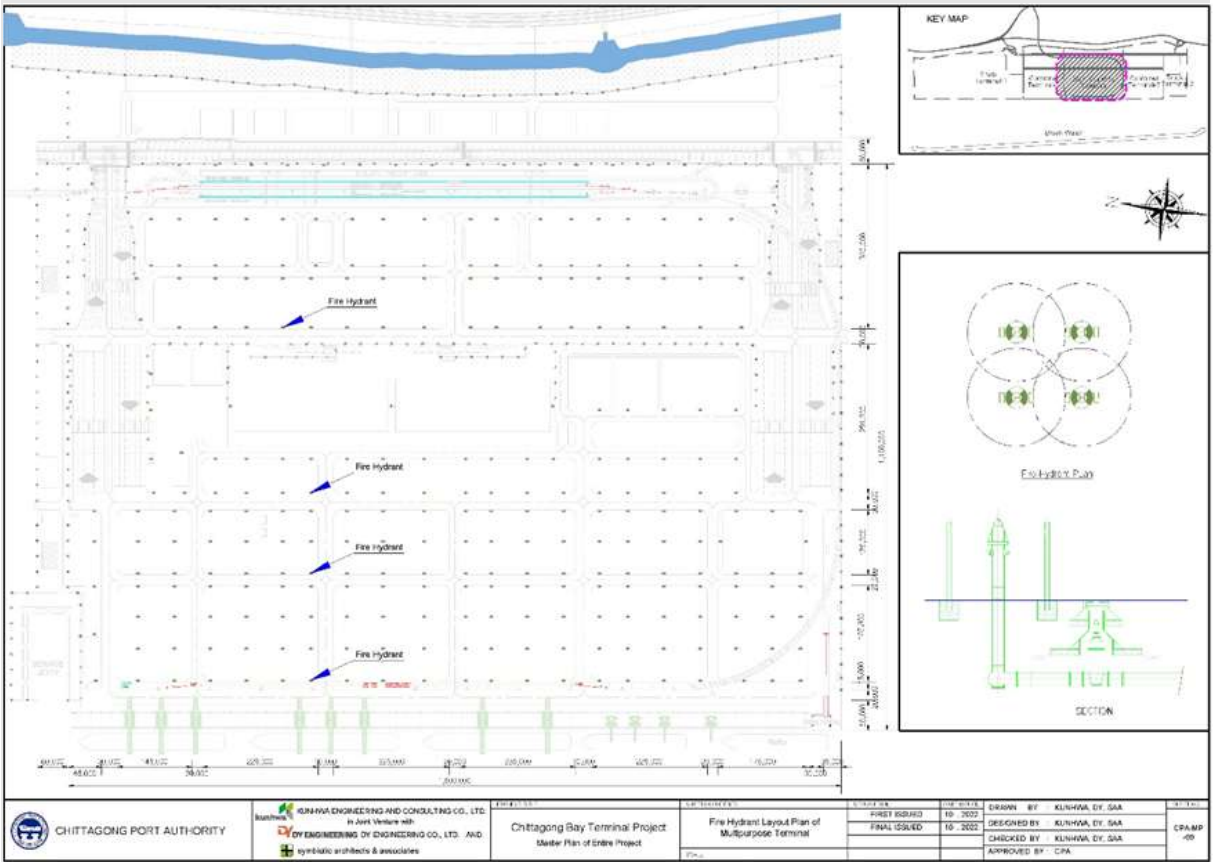


Figure 3-16: Fire Hydrant Lay Plan of the Multipurpose Terminal

3.4.3.3. Fuel Storage Tank

114. A stainless-steel underground fuel storage tank with excellent durability and corrosion resistance will be installed.

3.5. Construction Materials and Equipment

3.5.1. Source of Construction Materials

115. A material survey was conducted. The "CPA Material Survey Report" provides a thorough analysis of materials required for the Bay Terminal Project at Chittagong Port. It includes extensive details on various construction materials like embankment materials, subgrade, aggregates, cement, and steel. The document emphasizes the specifications, sourcing, and testing of these materials, ensuring they meet international standards. The report is essential for ensuring the quality and compliance of materials used in this significant infrastructure project. **Table 3-15** and **Table 3-16** presents the possible sources of materials and its distance from project site. **Figure 3-17** shows the material sources map.

Table 3-15: Summary of Possible Sources of Materials

Item	Bangladesh	Other countries	Remarks
Hard Rock	-	O	India, Indonesia, Malaysia, Thailand
Boulders	O	O	Bangladesh, India
Coarse aggregates	O	O	Bangladesh, India

Item	Bangladesh	Other countries	Remarks
(forconcreting)			
Fine aggregates (forconcreting)	O	-	Bangladesh
Cement	O	-	Bangladesh
Reinforcement	O	-	Bangladesh
Cohesive soil for claddingof Embankment	O	-	Bangladesh
PC strand and equipment(φ 12.7mm/ φ 15.2)	-	O	Japan, Korea, China
Steel plates	-	O	Japan, Korea, China
Water (for concreting)	O	-	Bangladesh
Admixtures	-	O	India, Japan
Rail	-	O	Japan, India, China, Canada, and Germany
Ballast	-	O	India, Indonesia, Malaysia, Thailand
High-strength Geo-textiles	O	-	Bangladesh
Separation Geotextiles	O	-	Bangladesh
Prefabricated Vertical Drains	-	O	Japan, Singapore
Drainage Blanket	O	-	Bangladesh
**Remarks: O Available, - Questionable for supply.*			

Table 3-16: Distance from Possible Source to Project Site

No	Location	Type of Material	Distance from Site (Km)
01	Chatak, Sunamganj	Sand	259
02	Domar, Nilphamari	Sand	260
03	Patgram, Lalmonirhat	Sand	280
04	Panchagarh	Sand	305
05	Bholaganj, Sylhet	Aggregate	265
06	Narayanganj	Cement	150
07	Munshiganj	Cement	165
08	Chittagong	Reinforcement	385
09	Sonandapur village, Koddarmore, (6 KM away from WestBanganndhu Railwaystation)	Clayey Soil	06
10	Polisha Dakhin Para (1 KM from west station towards Bhuapore)	Clayey Soil	02

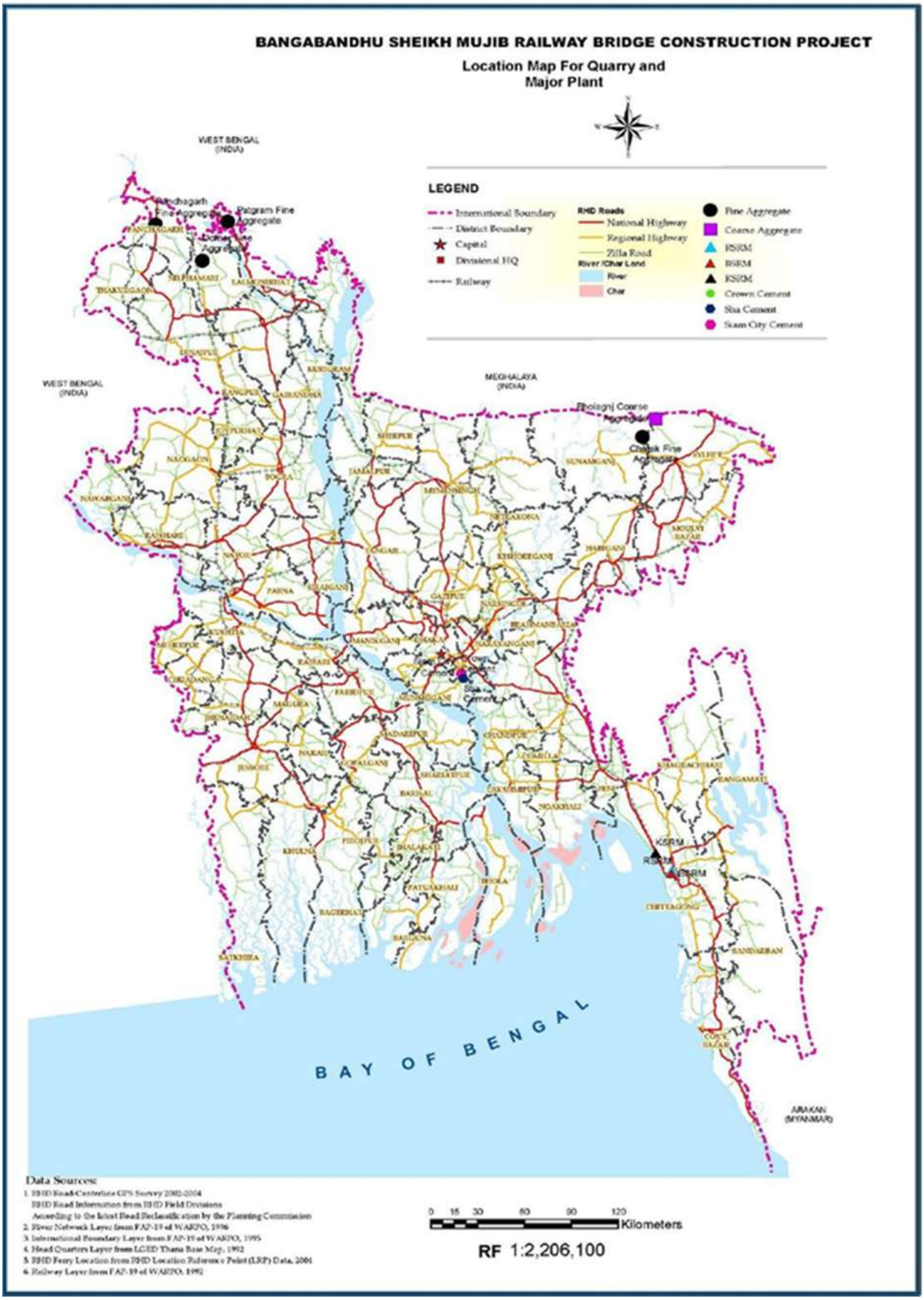


Figure 3-17: Material Sources Map

List of Construction Equipment

116. Port construction requires a wide range of construction equipment to handle various tasks involved in building and maintaining ports and harbors. Here is a list of common construction equipment used for port construction:

- Excavators: Used for digging, trenching, and removing soil and debris.
- Backhoes: Versatile machines for digging, trenching, and material handling.
- Bulldozers: Used for earthmoving, grading, and shaping the land.
- Wheel Loaders: Used to move materials, such as sand and gravel, within the port.
- Cranes: a. Mobile Cranes: Used for lifting heavy materials and containers. b. Crawler Cranes: Ideal for heavy lifting on rough terrain. c. Tower Cranes: Used for lifting materials and equipment during construction.
- Pile Drivers: Essential for driving piles into the ground to create foundations for structures like docks and piers.
- Dredgers: Used to deepen waterways and maintain navigable channels within the port.
- Tugboats: Assist in towing and maneuvering ships within the harbor.
- Barges: Used to transport heavy equipment, materials, and construction supplies.
- Material Handling Equipment: a. Forklifts: Used for moving palletized cargo and containers. b. Reach Stackers: Specifically designed for handling shipping containers. c. Straddle Carriers: Used for stacking and transporting containers.
- Concrete Mixers and Pump Trucks: Used for pouring and placing concrete in various construction projects within the port.
- Graders: Used to level and maintain roadways and surfaces within the port area.
- Road Rollers: Compacts soil and asphalt surfaces for road construction.
- Trenchers: Dig trenches for utility lines and drainage systems.
- Concrete Pavers: Used to lay down concrete for roads, runways, and pavements.
- Asphalt Pavers: For laying asphalt surfaces on roads and parking areas.
- Surveying Equipment: Includes total stations and GPS devices for precise measurements and mapping.
- Pipe Layers: Used for installing pipelines and conduits for utilities.
- Crushers and Screeners: Crush and screen aggregates and materials for various construction purposes.
- Portable Generators: Provide power for construction equipment and temporary facilities.
- Welding Equipment: Used for fabrication and repair work on structures and equipment.
- Tugmasters: Specialized vehicles for moving trailers and containers in port yards.
- Safety Equipment: Includes barricades, cones, signage, and personal protective gear for worker safety.

3.6. Pollution Control Facilities

3.6.1. Solid Waste

117. During construction, solid waste may include insulation, nails, electrical wiring, rebar, wood, plaster, paper, scrap metal, cement, and bricks. These materials may be damaged or unused but can be recycled or reused in other forms. Waste wood can be recovered and recycled into the wood for other construction. Cement, bricks, and plaster can be crushed and reused in other construction projects. These materials can be collected in a confined place and transferred to others by a collector for reuse. Moreover, some solid waste can be generated from labor camps, which is mostly biodegradable.

118. During operation, solid waste may include paper, packaging material, and kitchen waste. A small quantity of electronic waste could be generated from the office, which needs a proper management system.

3.6.2. Sewage Treatment

119. **Table 3-17** lists the estimated wastewater generation of the three terminals. A conventional biological treatment (activated sludge) sewage treatment plant (STP) with a capacity of 1,500 m^3/day will be installed to treat the wastewater generated during the port operation. A tertiary treatment system will be added for reusing treated wastewater for vehicle washing, gardening, and toilet flushing. **Figure 3-18** shows the layout plan of the STP.

Table 3-17: Wastewater Generation of the Three Terminals

No.	Wastewater Source	Estimated Daily Wastewater Generation from Port Operation
01	Port Operation Manpower (MTP+CT-1+CT-2)	932x3x 60 liter = 167,760 liter (167.76 m^3) Considering the generation of year 2053.
02	Port Visitor including Truck Divers	1000x3x40liter=120000 liter (120 m^3) Consider demand of year 2053.
03	Berthing ship	Sewage volume: 3 m^3/day, voyage time: 21 days x No. of ship 13 Total Sewage load = 819 m^3/ day
04	Subtotal	Total Sewage load = 1,107 m^3/ day
05	Factor of Safety	500 m^3/day
Total Sewage Load (Estimated)/day = 1500 m^3		
Source: Port engineering team & Pub; 7.I85 – The Management of Ship-Generated Waste On-board Ships		

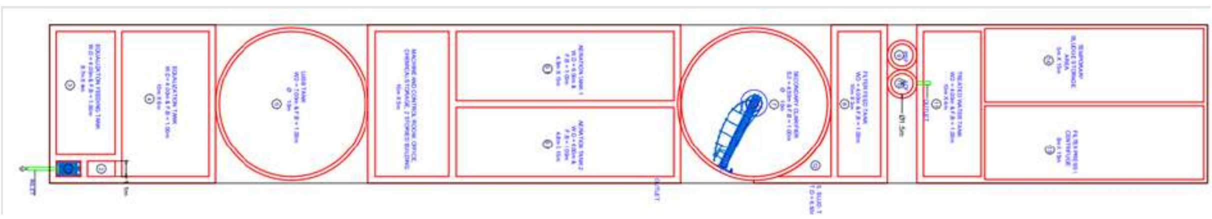


Figure 3-18: Layout Plan of Sewage Treatment Plant (STP)

3.6.3. Bilge Water Treatment

120. A conventional biological treatment (activated sludge) wastewater treatment plant (WWTP) with a capacity of 1,000 m^3/day will be installed to treat the bilge water[3]. The WWTP will be

[3] Bilge water is a mixture of water, oily fluids, lubricants, cleaning fluids, and other similar waste that accumulates in the lowest part of a vessel from a variety of different sources, such as the main and auxiliary engines, boilers, evaporators, and related auxiliary systems; equipment and related components; and other mechanical and operational sources found throughout a vessel's machinery spaces.

designed based on the number of berthing ships on the three terminals and other ships using the existing port. A tertiary treatment system will be added for reusing treated wastewater for vehicle washing, gardening, and toilet flushing. **Figure 3-19** shows the layout plan of the WWTP for treatment of bilge water.

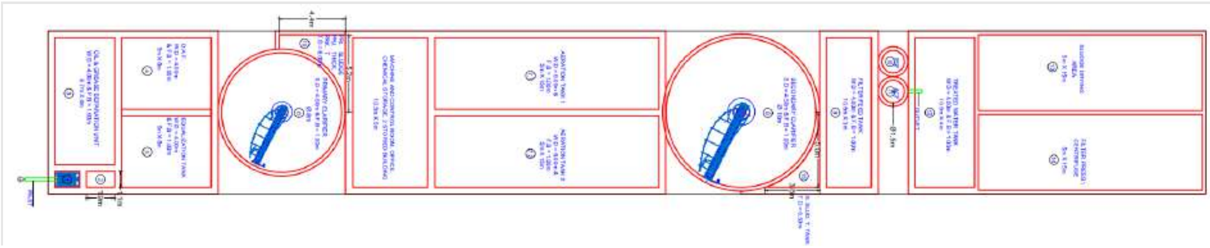


Figure 3-19: Layout Plan of Wastewater Treatment Plants (WWTP)

3.6.4. Ballast Water Discharge Management

121. The CPA needs to create a strategic policy for ballast water discharge management, as Bangladesh ratified the International Maritime Organization (IMO) Convention for the Control and Management of Ships' Ballast Water and Sediments in 2018. The primary objective is to prevent the spread of invasive aquatic species and maintain the biological balance of marine ecosystems along Bangladesh's coastline.

3.7. Project Phases

3.7.1. Pre-Construction

122. The pre-construction activities include the following:

- Environmental survey,
- Social survey,
- Bathymetry survey,
- Preparation of master plan,
- Design of breakwater and
- Design of associated facilities like terminal, jetty, road, rail networks,
- Design of other facilities such as WWTP, STP, WTP, etc.

3.7.2. Construction of Bay Terminal

123. The construction activities include the following:

- Capital Dredging and Backfilling
- Reclamation for the Port Terminal
- Construction of Breakwater
- Construction of Port Terminal Facilities

3.7.3. Operations (Port and Terminal Operation and Maintenance Dredging)

124. The operation activities include the following:

- Port Operation

125. **Figure 3-20** shows the layout of the access channel. It is the best option to avoid all sorts of disadvantages in handling approaching and leaving ships.

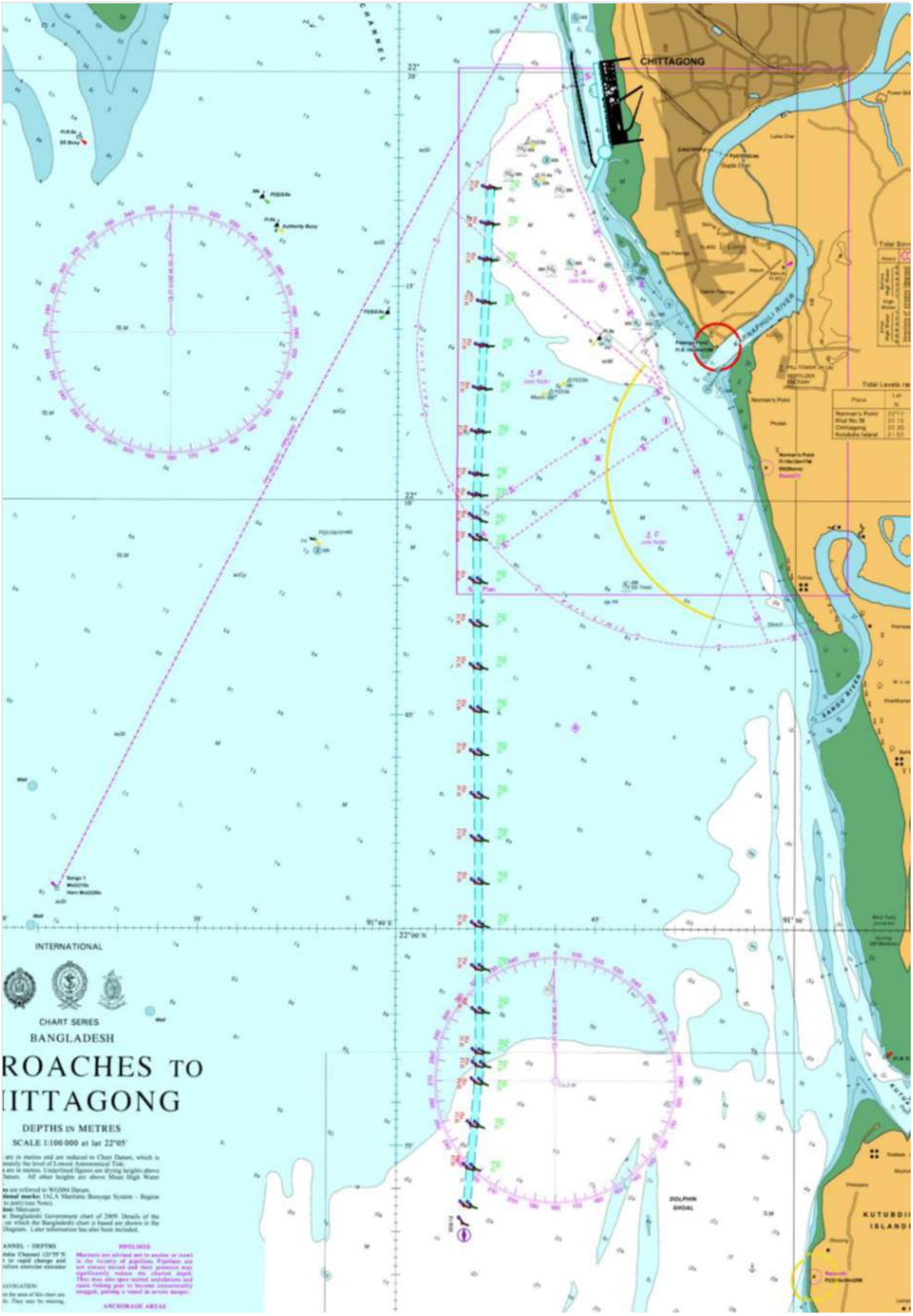


Figure 3-20: Optional Access Channel Layout

3.7.3.1. Terminal Operation

126. The handling capacity for Container Terminals 1, 2, and Multipurpose Terminal will be 1,225m, whereas Multipurpose Terminal will also allow 1,500m for general cargo handling. **Table 3-18** and **Table 3-19** list the equipment for the Container Terminals 1 and 2. **Table 3-20** list the equipment for Multipurpose Terminal.

Table 3-18: Equipment List for the Container Terminals 1

Equipment	Capacity
STS Crane	50 ton: Under Spreader
RTG	40 ton: Lifting Load
Terminal Tractor	60 ton: Pulling
Terminal Trailer	20ft x 2, 40 ft
Reach Stacker	Over 42 ton in 1 row
Empty Container Handler	Min 9 ton. 7 high
Shuttle (Straddle) Carrier	40 ton. Stacking 2 high
Forklift 3ton	Low Mast. Electric Driven
Forklift 5ton	Engine Driven
Forklift 15ton	Engine Driven
Forklift 25ton	Engine Driven
Mobile (Rough Terrain) Crane	10 ton
Mobile (Rough Terrain) Crane	20 ton
Mobile (Rough Terrain) Crane	30 ton
Mobile (Rough Terrain) Crane	50 ton
Mobile (Rough Terrain) Crane	100 ton
Shuttle Bus (20 Passenger)	Commercialized equipment
Terminal Bus	Commercialized equipment
Terminal Car	Commercialized equipment
Tank lorry	Commercialized equipment
Workshop Tools	To be defined at the detailed design stage
IT Systems (Infrastructure + TOS)	Commercialized equipment
Container X-Ray Scanner	Commercialized equipment
Truck Weigh Bridge	Commercialized equipment
Auxiliary Equipment & Spare Parts	To be defined at the detailed design stage

Table 3-19: Equipment List for the Container Terminals 2

Equipment	Capacity
STS Crane	50 ton: Under Spreader
RTG	40 ton: Lifting Load
Terminal Tractor	60 ton: Pulling
Terminal Trailer	20ft x 2, 40 ft
Reach Stacker	Over 42 ton in 1 row
Empty Container Handler	Min 9 ton. 7 high
Shuttle (Straddle) Carrier	40 ton. Stacking 2 high
Forklift 3ton	Low Mast. Electric Driven
Forklift 5ton	Engine Driven
Forklift 15ton	Engine Driven
Forklift 25ton	Engine Driven
Mobile (Rough Terrain) Crane	10 ton
Mobile (Rough Terrain) Crane	20 ton
Mobile (Rough Terrain) Crane	30 ton
Mobile (Rough Terrain) Crane	50 ton
Mobile (Rough Terrain) Crane	100 ton
Shuttle Bus (20 Passenger)	Commercialized equipment
Terminal Bus	Commercialized equipment
Terminal Car	Commercialized equipment
Tank lorry	Commercialized equipment
Workshop Tools	To be defined at the detailed design stage
IT Systems (Infrastructure + TOS)	Commercialized equipment

Equipment	Capacity
Container X-Ray Scanner	Commercialized equipment
Truck Weigh Bridge	Commercialized equipment
Auxiliary Equipment & Spare Parts	To be defined at the detailed design stage

Table 3-20: Equipment List for Multipurpose Terminal

Equipment	Capacity
Mobile Harbor Cranes with Grabs 10t	Under Spreader 41t @10m, 21t@48m
Mobile Conveyor System (units á 350m)	
Mobile Hoppers	15 ton
Grabs for Ship's Gear	5~10 ton
Auxiliary Equipment (ropes, slings, nets, etc.)	To be defined at the detailed design stage
Mobile (Rough Terrain) Crane	10 ton
Mobile (Rough Terrain) Crane	20 ton
Mobile (Rough Terrain) Crane	30 ton
Mobile (Rough Terrain) Crane	50 ton
Mobile (Rough Terrain) Crane	100 ton
Wheel Loaders	15 ton
Bobcats	2 m^3
Mobile Excavator (wood handling)	16 ton
Shuttle Bus (20 Passenger)	Commercialized equipment
Terminal Bus	Commercialized equipment
Terminal Car	Commercialized equipment
Pushers Cars (RoRo)	Commercialized equipment
Starter Cars (Roro)	Commercialized equipment
Tank Lorry	Commercialized equipment
Workshop Tools	To be defined at the detailed design stage
IT Systems (Infrastructure + TOS)	Commercialized equipment
Container X-Ray Scanner	Commercialized equipment
Truck Weigh Bridge	Commercialized equipment
Auxiliary Equipment & Spare Parts	To be defined at the detailed design stage

3.8. Project Schedule and Cost

127. The proposed Bay Terminal project's scheduled duration is from 2024 to 2070.

128. Investment Requirements. **Table 3-21** summarize all investments required for the Bay Terminal to establish the container and multipurpose operations as outlined before. The total investments are estimated with USD 4,768 million.

Table 3-21: Bay Terminal Capital Expenditures 2024-2070

	Infrastructure	Equipment	Total
Initial (2024-2026)	2,934,832,398	325,425,360	3,280,257,758
Additional Purchase and Replacement (2027 – 2070)	687,592,635	2,053,590,520	2,741,183,155
Total (USD)	3,622,425,033	2,399,015,880	6,021,440,913

129. Operation Expenses. The operating expenses for the total Bay Terminal project are summarized in the **Table 3-22**.

Table 3-22: Bay Terminal Operating Expenses (USD)

Year	2027	2030	2035	2040	2045	2050	2055	2060	2065	2070
Operation Expenses of MT	27,019,616	30,470,869	32,547,057	35,526,454	38,792,583	42,503,672	46,797,189	52,270,312	59,248,256	68,146,016

Year	2027	2030	2035	2040	2045	2050	2055	2060	2065	2070
Operation Expenses of CT-1	34,264,658	41,028,944	42,668,342	45,535,927	48,475,253	51,928,672	56,332,825	61,949,830	69,114,221	78,252,934
Operation Expenses of CT-2	-	11,795,601	26,364,555	39,746,507	46,223,078	51,961,058	56,377,835	62,011,206	69,196,765	78,362,805
Total Operting Cost	61,284,275	83,295,413	101,579,954	120,808,888	133,490,914	146,393,402	159,507,849	176,231,348	197,559,242	224,761,755

130. Revenues. The gross revenues of the Bay Terminal are calculated based on the expected throughput and applying the estimated port tariff at Chittagong Port. For other services and handling activities, an additional percentage of net revenue has been considered as miscellaneous income in the amount of 10% of the total revenues. The revenue of the Bay Terminal project is summarized in **Table 3-23**.

Table 3-23: Bay Terminal Revenues (USD)

Year	2027	2030	2035	2040	2045	2050	2055	2060	2065	2070
Revenue of MT	227,353,134	232,143,973	240,618,731	249,977,825	259,581,664	257,418,050	254,557,911	252,095,210	249,474,668	246,968,315
Revenue of CT-1	223,185,716	301,346,737	301,548,708	301,695,183	301,806,109	301,892,978	301,962,994	302,020,673	302,068,901	302,109,797
Revenue of CT-2	-	6,555,368	130,722,024	222,812,803	263,086,105	301,892,978	301,962,994	302,020,673	302,068,901	302,109,797
Total Revenue	450,538,850	540,046,078	672,889,463	774,485,811	824,473,879	861,204,006	858,483,899	856,136,556	853,612,469	851,187,909

4. Environmental and Socio-Economic Features of the Project Area

4.1. Introduction

131. The environmental and social baseline is the current state of the environment and society surrounding the proposed project site, and it is one of the most critical factors to consider when planning any type of development. When analyzing environmental factors such as the physical, biological, and socioeconomic status of the project area, the direct impact area is defined as being within 1 km of the project boundary, and the indirect impact area is defined as being within 5 km of the direct impact (**Figure 4-1** in the direct and indirect impact area of the proposed Bay Termina project), with the exception of the ecological survey, which has been expanded up to 10 nautical miles (18.52 km) or more due to nature of impacts.

132. The physical environment consists of terrain, land, soil, meteorology, air, water, noise, and so on, whereas the biological environment consists of flora and faunas. Demography, ethnicity, religion, education and job opportunities, occupation, income, poverty, social relations, and so on are all part of the studied area's socioeconomic environment.

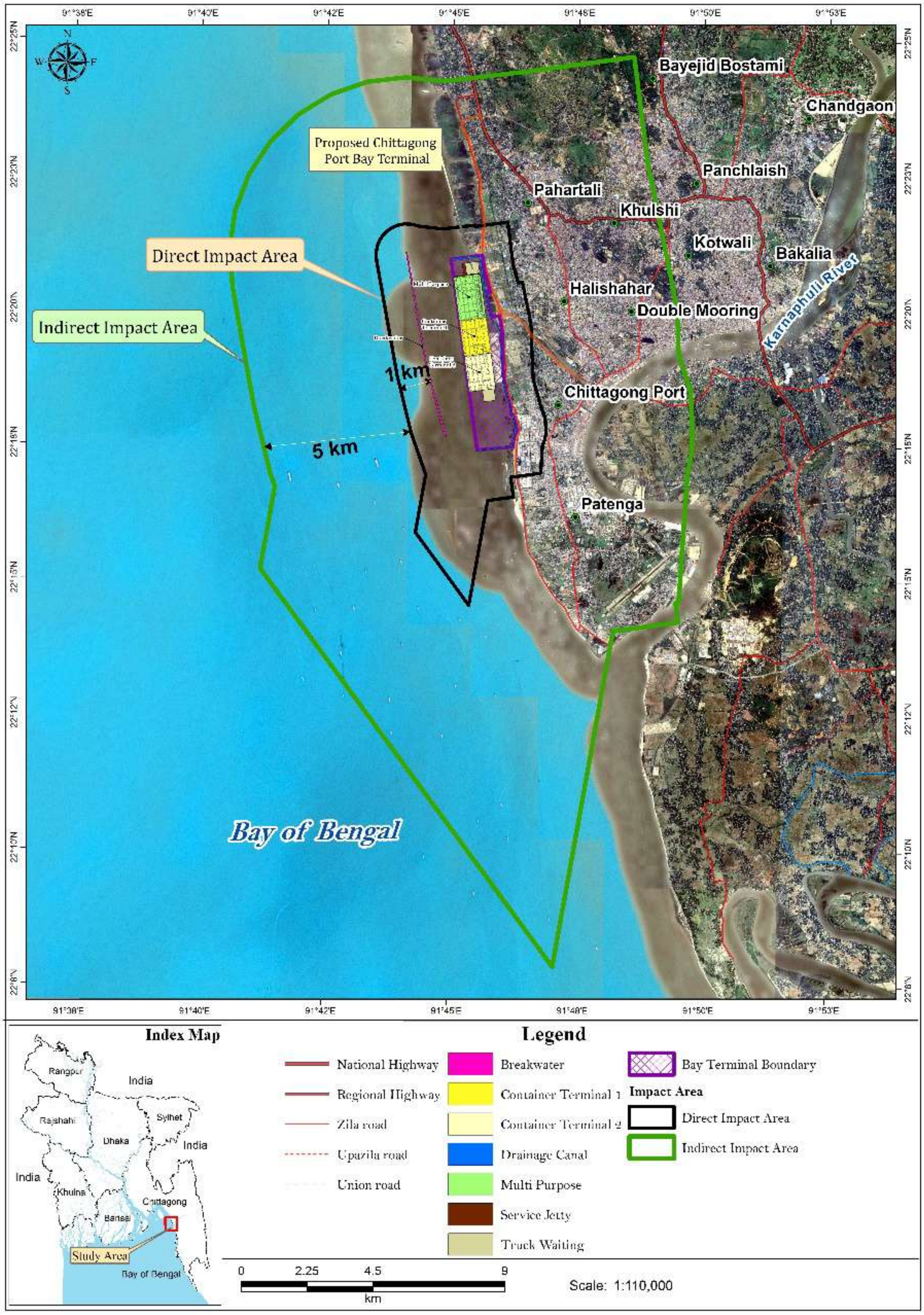


Figure 4-1: Direct and Indirect Impact Area of the Proposed Project

133. **Figure 4-2** shows the proposed project location in the Halishahar area, west of the present Chattogram Port and several kilometers north of the Chattogram Export Processing Zone (CEPZ). The project site is located within the boundaries of South Kattoli, Ward No. 11 and

Ward No. 26; Middle/South Halishahar, Ward No. 38; and North Halishahar, Ward No. 37. The project is surrounded to the east by the Port Link Road and to the west by the Bay of Bengal. The land of the site, which makes up a significant portion of the project area and was mostly created by sediment deposition over the previous few decades, is primarily plain ground with an average elevation of 3.6 meters above mean sea level (MSL).

134. **Table 4-1** provides a summary of various environmental settings in the impacts zone, respectively. The baseline environmental conditions are based on data gathered from numerous field surveys, associated agencies, and secondary documents obtained from published sources and websites. The baseline serves as the foundation for determining the impact (possible changes in baseline circumstances) of the proposed Bay Terminal construction and operation.

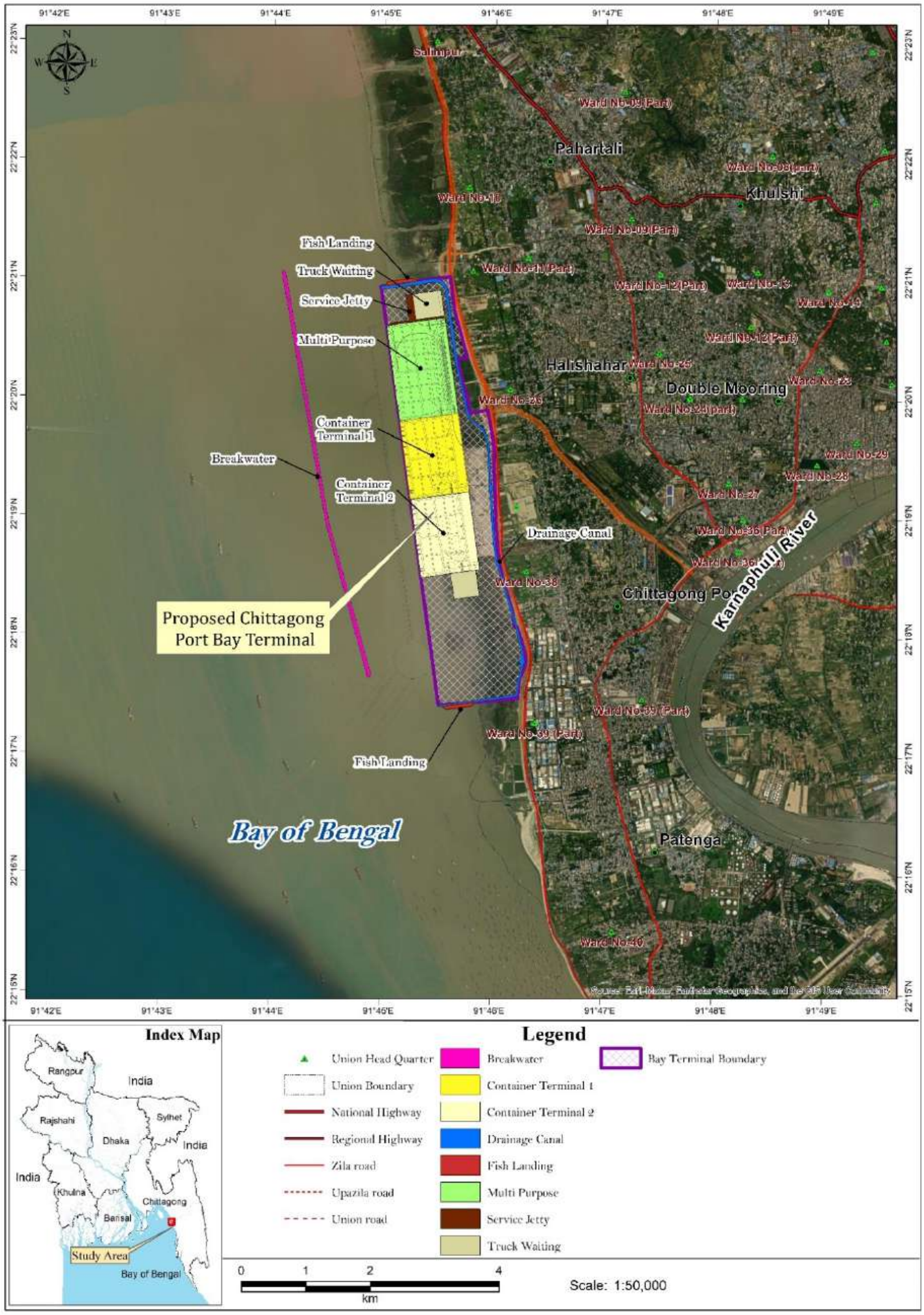


Figure 4-2: Location Map of the Project

Table 4-1: Existing Environmental Settings of the Project

Particulars	Details
Location	Ward No. 37, Middle/South Halishahar-Ward No. 38, and South Kattoli-Ward No. 11 and Ward No. 26.
Land Type	Medium highland.
Major Soil Type	Brown hill soils.
Major Physiographic Units	Chattogram coastal plain.
Flooding	Tidal flood-prone area
Seismicity	Falls in the earthquake Zone-2.
Nearest Airport	The Proposed Bay Terminal site is located at a distance of 9.0 km (approx.) north from the Shah Amanat International Airport.
Nearest Railway Station	Chattogram railway station is located at a distance of 6.0 km (approx.) east from the Proposed Bay Terminal site.
Nearest Port	The Proposed site is located at a distance of approx. 4.0 km south of the Chattogram Port.
Climatic conditions	The annual average temperature of this district varies from a maximum of 32.5°C to a minimum of 13.5°C. The average rainfall is 3378 mm.
Ecologically Critical Area	No ecologically critical areas were found within a 6 km radius of the project boundary.
Environment and Social Hotspots	Canals, homesteads, vegetation, school, college, university, madrasha, mosjid, mandir, etc.
Major Settlement	Residential area, industries, etc.
Major Industries	Fertilizer industry, Jute Mill, Paddy Mill, Flour Mill, Oil Mill, Biscuit Factory, Pharmaceuticals, RMGs, Chemical Factory, Brickfield, Press, etc.
Forests / National Parks	None within a 6 km radius of the project boundary.
Nearest major Water Bodies	Karnaphuli River and internal canals/stormwater drainage.
Key Installation Distance from the center of the proposed project	Bangladesh Naval Academy – 8 km Shah Amanath Airport – 9 km
Source: Google Earth, BBS District Statistics of Chattogram, 2011 & Site Visits	

4.2. Physical Environment

4.2.1. Land Resources

4.2.1.1. Land Use and Land Cover

135. The land use and land cover of the study area have been analyzed to assess the environmental impact of the proposed Bay Terminal Project in Chattogram. The direct impact area further included a 1.0 km buffer around the proposed Bay Terminal, while the indirect impact area extends 5.0 km beyond the boundary of the effective area. The land use data for the study area was derived from SENTINEL-2 satellite images (with a resolution of 10 m) captured in December 2021. Additionally, time series images from Google Earth were used for visual interpretation and to extract details that were not clear in the satellite images.

136. The total land use of the project study area for image analysis is considered for the direct and indirect impact area is about 3,843 ha and 28,084 ha respectively. The project area is mostly covered and surrounded by sea areas followed by urban areas, settlements with homestead vegetation, and agricultural areas. **Table 4-2** and **Table 4-3** present the land cover classification of the direct (including 1 km buffer) and indirect impact areas, respectively. **Figure 4-3** and **Figure 4-4** shows the land use map of the direct (including 1 km buffer) and indirect impact areas, respectively.

Table 4-2: Land Cover Classification of the Direct Impact Area Including 1 km Buffer

Land Use	Direct Impact Area (including 1 km Buffer of the Proposed Project)	
	Area (ha)	%
Single Crop	200.0	5.2
Multiple Crop	86.7	2.3
Mangrove Plantation	15.5	0.4
Orchards and Other Plantations (Trees)	51.8	1.3
Canal	18.7	0.5
Fresh Water Aquaculture	77.0	2.0
Ponds	28.6	0.7
Mud Flats or Intertidal Area	255.8	6.7
Rivers and Khals	0.5	0.0
Urban Area	380.9	9.9
Rural Settlement	11.5	0.3
Sand	4.7	0.1
Sea	2,711	70.5
Total	3,843	100
Source: Satellite Image Analysis		

Table 4-3: Land Cover Classification of the Indirect Impact Area

Land Use	Indirect Impact Area (6 km Buffer of the Proposed Project)	
	Area (ha)	%
Single Crop	1,198.3	4.3
Multiple Crop	141.0	0.5
Forest Plantation	249.6	0.9
Shrub Dominated Area	493.4	1.8
Mangrove Plantation	332.1	1.2
Mixed Hill Forest	182.4	0.6
Orchards and Other Plantations (Trees)	152.0	0.5
Canal	116.7	0.4
Fresh Water Aquaculture	123.7	0.4
Ponds	193.6	0.7
Lake	26.7	0.1
Mud Flats or Intertidal Area	312.7	1.1
Brickfield	20.8	0.1
Rivers and Khals	569.0	2.0
Riverbanks	2.4	0.0
Urban Area	5,744.5	20.5
Rural Settlement	599.8	2.1
Airport	258.7	0.9
Sand	4.7	0.0
Sea	17,361	61.8
Total	28,084	100
Source: Satellite Image Analysis		

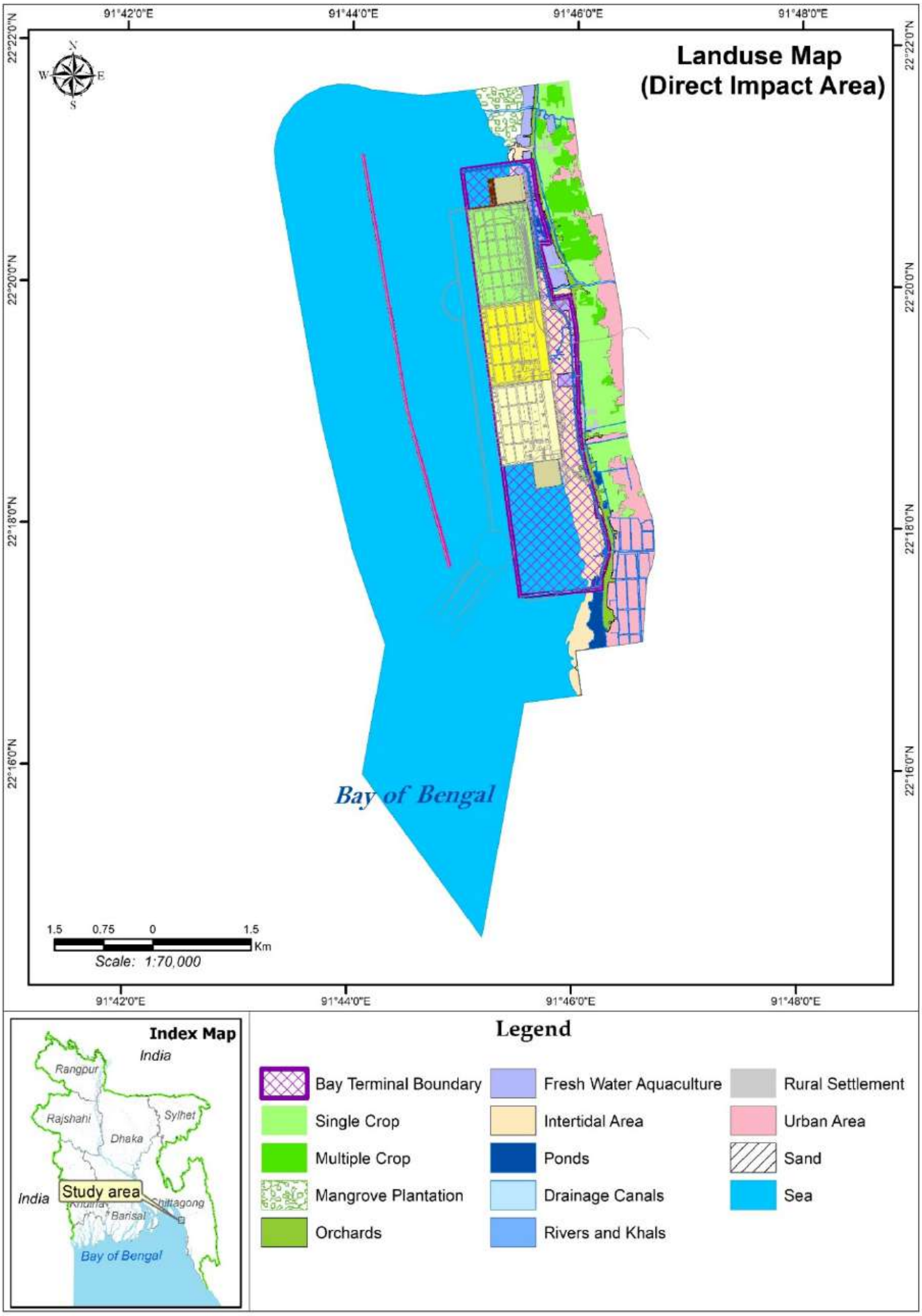


Figure 4-3: Land Use Map of the Direct Impact Area with 1 Km Buffer of the Proposed Bay Terminal

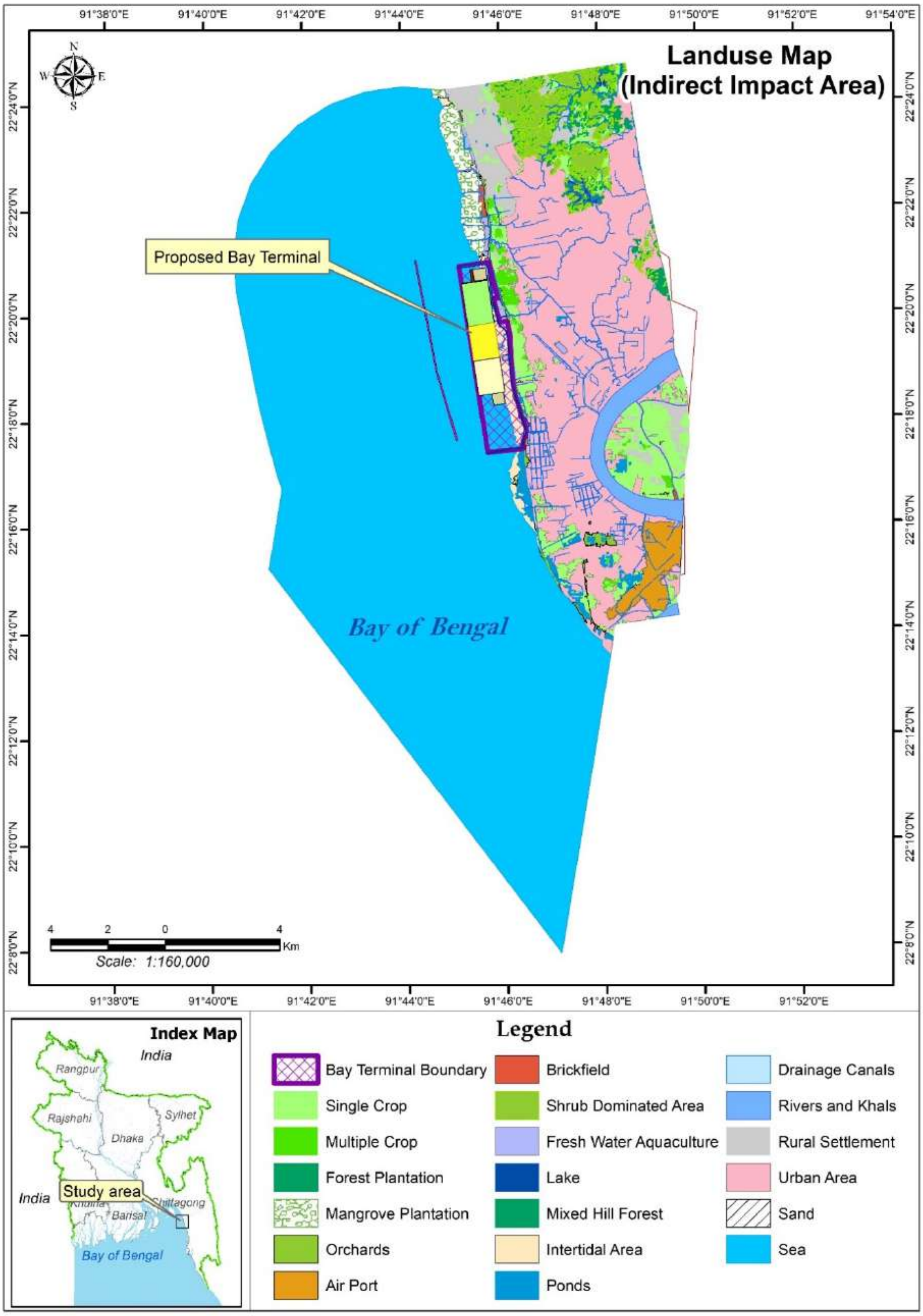


Figure 4-4: Land Use Map of the Indirect Impact Area of the Proposed Bay Terminal

137. The descriptions of the land use classes are:

- **Sea Area -** The sea area covers approximately 2,711 ha in the direct impact area and about 17,361 ha in the indirect impact area, accounting for 70 and 60% of the total land use respectively. This sea region primarily serves as a route for navigation (vessel movement) and fishing activities. This area is home to a diverse range fish species and other marine species in various categories.
- **Urban Area** - The areas which are compactly situated along with the well-planned as well as unplanned roads and building structures are referred as built-up-areas. The buildings are made of concrete and bricks which give a brighter white tone in false-color combination in satellite images. Basically, the residential areas fall in this class. Most of the construction materials and plant equipment will be transported using water vessels.
- **Rural Settlement** - Settlement area contains homesteads, house structures with yards, sometimes attached small agricultural lands, and are surrounded by different types of homesteads vegetation.
- **Agricultural Land** - Agricultural lands are flat lands comprising of a number of continuous plots and found in plain land areas, which may have a crop or maybe fallow. It was identified by its finer texture and specific shape (mostly rectangular form) in the satellite images.
- **River and Canal** - River is considered as a land use section if the actual riverbed is linear and wide, naturally flowing water bodies and never without water during any period of the year. Branches of the rivers which function as drainage of storm water and feeding of tidal water into the plain land are considered as canal. This class includes rivers, canals, Chharas (hill stream), and other linear water bodies that are visible in the satellite images. In some areas, especially in the hilly areas, some linear channels were included in this class which is even found dry or moist in the images.
- **Lake** - Lakes are a permanent natural collection of water.
- **Pond and Ditch** - Ponds are artificial storage of water. Basically, ponds have a rectangular or square shape. Ditches are the water bodies like ponds that are situated beside the riverside or roadside. They don’t have any regular shape like a pond.
- **Plantation** - Plantation class includes all type of species under short rotation and long rotation. The plantation areas are identified by the similarities of species for a large area, similar tree heights, smooth texture in satellite images, mostly high density of trees and by direct field observation. In case of failed plantation, if the tree canopy coverage is more than 10% then included in this class. The new plantation of three/four years old from satellite image dates may not be included in this class since they could not be separated from herbs and grass.
- **Plantation (Mangrove)** - Artificially created plantations of mangrove species along the coast and off-shore islands are included in this class. It is dominated by Keora (*Sonneretia apetala*) spp and Gewa (*Excoecaria agallocha*) is also found. These are broadleaved, evergreen, exist in saline water, and are inundated twice daily. The afforested mangrove plantation in the coastal areas is identified by the similarities of species for a large area, similar tree heights, smooth texture in satellite images, mostly high density of trees, and by direct field observation. In case of the presence of scattered mangrove trees, if the tree canopy coverage is more than 10% then they are included in this class. The new plantation of three/four years old from satellite image dates may not be included in this class since they could not be separated from bare mudflats and Uri grass. Direct field reference data, knowledge of foresters, and knowledge of local people of respective areas helped to delineate and finalized the class.
- **Shrubs and Grass** - Shrubs occur in heavily degraded forest areas, generally left fallow, and cover huge areas. Refers to vegetation types where the dominant woody elements

are shrubs i.e., woody perennial plants, generally of more than 0.5 m and less than 5 m in height on maturity and without a definite crown. The Shrubs and Grass-type include low to high dense non-timber low-height plants, bushes, grasses, some bare areas, etc. However, very scattered trees may be present and thus might include in the class. It was very difficult to separate this class from very young types of plantations since both types give similar spectral responses and signatures of the satellite images. Ground reference data additionally helped to interpret and assign the class and separate from young plantations. However, some may be wrongly interpreted due to the situation.

- **Bare Land** - Describe open areas covered by unconsolidated material. The unconsolidated material is generic-sized although this class was usually associated with fine-grain deposits along the lower reaches of the main river valleys or on the valley floor (such as along Brahmaputra River). Sand dunes (beaches), the mudflat areas, i.e., moist mud areas, which lie between low tidal and high tidal influences, are included in the class. Bare Land class includes the lands within forest areas which are bare without vegetation and are visible on the satellite images.
- **Brickfield** - This class was interpreted from images by using bright tones, regular shape patterns of piles of brick, at least one vertical chimney, and its shadow.
- **Mudflat and Moist Land** - Present in the coastal areas only. The mudflat areas, i.e., moist mud areas, which lie between low tidal and high tidal influences, are included in this class. Sometimes the areas may contain grass (locally known as Uri grass) and sometimes not. Some moist lands which are not directly influenced by tide and are situated in the coastal areas are also included in this class.
- **Sand** - This class includes dry sands near or beside rivers and in coastal areas. It was identified in the false color composite of the images by bright white to light cyan color, finer texture, and without vegetation.

138. In addition, **Figure 4-5** shows an old map of Bay Terminal area which also shows the sand bar in front of the project area.

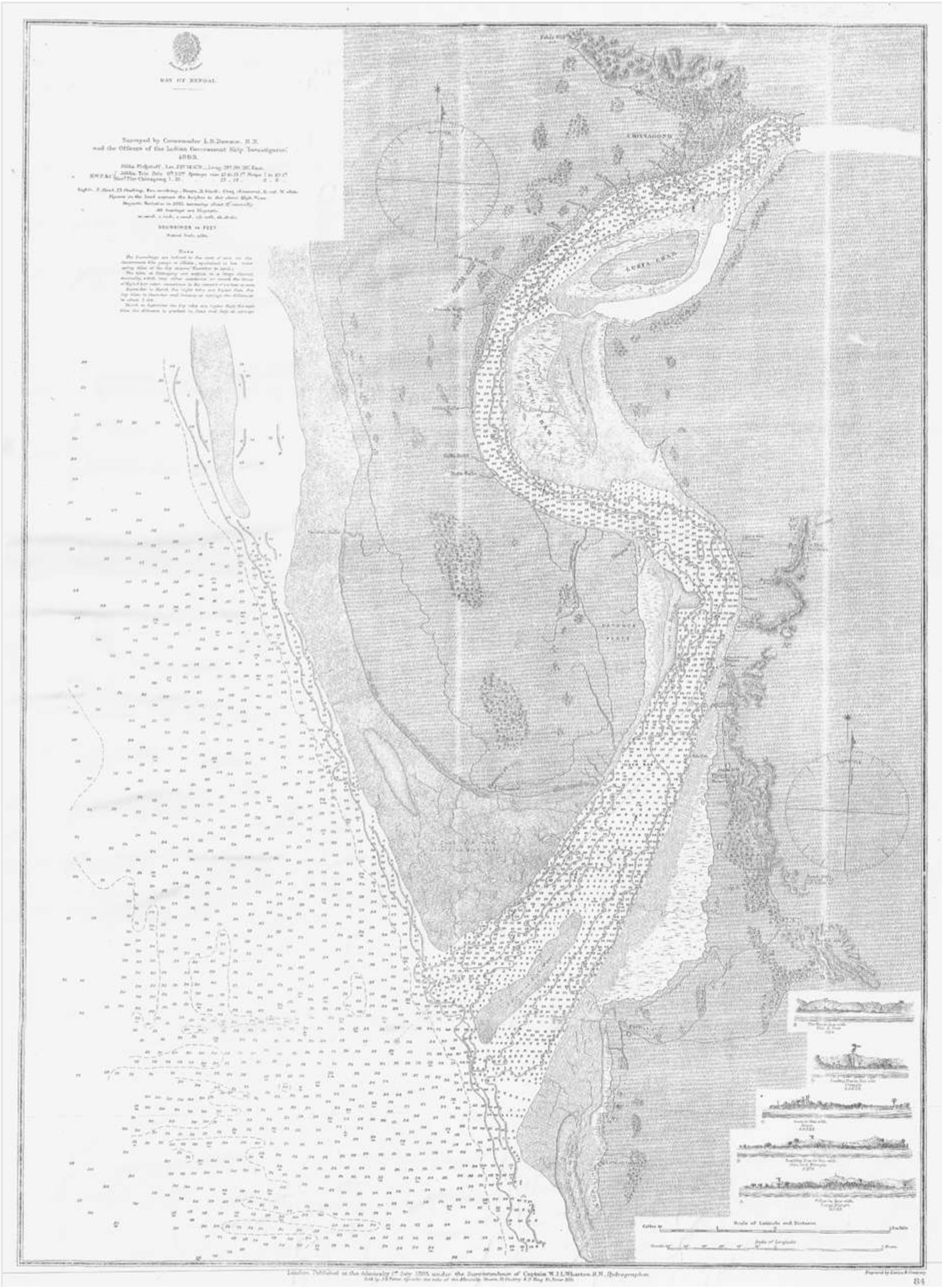


Figure 4-5: Old Map of Bay Terminal Area

4.2.1.2. Geology

139. The proposed Bay Terminal is in the Chattogram City, Bangladesh.

140. **Physiography**. The project site lies in the northern and eastern hills and is bounded to the east and west by the Chattogram coastal plain. **Figure 4-6** shows the physiographic map of the proposed project site and surrounding areas.

141. **Tectonics**. Bengal basin has been divided into the following tectonic divisions' i. Himalayan Fore deep, ii. Rangpur Platform, iii. Bogra Shelf, iv. Faridpur Trough, v. Sylhet Trough, vi. Hatiya Trough, vii. Barisal Gravity High and viii. Indo-Burman Ranges. Except for the first three, the rest are generally categorized as Bengal Fore deep area. Tectonically, the proposed project site is situated in Bengal fore deep more specifically within the Indo-Burman Ranges (**Figure 4-7**). It should be noted that the Indo-Burman range is considered as one of the most seismically active tectonic elements in the Bengal basin, although the historical seismicity is much smaller in the southern portion (where the study area is situated) compared to the northern section of that unit.

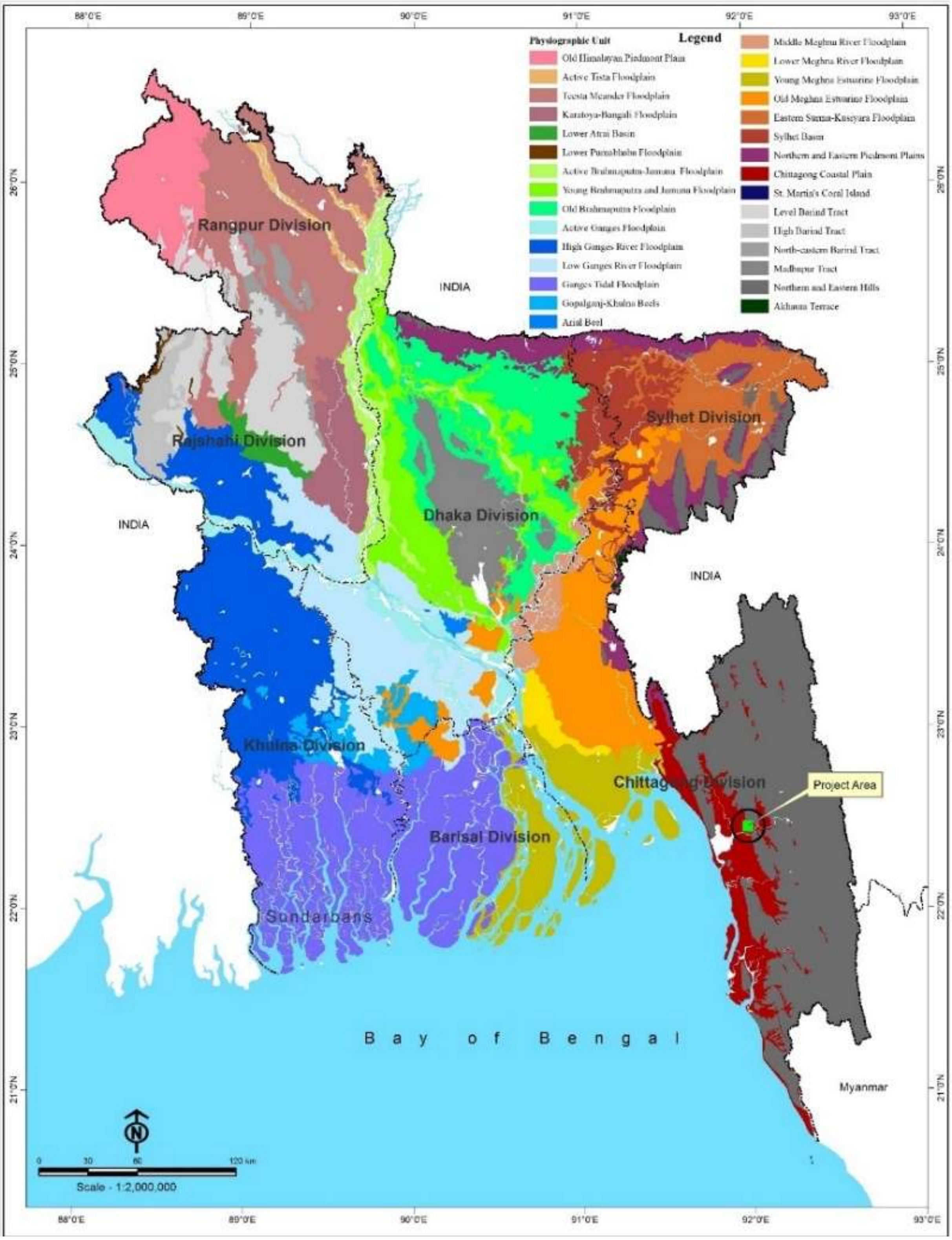
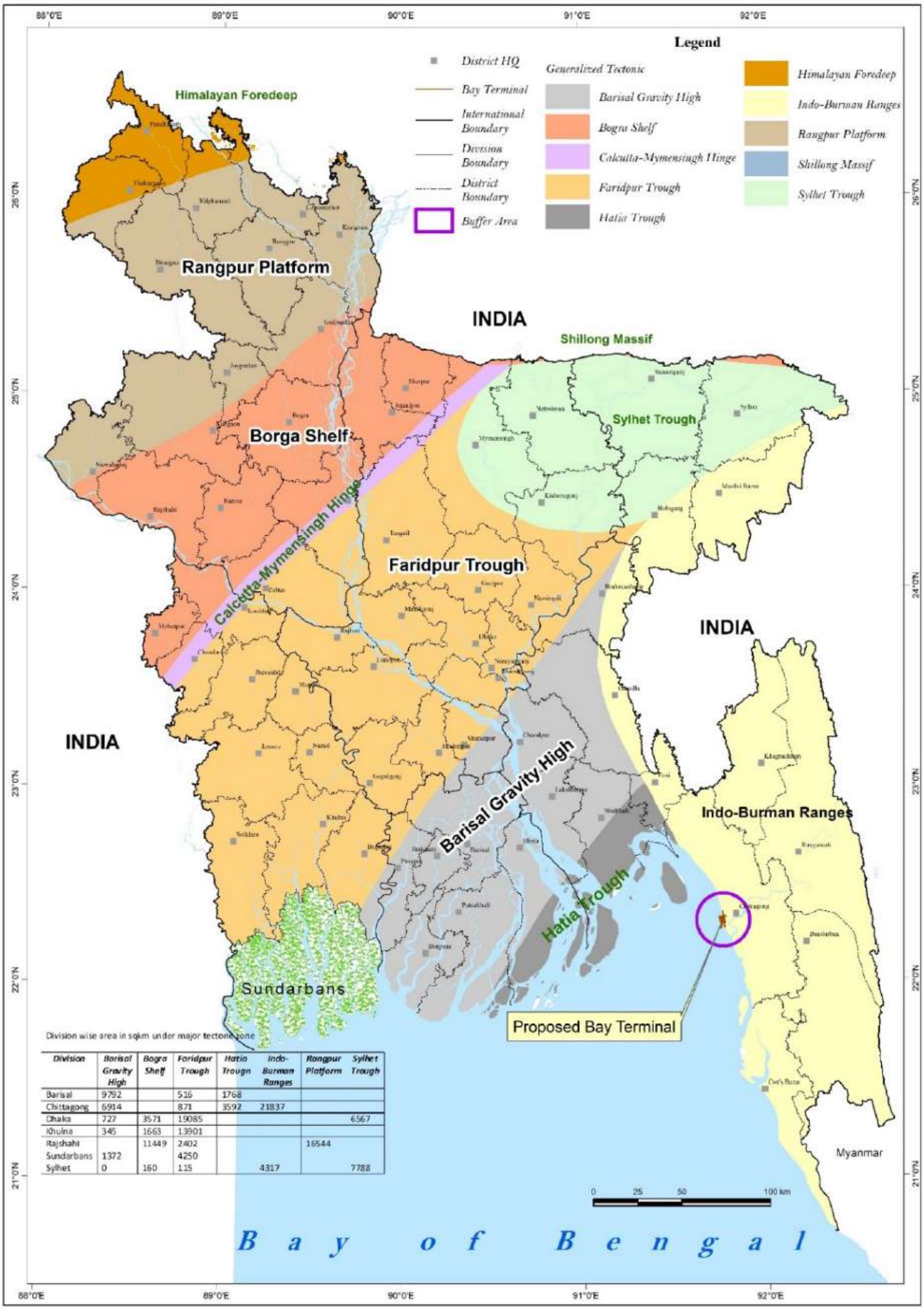


Figure 4-6: Physiographic Map of the Proposed Project Site and Surrounding Areas



Division wise area in sqkm under major tectonic zone

Division	Barisal Gravity High	Bogra Shelf	Faridpur Trough	Hatia Trougn	Indo-Burman Ranges	Rangpur Platform	Sylhet Trough
Barisal	9792		516	1768			
Chittagong	6914		871	3592	21837		
Dhaka	727	3571	19085				6567
Khulna	345	1663	13901				
Rajshahi		11449	2402			16544	
Sundarbans	1372		4250				
Sylhet	0	160	115		4317		7788

Figure 4-7: Tectonic Map of Bangladesh

142. **General Stratigraphy and Hydro-stratigraphy**. The project area comprises sediments from Oligocene to the recent age. A general stratigraphy of Chattogram City and the surrounding area is provided in **Table 4-4**.

Table 4-4: General Stratigraphy in the Chattogram City and Surrounding Area

Age	Formation	Description
Holocene	Alluvium	Lithology of Fluvio-Tidal Complex
Pliocene	Massive claystone with Sandstone (Dihing)	Poorly sorted, pebbly sandstone and mottled clay
Mio-Pliocene	Sandstone with shale (Dupitila)	Massive sandstone, sandy clay and siltstone
	Girujan clay	Not exposed in the area
	Tipam Sandstone Formation	Interbedded sandstone, interlaminated silty sandstone with occasional thinly laminated siltstone and shale
Miocene	Silty-Clayey Sandstone (Bokabil)	Silty shale, siltstone, sandstone and alternating siltstone and shale Unconformity

143. **Seismicity.** Depending on the geological structure, Bangladesh is subdivided into three seismic zones namely Zone I, Zone II, and Zone III with the seismic coefficient of 0.08g, 0.05g, and 0.04g respectively where Zone-I is the most and Zone-III is the least vulnerable to seismic risks. The study area falls under Zone-II, which is considered as a medium earthquake zone, with Seismic Zone coefficient of 0.05g. **Figure 4-8** shows the seismic location of the study area.

144. Analysis of earthquake hazards is a more regional concern than that of local. For example, an earthquake that occurred in Nepal may cause damage to Bangladesh. So, regional earthquake analysis is necessary to predict any earthquake hazard in Bangladesh. The size of seismic or earthquake hazards largely depends on the subsurface and surface geology, the magnitude of the earthquake, building density and quality, and population density. The Global Seismic Hazard Assessment Program (GSHAP) reported that the most hazardous city of Bangladesh is Chattogram and the surrounding area of Chattogram. Chattogram is a complex area mixed up with hills, an alluvial floodplain, and a sandy seashore area. If any mega earthquake arises in this area, the hilly region may not be liquefied but the alluvial floodplain and sandy seashore area may or may not be liquefied. It is suggested that during the designing and construction of civil structures and other building structures, Bangladesh National Building code (2015) covering the earthquake guidelines should strictly be followed.

Source: Geological Survey Data of Bangladesh in 1979

Figure 4-8: Seismic Zoning Map for Bangladesh

145. **Earthquake History of Bangladesh and Surrounding Areas**. Details of seismic intensity and the historical records of earthquakes in and around Bangladesh are presented in **Figure 4-9** and **Table 4-5**.

Table 4-5: List of Major Earthquakes in Past 450 Years

No.	Year	Source Area	Magnitude (Richter Scale)	Depth (Km)
1	1548	Sylhet	-	-
2	1664	Shillong-Plateau	-	-
3	1762	Chattogram -Arakan	-	-
4	1858	Sandway, Myanmar	6.5	-
5	1869	Cachar, India	7.5	48
6	1885	Sirajganj, Bangladesh	7	72
7	1897	Assam, India	8.1	60
8	1906	Calcutta, India	5.5	-
9	1912	Mandalay, Myanmar	7.9	25
10	1918	Srimangal, Bangladesh	7.6	14
11	1930	Dhubri, India	7.1	60
12	1934	Bihar, India-Nepal	8.3	33
13	1938	Mawlaik, Myanmar	7.2	60
14	1950	Assam, Himalaya	8.6	25
15	1954	Manipur, India	7.4	180
16	1975	Assam, India	6.7	112
17	1984	Cachar, India	5.7	4
18	1988	Bihar, India-Nepal	6.6	65
19	1997	Sylhet, Bangladesh	5.6	35
20	1997	Bangladesh-Myanmar	5.3	56
21	1999	Maheskhali, Bangladesh	4.2	10
22	2003	Rangamati, Bangladesh	5.6	-
23	2011	Sikim, India	6.9	-

146. Historically, several minor earthquakes ($4 \leq M < 5$) and one major earthquake ($6 \leq M < 7$) were reported at nearby locations of the study area. However, the possible effects of a high-magnitude earthquake in adjacent locations should not be overlooked and seismic investigations need to be carried out before making a final decision for the construction of the Bay Terminal.

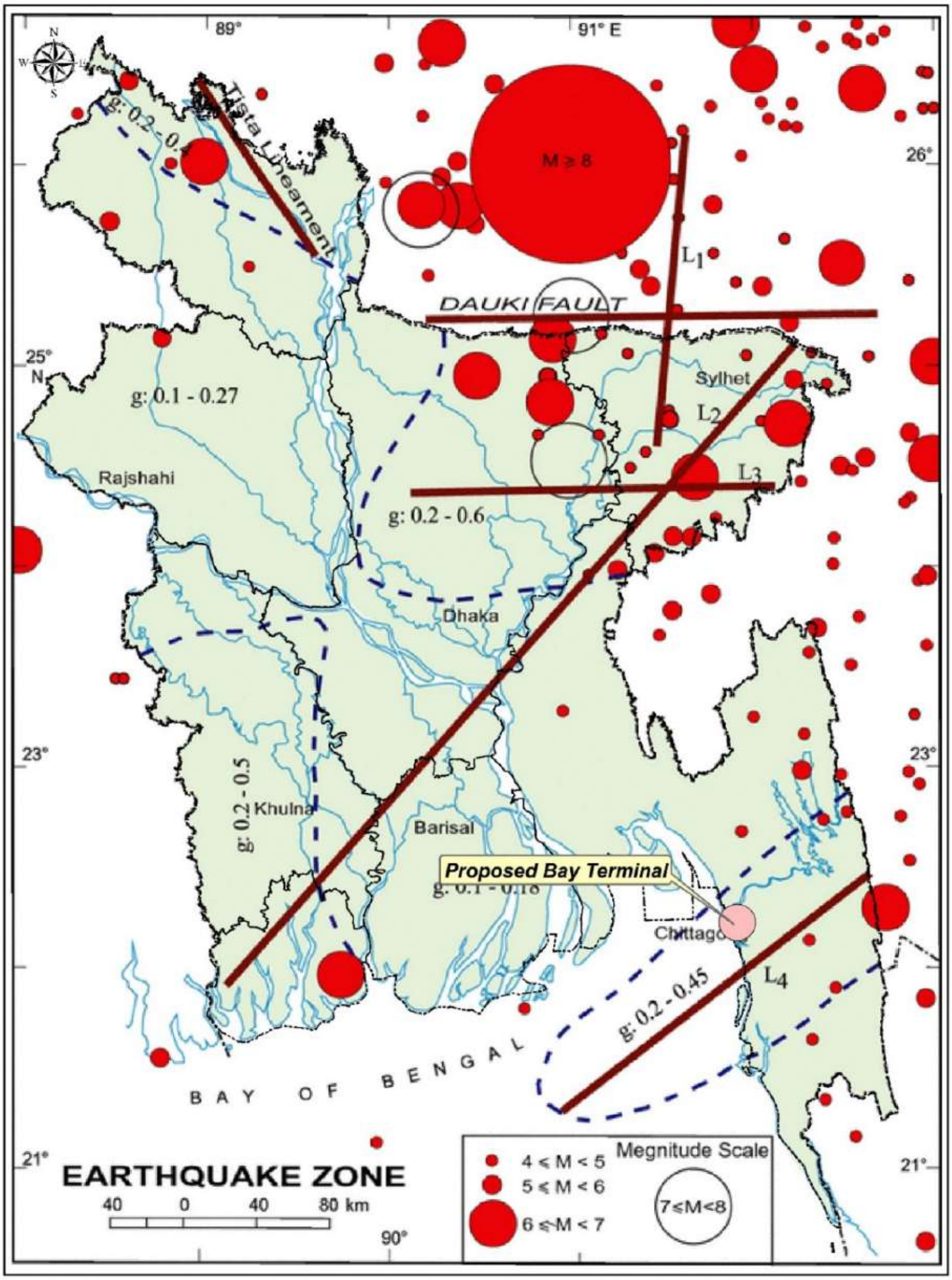


Figure 4-9: Major Lineaments and the Historical Records of Earthquakes in Bangladesh and Adjoining Areas

4.2.1.3. Topography

147. The study area is located on the banks of the Karnaphuli River in the foothills of the Chattogram Hill Tracts, linking it to the Bay of Bengal. It consists of rugged and undulating terrain as portrayed by the DEM in **Figure 4-10**, which shows that the north-central part of the land surface is much higher than the other part of the study area and gradually slopes down towards Halda to the northeastern part, Karnaphuli to the bulk of the eastern and southern portion and the Bay of Bengal to the west. The land elevation of the study area varies from 0.5 m MSL to 90 m MSL, where 18 percent of the land has an elevation between 0.5-2.5 m MSL, 52 percent of the land has an elevation between 2.5-4.5 m MSL, 22 percent of the land has an elevation between 5-30 m MSL, and 9 percent of the land has an elevation between 30-90 m MSL.

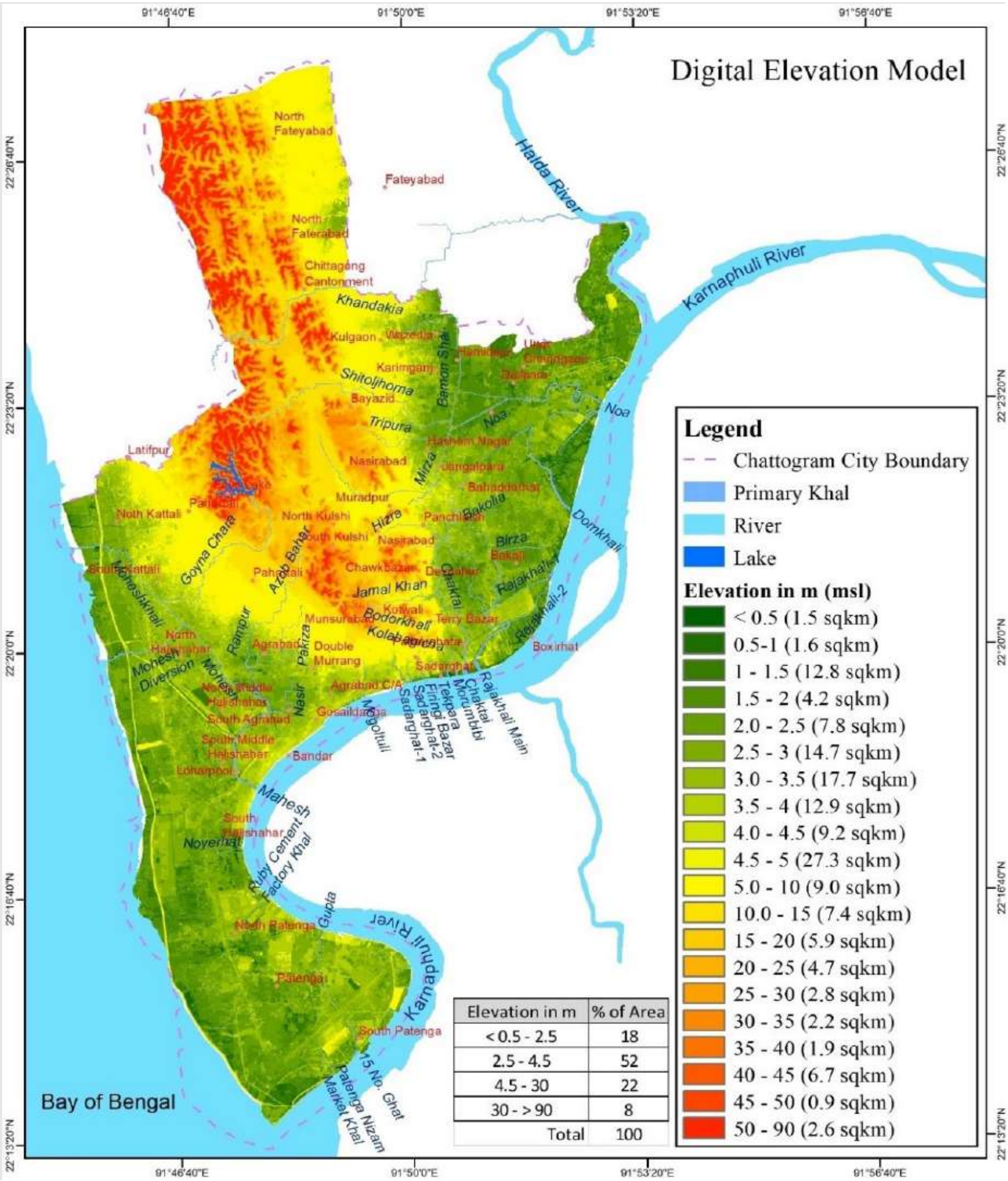


Figure 4-10: Digital Elevation Model (DEM) map of the Study Area

4.2.2. Water Resources

148. One of the most important elements is water for the operation of the proposed Bay Terminal and navigation for the vessel. The sources of water are surface water and groundwater. The surface water sources include sea, river, canal/ khal, pond etc.

4.2.2.1. Navigation

149. Seawater plays a crucial role in navigation, offering a vast and versatile medium for transportation and exploration. Navigation at seaports is crucial for the safe and efficient handling of maritime traffic. The required depth for vessel movement, called "draft," varies by vessel size and type. It's the vertical distance from the waterline to the hull's (keel) bottom and determines the minimum safe water depth for navigation. The proposed Bay Terminal draft is 14.0 m where the keel clearance is 2.0m.

150. Dredging is vital for port operations, maintaining the required water depth for safe vessel navigation. It involves removing sediments to keep or deepen navigation channels, berths, and harbors. The amount of dredging depends on vessel size and sedimentation rates. Capital dredging and maintenance dredging are essential for port development and sustainable operations. For smooth port operations, the channel should be 100 km long and 1 km wide. A Bathymetric analysis will estimate the quantity of dredging needed to achieve the desired depth of the navigation channel.

4.2.2.2. Coastal Water (Oceanography, Bathymetry)

151. A bathymetry/hydrography survey allows measuring the depth of a water body and underwater features such as the bed level of the sea or river surface. The bathymetric survey used a multi-beam echo sounder attached to the boat. The hydrography survey provides information on the seabed's physical features, which will be useful for the safety of navigation and support of all other marine activities, including economic development and environmental protection. The locations of the bathymetric survey and surveyed data are shown in **Figure 4-11** and **Figure 4-12**, respectively.

152. The bathymetric survey data from the waterfront of the Chattogram Port Bay Terminal, collected in 2013, 2016, 2020, and 2022, reveal significant changes in the bed profiles of the area. The analysis focused on 20 cross-sections, each 3500 m long, with a particular emphasis on Sections 5 to 15 for bed level comparisons.

153. Key findings include:

- The 2022 survey profile notably deviated from the earlier patterns observed in 2013, 2016, and 2020. For instance, in cross-section 5, there is a noticeable channel around 1200 m and a hump around 1900 m. These changes aren't consistent with either accretion or erosion patterns.
- In sections like 7, 8, 9, and 10, there was a leftward erosion, resulting in deeper and wider profiles. Specifically, in Section 9, depth and horizontal shifts were observed across different years, with varying upward and downward movements. Section 11 exhibited similar trends with both vertical and horizontal changes.
- When examining all the sections from 5 to 15, it becomes evident that there is no clear pattern of erosion or accretion.
- The char areas did not show significant vertical growth over the years. In some cases, it remained below mean sea level, while occasionally rising slightly above it.
- Profile Beyond 2000 m: The bed profile beyond 2000 m showed mostly erosion between 2016 and 2020, with heavy erosion/cutting observed along the sea-side slope of the char between 2020 and 2022. This could be due to natural erosion or extensive dredging.
- Generally, the channel sections tended to widen, especially in the upstream areas.

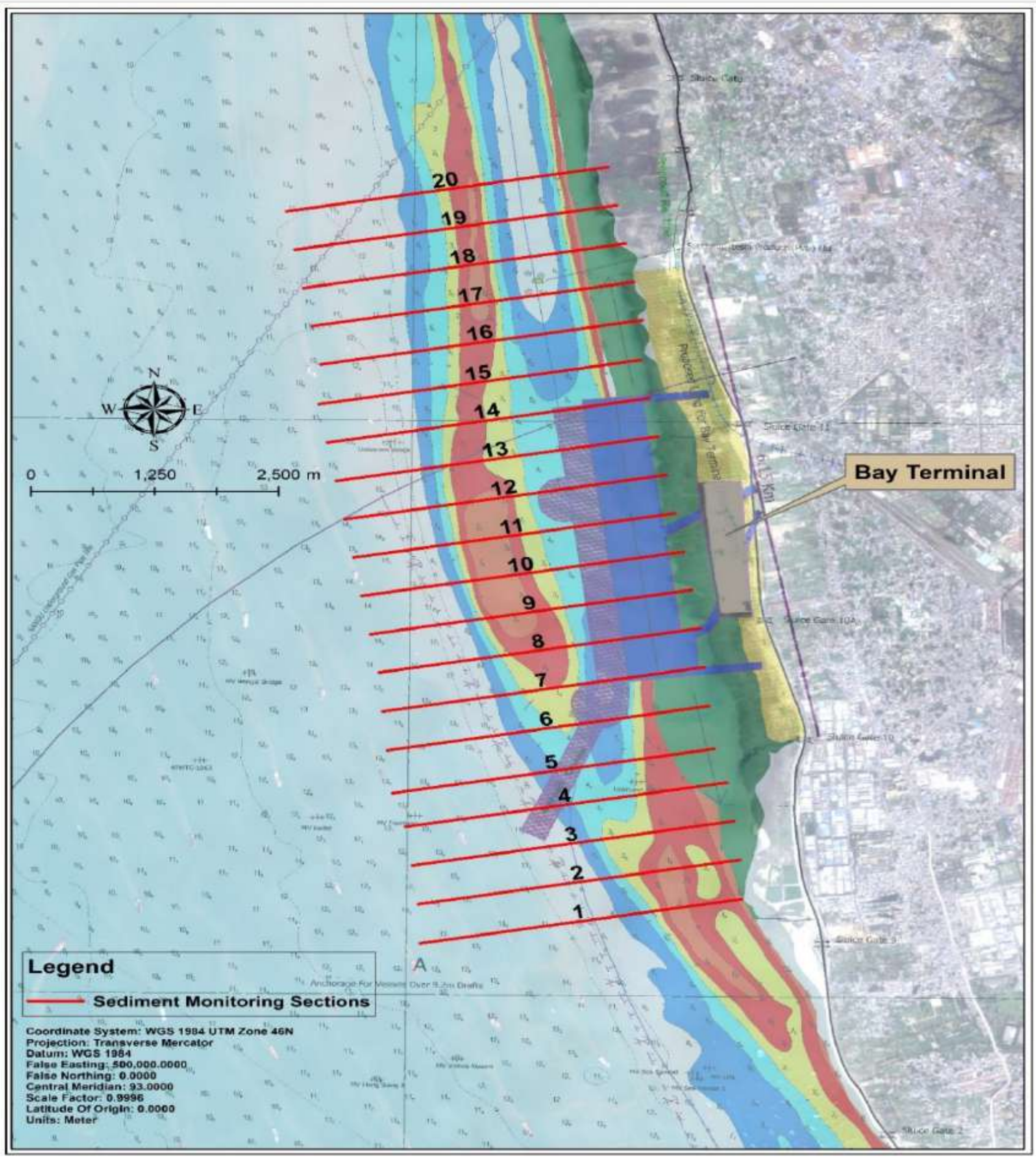


Figure 4-11: Bathymetric Survey Area

154. **Dredging volume**. The dredged volume has been collected from the Morphology and Sedimentation Empirical Study (Draft) by Sellhorn, 2023. The total dredging volume will be 115.13 million m^3. The summay of the dredging volume is presented in **Table 4-6**.

Table 4-6: Summary of Dredged Volume

SL No	Description of Item	Dredged Volume (m³)
01	Breakwater	
01.02.01	Toe trench dredging	731,838
02.01	Terminal dredging	
02.01.01	Access, 550m wide basin + Service area	26,095,204
02.01	Outer Navigation channel	
02.01.01	Dredging work in the navigation channel	88,304,662
	Total =	**115,131,704**

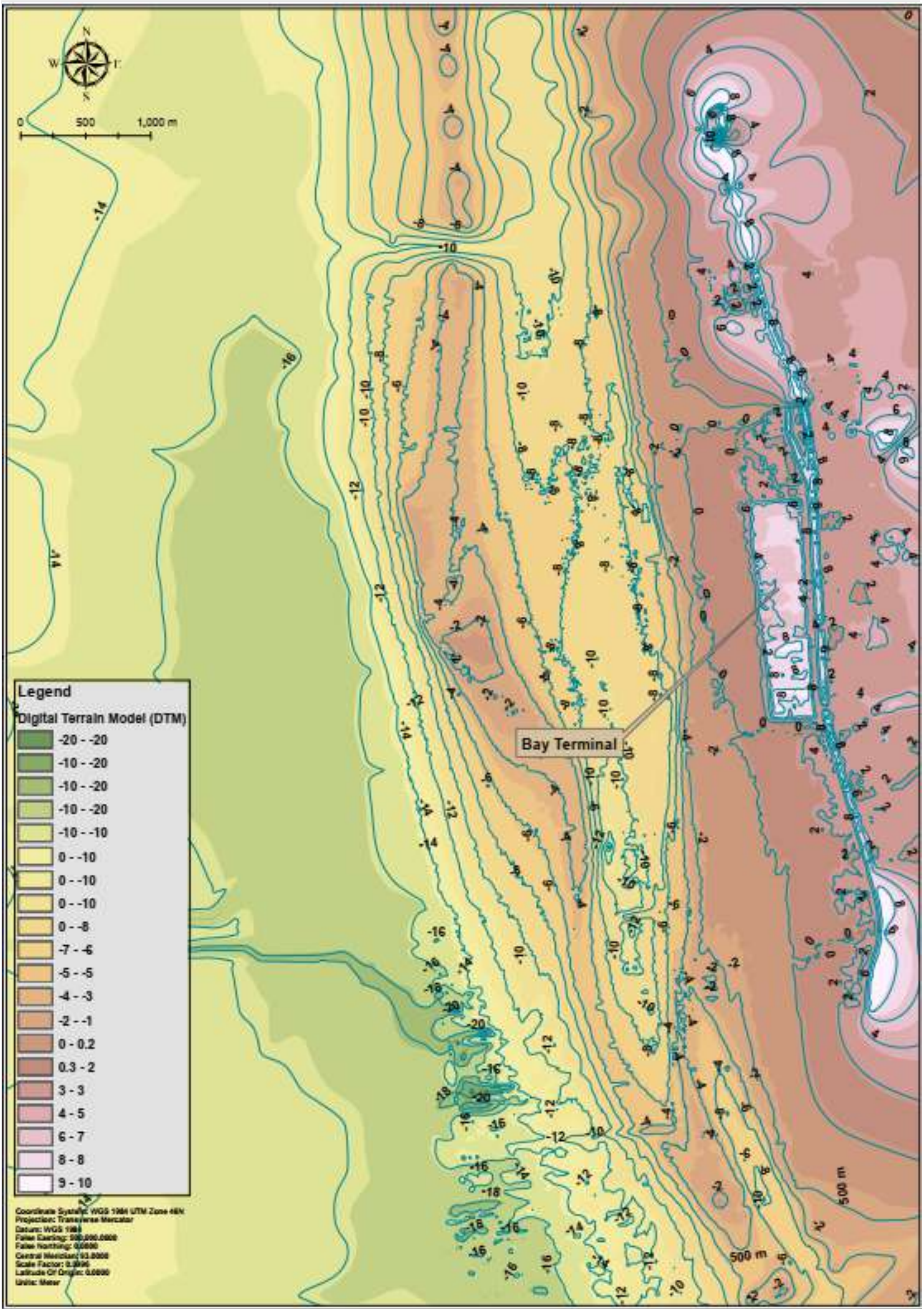


Figure 4-12: Digital Terrain Model of the Survey of 2022

4.2.2.3. Surface Water

155. **Water Level Analysis**. Water levels were monitored during the hydrography survey. An auto-tide gauge was used for water level data collection. Bay Terminal tide gauge location

is Lat: 22 º 19’ 44.80’’ and Long: 91º 45’14.08”, and Khal-18 gauge location is Lat: 22º 13’ 33.00’’ and Long: 91º 48’18.00”. The data were compared with CPA tide gauge data collected from CPA for July 2022 and August 2022, Khal-18 and Bay Terminal. In addition, the tidal record data for Khal-18 and Bay Terminal auto tide gauge from CPA were also collected. **Plate 4-1** shows the photograph of Bay Terminal water level measurement.

Plate 4-1: Photograph of Bay Terminal Water Level Measurement

156. Relevant data were collected from the auto tidal gauge level station, which the feasibility study team installed to assess the daily tidal variation. The maximum water level is 4.85 m during high tide, and the minimum is 0.18 m during low tide, with respect to mean sea level. **Figure 4-13** shows the water level variation of the gauge station.

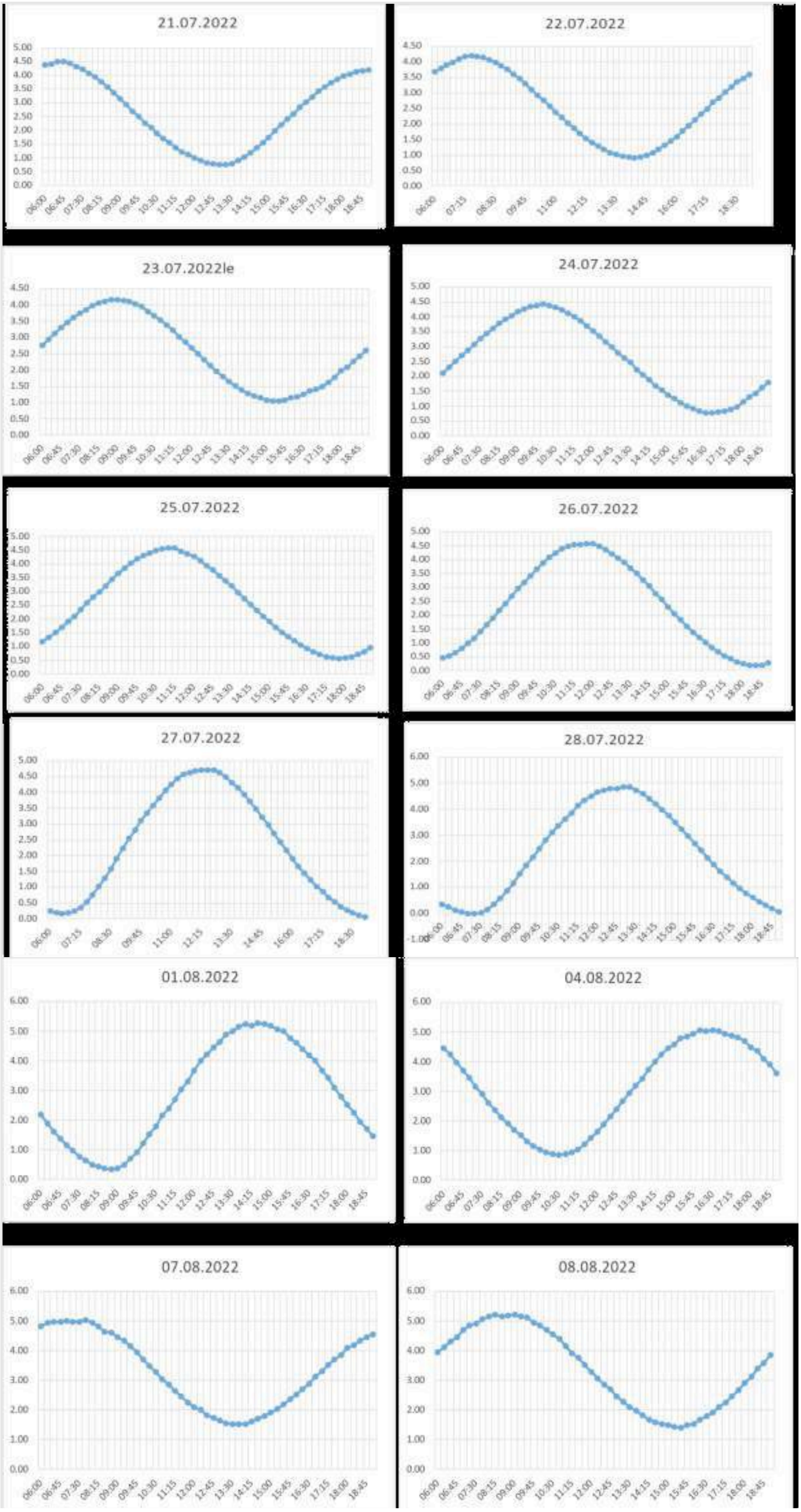


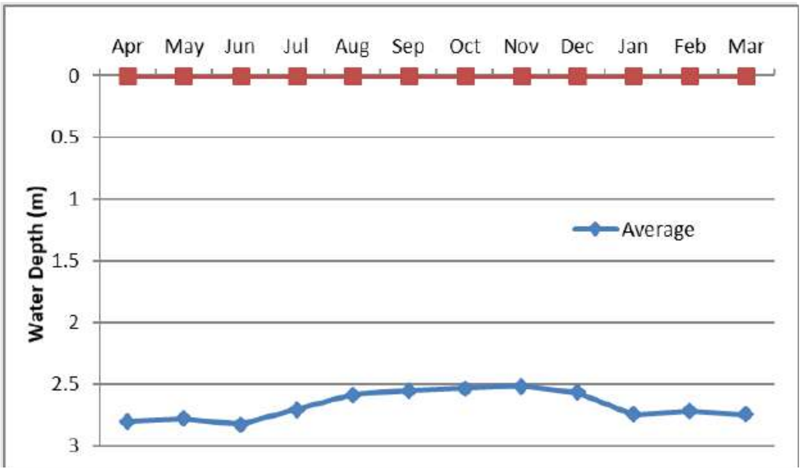
Figure 4-13: Water Level Variation of the Measured Gauge Station

4.2.2.4. Port Operation

157. For the proposed Bay Terminal port operation, various water sources could be used, such as groundwater through deep tube well, surface water from the Karnaphuli River through a piping network, rainwater harvesting, and seawater collected via pipes. Naturally, seawater contains high Total Dissolved Solids (TDS), which need to be removed through a desalination process. This process is quite expensive for use in port operation activities, such as drinking, washing, and toilet flushing. Therefore, seawater is considered an expensive alternative source for port operations.

158. Groundwater will primarily be used for port operation. Embracing green port operations involves using surface and rainwater alongside groundwater, easing the pressure on groundwater sources. The estimated daily water demand for the port and ship operation, is about 12,000 cubic meters (port operation 2,000 m³ and berthing ship requirement is 10,000 m³). To make environmentally sustainable and cost-effective port operation, a blend of rainwater, surface water, and groundwater will be utilized during the monsoon, treated at an 800 m³/h water treatment plant to produce potable water. The port's rainwater storage capacity is 292,789 m² with a 4.5 m depth, allowing for a total collection of 1,317,325 m³ of rainwater.

159. To understand the status of groundwater availability in the project area, groundwater data from Chattogram Station (ID: CHI024) nearest to the proposed Bay Terminal was collected between 1987 and 2017 and analyzed. **Figure 4-14** shows the monthly variation of groundwater depth in the above-mentioned station. According to the figure, groundwater in the study area usually starts to deplete at the later stages of monsoon (end of August) and continues up to the end of March. Thereafter, with the beginning of monsoon, it starts to increase due to aquifer recharge. Maximum groundwater depth in Chattogram station occurs in June which is around 2.83 mPWD. On the other hand, the minimum depth at those stations in November is around 2.51 mPWD.



Source: National Water Resource Database

Figure 4-14: Average Monthly Groundwater Depth Inside the Study Area

160. To analyse the aquifer condition of the proposed project area, a test tube well boring has been conducted up to the depth of 1050 feet, where the main sand or aquifer layer was identified between 690-770 feet. Based on geological lithology and sieve analysis of samples, a Production Deep Tube Well (DTW) of size 16”X8”X780’ can produce 120-150 cubic meters of water per hour. However, the test report indicates higher iron levels than the Bangladesh standard, necessitating an Iron Removal Plant (IRP) to purify the water for drinking purposes. Although no salinity was detected in the tested water, there could be a potential risk of salt intrusion into the groundwater in the future. This situation could happen due to prolonged extraction of groundwater, as the project location is in proximity to the sea.

4.2.2.5. Water resources for Biodiversity and fishing

161. Marine water resources hold immense significance for both biodiversity and fishing activities. These resources serve as a crucial habitat for a vast array of marine life, fostering a rich biodiversity that is essential for healthy marine ecosystems. The marine water resources provide essential habitats for various marine organisms, from microscopic plankton to large marine mammals. These habitats are vital for breeding, feeding, and growth, supporting the life cycles of numerous species. The biodiversity of marine fisheries has been experiencing a downward trend in recent years around the Bay Terminal Area. This decline in fish abundance and diversity is primarily due to habitat degradation. Factors contributing to this degradation include the discharge of untreated industrial effluents, urban wastewater, and seepage from landfills to the sea, all of which are adversely affecting the marine life near the Bay Terminal's vicinity. The major fish species adjacent area of the proposed Bay Terminal area are shrimp (*Penaeus monodon*), black pomfret (*Parastromateus niger*), hilsa shad (*Tenualosa ilisha*), blackspotted croaker (*Protonibea diacanthus*), humphead thryssa (*Thryssa* sp.), tengra (*Glyptothorax cavia*), chitra (*Scatophagus argus*), flat head fish/bartail flathead (*Platycephalus indicus*), barramundi (*Lates calcarifer*), Chinese silver pomfret (*Pampus chinensis*) and Indian white shrimp (*Penaeus indicus*).

4.2.3. Climate and Meteorology

162. Available meteorological data such as rainfall, temperature, humidity, evaporation, wind speed, and sunshine hours at the nearest meteorological station at Ambagan of Chattogram were collected from the Bangladesh Meteorological Department (BMD) and Bangladesh Water Development Board (BWDB) databases.

4.2.3.1. Temperature and Humidity

163. Analyzing monthly maximum and minimum temperature data at the station Ambagan, Chattogram, from 1999 to 2020, it was observed that the warmest month was noticed in April (about 41°C), whereas January was noticed as the coldest month with an average temperature of about 9°C, as shown in **Figure 4-15**. The minimum temperature remains close to 22°C during the monsoon (June to September).

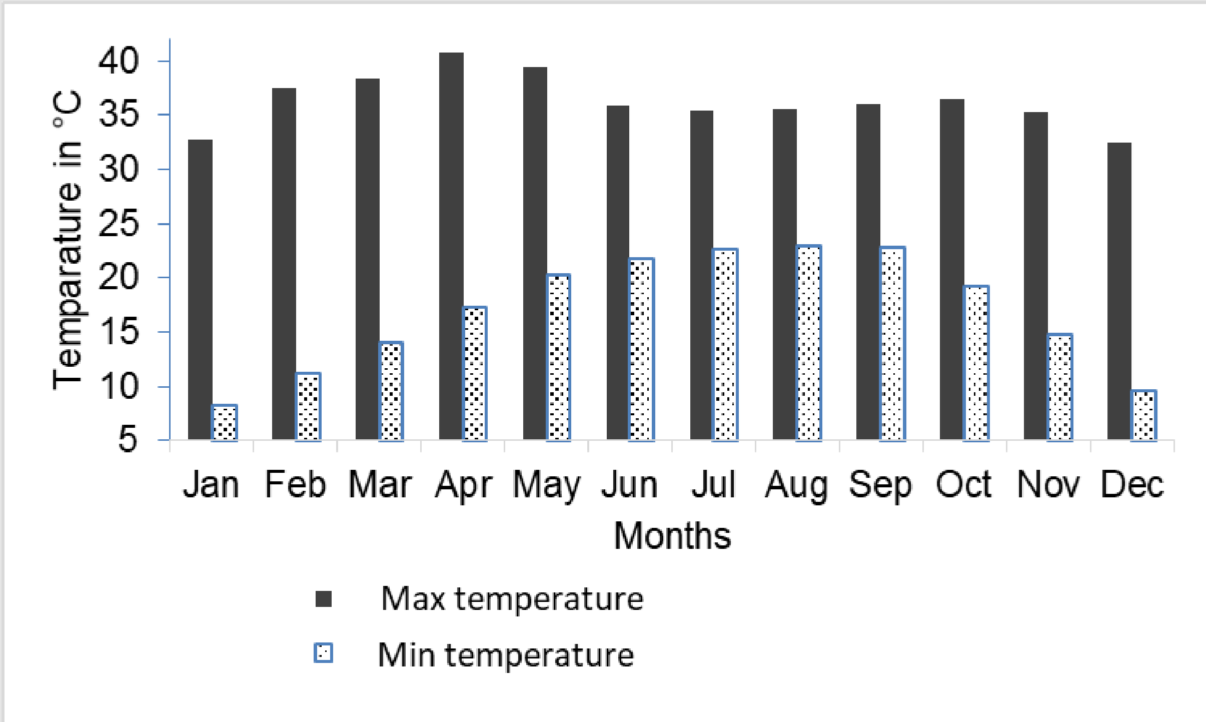


Figure 4-15: Monthly Maximum and Minimum Temperature at Ambagan, Chattogram

164. The range of monthly average humidity varies between 67% and 87%. A bi-modal peak distribution of humidity was noticed at that location. The most humidity was noticed during June through October (humidity greater than 84%). The monthly average humidity at Ambagan, Chattogram from 1999 to 2020 is shown in **Figure 4-16**.

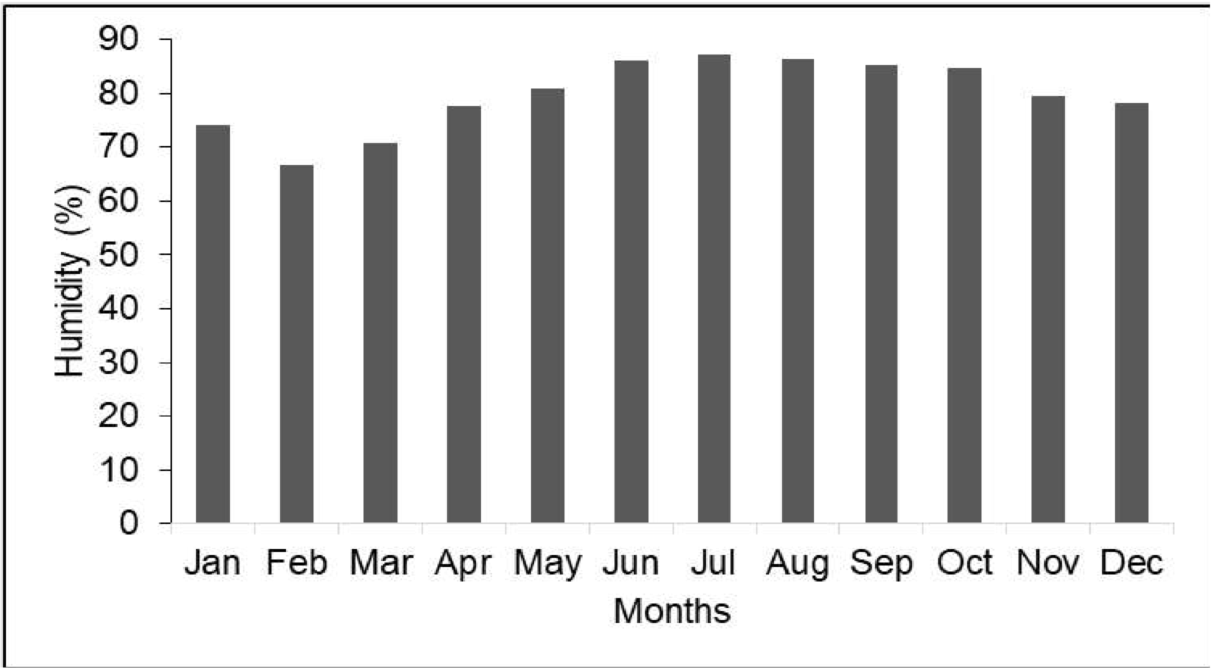


Figure 4-16: Monthly Average Humidity at Ambagan, Chattogram

4.2.3.2. Rainfall

165. The results of average monthly rainfall analyses for Ambagan station from 2003 to 2020 are given in **Figure 4-17**. The peak average monthly rainfall was noticed in July, which was about 700 mm. The pre-monsoon and monsoon periods undergo significant rainfall, whereas the dry period (December to March) experiences a scarcity of rain.

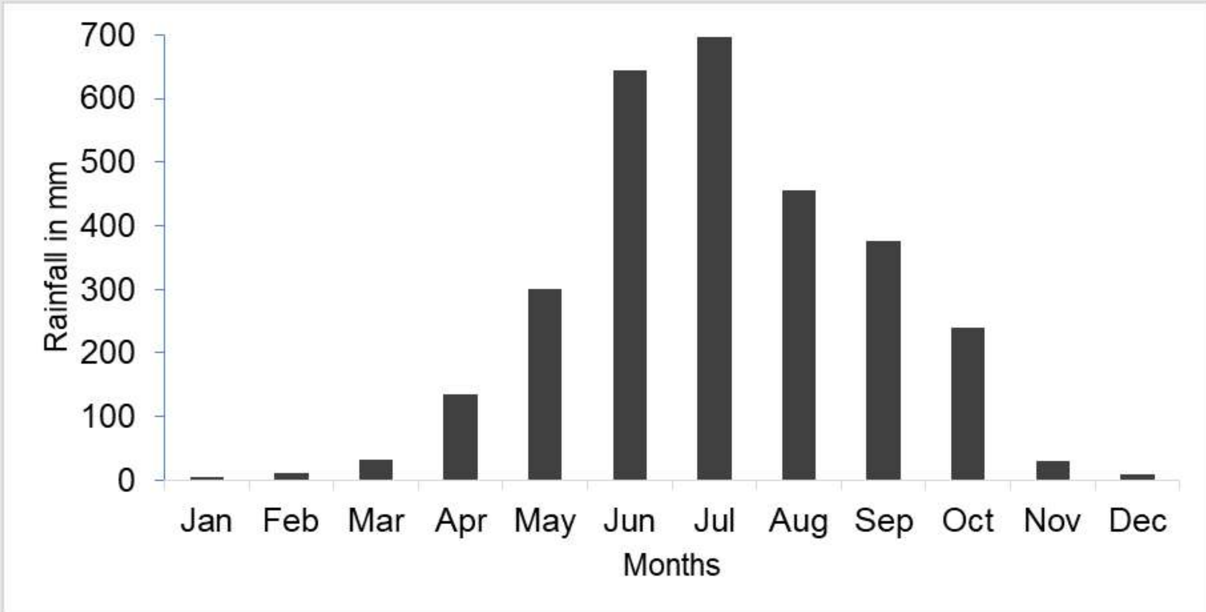


Figure 4-17: Monthly Average Rainfall at Ambagan, Chattogram

4.2.3.3. Evaporation

166. Historical data on evaporation for the last 30 years (1984–2020) was collected and analyzed. It is observed that the monthly average evaporation rate varied from 2.2 to 4.4 mm/day.

4.2.3.4. Wind Speed

167. The variation in monthly average wind speed from 1999 to 2018 is shown in **Figure 4-18**. A higher wind speed was found during the pre-monsoon and monsoon months. A comparatively lower wind speed prevails during the post-monsoon and dry periods. The monthly average wind speed varied between 34 and 140 km/day.

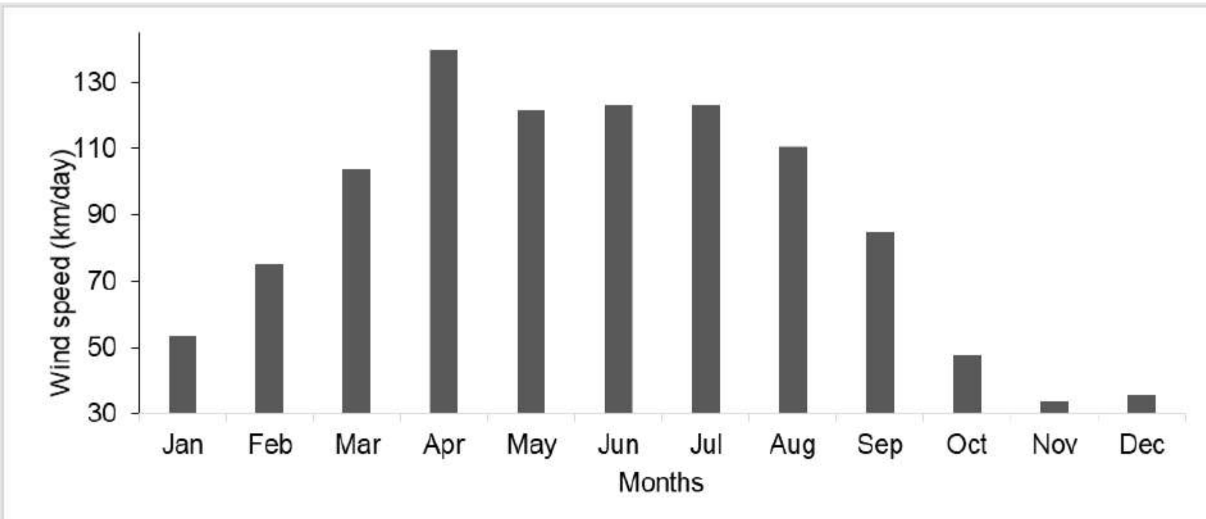


Figure 4-18: Monthly Variation of Average Wind Speed at Chattogram

4.2.3.5. Sunshine Hour

168. The monthly average values of sunshine hours in Chattogram from 2009 to 2017 vary between 4 and 8 hours per day. **Figure 4-19** also shows that the daily average sunshine hours are higher from the end of the monsoon and extend up to the dry months (November to March). However, the values are considerably low during the monsoon and drop to close to 4 hours per day in July due to an increased extent of cloud cover.

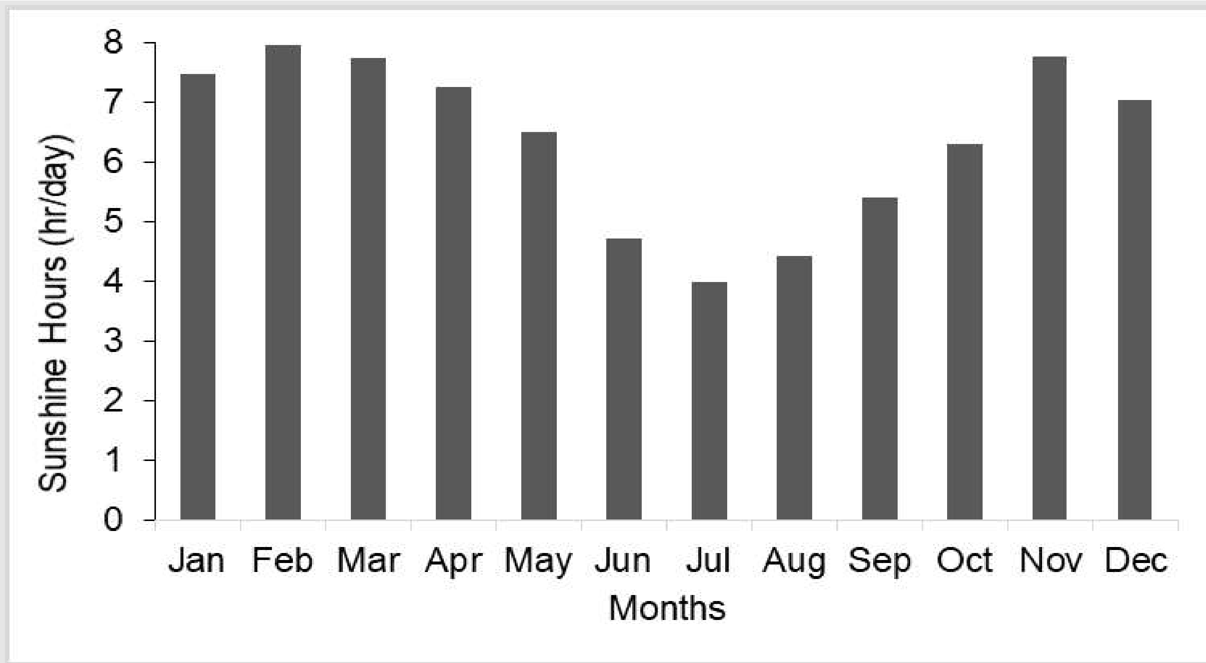


Figure 4-19: Monthly Average Sunshine Hours per day at Chattogram

4.2.4. Environmental Quality (Primary and Secondary Baseline)

4.2.4.1. Ambient Air Quality

169. Air quality is one of the very important factors for the proposed industry, and available data from the closest CAMS station (No. 6), which is located at Chattogram TV Station, was recorded to get a general idea about the air quality status in the study area. The Clean Air and Sustainable Environment (CASE) project under the Department of Environment (DoE) has categorized Chattogram as "unhealthy" in the Air Quality Index (AQI) (Clean Air and Sustainable Environment, 2016). The measured station data along with national standards for the major air quality parameters are given in **Table 4-7**.

170. Data indicates that the concentration of $PM_{2.5}$ (in µg/m^3) significantly exceeded the National Ambient Air Quality Standard (NAAQS) during the winter, which may affect young and elderly people, especially those who have respiratory problems. However, the concentration of air particulate matter remains within the permissible limit in monsoons because of rainwater washing and fewer construction and demolition activities.

Table 4-7: Summary of Air Quality Data Measured during July 2018 and January 2019 at CAMS-6

Parameter	Unit	NAAQS	Summary	CAMS-6 (Chattogram)	
				Lat: 22.36 N; Long: 91.80 E	
				July 2018	January 2019
SO2- 24 hr	ppb	140	Average	15.1	DNA
			Max	31.0	DNA
			Min	3.39	DNA
NO2- 24 hr	ppb	53	Average	20.2	18.0
			Max	44.3	24.3
			Min	11.8	13.2
CO- 1 hr	ppm	35	Average	1.33	1.53
			Max	4.02	10.1
			Min	0.13	0.05
CO- 8 hr	ppm	9	Average	1.41	1.61
			Max	2.69	3.84
			Min	0.38	0.20

Parameter	Unit	NAAQS	Summary	CAMS-6 (Chattogram)	
				Lat: 22.36 N; Long: 91.80 E	
				July 2018	January 2019
O3- 1 hr	ppb	120	Average	3.50	DNA
			Max	8.81	DNA
			Min	1.14	DNA
O3- 8 hr	ppb	80	Average	3.49	DNA
			Max	6.52	DNA
			Min	2.96	DNA
PM2.5- 24 hr	µg/m3	65	Average	14.6	87.2
			Max	26.5	111
			Min	8.67	64.5
			Exceedance (Days)	0	13
			Data capture (%)	80	44
PM10- 24 hr	µg/m3	150	Average	26.9	104
			Max	47.1	144
			Min	16.4	64.3
			Exceedance (Days)	0	0
			Data capture (%)	79	40

Note: CAMS - Continuous Air Monitoring Station; NAAQS- National Ambient Air Quality Standard; DNA- Data Not Available due to malfunction of the analyzer/sensor*
Source: CASE project-Monthly Air Quality Monitoring Report, July 2018 and January 2019

171. Air quality has been tested for the parameters as stated in **Table 4-8** at four locations shown in **Figure 4-20**. A comparison with the Air Pollution Control Rules for 2022 indicates that the concentration of atmospheric pollutants is well below the maximum allowable limit in most of the cases.

Table 4-8: Concentration of Atmospheric Pollutants in the Study Area in September 2022

Location	Parameters	GPS Co-ordinate		Ambient air pollution concentration			
				PM10*	PM2.5*	SO_2**	NO_2***
	Date	Latitude	Longitude	µg/m³	µg/m³	µg/m³	µg/m³
AAQ1	9/8/2022	N22º19'39"	E91º45'56"	38.28	19.14	44.2	28.77
AAQ2	9/8/2022	N22º19'5"	E91º46'1"	56.02	27.83	37.75	31.8
AAQ3	9/7/2022	N22º18'30"	E91º46'4"	29.08	16.46	23.1	18.57
AAQ4	9/7/2022	N22º17'46"	E91º46'18"	85.35	41.2	35.62	26.95
Duration (hr)				24	24	24	24
Air Pollution (control) rules, 2022				150	65	80	80

Notes:
Instrument Used: Haz-Scanner (HIM,6000)
Methods of Analysis:
(*) Particulates Sensor Light Scattering Nephotometer
(**) Sulphur dioxide (SO_2) Sensor High Sensitivity Electrochemical
(***) Nitrogen dioxide (NO_2) Sensor High Sensitivity Electrochemical

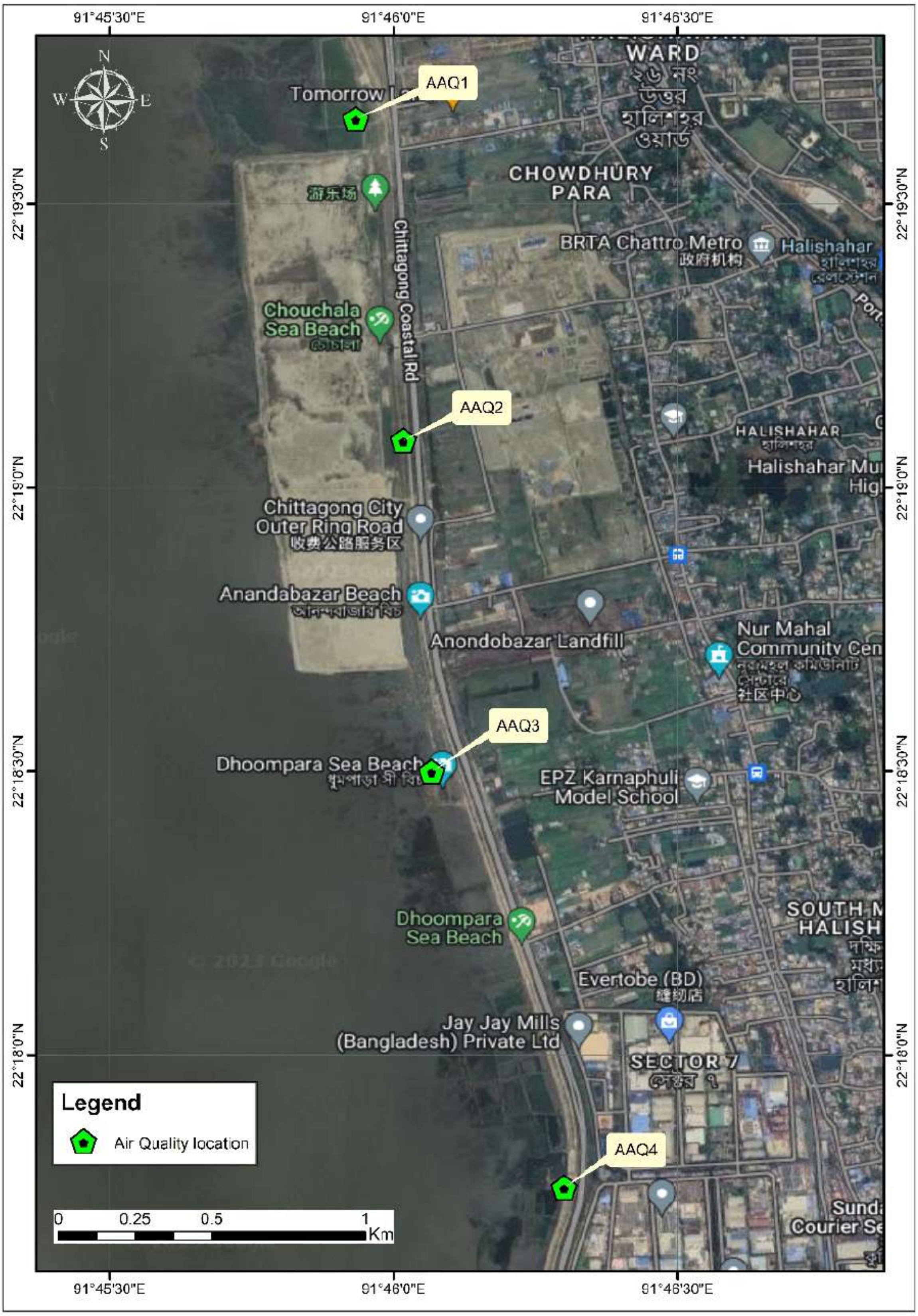


Figure 4-20: Air Quality Sampling Location Map

4.2.4.2. Noise Level

172. Several suitable sites were selected within the project area for recording noise levels, such as at places where sound could be generated due to the construction of various structures related to the project and other secondary activities, as well as at places like settlements and other infrastructure, etc., which could be affected by the movement of vehicles and equipment. DoE Bangladesh has defined standard noise levels during the day and night, as shown in **Table 4-9**. The study area has fallen under the mixed area category, and the noise levels' values were almost within the standard limit.

Table 4-9: Standards of Noise Levels for Different Zones of Bangladesh

Zone Class	Limits in dB	
	Daytime (6 am – 9 pm)	Nighttime (9 pm – 6 am)
Silent zone	45	35
Residential zone	50	40
Mixed	60	50
Commercial zone	70	60
Industrial zone	75	70

173. The noise level has been checked in several locations along the coastal road (marine drive road) in the study area. **Plate 4-2** and **Figure 4-21** show the photo documentation and location map of the noise data collection.

Plate 4-2: Photograph of Noise Level Data Collection

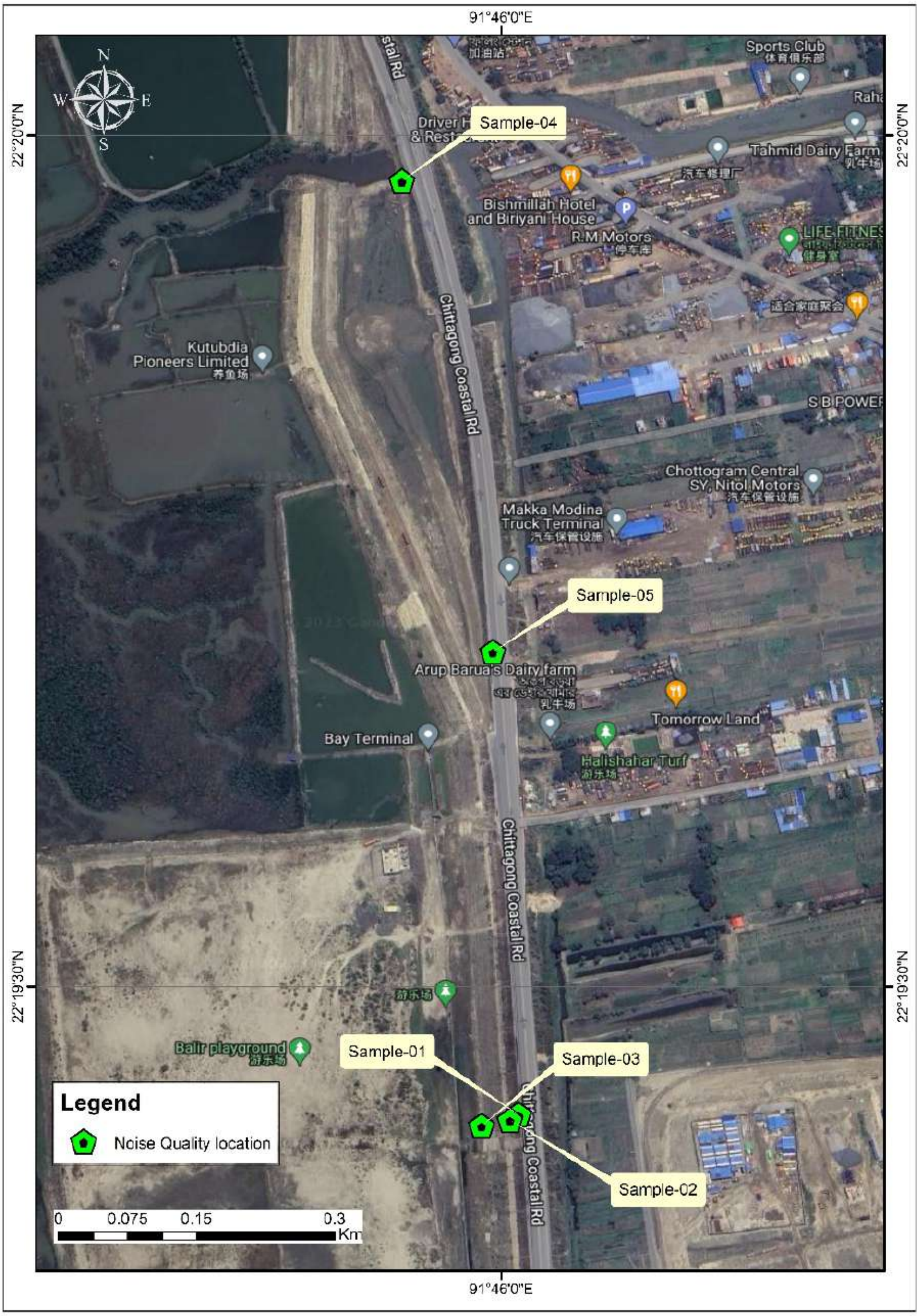


Figure 4-21 : Noise Quality Sampling Location Map (2022)

Figure 4-22 : Noise Quality Sampling Location Map (17 to 20 December 2023)

174. Noise level is measured on the coastal road in front of the proposed Bay Terminal of Chattogram Port using a sound level meter during the day and night in five different locations in year 2022. It has been observed that the moment single truck noise rises between 61 and 66 dB (A) from the base level, it could increase between +10 and +18 dBA. During the moment, double-truck or combination with other motorized vehicles, noise rises between 71 and 74 dB (A) from the base level; it could raise between +16 and +24 dBA. The nature of the noise level is not continuous; it is intermittent sound, and all noise comes from the movement of the motorized vehicle. The results of the noise level are shown in **Table 4-10** and **Figure 4-21** shows the sample location**.**

175. In similar fashion noise level is measured in the December 2023 along coastel road and inside the project area(sand fill area) around 30 sample location was covered where noise level found around 70-75 dBA at road side during movement transport where as noise level inside the project is in between 52 to 45 dBA (**Figure 4-22)** shows the sample location) and **Table 4-11** a few sample of test result.

Table 4-10: Noise Level Assessment of the Bay Terminal (10:04 am-4:08 pm) at year 2022

Location No.	GPS Point	Noise Value Obtained; dB(A)	Time
1	22°19'25.5"N 91°46'0.6"E	82,89,81,86	10:04 am
		65,81,86,73	10:16 am
		86,73,83,87	10:33 am
		85,88,84,90	10:48 am
		65,82,83,86	11:05am
2	22°19'25.3"N 91°46'0.3"E	53,59,52,58	11:19am
		52,61,56,70	11:34 am
		56,70,47,46	11:46 am
		51,57,59,72	11:58 am
		72,75,68,74	12:08 pm
3	22°19'25.1"N 91°45'59.3"E	63,64,61,75	12:21 pm
		62,63,59,60	12:35 pm
		59,55,48,51	12:44 pm
		49,48,50,49	12:56 pm
		50,49,62,69	1:08 pm
4	22°19'58.4"N 91°45'56.5"E	86,73,83,87	1:19 pm
		82,89,81,86	1:35 pm
		65,81,86,73	1:48 pm
		85,88,84,90	1:57 pm
		72,75,68,74	2:08 pm
5	22°19'41.8"N 91°45'59.7"E	59,55,48,51	3:19 pm
		58,61,56,70	3:34 pm
		56,71,47,54	3:46 pm
		51,58,65,72	3:58 pm
		72,75,68,74	4:08 pm
Noise Level Assessment of the Bay Terminal (09:00 am-11:55 pm)			

Location No.	GPS Point	Noise Value Obtained; dB(A)	Time
1	22°19'25.5"N 91°46'0.6"E	72,79,71,76	9:15 pm
		55,71,76,63	9:28 pm
		76,63,73,77	9:36 pm
		75,78,74,70	9:48 pm
		65,72,73,76	10:08 pm
2	22°19'25.3"N 91°46'0.3"E	46,49,52,48	10:21 pm
		52,51,56,60	10:35 pm
		48,60,47,46	10:48 pm
		46,47,49,52	11:00 pm
		62,65,58,64	11:12 pm
3	22°19'25.1"N	53,54,51,65	11:24 pm

Location No.	GPS Point	Noise Value Obtained; dB(A)	Time
	91°45'59.3"E	52,53,49,50	11:38 pm
		49,45,43,51	11:49 pm
		44,43,50,46	11:50 pm
		50,49,52,59	11:52 pm
		50,49,52,59	11:52 pm
4	22°19'58.4"N 91°45'56.5"E	66,53,63,67	7:29 pm
		62,69,61,66	9:35 pm
		45,51,56,53	9:48 pm
		65,68,64,70	9:57 pm
		52,55,58,54	10:09 pm
5	22°19'41.8"N 91°45'59.7"E	49,45,48,51	11:19 pm
		48,51,56,50	11:34 pm
		46,51,47,54	11.35 pm
		41,38,55,42	11:38 pm
		42,35,38,44	11:42 pm

Table 4-11: Noise Level Assessment of the Bay Terminal Decmber 2023.

Location No.	GPS point	Average value(dba)	Date: 17/12/2023 Time
01	22°20'58.22"N 91°45'36.30"E	82,89,87,81	08:05am
		70,90,78,75	08:10am
		88,70,79,89	08:17am
		87,81,86,83	08:25am
		70,87,86,81	08:30am
02	22°20'41.22"N 91°45'41.33"E	71,66,58,70	08:35am
		65,67,70,78	08:40am
		63,75,61,50	08:45am
		75,59,66,78	08:50am
		79,85,75,79	08:55am
03	22°20'21.01"N 91°45'47.69"E	55,80,63,71	09:03am
		70,78,60,57	09:10am
		70,63,50,53	09:15am
		60,75,55,60	09:25am
		70,50,78,81	09:33am
04	22°19'51.12"N 91°45'58.90"E	88,55,88,70	09:40am
		78,75,70,65	09:55am
		80,81,78,88	10:00am
		70,80,81,88	10:07am
		68,77,61,79	10:14am
05	22°19'28.22"N 91°46'0.63"E	62,67,51,82	10:20am
		65,48,60,90	10:25am
		80,80,65,73	10:32am
		69,80,88,70	10:37am
		70,78,90,64	10:45am
06	22°19'10.66"N 91°46'1.81"E	78,75,79,88	10:51am
		60,78,71,66	11:00am
		70,75,65,71	11:08am
		78,70,80,86	11:13am
		80,90,88,65	11:20am
07	22°18'48.83"N 91°46'3.31"E	49,50,60,45	11:30am
		60,76,75,65	11:38pm
		60,70,55,90	11:45am
		60,55,68,60	11:56am
		69,80,85,64	12:00pm
08	22°18'31.11"N 91°46'7.35"E	70,80,81,65	12:10pm
		47,55,66,90	12:25pm
		80,75,65,50	12:34pm

		60,45,77,80	12:45pm
		66,55,67,75	12:54pm

4.2.4.3. Water Quality

176. Water samples were collected from the sea beach and internal canal area during the month of October 2022(Two Location) which further done in December 2023(Four Location), and six sample locations as shown in **Figure 4-23**. The parameters of water quality that were tested and the results are shown in **Table 4-12** and **Table 4-13**.

Table 4-12: Water Quality Test Result of the Study Area

Parameters	**Unit**	**SW1 (Sea Beach)** N22º19'7" E91º45'46.1"	**SW2 (Canal)** N22º19'3" E91º45'56.1"	**Bangladesh Standards**
pH	mg/l	7.66	7.68	6.5-8.5
Turbidity	NTU	296	123	–
DO	mg/l	7.9	5.8	6
BOD_5	mg/l	1.1	1.6	2 or less
TSS	mg/l	139	116	–
TDS	mg/l	212	78	1000
Oil & Grease	mg/l	BDL	BDL	0.01
Total Coliform	n/100 ml	126	283	0
Temperature	ºC	30.4º	30.2º	20-30

Table 4-13: Water Quality Test Result of the Study Area (December-2023)

Parameters	**Unit**	Baruni suicide gate **1** 22°19'59.78" N 91°45'55.73" E	Army Suicide gate **2** 22°19'53.25" N 91°45'57.49" E	Kattholi suicide gate **3** 22°20'52.66" N 91°45'36.20" E	Sea Water Halisahar **4** 22°18'26.69" N 91°45'9.60"E	Bangladesh Standards ECR-2023 (Coastal water)
pH	mg/l	7.6	7.7	8.0	8.1	6.5-8.5
Turbidity	NTU	<1	2.5	1.7	2.1	5
COD	mg/l	3.88	1.8	4.0	4.3	-
BOD_5	mg/l	1.1	0.3	0.8	1.0	2 or less
TSS	mg/l	2,992	868	910	21,005	–
TDS	mg/l	2,810	810	830	19,970	–
Temperature	ºC	25º C	25º C	25º C	25º C	20-30

177. Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) express suspended organic and inorganic matter and dissolved matter in a water body. The inland surface water standard for suspended matters is only 150 mg/L (ECR-2023), and suspended matters are found within the standard limit. Dissolved Oxygen (DO) is an important ecological factor that determines the environmental health of water bodies and supports a well-balanced aquatic living organism. The highest amount of DO (7.9 mg/L) was recorded in seawater, which is comparatively higher than the critical range. However, in the canal, the low concentration of DO might be due to the large amount of waste discharged by Khal and the drainage system, which utilizes a significant amount of DO for biochemical degradation. In the present investigation, the depletion of DO was found to be mainly due to the effluent discharged from CEPZ and the Patenga industrial area.

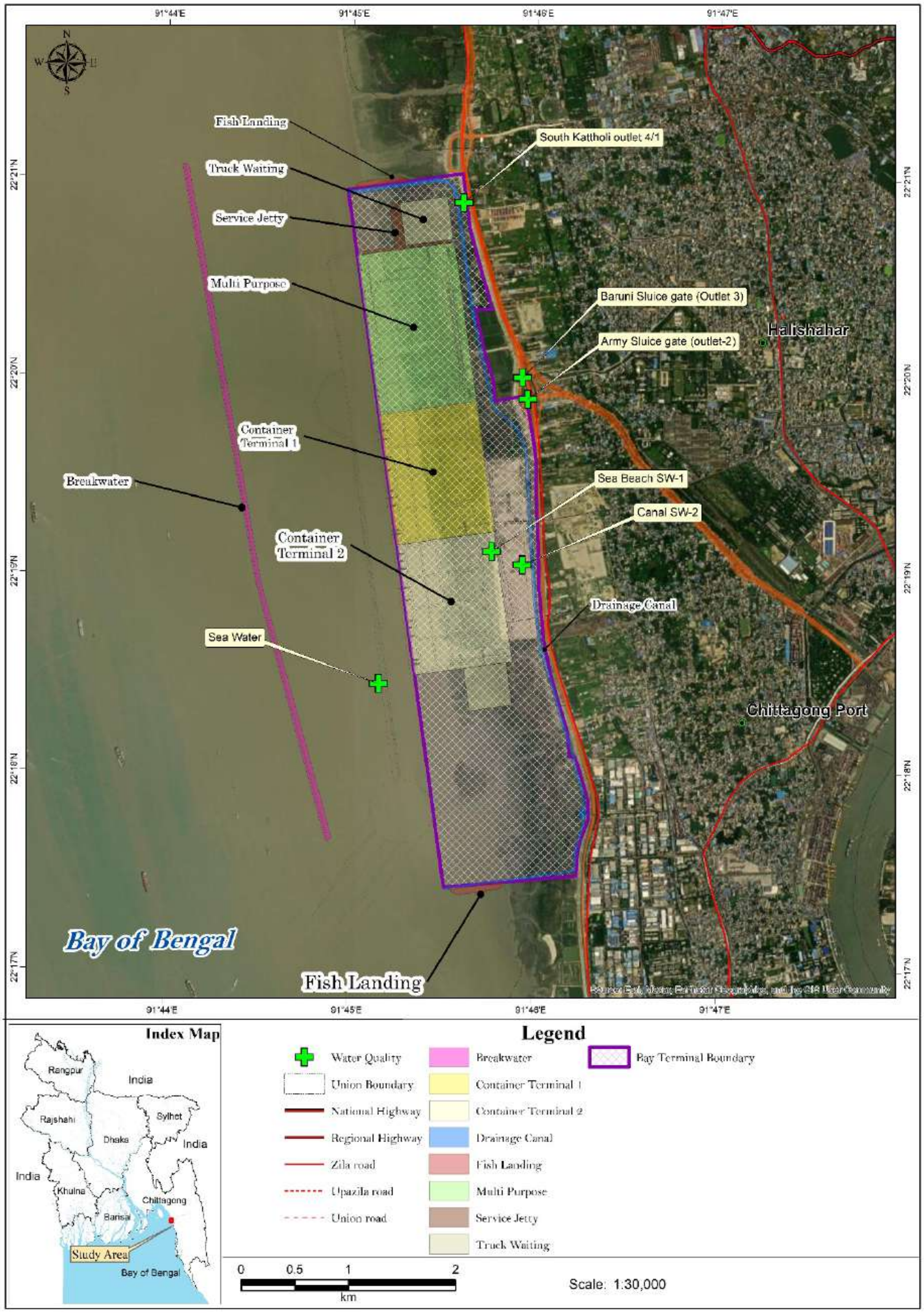


Figure 4-23: Water Quality Sampling Location Map

4.2.5. Natural and Climate-Induced Hazards

4.2.5.1. Impacts of Climate Change

178. **Assessment of a 100-years Return Period Water Level**. A water level with a return period of 100 years (HW100) or a probability per year of p = 0.01 has been assessed by carrying out an extreme value statistical analysis of the historical high-water levels at Chattogram. The water level data corresponding to the 100-years return period from the manually fitted curve in **Figure 4-24**, it was found a water level of 7.60 m MSL. Using the relationship MSL = 2.80 m ISLW (based on information from CPA), HW100 would be 10.4 m ISLW (Indian Spring Low Water)

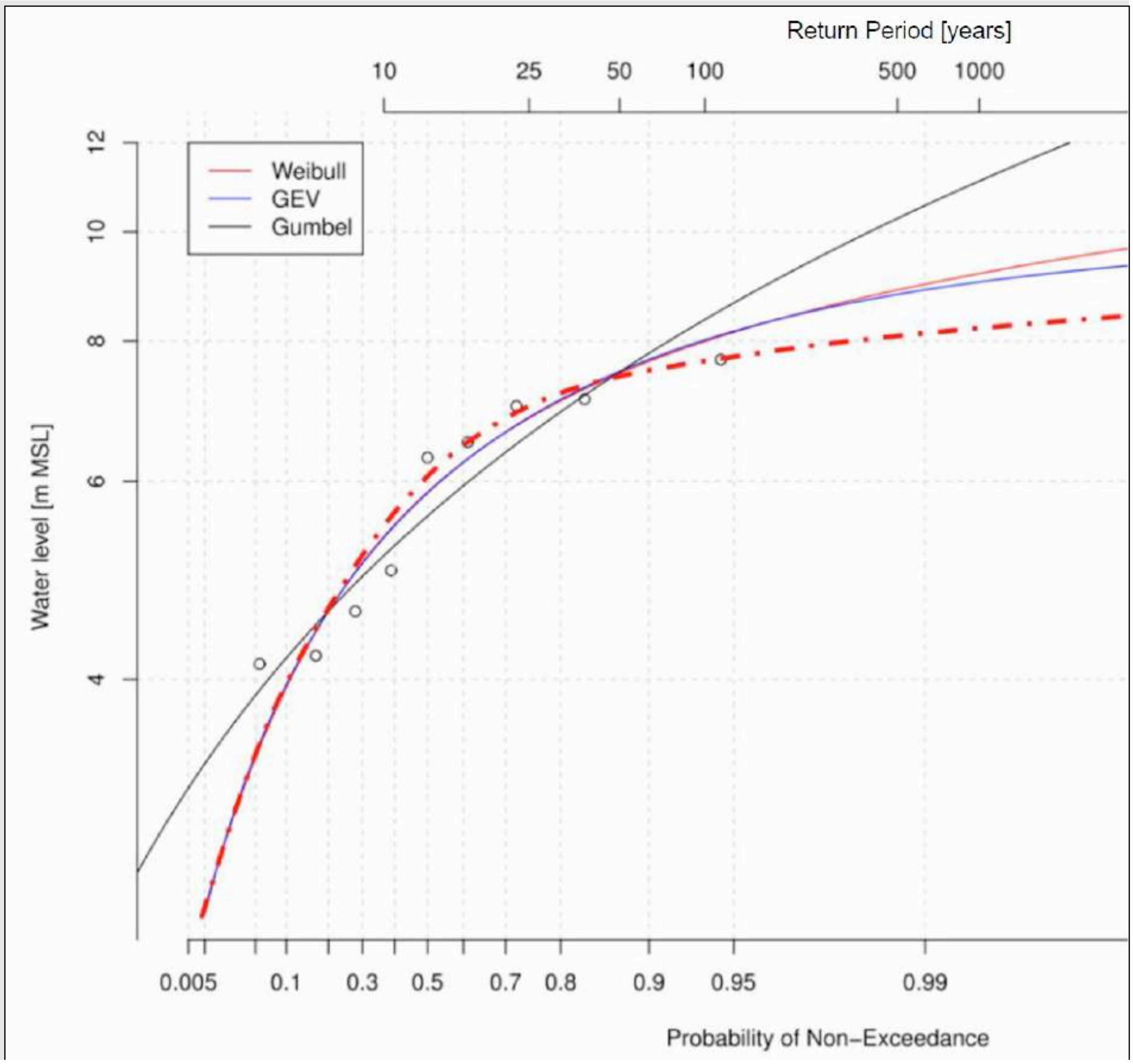


Figure 4-24: Probability of Non-Exceedance and Return Period of the Historical Water Levels at Chattogram and Fitting of Four Well-known Distributions to the Data

4.2.5.2. Tropical Cyclones

179. Geographically, Bangladesh is located in a delta of three mighty rivers, such as the Padma, the Meghna, and the Jamuna, and this has made the country very much exposed to natural hazards. Additionally, the land characteristics of the country, its climatic conditions, and the impact of climate change make the country vulnerable to natural hazards. The location of the proposed project falls under the coastal region of Bangladesh and the coastal morphology also triggers the impact of natural hazards. People living in this region periodically experience certain coastal hazards like a cyclone with storm surges, coastal

bank erosion, salinity intrusion, etc. However, cyclones coupled with storm surges caused huge damage to live, properties, and livelihoods, and Bangladesh experienced 219 natural disasters from 1980 to 2008.

180. The coastal regions of Bangladesh are subject to damaging cyclones almost every year, which generally occur in early summer (April-May) or late rainy season (October-November). Cyclones originate from low atmospheric pressures over the Bay of Bengal. A tropical cyclone forming in the Bay of Bengal has a lifetime of one week or longer. The height of the surges is limited to a maximum of 10 meters in the bay. When propagating into the shallower inland coastal areas, the heights of these waves are further reduced. The frequency of a wave (surge plus tide) with a height of about 10 m is approximately once per 20 years. A storm surge of approximately once in 5 years has a height of about 7 m (surge plus tide).

181. The study area faced devastating natural disasters in April 1991, May 1997, and May 2017 where many people were victims of the cyclones. Besides, these natural disasters also caused heavy damage to settlements, livestock, and other properties in the area.

182. In 1991, the tropical cyclone reached the land on 29 April with a wind speed of around 235 km/h and the storm formed a 6 m high surge that inundated the entire area. In 1997, another strong tropical cyclone arrived on land on 17 May with winds of 215 km/h and resulted in huge damage in the area. On 30th May 2017, Category 1 tropical Cyclone “Mora” made landfall in Cox’s Bazar District, with a maximum wind speed of 130 km/h. Several hours later the cyclone moved north across the Chattogram Districts of Bangladesh.

183. Bangladesh Meteorological Department (BMD) regularly monitors tropical cyclones. **Table 4-14** shows the recorded major historical cyclones that occurred in and around Bangladesh from 2005 to 2021, and **Table 4-15** shows the major cyclones those crossed Chattogram Coastal Area and their maximum wind speed.

Table 4-14: Recent Historical Cyclone at the Bangladesh Coast

No	Cyclone Name	Status	Landfall Area	Landfall Date
1	BAAZ	Cyclonic Storm	Weakened into a well-marked low-pressure area over southwest Bay	02 December 2005
2	AKASH	Cyclonic Storm	Crossed south Bangladesh coast close to the south of Cox's Bazar	14 May 2007
3	SIDR	Very Severe Cyclonic Storm	Crossed Bangladesh coast near Baleshwar River	15 November 2007
4	RASHMI	Cyclonic Storm	Crossed Bangladesh coast near Khepupara	26 October 2008
5	BIJLI	Cyclonic Storm	Crossed Bangladesh coast near Chattogram	17 April 2009
6	MAHASEN	Cyclonic Storm	Crossed Bangladesh coast between Chattogram and Feni	16 May 2013
7	KOMEN	Cyclonic Storm	Chattogram-Cox’s Bazar Coast	30 July 2015
8	ROANU	Cyclonic Storm	Barisal-Chattogram Coast near Patenga	21 May 2016
9	MORA	Severe Cyclonic Storm	Chattogram-Cox’s Bazar Coast near Kutubdia	30 May 2017
Source: Bangladesh Meteorological Department, 2021				

Table 4-15: Major Cyclones near the Chattogram Coast

Date of Occurrence	Nature of Phenomenon	Landfall Area	Maximum Wind Speed in km/hr.	Tidal Surge Height in ft.	Central Pressure (mbs)
11 October 1960	Severe Cyclonic Storm	Chattogram	160	15	-
31 October 1960	Severe Cyclonic Storm	Chattogram	193	20	-

Date of Occurrence	Nature of Phenomenon	Landfall Area	Maximum Wind Speed in km/hr.	Tidal Surge Height in ft.	Central Pressure (mbs)
09 May 1961	Severe Cyclonic Storm	Chattogram	160	8-10	-
30 May 1961	Severe Cyclonic Storm	Chattogram (Near Feni)	160	6-15	-
28 May 1963	Severe Cyclonic Storm	Chattogram-Cox's Bazar	209	8-12	-
11 May 1965	Severe Cyclonic Storm	Chattogram-Barisal Coast	160	12	-
05 November 1965	Severe Cyclonic Storm	Chattogram	160	8-12	-
15 December 1965	Severe Cyclonic Storm	Cox's Bazar	210	8-10	-
01 November 1966	Severe Cyclonic Storm	Chattogram	120	20-22	-
12 November 1970	Severe Cyclonic Storm with a core of hurricane wind	Chattogram	224	10-33	-
28 November 1974	Severe Cyclonic Storm	Cox's Bazar	163	9-17	-
15 October 1983	Cyclonic Storm	Chattogram	93	-	995
09 November 1983	Severe Cyclonic Storm	Cox’s Bazar	136	5	986
24 May 1985	Severe Cyclonic Storm	Chattogram	154	15	982
18 December 1990	Cyclonic Storm (crossed as a depression)	Cox's Bazar Coast	115	5-7	995
29 April 1991	Severe Cyclonic Storm with a core of hurricane wind	Chattogram	235	12-22	940
02 May 1994	Severe Cyclonic Storm with a core of hurricane wind	Cox's Bazar-Teknaf Coast	220	5-6	948
25 November 1995	Severe Cyclonic Storm	Cox's Bazar	140	10	998
19 May 1997	Severe Cyclonic Storm with a core of hurricane wind	Sitakundu	232	15	965
27 September 1997	Severe Cyclonic Storm with a core of hurricane wind	Sitakundu	150	10-15	-
20 May 1998	Severe Cyclonic Storm with core of hurricane winds	Chattogram Coast near Sitakunda	173	3	
19 May 2004	Cyclonic Storm	Teknaf-Akyab Coast	65-90	2-4	990
16 May 2013	Cyclonic Storm (MAHASEN)	Noakhali-Chattogram Coast	100	-	-
30 July 2015	Cyclonic Storm (KOMEN)	Chattogram-Cox’s Bazar Coast	65	5-7	988
21 May 2016	Cyclonic Storm (ROANU)	Barisal-Chattogram	128	4-5	992

Date of Occurrence	Nature of Phenomenon	Landfall Area	Maximum Wind Speed in km/hr.	Tidal Surge Height in ft.	Central Pressure (mbs)
		Coast near Patenga			
30 May 2017	Severe Cyclonic Storm (MORA)	Chattogram-Cox's Bazar Coast near Kutubdia	146	-	-
Source: Bangladesh Meteorological Department, 2021					

184. To identify the storm surge height at the proposed Bay Terminal of Chattogram, the past 70 years data on storm surge track data with wind speed, pressure drop, cyclone locations, track, a radius of maximum wind speed, eye diameter, etc. have been considered. **Figure 4-25** shows the tracks of the last 50 years' storm surge data over the Eastern Coast of Bangladesh.

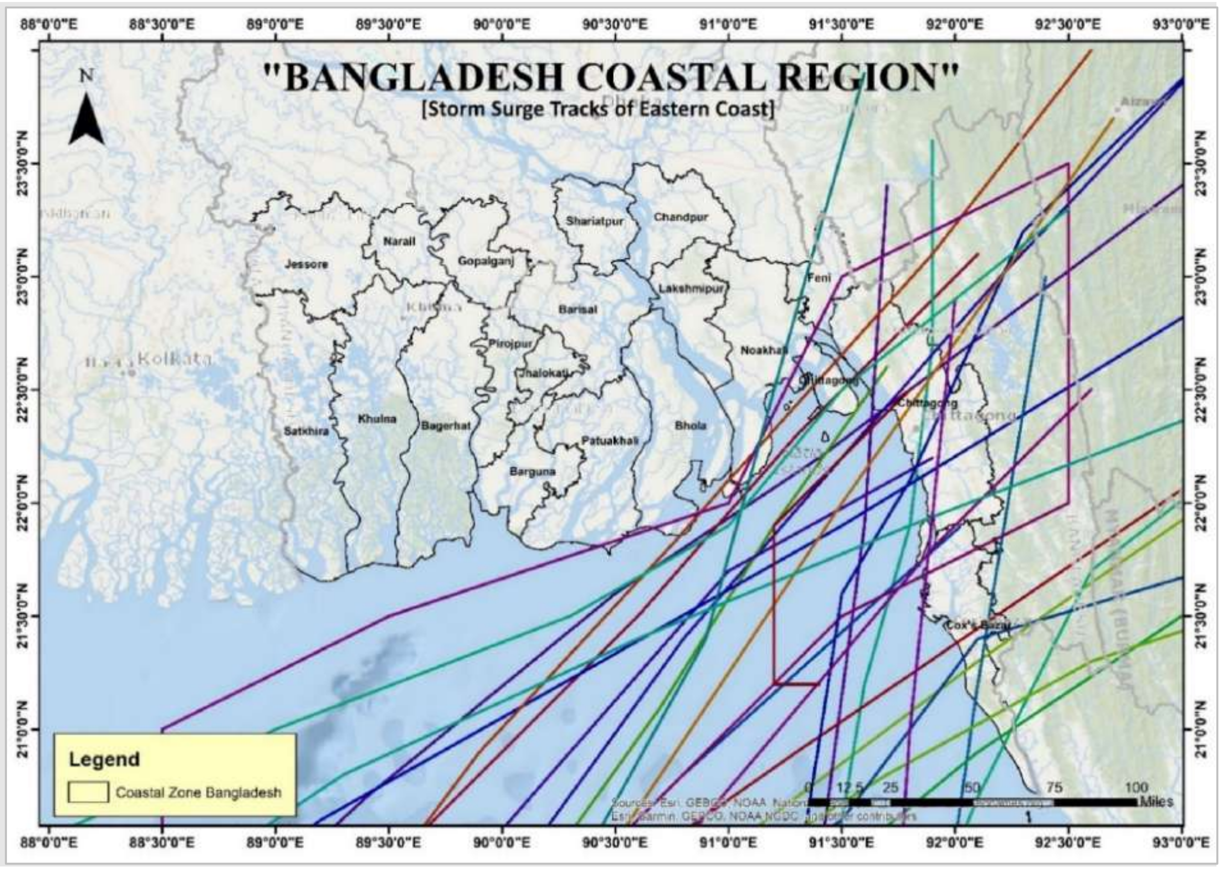


Figure 4-25: Storm Surge Tracks of the last 50 Years over Eastern Coast of Bangladesh

185. A representative cyclone has been selected form the historical data and used to determine the critical risk in the region due to storm surge hazards. To generate this representative hazard event, both wind speed and landfall location of the representative cyclone have been considered. Based on the extreme event, high-strength cyclones have been selected which have a wind speed equal to or greater than 200 km/hr. Frequency analysis is based on fitting theoretical probability distributions to a given set of data. Numerous distributions have been suggested in the literature based on their ability to "fit" the plotted data from history. The first asymptotic distribution of extreme values (EV1); commonly called Gumbel Distribution is widely used and is recommended for Bangladesh coast and river-related calculations. The frequency function is:

$$XT = \bar{X} + KTS \quad (1)$$

186. Where XT is specific data of specified probability with return period T, $\bar{X}$ is the mean of the data series, S is the standard deviation of the series, and KT is the frequency factor and is a function of the return period. Chow (1951) derived the following expression for the frequency factor for the Extreme Value I (EVI) Distribution:

$$KT = \frac{\sqrt{6}}{\pi}\left[0.5772 + \ln\left\{\ln\frac{T}{T-1}\right\}\right] \quad (2)$$

187. Using the equations (1) and (2), the return period for each of the high-strength cyclones (cyclone wind speed greater than or equal to 200 km/hr). The results are shown in **Table 4-16**.

Table 4-16: Return Periods for High-Strength Cyclones in Bangladesh

Storm Year/ Name	Max Wind (km/hr)	Calculated Return Period (years)
November 1975	111	11
March 1985	93	14
April 1991	235	15
May 1998 (Roanu)	111	12
May 2016 (Mora)	120	15

188. The result shows that the wind speed of high-strength cyclones varies from 111 km/hr to 235 km/hr with a return period varying from 11 years to 15 years. The 15-year return period is within the maximum and minimum range of return periods of high-strength cyclones on the Bangladesh coast. Wind speed corresponding to 15 years returns period is found to be 235 km/hr. Considering all these, to determine critical risk in the region, in this study representative cyclone is selected as a cyclone that has a return period of 15 years with a wind maximum speed of 235 km/hr.

189. Considering the frequency, representative cyclone wind speed is determined as the cyclone corresponding to a 10-years return period. To be compatible with this, a representative landfall location is also selected as the cyclone landfall location that corresponds to a 15-years return period. To locate the landfall location of the cyclone that represents the 15-year return period, Bangladesh's coastal region is divided into three major parts as Western, Central, and Eastern. As our study area falls within the eastern zone of Bangladesh, here for calculating Representative Landfall Location, and storm surge tracks in the eastern zone have been used.

190. With the landfall locations shown in **Figure 4-26**, frequency analysis is performed to determine the 15-year return period landfall location for east coasts. **Table 4-17** shows these locations.

Table 4-17: Landfall Locations Corresponding to the 15-Year Return Period

Region	Landfall Location (in Degrees Minutes Seconds)	
Eastern Coastal Region	22° 29’ 14.0”	91° 42’ 37.0”

191. Considering the wind speed, return period, and location of representative landfall locations in **Figure 4-27**, 1991 storm surge in **Figure 4-28** has been selected as an extreme event.

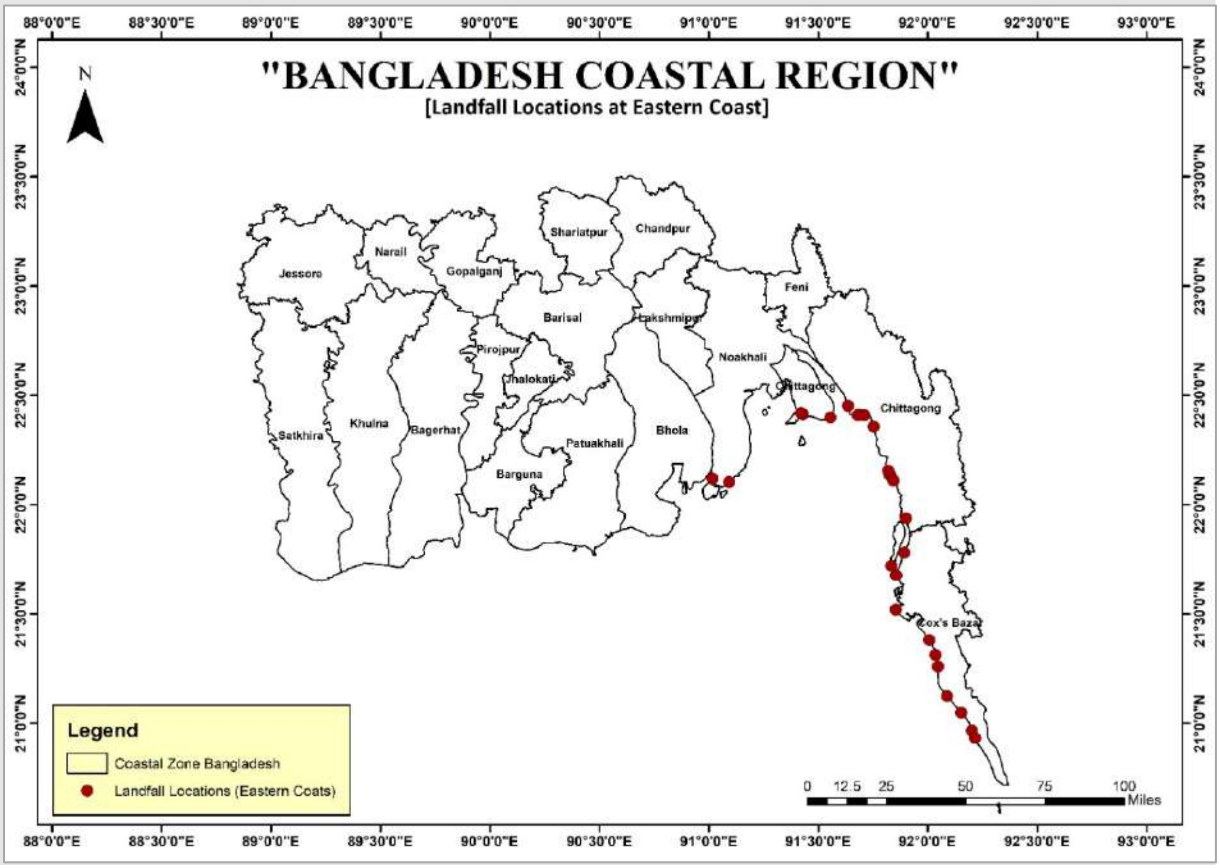


Figure 4-26: Landfall Locations of Historic Cyclone Events at East Coast of Bangladesh

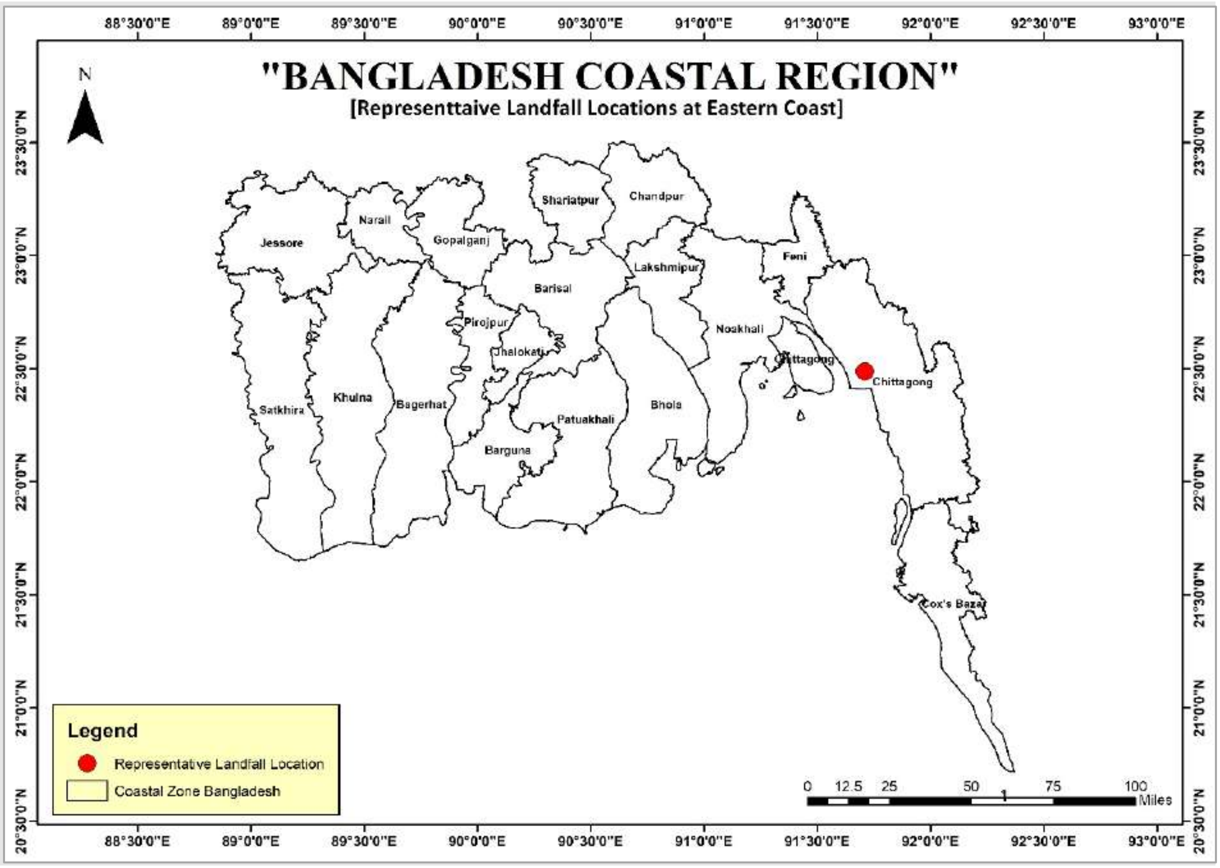


Figure 4-27: Representative Landfall Locations of Historic Cyclone Events at Coastal Zone Bangladesh

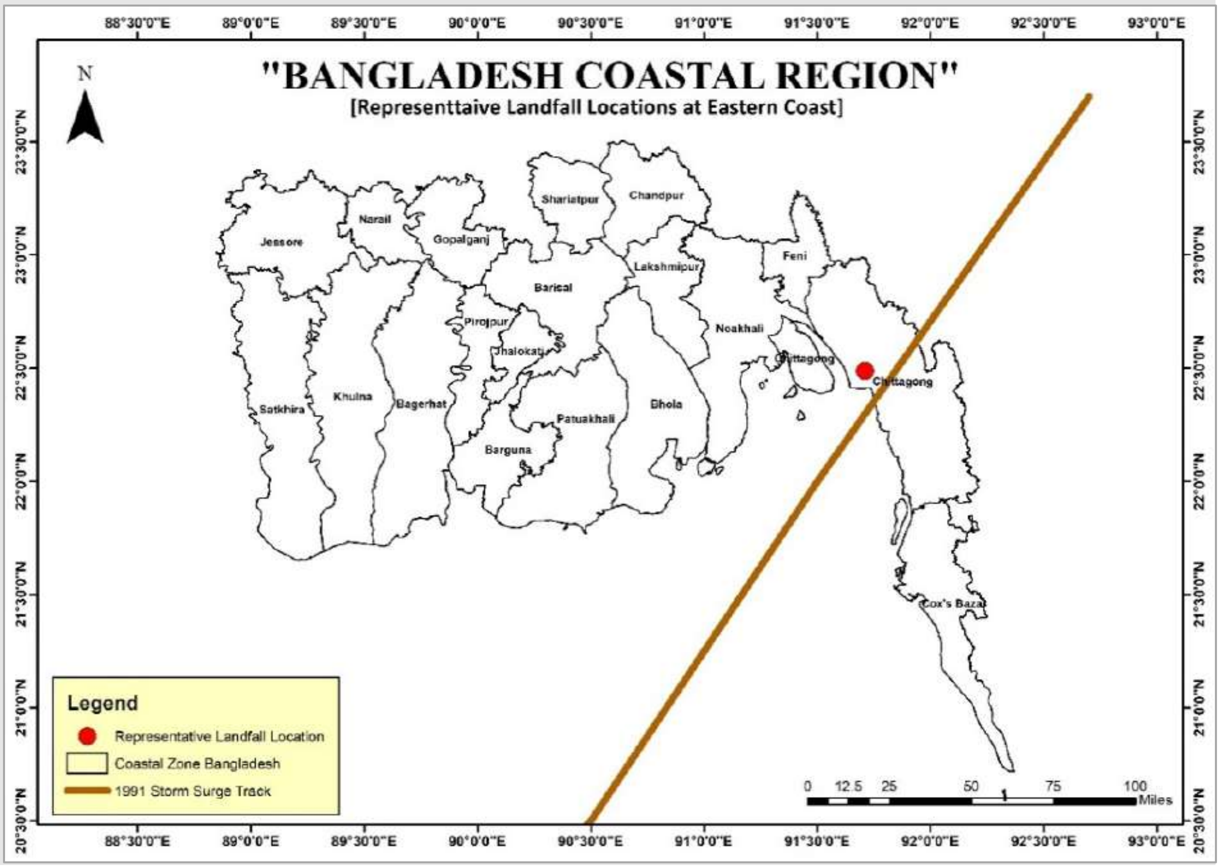


Figure 4-28: Representative Landfall Location is Close to 1991 Storm Surge Track

4.2.5.3. Tidal Flooding

192. Tidal flood is common in most of the Chattogram City. The aged drainage infrastructure, poorly maintained drainage system, illegal dumping of solid waste, heavy sedimentation in drainage canals, and lack of tidal control gates at the mouth of each canal are the root causes of tidal flooding. Tidal flow entering the Karnaphuli River from the sea is highly responsible for tidal flooding even without sufficient rainfall. During the high tide and the spring tide, specifically during the monsoon, the river water levels increase and push the flows back up through the drainage canals into the urban areas. Due to this opposite force of the tide, the water of canals cannot drain into the river and causes tidal flooding. The most affected areas by tidal flooding are Halishahar and its adjacent areas, where water generally stays for 1 to 2 days hampering the people's daily lives. For tidal water management adjacent to the project area, there are four newly constructed regulators/sluices by the Bangladesh Water Development Board (BWDB). However, due to the development of the proposed Bay Terminal, the drainage system might interrupt the drainage network in the adjacent area. **Plate 4-3** shows the flooding situation in Chattogram City.

Solosahar

Bakolia

Plate 4-3: Photograph of Flooding Situation in Chattogram City

4.2.5.4. Sea Level Rise

193. As for the annual average water level rise in the Chattogram area, an annual average of 11mm/yr, which is the value of the Rangadia area closest to the project area, was applied. The observed trend of tidal water level at Rangadia based on Linear Regression Analysis over the last 20 years is shown in **Figure 4-29**.

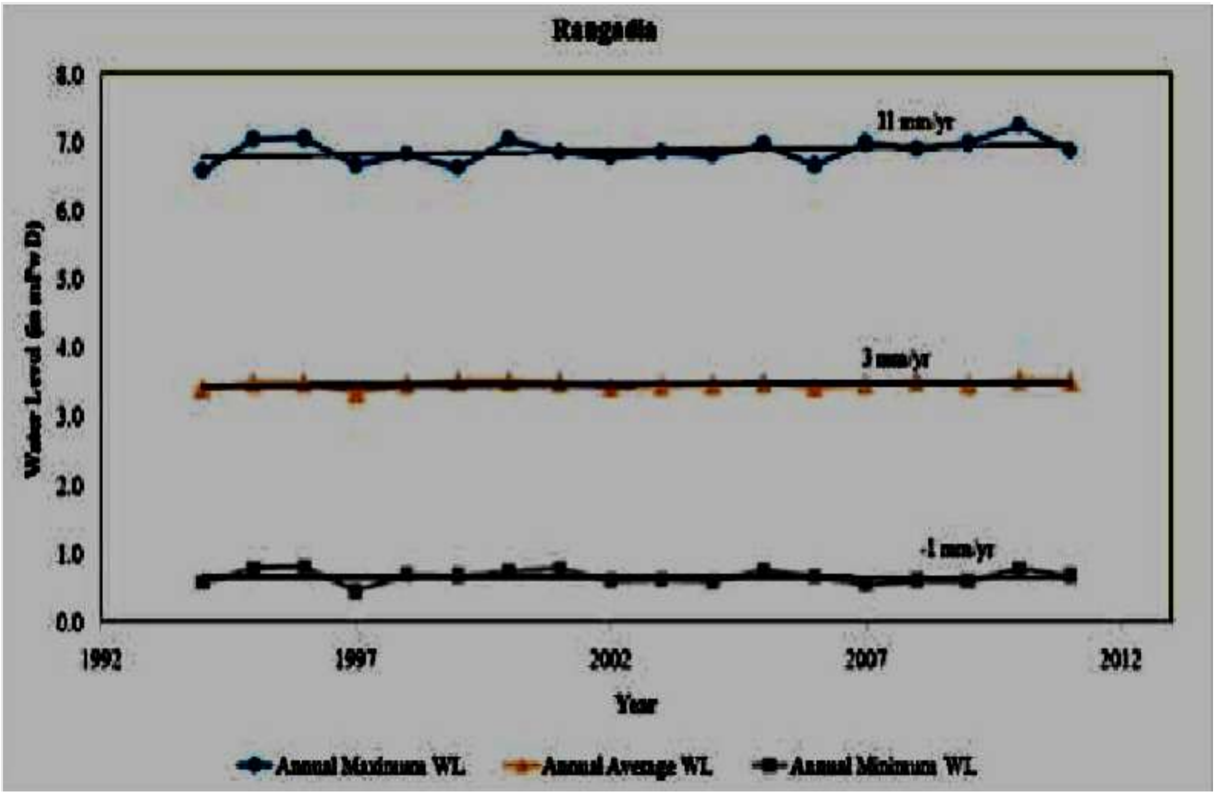


Figure 4-29: Sea Level Rise of the Study Area

4.2.5.5. Erosion and Sedimentation

194. The tendency of hill cutting is one of the main sources of siltation downstream in the city areas. The khals draining the hills surrounding the city have a higher elevation compared to the surrounding ground levels, due to the vast amounts of silt transported downstream and deposited on the bed. This situation is severely aggravated by hill-cutting activities. Low flow velocities in the khals are caused due to siltation. In order to tackle the siltation of the proposed bay terminal drainage channel, silt traps have been planned to control sedimentation.

4.3. Biological Environment

4.3.1. Bio-ecological Zones and Ecological Resources

195. The ecological resources of Chattogram City consist of vegetation and wildlife composition inside the khal and on the peripheral side (riparian area) of the khal. IUCN, the World Conservation Union, has divided the whole country into 25 bio-ecological zones (2002), considering physiographic conditions, climate, soil type, flooding depth, and biodiversity. The study area has fallen under three bio-ecological zones: coastal marine water, coastal plains, Chattogram Hills, and the CHTs. The study area comprises a wide range of habitat patterns, including urban areas, ponds, khal, hill slopes, rural homesteads, shrubby bush areas, agriculture areas, etc. The bio-ecological zone map is shown in **Figure 4-30**. For data collection, habitats were categorized into six categories, viz. i) urban area; ii) rural

homestead; iii) sandy beach; iv) coastal mudflats; v) mangrove patches; and vi) marine water. Line transects were drawn, covering all the habitats.

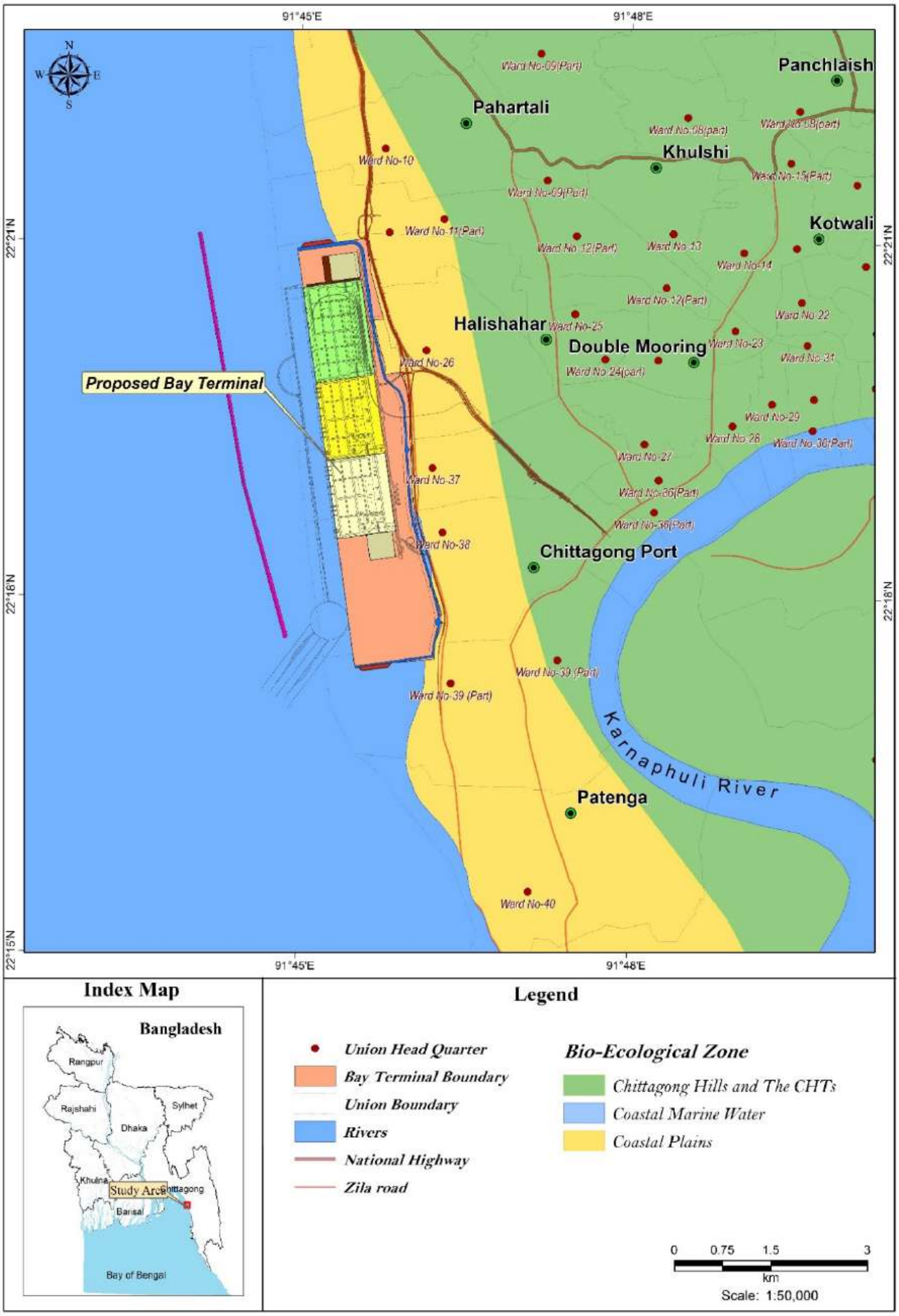


Figure 4-30: Bio-Ecological Zone of the Study Area

4.3.2. Biodiversity

4.3.2.1. Ecological Survey Approach and Methodology

196. The study team conducted an ecological survey following the line transect method. The overall objective of this survey is to prepare detailed baseline conditions for existing floral and faunal information within a 6 km radius for terrestrial and freshwater flora and fauna and an 18.52 km radius for marine species, as shown in **Figure 4-31** and **Figure 4-32**. The survey was conducted in both the monsoon and dry seasons using different methods. The ecological survey was conducted in and around the Bay Terminal project area from 18 to 24 July 2022, 25 to 29 November 2022, 3 to 7 February 2023, and 31 May to 2 June 2023. A total of 14 transect lines were set to observe the area's flora and fauna composition.

197. The specific objectives of the survey were as follows:

- To prepare the baseline condition of the marine and terrestrial flora and fauna in and around the project area,
- To find out the rare and threatened flora and fauna species,
- To prepare a baseline of floral diversity and assess the flora of conservation interest,
- To find out the ecologically valuable wildlife habitats and the factors that are supporting them to live here,
- To identify the possible impacts on the ecosystem due to proposed bay terminal development activities.

Figure 4-31: Ecological Study Area for Terrestrial and Freshwater Species

Figure 4-32: Ecological Study Area for Marine Species

4.3.2.2. Survey Methods for Flora

198. An extensive floristic survey (Hyland 1972, Balick et al. 1982, and Alexiades 1996) was conducted in and around the Bay Terminal project area. A team of three biologists conducted the survey. A total of seven survey sites were selected. The survey team repeatedly visited each of the habitats for data collection. Special efforts were made to find plant species of conservation concern, including threatened, endemic, and rare.

199. Observations were made on plant communities during fieldwork and tried to identify different life forms of plant communities, including herbs, shrubs, trees, climbers, epiphytes, parasites, and grass-sedge populations. The local or Bengali name of each plant species collected whenever it is available at the sampling points. Most of the identification was done at the field site, and in case of confusion in identity, photographs of the plant species were taken for further identification.

200. **Transect Survey.** A transect survey was used to explore the existing floristic composition of the survey area. A sample of the plant species was collected to prepare an herbarium to identify the plant species wherever necessary. The floristic composition included the species of under trees, shrubs, herbs, climbers, epiphytes, parasites, and ferns. **Figure 4-33** and **Figure 4-34** show the line transects in different habitats in and around the Bay Terminal Area.

201. Identifications have been done by consulting different kinds of literature (Uddin and Hassan 2004; Siddiquiet al. 2007c; Ahmed et al. 2008a, 2008b, 2009b, 2009c, 2009d, 2009e). The updated nomenclature of the species has been followed by Siddiquiet al. (2007), Siddiquiet al. (2007), and Ahmed et al. (2008) (2008a, 2008b, 2009b, 2009c, 2009d, 2009e). Threatened categories of plants have been confirmed with the help of Khan et al. (2001).

Figure 4-33: Location of Line Transect in Patenga Beach Area

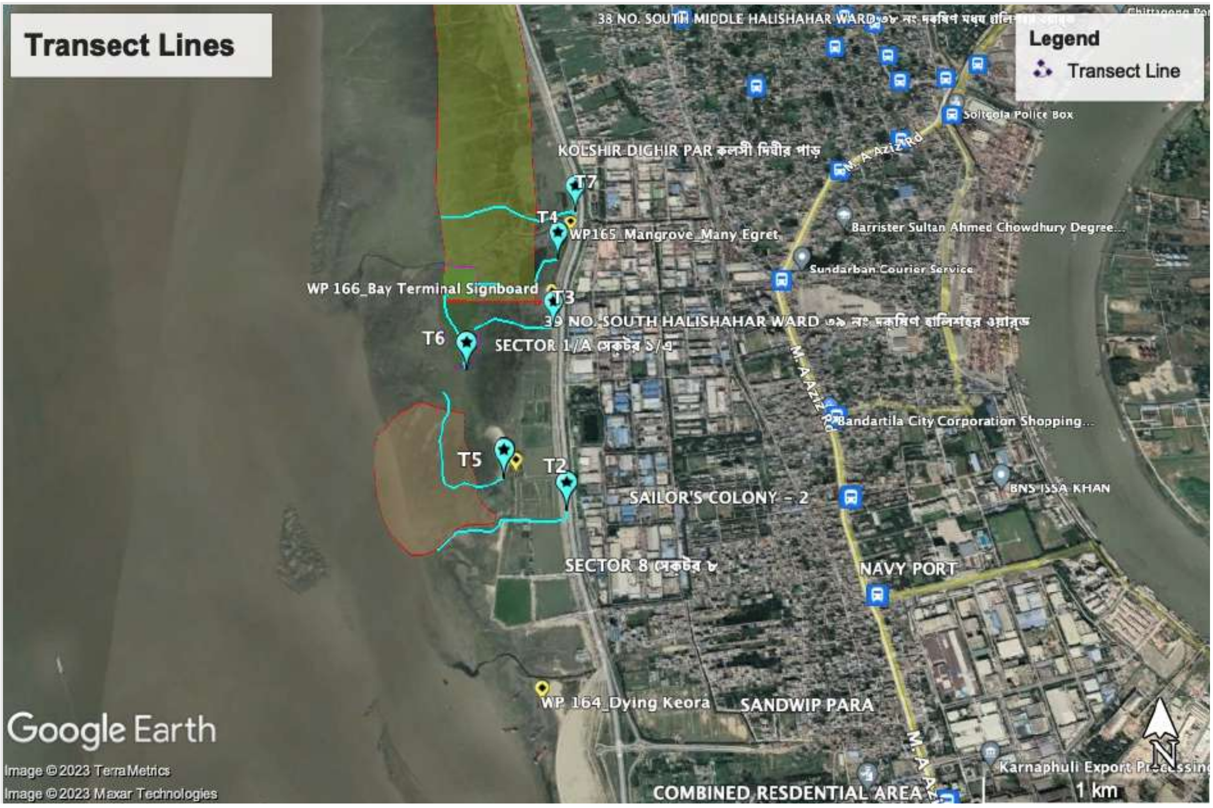


Figure 4-34: Location of Line Transects in Different Habitats In and Around the Bay Terminal Area

4.3.2.3. Survey Methods for Fauna

202. A team of three wildlife biologists conducted a faunal survey from November 25 to 29, 2022, February 3–7, 2023, and May 31–2, 2023. A total of 30 man-days were spent on field data

collection. A combination of different methods was used for the survey. The following methods were used for faunal data collection:

203. **Strip-transect Sampling**. The strip-transect sampling method (Buckland et al. 2001) was used to record the birds, mammals, reptiles, and amphibians. In this method, the observer(s) walk on a relatively straight line through the study area and count the objects from both sides. The observation range varies depending on the visibility of the study area.

204. A total of 14 permanent transect lines were set up in different habitats, including: i) urban areas; ii) rural homesteads; iii) sandy beaches; iv) coastal mudflats; v) mangrove patches; and vi) marine water, as shown in **Figure 4-35** to **Figure 4-38**. The description of the transects is provided in **Table 4-18**.

Figure 4-35: Transect Lines in Bay Terminal Area

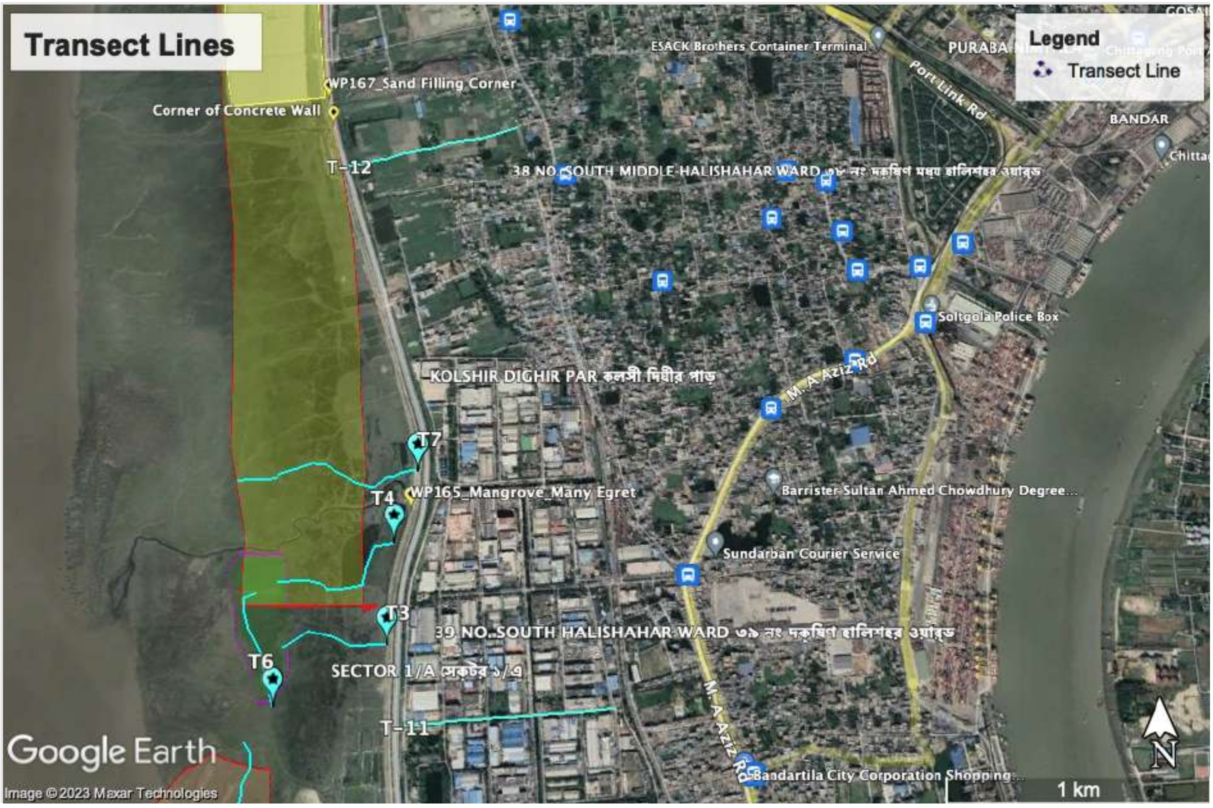


Figure 4-36: Transect Lines in Urban Areas

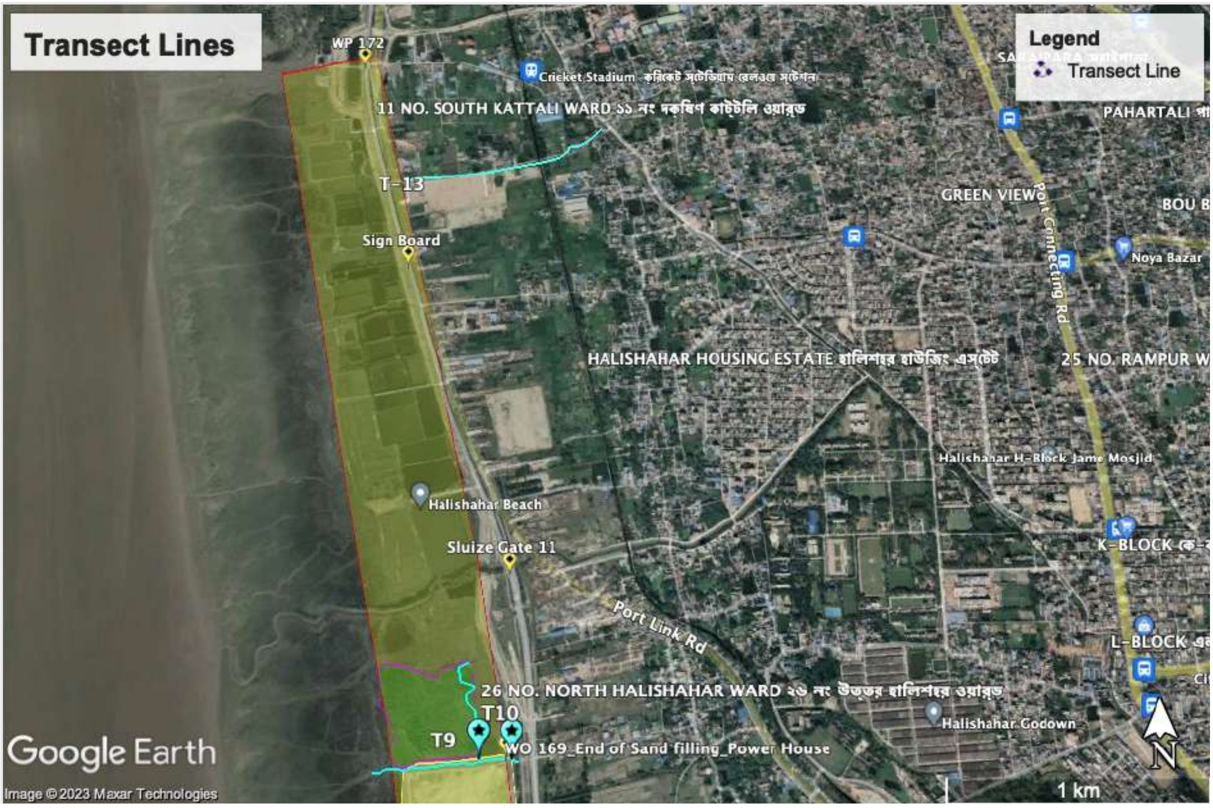


Figure 4-37: Transect line (T-13) in Semi-Urban Area

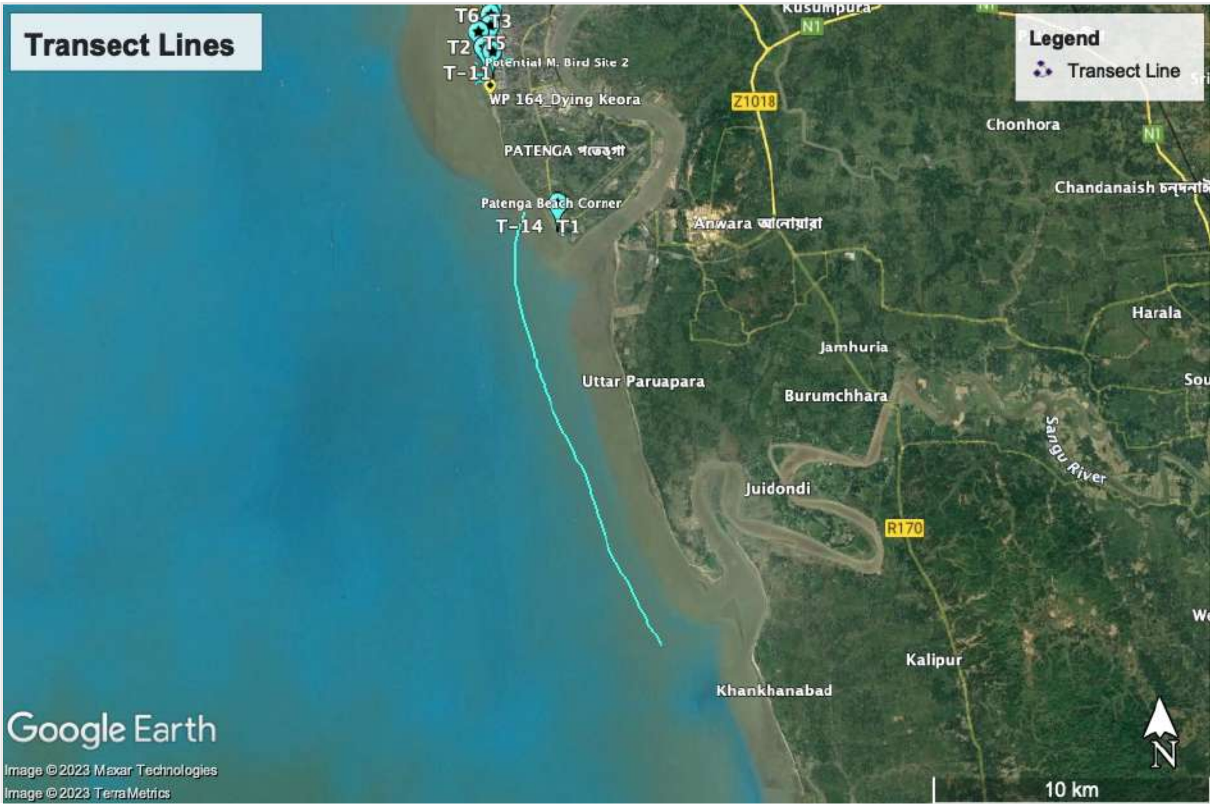


Figure 4-38: Transect lines (Boat Transect) in Marine Water

Table 4-18: Description of the Transects Followed for Faunal Survey

Transect No.	Habitat Description	Length (m)	Width (m)	Square meter
T1	Sandy beach	272	100	27200
T2	Aqua culture, sandy beach	721	100	72100
T3	Aqua culture, marshy grassland	433	100	43300
T4	Aqua culture, marshy grassland, mudflats	774	100	77400
T5	Marshy grassland, mudflats	809	100	80900
T6	Mangrove patch	521	100	52100
T7	Grassland, mudflats	788	100	78800
T8	Sand filled area	518	100	51800
T9	Mangrove patch	460	50	23000
T10	Mangrove patch and sand filled area	581	100	58100
T11	Urban area	807	40	32280
T12	Sub-urban / rural area	730	50	36500
T13	Sub-urban / rural area	889	50	44500
T14	Marine water	17033	100	1703300
	TOTAL	25336	1190	2381280

205. The team of wildlife biologists (ecologists) repeatedly surveyed each transect area at different times of the day and in different tidal conditions.

206. **Night Survey.** A night survey was conducted in the project area to see the status of nocturnal animals. A team of three wildlife biologists with a powerful head torch conducted the survey, following transect lines. The team actively searched for amphibians, snakes, nocturnal birds like owls and nightjars, and nocturnal mammals like jackals, cats, civets, and bats. **Plate 4-4** shows photographs of night survey activities.

Plate 4-4: Photographs of Night Survey Activities

207. **Indirect Survey.** In this survey method, all the presence indices of fauna, such as footprints, scats, feces, pellets, burrows, feathers, etc., that indicate the presence of a particular animal in that area were noted. **Plate 4-5** shows the observed footprint of the Asian Golden Jackal.

Plate 4-5: Footprint of Asian Golden Jackal

208. **Opportunistic Survey.** In an opportunistic survey, any important or interesting observation or piece of information was recorded at any time while in the field. This method was suitable for recording the occurrence, relative abundance, and distribution of rare and secretive species of wildlife. **Plate 4-6** shows photographs of field activities.

Plate 4-6: Photographs of Some Field Activities

209. **Relative Abundance**. The relative abundance of plants in the survey area was expressed in three categories.

- Common (C): Species found in 70–100% of encounters in their habitats.
- Less Common (LC): Species found in 40–70% of encounters in their habitats.
- Rare (R): Species found with 40% or less of encounters in their habitats.

- The local status of the animals was calculated from their relative abundance in the survey area and expressed in four categories (Khan 2018).
- Very Common (VC): Species found 76–100% of encounters in their habitats at the time when they were most active.
- Common (C): Species found 51–75% of encounters in their habitats at the time when they were most active.
- Uncommon (UC): Species found 26–50% of encounters in their habitats at the time when they were most active.
- Rare (R): Species found with 25% or less of encounters in their habitats at the time when they were most active.

210. **Diversity Indices**. Two diversity indices were calculated from the collected data.

Simpson Index $D = \frac{\Sigma\, n(n-1)}{N(N-1)}$

Where, n= number of individuals, N = total number of individuals.

The values of D ranged between 0 to 1. With this index, 0 represents infinite diversity and 1, no diversity. That is, the bigger the value of D, the lower the diversity.

Shannon-Weiner Index $$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Where, Pi = n/N, ln = natural log.

The value of H' in the natural population, usually varies from 1.5 to 3.5. The values of H' < 1.5 indicates low diversity, 1.5 to <2.5 indicates medium diversity and > 2.5 indicates high diversity.

4.3.2.4. Survey Methods for Fisheries Resources

211. The study team designed fisheries resources assessment approach addressing present status of species abundance and distribution in the coastal and riverine ecosystems along the vicinity of the proposed Bay Terminal site. Considering the timeframe and constraints related to the availability of site-specific data, the study team discussed for adaptive mixed-method approach including both quantitative and qualitative analysis. The mixed-method approach is well-suited to the activity being evaluated and enabled the team to work efficiently in the field with flexibility to collect data from several sources concurrently (Chambers 1980; IIRR 1998; Dutton *et al.* 2018). The ESIA team was consisted with Marine Ecologist cum Fisheries Specialists with extensive experience in quantitative and qualitative survey methods and a deep knowledge of local factors that shape options for objective oriented data collection on fisheries resources, fishing practices, community livelihoods and resilience.

212. **Literature Review:** The team members have reviewed relevant documentation including scientific articles published in different journals, government reports, World Bank data/documents, FAO data/records and academic research at the time of mobilization. These were supplemented throughout the study process with more detailed program reports on diverse aspects of marine and freshwater fisheries across the life cycle, climatic and hydro-dynamic features, oceanographic characteristics, geo-spatial modeling, community resilience, climate change adaptation and blue economy development.

213. **Information Exchange Meetings (IEM):** These were convened with key organizations including Department of Fisheries (DoF), Institute of Marine Science (IMS) under the University of Chittagong, Department of Environment (DoE), Chittagong Port Authority (CPA), Marine Fisheries Academy (MFA), and local NGOs to obtain additional background on fisheries resources.

214. **Informal Meetings and Observations:** The team visited and conducted short meetings (15 to 30 minutes) in different sites to observe and verify fisheries status including abundance, distribution, migration routes, breeding and nursery grounds, fishing gears used, and to ask any questions. These informal interviews provided valuable insights into the different issues affecting local communities because they could be spontaneously tailored to issues that were locally or seasonally important such as coastal erosion-accretion patterns, monsoon rainfall, fishing grounds, fishing periods, or the effects of fish harvest restrictions on livelihoods. **Plate 4-7** shows the photographs during the meeting with the fishermen community.

Plate 4-7: Informal meeting with fishermen community.

215. **Field Investigation:** The team members visited fish landing areas, fisher's village and local markets and spent a couple of hours in several days with the respondents to develop a sense of intimacy and trust, and specially to learn about beneficiary's customs and attitudes. Direct observations and participation with the fishers for gear use, on-field surveillance, homestead drying of fishes, and selling at retail market of city, was the most useful and meaningful way to confirm the abundance and marketing of fishes, and to know about beneficiary's livelihood dynamics, work practices, vulnerabilities, and their indigenous knowledge in a social setting (Hossain *et al.* 2014; Deb and Haque 2011). **Plate 4-8** shows a photograph of fish market near the Bay Terminal area.

Plate 4-8: A view of fish market near Bay Terminal Area

216. **Questionnaire Survey (Fish Catch Assessment):** The survey team visited three fish landing zones at Bay Terminal Area *viz.* Ganga Snan Ghat, Akmal Ali Ghat and Rani Rashmoni Ghat on **24 to 25 December 2023**. The team investigated available fish species, number and catch weight of fishes. A total of 46 fishermen were interviewed, of which 13 in Ganga Snan Ghat, 20 in Akmal Ali Ghat and 13 in Rani Rashmoni Ghat. A predesigned questionnaire was used for the survey. Among the fishermen, 83% was Hindu and remaining 17% was Muslim and their age varied from 17 to 65 years with the majority (39.13%) from 21-30 years old (**Figure 4-39**). About 26% of the fishermen were illiterate, while 35% completed up to primary level and remaining 39% completed up to class eight. **Plate 4-9** shows the photograph during the survey of the fishermen near the Bay Terminal area.

Plate 4-9: Questionnaire Survey of the fishermen near Bay Terminal Area.

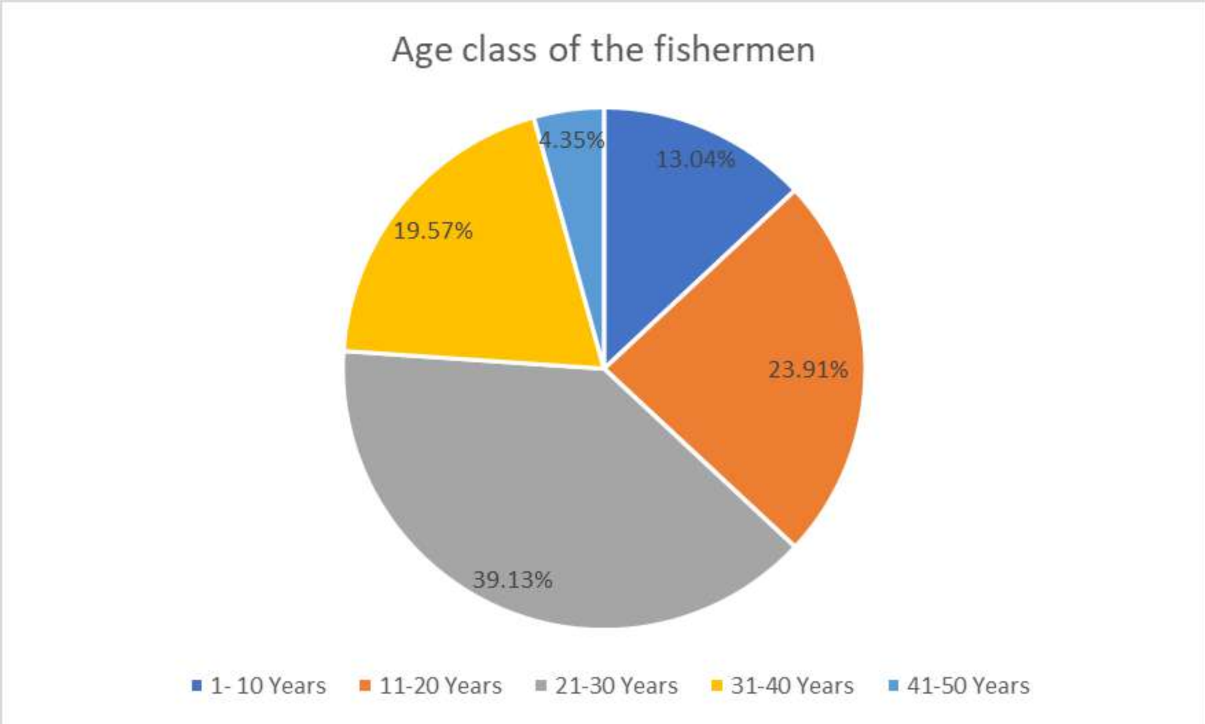


Figure 4-39: Age class of the fishermen in Bay Terminal Area.

4.3.2.5. Terrestrial and Coastal/Aquatic Flora (Dry and Wet Season)

217. During the survey in the dry and wet seasons, no differences in floral diversity were observed. A total of 61 plant species were recorded from different habitats, including mangroves. Among these plants, sub-urban and urban homesteads are mostly occupied by fruit and ornamental plants, while mangroves are dominated by Keora and Bain. Common tree species are Burflower-tree (kadam), Raintree (megh sirish), Mango (aum), Areca nut (supari), Coconut (narikel), Indian alomond (khatbadam), castor oil plant (verenda), Blackberry (jum), Moringa (sajna), Tamarind (tentul), Bamboo thickets (bash), Banana (kala), False white teak (pitali), Three-leaved caper (baroon), Indian oak (hizal), Indian Lilac (neem), Acacia (akashmoni), Banana (kala), etc. Among the shrubs, Crown Flower (akando) and Hairy fig (dumur) are the most common of all species. The common weed species seen during the field visit are Taro (kachu), Grass (chapra), Jungle tulshi (ban tulshi), Sessile joyweed (agacha), Spiny amaranth (kanta-nota), Indian heliotrope (hatisuri), Arrowhead (nakha), Creeping woodsorre (amrul shak), Four Leaf Clove (susni shak), Minnie-root (patpati), Ivy Wood rose (halud kalmi), Flannel weed (sida), Dodder (swarnolata), Pignut (tokma), Crown flower (akando), Hairy fig (dumur), Sickle senna (kalasunda), Orange berry (daton), Hill glory bower (Bhant), Sogon grass (chon), and Wild Sugarcane (kasha), etc. Common mangrove species are sonneratia (*Sonneratia apetala*), holly-leaved acanthus (*Acanthus ilicifolius*), mangrove apple (*Sonneratia caseolaris),* and the golden leather fern (*Acrostichum aureum*).

218. Homestead vegetation is an important plant community in the project area. Homestead vegetation generally includes two types of plants: those that are cultivated for their economic value and those that are self-propagating. Most of the homestead cover consists of a few fruit plant species, medicinal plants, some vegetables, and timber trees. According to the vegetation survey, homestead vegetation is exclusively dominated by Narikel (*Cocos nucifera),* Supari (Areca catechu), Tal (*Boassus flabelifer), and* Babla (*Acacia nilotica*) trees. The same species occupied the top canopy of the vegetation layers. Among the other species, Aam (*Mangifera indica*), Mahogoni (*Swietenia mahagoni*), Khejur (*Phoneix sylvestirs*), Sil Koroi (*Albizia procera),* etc. are common. Eucalyptus (*Eucalyptus spp.*) and Akashmoni (*Acacia auriculiformes*) are the other common exotic species. Shrubs and herbs

occupy lower canopies. The homestead vegetation is an important place for wildlife dwellings.

219. **Homestead, Sub-Urban and Urban Areas**. During the study period, a total of 53 plant species were recorded from the homesteads of sub-urban and urban areas, as provided in **Table 4-19**.

Table 4-19: Plant Species Found in the Homestead, Sub-urban and Urban Areas

No.	Scientific name	Local name	Family
1	*Ablemoschus esculentus*	Derosh	Malvaceae
2	*Citus grandis*	Jambura	Rutaceae
3	*Cocos nucifera*	Narikel	Arecaceae
4	*Dolichos lablab*	Seem	Fabaceae
5	*Eucalyptus camaldulensis*	Eucalyptus	Myrtaceae
6	*Ipoemoea aquatica*	Kalmi	Convolvulaceae
7	*Ipoemoea fistulosa*	Dolkolmi	Convolvulaceae
8	*Lagenaria vulgaris*	Lao	Cucurbitaceae
9	*Psidium guajava*	Peara	Myrtaceae
10	*Syzygium cumini*	Jam	Myrtaceae
11	*Ziziphus mauritiana*	Boroi	Rhamnaceae
12	*Acacia auriculiformis*	Akashmoni	Mimosaceae
13	*Acacia maengium*	Beljium	Mimosaceae
14	*Artocarpus heterophyllus*	Kathal	Moraceae
15	*Bougainvillea glabra*	Bagan bilash	Nyctaginaceae
16	*Carica papaya*	Pepe	Caricaceae
17	*Catharanthus roseus*	Noyontara	Apocynaceae
18	*Ceiba pentandra*	Ceiba	Bombacaceae
19	*Celosia argentea*	Morog ful	Amaranthaceae
20	*Citrus auranticola*	Lebu	Rutaceae
21	*Delonix regia*	Krishnachura	Caesalpiniaceae
22	*Ixora coccinia*	Rongon	Rubiaceae
23	*Kalanchoe pinata*	Pathor kuchi	Crassulaceae
24	*Lawsonia inermis*	Mehedi	Lythraceae
25	*Mangifera indica*	Aam	Anacardiaceae
26	*Mimosa pudica*	Mimosa	Mimosaceae
27	*Moringa oleifera*	Sajna	Moringaceae
28	*Samanea saman*	Raintree	Mimosaceae
29	*Tabernaemontana divaricata*	Togor	Apocynaceae
30	*Tagetes erecta*	Gada	Asterace
31	*Albizia procera*	Sadakoroi	Mimosaceae
32	*Butea monosperma*	Palash	Fabaceae
33	*Ficus infectoria*	Pakur	Moraceae
34	*Spondias pinnata*	Amra	Anacardiaceae
35	*Casuarina equisetifolia*	Jhau	Casuarinaceae
36	*Ficus hispida*	Kak Dumur	Moraceae
37	*Musa paradisiaca*	Kola	Musaceae
38	*Clerodendrum viscosum*	Bhat	Verbenaceae
39	*Phoenix sylvestris*	Khejur	Arecaceae
40	*Dalbergia sissoo*	Shishu	Fabaceae
41	*Solanum nigrum*	Tit begun	Solanaceae
42	*Azadirachta indica*	Neem	Meliaceae
43	*Neolamarckia cadamba*	Kodom	Rubiaceae
44	*Lantana camara*	Lantana	Verbenaceae
45	*Pandanus tectorius*	Keya	Pandanaceae
46	*Calotropis procera*	Akondo	Asclepiadaceae
47	*Eichhornia crassipes*	Uri Ghash	Poaceae
48	*Echinochloa colonum*	Nol Khagra	Poaceae
49	*Cynodon dactylon*	Durbagas	Poaceae
50	*Calotropis gigentea*	Akanda	Apocynecae
51	*Areca catechu*	Supari	Aracaceae

52	*Boassus flabelifer*	Tal	Aracaceae
53	*Acacia nilotica*	Babla	Fabaceae

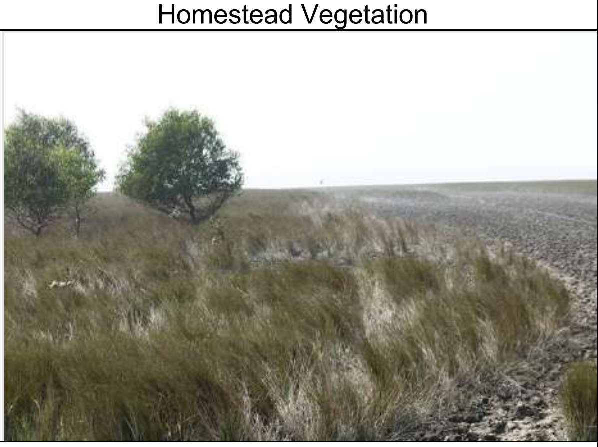
220. **Mangrove and Coastal Vegetation.** A total of 8 plant species were recorded from the mangrove vegetation provided in **Table 4-20**. Species of Bain and Keora are more abundant in the mangrove vegetation. These mangrove plants have been planted for coastal belt protection. Local wader birds such as Egrets, Herons, Cormorants use these trees as roosting places as well as nesting grounds. **Plate 4-10** shows the different types of habitats in the project area.

Table 4-20: Plant Species Found in the Mangrove Vegetation

No.	Scientific name	Local name	Family
1	*Acanthus ilicifolius*	Hargoza	Acanthaceae
2	*Avicennia marina*	Sada Baen	Verbenaceae
3	*Dalbergia spinosa*	Chulikanta	Fabaceae
4	*Sonneratia apetala*	Keora	Sonneratiaceae
5	*Ceriops decandra*	Goran	Rhizophoraceae
6	*Excoecaria agallocha*	Gewa	Euphorbiaceae
7	*Luminitzera racemosa*	Kirpa	Combretaceae
8	*Suaeda meritima*	Nuina jao	Chenopodiaceae

Homestead Vegetation

Mangrove Patch



Grassland

Sandy Beach

Plate 4-10: Different Types of Habitats in the Project Area

4.3.2.6. Terrestrial and Coastal/Aquatic Fauna (Wet & Dry Season)

221. <u>Faunal Diversity in Wet Season</u>

222. Though the survey area consists of different types of habitats, but the faunal diversity is very low except the bird population. Habitat alteration, destruction of habitats, different anthropogenic activities are the major causes of less faunal diversity.

223. **Mammals**. Though the project sites are in highly modified or disturbed habitats for mammals, a total of six species were recorded, as provided in **Table 4-21**. Among the recorded mammals, 33% were very common, 50% were common, and the remaining 17% were rare, as shown in **Figure 4-40**. Bat species, viz. Flying Fox (*Pteropus giganteus*), Pipistrele Bat (*Pipistrellus sp.*) were found to fly during the evening. Feces of the House Shrew (*Suncus murinus*) and Golden Jackal (*Canis aureus*) were found in the project area. Both Bandicote Rats, Lesser Bandicote Rat (*Bandicota bengalensis*) and Greater Bandicote Rat (*Bandicota indica*) were also found in the project area. Most of the mammal species were found in the rural homestead (6 species), followed by mangroves (5 species). The overall diversity of mammals was low (D = 0.23, H' = 1.56).

Table 4-21: List of Mammals Found in the Project Area

No.	English Name	Scientific Name	Abundance	IUCN National Status	IUCN Global Status	Presence	
						Wet Season	Dry Season
1	Flying Fox	Pteropus giganteus	VC	LC	LC	+	+
2	Pipistrelle Bat	Pipistrellus sp.	C	LC	LC	+	+
3	House shrew	Suncus murinus	VC	LC	LC	+	+
4	Golden Jackal	Canis aureus	R	LC	LC	+	+
5	Lesser Bandicote Rat	Bandicota bengalensis	C	LC	LC	+	+
6	Greater Bandicote Rat	Bandicota indica	C	LC	LC	+	+
7	Ganges River Dolphin	Platanista gangetica	R	VU	EN	+	+
Note: IUCN Status: LC = Least Concern, VU= Vulnerable, EN= Endangered; Abundance: VC= Very Common, C = Common, UC = Uncommon, R= Rare.							

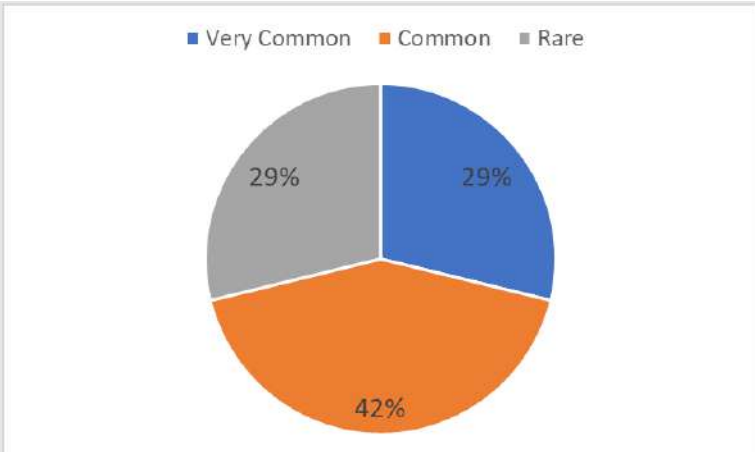


Figure 4-40: Local Status of Mammals in the Study Area During Wet Season

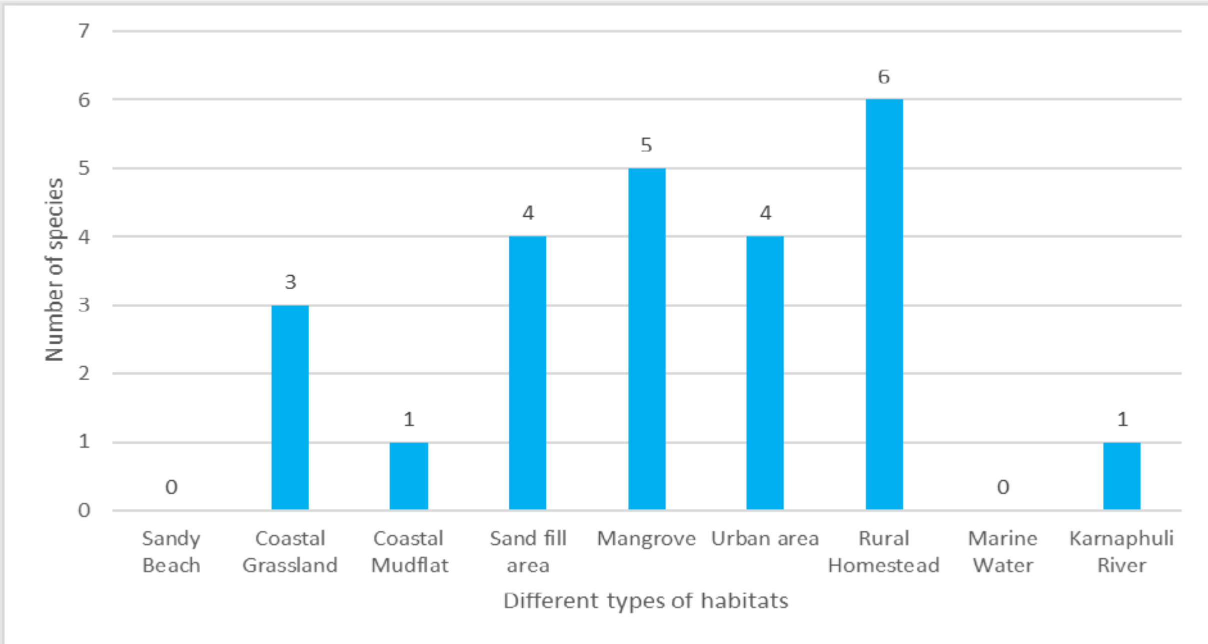


Figure 4-41: Number of Mammalian Species in Different Habitats During Wet Season

224. **Birds**. A total of 42 species of local resident birds were observed in 23 families of 10 orders. Most of the species were passerine birds, including 13 families. Sturnidae and Corvidae were the two representative families, mostly found in the wet season. All the bird species were assessed as having the least concern according to the IUCN Red List. Mangrove is a suitable habitat for the local resident birds in the study area. The overall diversity of birds in the rainy season was lower than in the winter season (D = 0.04, H' = 3.41). **Figure 4-42** and **Table 4-22** present the number of bird species in different habitats during the wet season. **Plate 4-11** and **Plate 4-12** show some photographs of the birds recorded during the wet season.

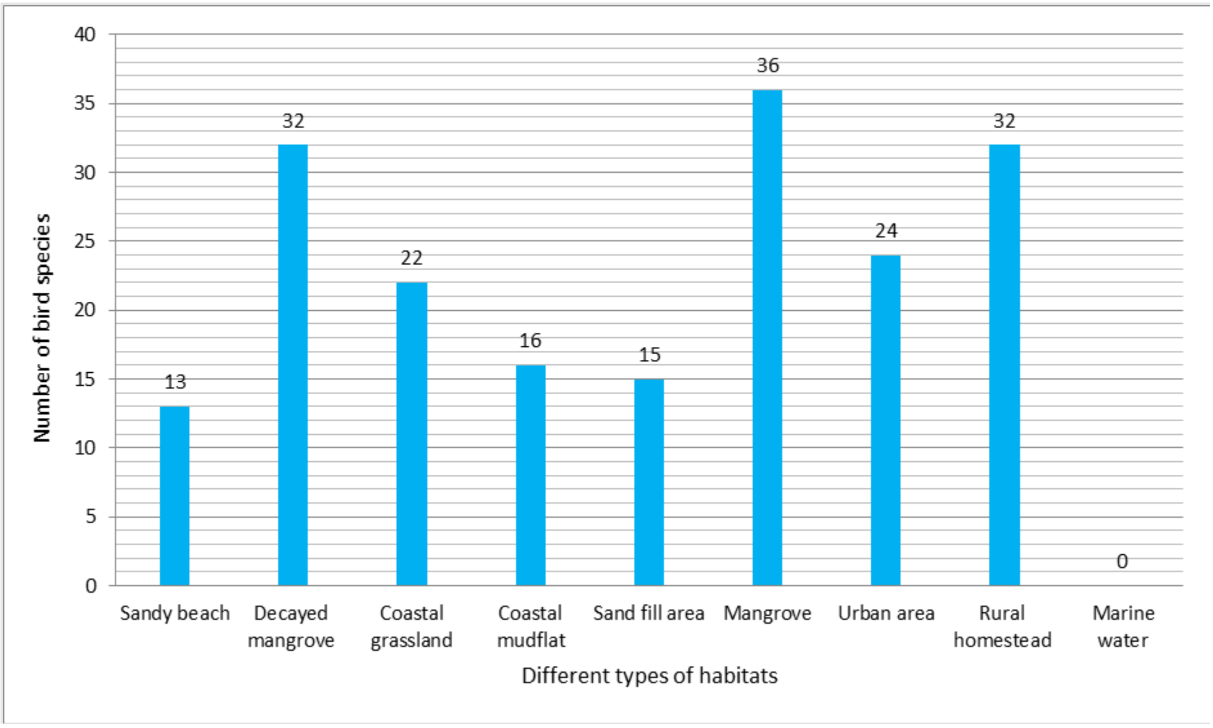


Figure 4-42: Number of Bird Species in Different Habitats During Wet Season

Table 4-22: Transect Description and Number of Bird Species for Each of the Transects During Wet Season

Transect	Habitat Type	Total Bird Species
T1	Sandy beach	13
T2	Decayed mangrove	31
T3	Decayed mangrove	32
T4	Coastal grassland	22
T5	Coastal mudflat	16
T6	Coastal mudflat	16
T7	Coastal mudflat	16
T8	Sand fill area	15
T9	Mangrove	33
T10	Mangrove	36
T11	Urban area	24
T12	Rural homestead	32
T13	Rural homestead	31
T14	Marine water	0

	
Black Drongo	Long-tail Shrike
	
Great Egret	Black Kite

Plate 4-11: Photographs of Some Birds Recoded During Wet Season During Wet Season

Plate 4-12: Photograph of a Flock of Egrets in the Project Area

225. **Reptiles**. A total of 10 species of reptiles were recorded, as presented in **Table 4-23**. Among the recorded species, three species of snakes were notable. About 10% of reptiles were very common, 30% were common, 20% were uncommon, and the remaining 40% were rare, as shown in **Figure 4-43**. Striped Keelback and Common Blind Snake were found in the sub-urban areas. **Plate 4-13** shows a photograph of a common garden lizard found in the project area during the wet season.

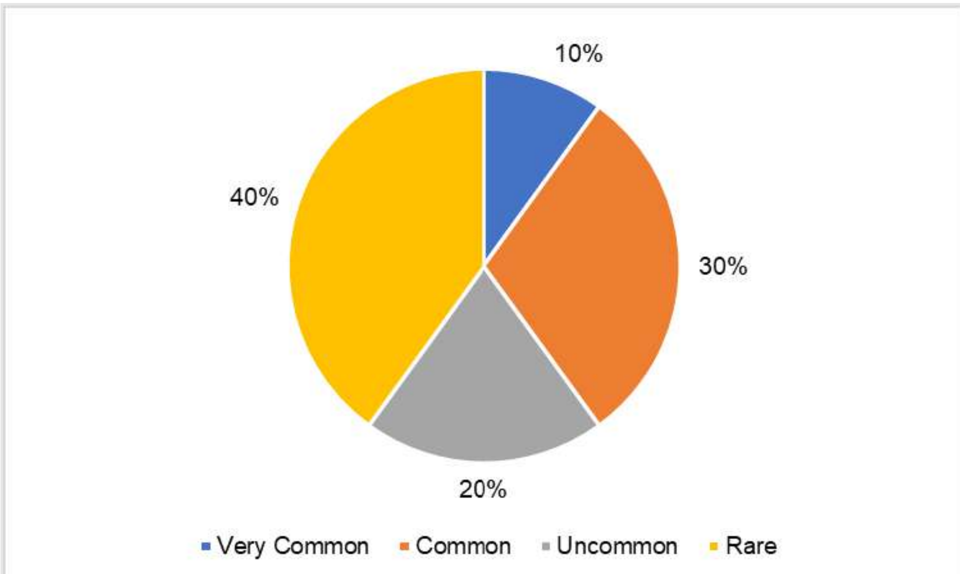


Figure 4-43: Local Status of Reptiles in the Project Area During Wet Season

Plate 4-13: Photograph of a Common Garden Lizard Found in the Project Area During Wet Season

Table 4-23: List of Reptiles found in the Project Area

No.	Name of the Species	Scientific Name	Abundance	IUCN National Status	IUCN Global Status	Presence	
						Wet Season	Dry Season
1	Striped Keelback	*Amphiesma stolata*	R	LC	LC	+	-
2	Common Blind Snake	*Rhamphotyphlops braminus*	UC	LC	LC	+	-
3	Dog-faced water snake	*Cerberus rynchops*	R	LC	LC	+	+
4	Checkered Keelback	*Xenochrophis piscator*	C	LC	LC	+	+
5	Smooth Water Snake	*Enhydris enhydris*	R	LC	LC	+	+
6	Common Garden Lizard	*Calotes versicolor*	VC	LC	LC	+	+
7	Common House Gecko	*Hemidactylus frenatus*	C	LC	LC	+	+
8	Brook's House Gecko	*Hemidactylus brooki*	C	LC	LC	+	+
9	Bronze Grass Skink	*Eutropis macularia*	UC	LC	NE	+	+
10	Olive Ridley Sea Turtle	*Lepidochelys olivacea*	R	VU	VU	+	+

Note: C = Common, R = Rare. IUCN Status: LC = Least Concern, NE = Not Evaluated, VU= Vulnerable.

226. Most of the reptiles (5 species) were found in rural homesteads, followed by coastal grassland, mangroves, and urban areas, as shown in **Figure 4-44**. The overall diversity of reptiles was moderate (D = 0.56, H' = 1.83).

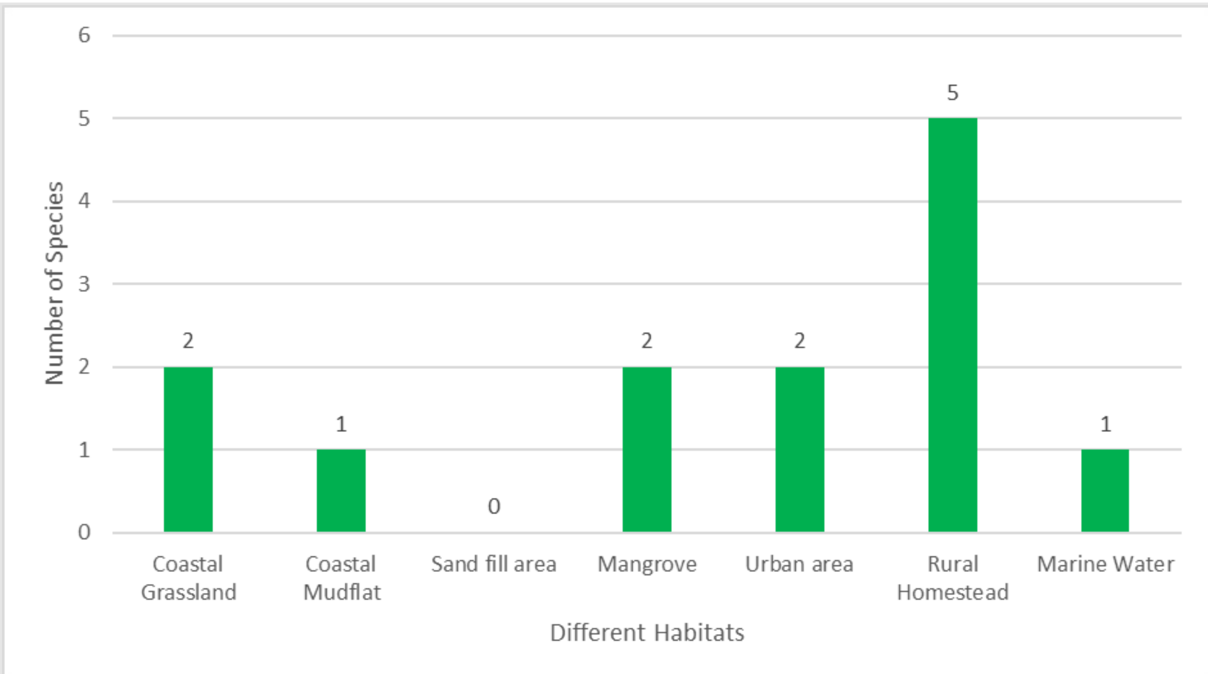


Figure 4-44: Number of Reptile Species in Different Habitats During Wet Season

227. **Amphibian**. A total of seven species of amphibians have been recorded from the project sites, as presented in **Table 4-24**. Among the recorded amphibian species, 14% each were

very common and uncommon, while 43% were common and 29% were rare, as shown in **Figure 4-45**. Amphibians were mostly found in rural homesteads (7 species), followed by urban areas (3 species). None of the amphibians were found in the coastal grassland, coastal mudflats, sandy beaches, or marine water due to the intolerance of salinity, as shown in **Figure 4-46**. The overall diversity of amphibians was moderate (D = 0.19, H' = 1.75).

Table 4-24: List of Amphibians found in the Project Area During Wet Season

English Name	Scientific Name	Abundance	IUCN BD 2015 Status	IUCN Global Status	Presence	
					Wet Season	Dry Season
Common toad	*Duttaphrynus melanostictus*	VC	LC	LC	+	+
Indian Bullfrog	*Hoplobatrachus tigerinus*	R	LC	LC	+	+
Skipper Frog	*Euphlyctis cyanophlyctis*	UC	LC	LC	+	+
Asmat's Cricket Frog	*Fejervarya asmati*	C	LC	LC	+	+
Pierre's Cricket Frog	*Fejervarya pierrei*	C	LC	LC	+	+
Ornate Microhylid Frog	*Microhyla ornata*	R	LC	LC	+	-
Common Tree Frog	*Polypedates leucomystax*	C	LC	LC	+	-
Note: C = Common, R = Rare. IUCN Status: LC = Least Concern, NE = Not Evaluated, VU= Vulnerable.						

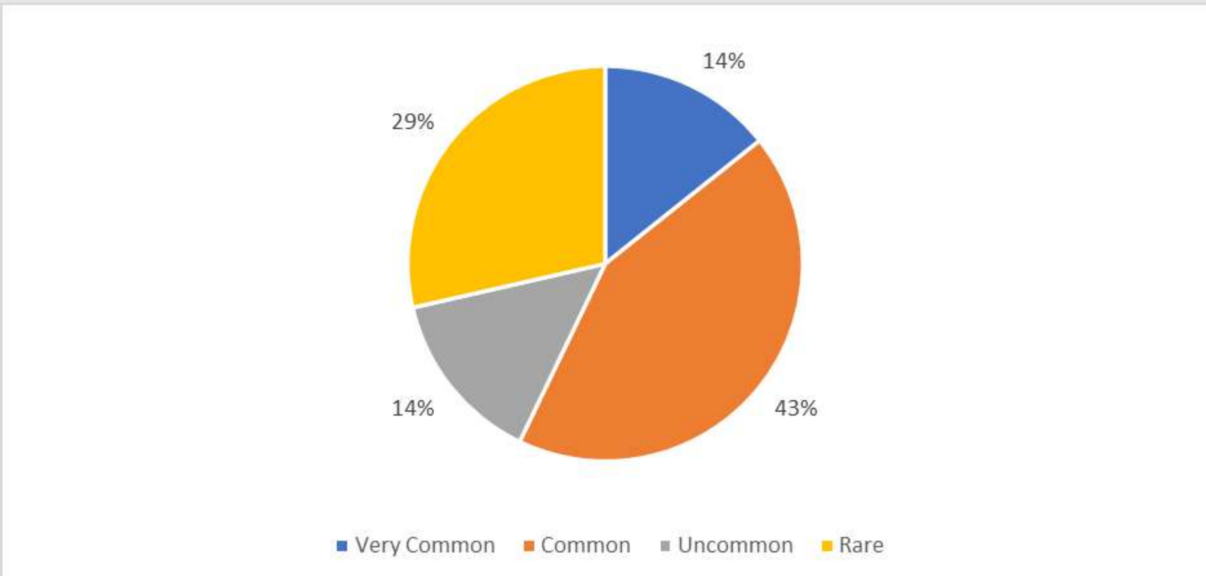


Figure 4-45: Local Status of Amphibians in the Project Area During Wet Season

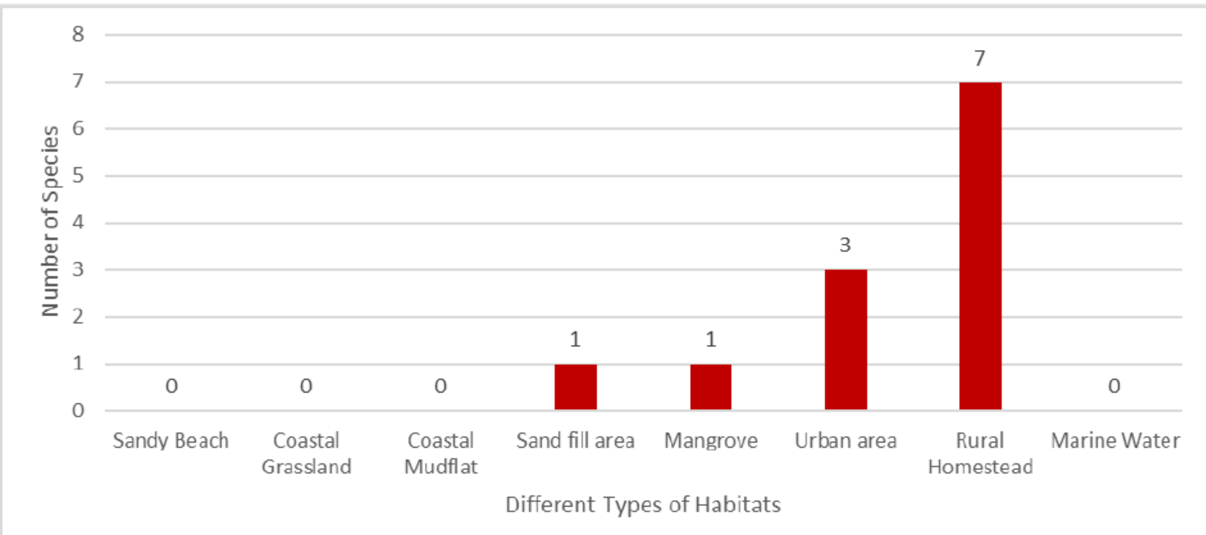


Figure 4-46: Number of Amphibian Species in Different Habitats During Wet Season

228. Faunal Diversity in Dry Season

229. **Mammals**. During the faunal survey in the dry season, November 25–29, 2022, and February 3–7, 2023, six species of mammals were recorded, the same as the mammalian diversity in the wet season. The overall diversity of mammals were also low in the wet season.

230. **Dolphins**. The confluence points of the Halda River and its adjacent Karnaphuli River area have a good number of Ganges River Dolphin populations (*Platanista gangetica*). There are frequent movements of dolphins from Karnaphuli to Halda Rivers and vice versa, making the entire river system of Karnaphuli-Halda an ideal ecosystem for the long-term survival of this species. This dolphin species is found exclusively in freshwater habitats, and the Halda River is one of the suitable habitats for them. Besides, the Halda River, which is 17 km from the proposed Bay Terminal site, is the hotspot of the Ganges River Dolphin.

231. According to the study "Management Plan for the Ganges River Dolphin in the Halda River of Bangladesh" by UNDP-BFD (2018), a 20-kilometer segment from the Halda River mouth to Sattar Ghat has been identified as the hotspot for dolphins. The Halda River is mostly a freshwater river with a small amount of salt (1 ppm) from the Halda River mouth to 12 km upstream. Illegally setting fishing nets, high water pollution levels (oil spills, industrial effluents, pesticides from agricultural fields, etc.), and the movement of mechanized vessels are the major threats to the Ganges River Dolphin. Dolphins usually travel through the Karnaphuli to the Halda river, and the proposed Bay Terminal and breakwaters are about 9.0 km north from the confluence of the Karnaphuli River; therefore, there's no possibilityof impact on the Ganges River Dolphin by the proposed project during the construction and operation. **Figure 4-47** shows the hotspot of the Ganges River Dolphin in the Halda river.

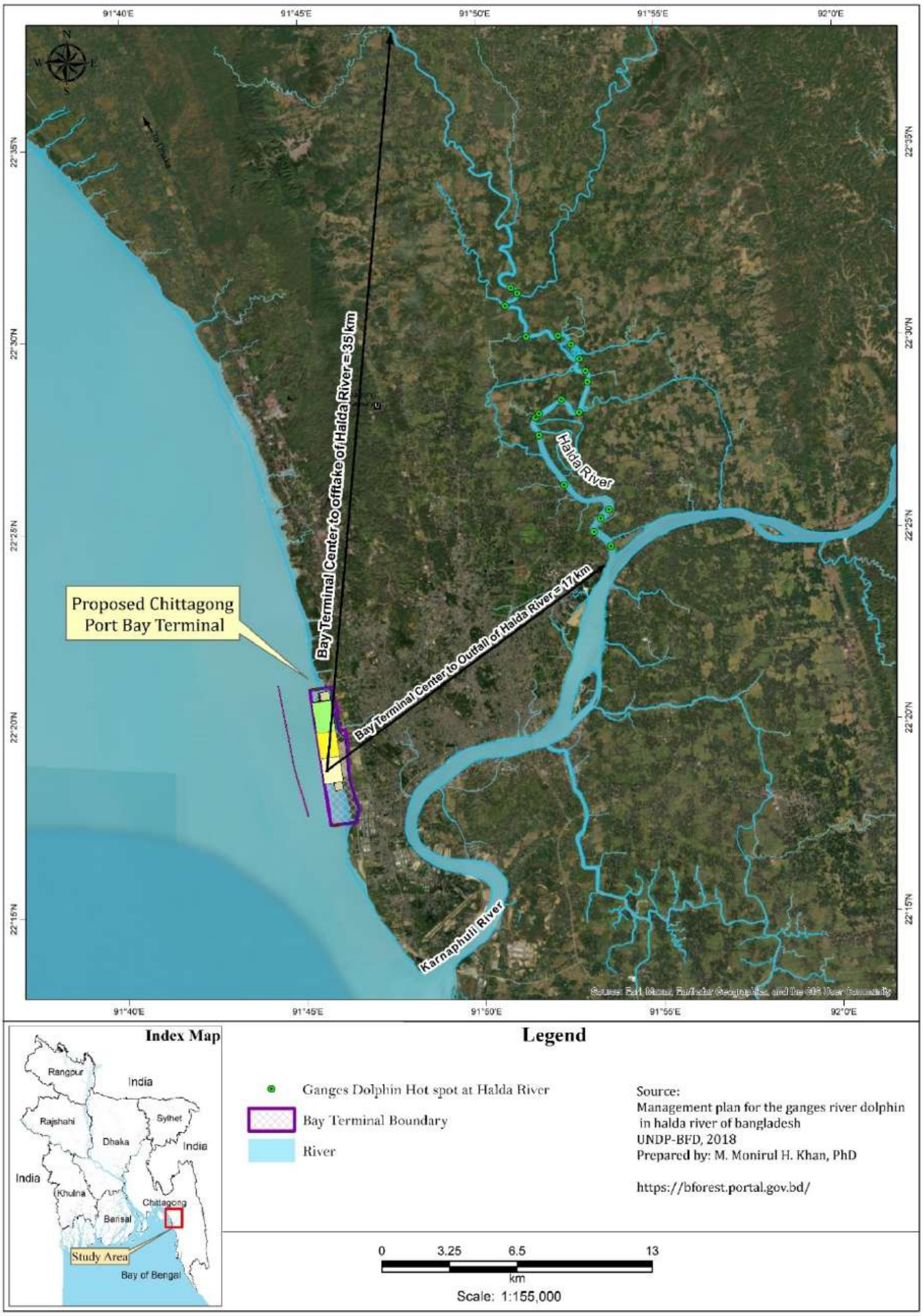


Figure 4-47: Ganges River Dolphin (*Platanista gangetica*) Hot Spot at from Halda River Mouth to Sattar Ghat

232. Bangladesh coastal waters also support a strong population of Irrawaddy Dolphin (*Orcaella brevirostris*), a globally endangered species (EN), which are mainly distributed to the freshwater affected river estuaries. Global Population of the species is estimated as 7,533 individuals, of which the largest number of individuals 451 individuals located in Sundarbans; in total 5,383 individuals in the Bay of Bengal. There is no record of the species in the vicinity of the project area. However, there is a possibility of its presence within the Impact Area.

233. **Birds**. During this ecological survey, 59 species were observed in 28 families of 11 orders. Passeriformes is the dominant order, including 21 species from 14 families. Among the listed bird species, 42 species are found to be local residents, and the rest of the 17 species migrate in winter. Charadriformes is the most representative family of migratory birds, along with one duck species (Common Shelduck) from the Anseriformes. Among the recorded birds, 22% were very common, 27% were common, 8% were uncommon, and 43% were rare, as shown in **Figure 4-48**.

234. According to the IUCN Red List of Bangladesh (2015), 56 species are in the category of least concern (LC), 2 of them are near threatened (NT), and only one species is vulnerable (VU). Locally, Black-headed Ibis (Order: Pelecaniformes) is considered a vulnerable (VU) species in Bangladesh, although globally it was assessed as near threatened (NT) by the IUCN. This species has been resident in Bangladesh since the 1980s but now visits in winter thoroughly in the coastal and marshy inland areas. Black-tailed Godwit, Curlew Sandpiper, and Eurasian Curlew are also threatened bird species globally and were observed during the survey period.

235. Degrading habitat, mangrove areas are found to support the highest number of bird species, especially those of the local residents. On the contrary, coastal mudflats support mainly migratory bird species. The lowest number of bird species is observed in the urban area, sandy beach, and sand filling area as well, as shown in **Figure 4-49**. The overall diversity of birds was high (D = 0.14, H' = 2.95). **Plate 4-14** to **Plate 4-17** show photographs of birds observed in the project area during the dry season. **Table 4-25** presents the taxonomic information of the listed bird species from the study area and their conservation status during the dry season. Table 4-24 presents the transect description and number of species along each of the transects during the dry season.

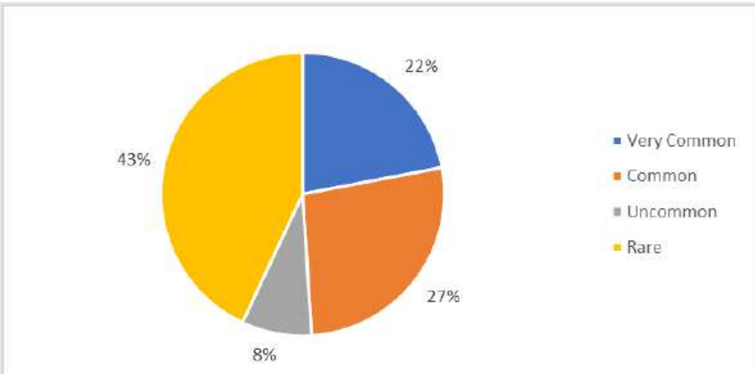


Figure 4-48: Local Status of Birds in the Project Area During the Dry Season

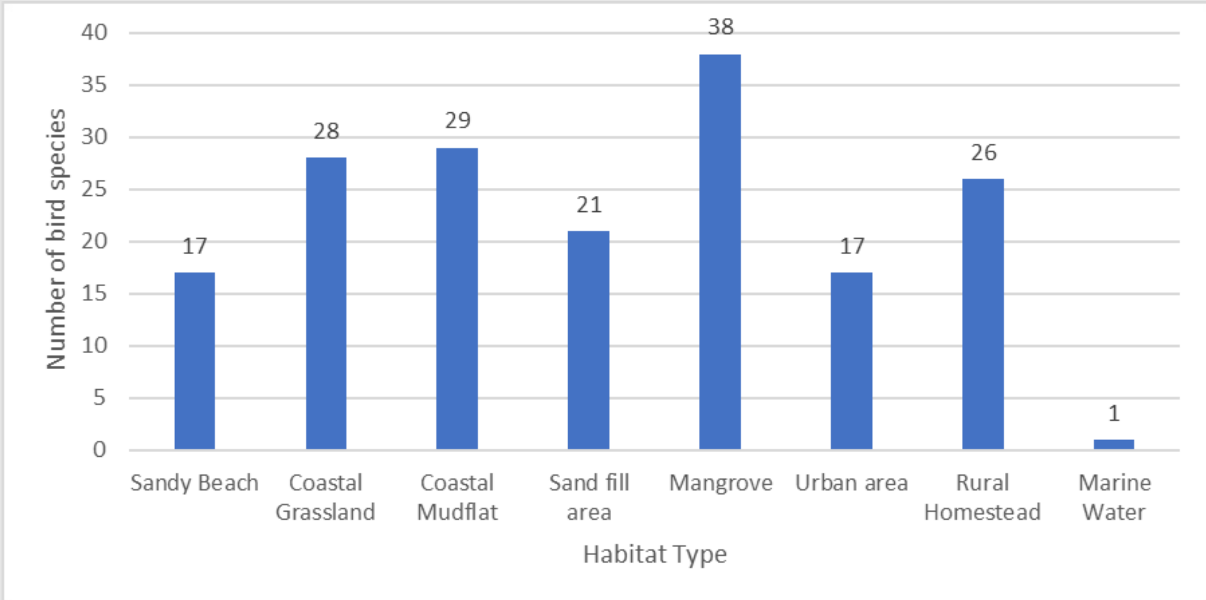


Figure 4-49: Number of Bird Species in Different Habitats During Dry Season

Plate 4-14: Photograph of a Flock of Black-Tailed Godwit in the Project Area During the Dry Season

Table 4-25: Taxonomic Information of the Listed Bird Species from the Study Area and their Conservation Status During the Dry Season

Order	Family	Scientific Name	English Name	IUCN BD 2015 Status	IUCN Global Status	Resident Status
Accipitriformes	Accipitridae	*Milvus migrans*	Black Kite	LC	LC	Resident
Accipitriformes	Accipitridae	*Haliastur indus*	Brahminy Kite	LC	LC	Resident

Order	Family	Scientific Name	English Name	IUCN BD 2015 Status	IUCN Global Status	Resident Status
Coraciformes	Alcedinidae	*Halcyon smyrnensis*	White-throated Kingfisher	LC	LC	Resident
Coraciformes	Alcedinidae	*Pelargopsis capensis*	Stork-billed Kingfisher	LC	LC	Resident
Coraciformes	Alcedinidae	*Alcedo atthis*	Common Kingfisher	LC	LC	Resident
Coraciformes	Alcedinidae	*Todiramphus chloris*	Collared Kingfisher	LC	LC	Resident
Caprimulgiformes	Apodidea	*Apus nipalensis*	House Swift	LC	LC	Resident
Caprimulgiformes	Apodidea	*Cypsiurus balasiensis*	Asian Palm Swift	LC	LC	Resident
Pelecaniformes	Ardeidae	*Ardeola grayii*	Indian Pond Heron	LC	LC	Resident
Pelecaniformes	Ardeidae	*Bubulcus ibis*	Cattle Egret	LC	LC	Resident
Pelecaniformes	Ardeidae	*Ardea cinerea*	Grey Heron	LC	LC	Resident
Pelecaniformes	Ardeidae	*Egretta garzetta*	Little Egret	LC	LC	Resident
Pelecaniformes	Ardeidae	*Ardea intermedia*	Intermediate Egret	LC	LC	Resident
Pelecaniformes	Ardeidae	*Ardea alba*	Greater Egret	LC	LC	Resident
Charadriiformes	Charadriidae	*Charadrius dubius*	Little Ringed Plover	LC	LC	Resident
Charadriiformes	Charadriidae	*Vanellus indicus*	Red-wattled Lapwing	LC	LC	Resident
Passeriformes	Cicticolidae	*Cisticola juncidis*	Zitting Cisticola	LC	LC	Resident
Columbiformes	Columbidae	*Streptopelia decaocto*	Eurasian Collared Dove	LC	LC	Resident
Columbiformes	Columbidae	*Spilopelia chinensis*	Eastern Spotted Dove	LC	LC	Resident
Columbiformes	Columbidae	*Columba livia*	Rock Pigeon	LC	LC	Resident
Passeriformes	Corvidae	*Corvus splendens*	House Crow	LC	LC	Resident
Passeriformes	Corvidae	*Corvus levaillantii*	Jungle Crow	LC	LC	Resident
Passeriformes	Corvidae	*Dendrocitta vagabunda*	Rufous Treepie	LC	LC	Resident
Passeriformes	Dicruridiae	*Dicrurus macrocercus*	Black Drongo	LC	LC	Resident
Passeriformes	Herundinidae	*Hirundo rustica*	Barn Swallow	LC	LC	Resident
Passeriformes	Lanidae	*Lanius schach*	Long-tailed Shrike	LC	LC	Resident
Coraciformes	Meropidae	*Merops orientalis*	Asian Green Bee-eater	LC	LC	Resident
Passeriformes	Motacillidae	*Motacilla maderaspatensis*	White-browed Wagtail	LC	LC	Resident
Passeriformes	Muscicapidae	*Copsychus saularis*	Oriental Magpie-robin	LC	LC	Resident
Passeriformes	Oriollidae	*Oriolus xanthornus*	Black-hooded Oriole	LC	LC	Resident
Passeriformes	Paridae	*Parus major*	Great Tit	LC	LC	Resident
Passeriformes	Passeridae	*Passer domesticus*	House Sparrow	LC	LC	Resident
Suliformes	Phalacrocoracidae	*Microcarbo niger*	Little Cormorant	LC	LC	Resident
Piciformes	Picidae	*Dendrocopos macei*	Fulvous-breasted Woodpecker	LC	LC	Resident

Order	Family	Scientific Name	English Name	IUCN BD 2015 Status	IUCN Global Status	Resident Status
Piciformes	Picidae	*Dinopium benghalense*	Black-rumped Flameback	LC	LC	Resident
Passeriformes	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	LC	LC	Resident
Strigiformes	Strigidae	*Athene brama*	Spotted Owlet	LC	LC	Resident
Passeriformes	Sturnidae	*Acridotheres tristis*	Common Myna	LC	LC	Resident
Passeriformes	Sturnidae	*Sturnus malabaricus*	Chestnut-tailed Starling	LC	LC	Resident
Passeriformes	Sturnidae	*Sturnus contra*	Asian Pied Starling	LC	LC	Resident
Passeriformes	Sturnidae	*Acridotheres fuscus*	Jungle Myna	LC	LC	Resident
Passeriformes	Sylvidae	*Orthotomus sutorius*	Common Tailorbird	LC	LC	Resident
Anseriformes	Anatidae	*Tadorna tadorna*	Common Shelduck	LC	LC	Winter Migratory
Charadriiformes	Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	LC	LC	Winter Migratory
Charadriiformes	Charadriidae	*Charadrius mongolus*	Lesser Sand Plover	LC	LC	Winter Migratory
Charadriiformes	Charadriidae	*Charadrius alexandrinus*	Kentish Plover	LC	LC	Winter Migratory
Charadriiformes	Charadriidae	*Pluvialis fulva*	Pacific golden Plover	LC	LC	Winter Migratory
Passeriformes	Motacilidae	*Motacilla citreola*	Citrine Wagtail	LC	LC	Winter Migratory
Passeriformes	Motacilidae	*Motacilla alba*	White Wagtail	LC	LC	Winter Migratory
Charadriiformes	Recurvirostridae	*Recurvirostra avosetta*	Pied Avocet	LC	LC	Winter Migratory
Charadriiformes	Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	LC	LC	Winter Migratory
Charadriiformes	Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	LC	LC	Winter Migratory
Charadriiformes	Scolopacidae	*Calidris alpina*	Dunlin	LC	LC	Winter Migratory
Charadriiformes	Scolopacidae	*Calidris temminckii*	Temminck's Stint	LC	LC	Winter Migratory
Passeriformes	Sylvidae	*Phylloscopus fuscatus*	Dusky Warbler	LC	LC	Winter Migratory
Charadriiformes	Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	LC	NT	Winter Migratory
Charadriiformes	Scolopacidae	*Limosa limosa*	Black tailed Godwit	NT	NT	Winter Migratory
Charadriiformes	Scolopacidae	*Numenius arquata*	Eurasian Curlew	NT	NT	Winter Migratory
Pelecaniformes	Threskiornithidae	*Threskiornis melanocephalus*	Black-headed Ibis	VU	NT	Winter Migratory

Plate 4-15: Photograph of a Flock of Kentish Plover in the Project Area

Table 4-26: Transect Description and Number of Species Along with Each of the Transects During Dry Season

Transect	Habitat type	Total bird species	Resident	Migratory
T1	Sandy beach	17	13	4
T2	Decayed mangrove	33	31	2
T3	Decayed mangrove	34	32	2
T4	Coastal grassland	28	22	6
T5	Coastal mudflat	27	16	11
T6	Coastal mudflat	29	16	10
T7	Coastal mudflat	23	16	7
T8	Sand fill area	21	15	6
T9	Mangrove	35	33	2
T10	Mangrove	38	36	2
T11	Urban area	17	17	0
T12	Rural homestead	26	25	1
T13	Rural homestead	21	20	1
T14	Marine water	1	1	0

Plate 4-16: Photograph of a Flock of Common Shelduck in the Project Area

Collared Kingfisher

Eurasian Curlew

Great Plover

Pacific Golden Plover

Black-headed Ibis

Common Sand Piper

Plate 4-17: Photograph of Some of the Migratory Birds Found in the Project Area

236. **Reptiles**. Reptiles are the first group of vertebrates that are adapted to dry places. Their bodies are covered with scales, or scutes, to conserve moisture. Like amphibians, they are also cold-blooded vertebrates and cannot generate their own internal heat. That's why they bask in the sun during the day and seek shelter at night to avoid the cold. Since the survey was conducted in the dry winter in a degraded habitat with a dense human population, it was very practical not to have many reptiles during the study period.

237. During the survey period, a total of eight species of reptiles were recorded. Among the recorded species, three species of snakes were notable. About 12.50% of reptiles were very common, 37.50% were common, 12.50% were uncommon, and the remaining 37.50% were rare, as shown in **Figure 4-50**. Dog-faced Water Snakes (*Cerberus rynchops*) were found in the mud flats near the coast; Checkered Keelback (*Xenochrophis piscator*) and Smooth Water Snake (*Enhydris enhydris*) were found in the fish culture farms near the project area. The Common Garden Lizard (*Calotes versicolor*) and Bronze Grass Skink (*Eutropis macularia*) were found in the bushes near the beach area. A dead Olive Ridley Sea Turtle was found on the mudflats. The Olive Ridley Sea Turtle is globally and nationally vulnerable. None of the breeding signs of any sea turtle were found on the coast. Most of the reptiles

(3 species) were found in rural homesteads, followed by coastal grassland, mangroves, and urban areas, as shown in **Figure 4-51**. The overall diversity of reptiles was low (D = 0.60, H' = 1.55). **Plate 4-18** and **Plate 4-19** show photographs of reptiles found in the project area during the dry season.

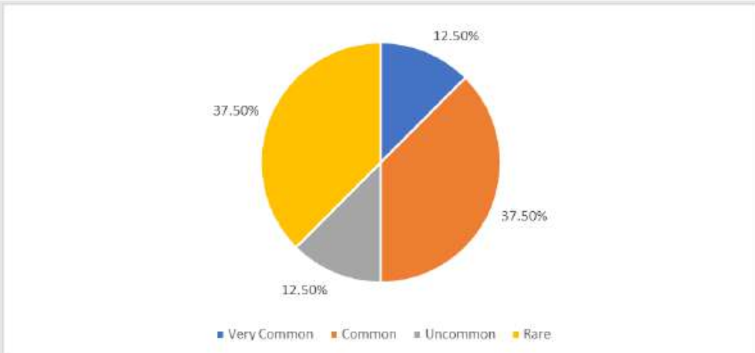


Figure 4-50: Local Status of Reptiles in the Project Area During Dry Season

Plate 4-18: Photograph of a Dog-faced Water Snake Found in the Project Area During Dry Season.

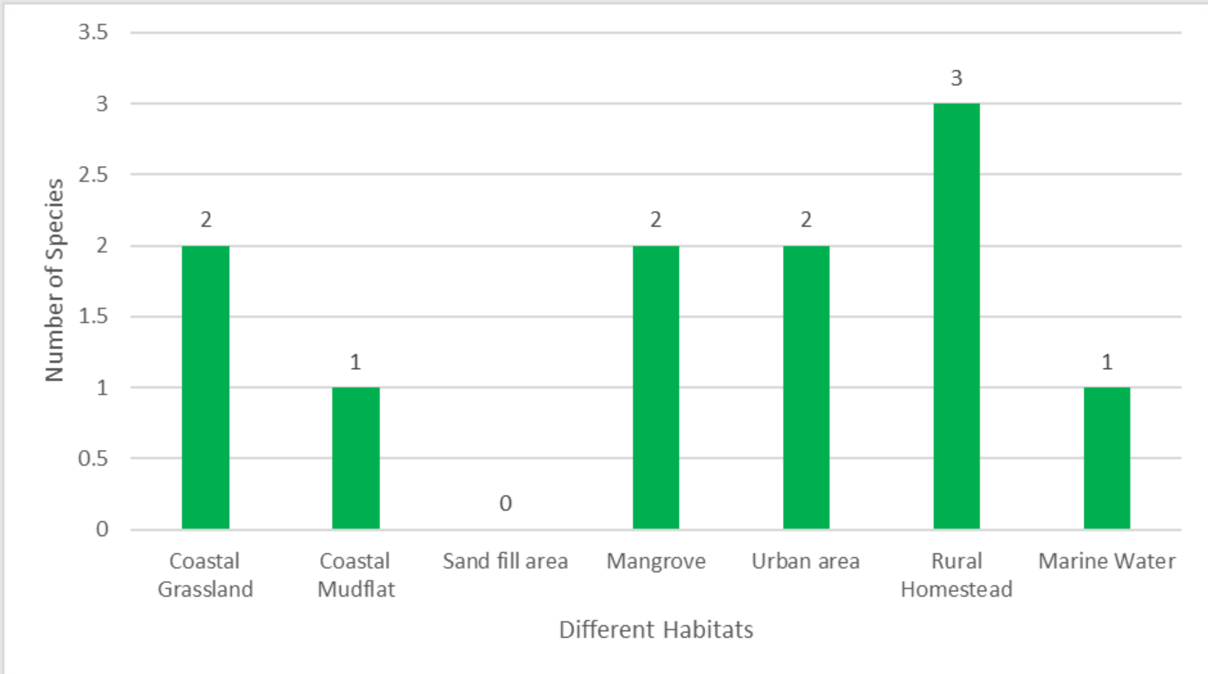


Figure 4-51: Number of Reptile Species in Different Habitats During Dry Season

Plate 4-19: Photograph of a Dead Olive Ridley Sea Turtle on the Coast

238. **Amphibians**. As the field survey was conducted during the dry winter months, only five species of amphibians have been recorded from the project sites. Among the recorded amphibian species, 20% each was very common, uncommon, and rare, while 40% was common, as shown in **Figure 4-52**. Amphibians were mostly found in rural homesteads (5 species), followed by urban areas (3 species). None of the amphibians were found in the coastal grassland, coastal mudflats, sandy beaches, or marine water due to the intolerance of salinity, as shown in **Figure 4-53**. The overall diversity of amphibians was low (D = 0.27, H' = 1.38).

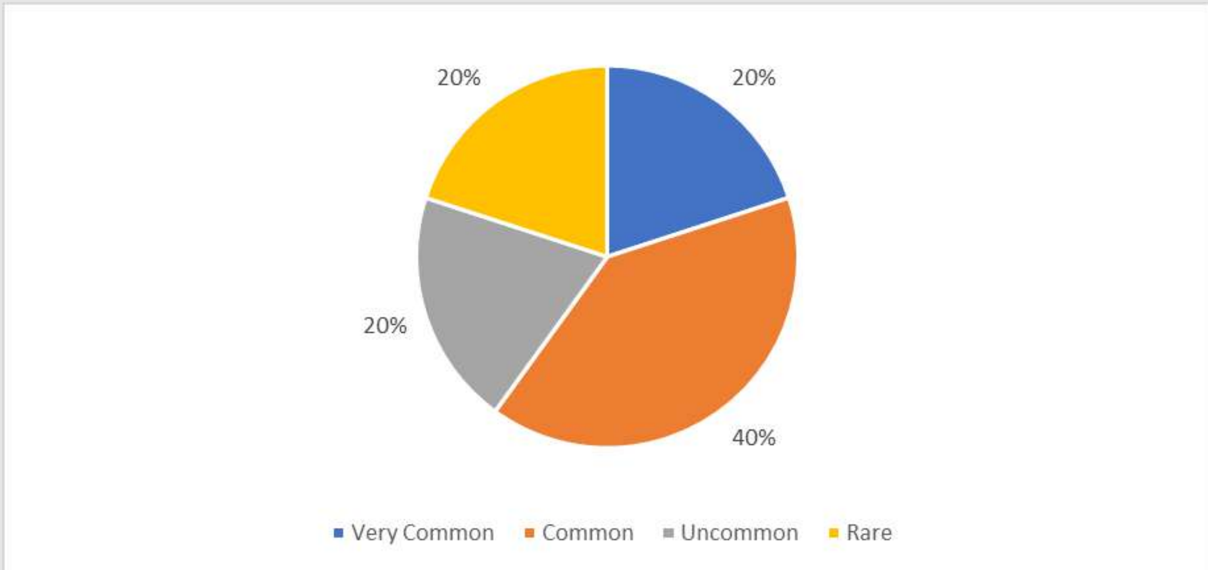


Figure 4-52: Local Status of in the Project Area During Dry Season

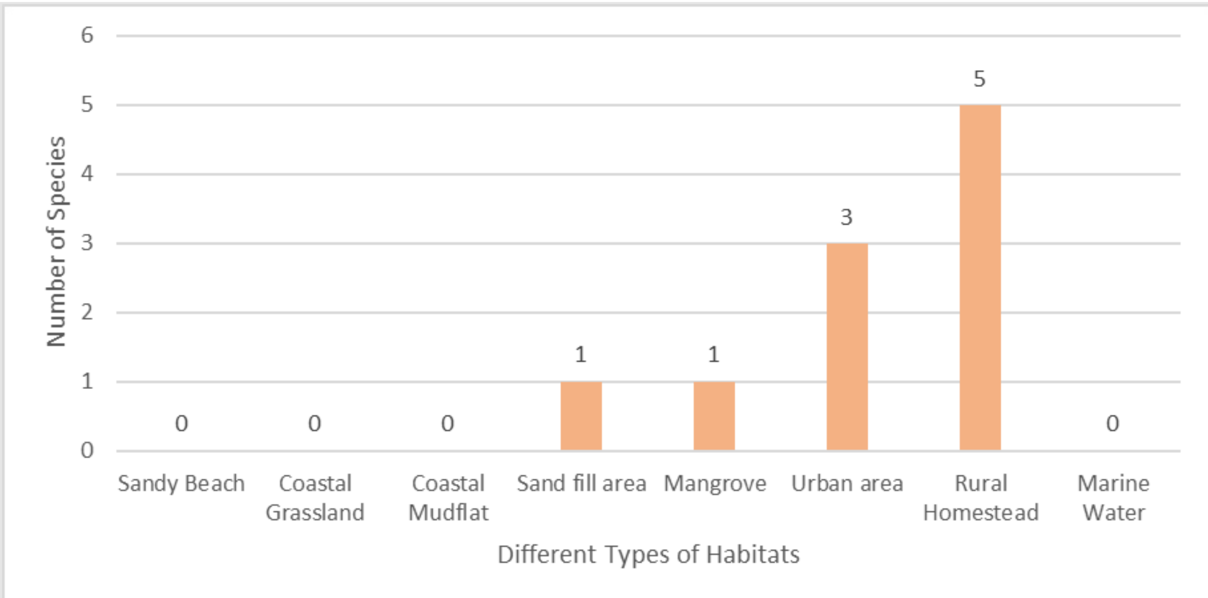


Figure 4-53: Number of Amphibian Species in Different Habitats During Dry Season

4.3.2.7. Fisheries Resources

239. Bangladesh, fortunate in having potential water resources, is one of the world's leading fish producing countries with a total production of 4.621 million MT in FY 2020-21, where aquaculture accounts for 57.10 percent of the total fish production. Bangladesh becomes self-sufficient fish producing country supplements about 60% (with per capita of 63 g/day against targeted 60 g/day) of total daily animal protein intake of her people. Bangladesh earns a considerable amount of foreign currencies by exporting fish, shrimps and other fishery products.

In 2020-21, the country earns BDT 4,088.96 crore by exporting almost 76.59 thousand MT of fish and fishery products (DoF 2022). According to FAO report: The State of World Fisheries and Aquaculture 2020, Bangladesh ranked 3rd position in inland open water capture production and 5th position in world aquaculture production. Currently Bangladesh ranks 4th in Tilapia fish production in the world and 3rd in Asia. The national fish hilsa (*Tenualosa ilisha*) is the GI product (Geographical Indicator) and as a single species has been making the highest contribution (12.23%) to the country's total fish production. Bangladesh also ranks 1st in global production of hilsa.

240. Bangladesh having sovereign rights over almost 118,813 sq. km in the Bay of Bengal. Marine fishing sector provides only about 14.74% of national fisheries production of 6.81 lakh MT in 2020-21, it involves over 200 industrial trawlers and more than 67,000 artisanal vessels. Artisanal small-scale fishery contributes 82.51% i.e., 5.62 lakh MT and large industrial fishery contributes 17.49% i.e., 1.19 lakh MT of total marine production. Over the three decades, since 1983-84, the total marine catch of 1.65 lakh MT has increased to 6.81 lakh MT in FY 2020-21. The government has given much priority for the sustainable management of marine fisheries resources and undertaken various measures like strengthening monitoring, controlling and surveillance (MCS), catch monitoring, declaration of St. Martin Island and Sundarbans mangrove forest as sanctuary, and declaration and surveillance of 698 sq.km marine reserve, and marine protected area of 1738 sq. km in the Bay of Bengal and to protect and conserve the breeding grounds of marine flora and fauna.

241. Fisheries resources in the project area are enriched with mostly the capture and partially the culture fish habitat. The captured fish habitats are included in Bay of Bengal, Karnaphuli River, and internal canals. The Bay of Bengal is situated on the west side of the proposed bay terminal, and different types of aquaculture fish farming are practiced inside the proposed project site. The project study area is tidal in nature. The fish habitat quality of the Bay of Bengal is deteriorating due to a number of large and lightship movements and the discharge of various wastes from those like oil, grease, disposal of solid waste, and other toxic chemicals into the seawater, and also industrial effluent from different industries. Therefore, fisheries productivity and species diversity are reducing in the study area. Local fishermen rely heavily on marine fisheries and rely on them for a living. As a result, the income level of all sorts of the local fisherman is declining, putting their livelihoods in jeopardy.

242. Fisheries resources also include assorted aquaculture practices. The study area has a number of big and small ponds. Large ponds hold water all the year round, but tiny ponds retain water for 9 to 10 months in a year. Two cycles of fish cultivation are conducted in the perennial pond, focusing on indigenous big carps and exotic carps. Small ponds, on the other hand, are used with a single cycle of fish culture and provide minimal production. Locals have opinions about monoculture, polyculture, and mixed cultures in various types of aquaculture ponds.

243. Fish production is coming from mostly captured fish habitats while the culture habitat contributes a small part of fish production. Fish production is declining gradually from the open water sources due to the degradation of habitat quality and indiscriminate fishing activities. The area is moderate in fish biodiversity. However, fish biodiversity is decreasing because of many manmade activities. The fisheries sector is contributing a significant part to the local economy by improving the local livelihood.

244. Different types of pollutants like untreated effluents from industries, municipal wastes, household waste, stormwater run-off, etc. make the internal Khals as well as the Karnaphuli River locally less suitable for fish habitation, particularly during the dry season. Oil slick also causes suffocation to aquatic species including fish. However, due to the diluteness of pollution in the wet season, some opportunistic fishes migrate from the Karnaphuli River to the Khals in search of food. Fisheries problems and issues identified during the field survey and consult with local fishermen and elder people in the area are as follows;

- Contaminate marine habitat because of industrial influent and chemical discharge from the big and lightships;

- Decline fish biodiversity due to indiscriminate fishing activities and degradation of habitat quality;
- Indiscriminate fishing activities and violation of fisheries rules; and
- Inadequate fish culture knowledge for the local fish farmer, etc.

245. **Brackish Water and Pond Aquaculture**. Shrimp culture is done in the wet season on land in a trapped saline water environment which is nourished by tidal flow at times when required. Bagda (*P. monodon*) is the key species in such a culture system. Mainly, wild seeds are used in shrimp farms in this area as it is adjacent to the sea. The mortality of those seeds is 50% which is less than the hatchery seeds. Shrimp culture usually starts in May/June and is harvested at different times in five months and ended in October. Wild fish or shrimp that enter into the culture system and become trapped include but not limited to Chaka Chingri (*P. indicus*), Loli Icha (*M. spinulatus*), Kharul Bata (*M. cephalus*), Koral (*L. calcarifer*), Datina (*A. latus*), Chiring (*S. histophorus*), etc. The major risks that encountered by the farmers in shrimp farms include the followings: (i) Water quality; (ii) Tidal surge; and (iii) Viral infection.

246. **Fish Migration**. A big percentage of fish generally migrate from one habitat to another for breeding, feeding or sheltering purposes. Various fish species migrate horizontally to these water bodies as part of their life cycle. The Karnaphuli River acts as a fish migration route to the study area. Fish migration of brackish water fish species like tengra, gulsha, bagda, persa, bata, thuitta, etc. fish species usually occurs in the study area during the high tide.

247. **Fish Diversity**: The study area occupies brackish and freshwater fish biodiversity. There are 45 fish species including 39 fin fish, 3 prawn and shrimp and 3 crab species were available in the study area. The fin fishes comprised six orders (i.e. Carcharhiniformes, Clupeiformes, Siluriformes, Cypriniformes, Anulopiformes and Perciformes) and Perciformes dominated all of the orders. Fish order Perciformes comprised of highest proportion of fish species (44.44%, 20 species) while order Anulipiformes comprised only 2.22% (1 species) of the fish community. This finding suggested that the order Perciformes is extensively diverse with twelve families in the study area. Non-fin fish comprised of six species with the highest species (50%) in Palaemonidae family and lowest (33.33%) in Penaeidae family. There were 19 fin-fish families found in the Bay Terminal area, where the highest number of species (6 species) was found in Clupeidae family followed by Sciaenidae (5 species) and Bagridae (4 species). Prawn and shrimp had 2 families (i.e. Palaemonidae and Penaidae) whereas crab possessed single family (i.e. Portunidae) in the study area. The biodiversity of fishes is declining trend over the years. Degradation of habitats by industrial effluent, agrochemicals, and pesticides used in crop fields etc. are responsible for the gradual decline of fish abundance and fish biodiversity.

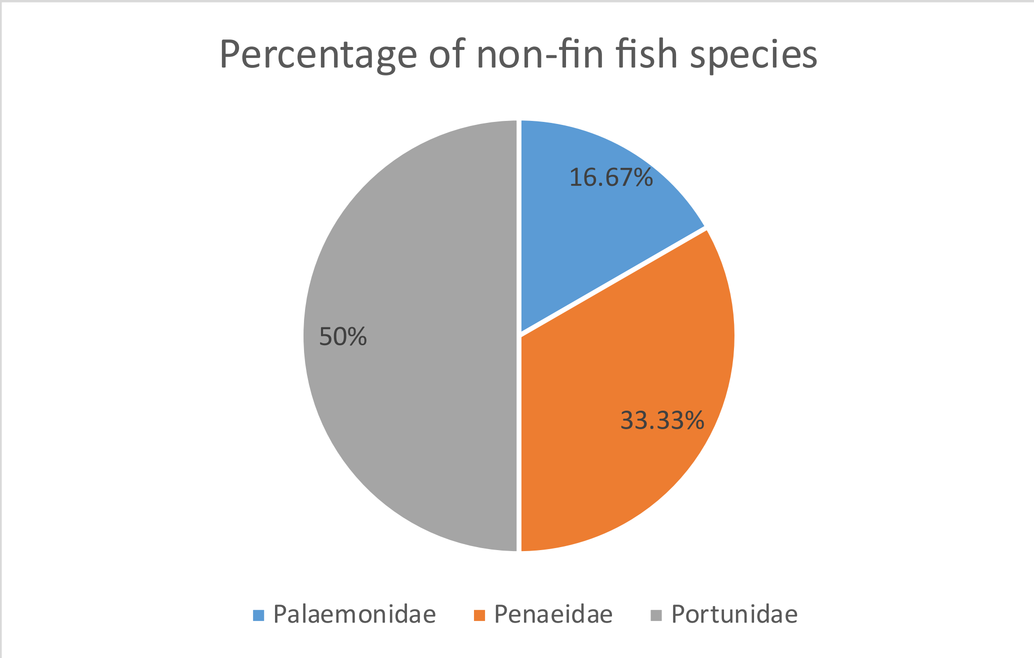


Figure 4-54: Different Non-fin Fish Families Found in the Study Area

248. The marine water major fish species are shrimp (*Penaeus monodon*), Black pomfret (*Parastromateus niger*), Hilsa shad (*Tenualosa ilisha*), Tiger Toothed croaker (*Otolithes ruber*), Spotted Catfish (*Arius maculatus*), Spotted scat (*Scatophagus argus*), Chinese silver pomfret (*Pampus chinensis*) and Barramundi (*Lates calcarifer*). A checklist of the fish of different habitats reported by direct observation and local fishermen is analyzed to draw a tentative scenario of the local fish biodiversity of the study area. The list of the fishes of different habitats of the study area is presented in **Table 4-27**. **Plate 4-20** shows different species of fish identified from the Bay Terminal area.

Table 4-27: Indicative Fish Species Diversity of Different Fish Habitats in the Coastal Areas

SL	Scientific Name	Local Name	Order	Family	IUCN Threat Status	
					National (IUCN BD-2000)	Global
			Fin Fish			
1	*Carcharhinus sorrah*	Kamot	Carcharhiniformes	Carcharhinidae	NT	NT
2	*Carcharhinus melanopterus*	Kamot	Carcharhiniformes	Carcharhinidae	NT	VU
3	*Tenualosa ilisha*	Ilish	Clupeiformes	Clupeidae	NT	LC
4	*Hilsa kelee*	Gurta Ilish	Clupeiformes	Clupeidae	NT	LC
5	*Nematalosa nasus*	Khoira	Clupeiformes	Clupeidae	NE	LC
6	*Sardinella fimbriata*	Khoira	Clupeiformes	Clupeidae	T	LC
7	*Sardinella gibbosa*	Khoira	Clupeiformes	Clupeidae	T	LC
8	*Gudusia chapra*	Chapila	Clupeiformes	Clupeidae	NE	LC
9	*Coilia dussumieri*	Olua	Clupeiformes	Engraulidae	NE	LC
10	*Setipinna taty*	Teli phasa	Clupeiformes	Engraulidae	NT	LC
11	*Mystus vitatus*	Tengra	Siluriformes	Bagridae	NT	NE
12	*Mystus cavasius*	Gulsha tengra	Siluriformes	Bagridae	NT	LC
13	*Mystus tengra*	Bajari tengra	Siluriformes	Bagridae	NT	NE
14	*Mystus gulio*	Guillya	Siluriformes	Bagridae	NT	LC

SL	Scientific Name	Local Name	Order	Family	IUCN Threat Status	
					National (IUCN BD-2000)	Global
15	*Arius maculatus*	Kata Machh	Siluriformes	Ariidae	NT	LC
16	*Arius platystomus*	Kata Machh	Siluriformes	Ariidae	NT	LC
17	*Labeo boggut*	Goinna	Cypriniformes	Cyprinidae	NE	LC
18	*Labeo bata*	Bata	Cypriniformes	Cyprinidae	NT	LC
19	*Harpadon nehereus*	Loitta	Anulopiformes	Harpadontidae	NT	NT
20	*Sillago sihama*		Perciformes	Sillaginidae	NE	LC
21	*Pomadasys argenteus*	Datina	Perciformes	Haemulidae	NE	LC
22	*Johnius dussumieri*	Kala poa	Perciformes	Sciaenidae	NT	LC
23	*Johnius macropterus*	Dhari poa	Perciformes	Sciaenidae	NT	LC
24	*Argyrosomus amoyensis*	Poa	Perciformes	Sciaenidae	NT	EN
25	*Panna microdon*	Chotta lambu	Perciformes	Sciaenidae	NT	LC
26	*Otolithes ruber*	Poa	Perciformes	Sciaenidae	NT	LC
27	*Liza parsia*	Parse bata	Perciformes	Muglidae	NT	NE
28	*Mugil cephalus*	Kharul bata	Perciformes	Muglidae	NE	LC
29	*Scartelaos histophorus*	Chiring	Perciformes	Gobiidae	NE	LC
30	*Lepturacanthus savala*	Churi	Perciformes	Trichiuridae	NE	NE
31	*Rastrelliger kanagurta*	Maitta	Perciformes	Scombridae	NE	DD
32	*Auxis rochei*	Maitta	Perciformes	Scombridae	NE	LC
33	*Auxis thazard*	Tuna machh	Perciformes	Scombridae	NE	LC
34	*Lates calcarifer*	Koral	Perciformes	Centropomidae	NE	LC
35	*Leptomelanosoma indicum*	Lakhua	Perciformes	Polynemidae	NT	NE
36	*Polynemus paradiseus*	Tapasi	Perciformes	Polynemidae	NT	LC
37	*Scatophagus argus*	Bishtara	Perciformes	Scatophagidae	NE	LC
38	*Parastromateus niger*	Kala chanda	Perciformes	Carangidae	NT	LC
39	*Pampus chinensis*	Rup chanda	Perciformes	Stromateidae	NT	LC
			Prawn and Shrimp			
40	*Macrobrachium rosenbargii*	Golda chingri	Decapoda	Palaemonidae	NE	NE
41	*Penaeus monodon*	Bagda chingri	Decapoda	Penaeidae	NE	NE
42	*Metapenaeus monoceros*	Harina icha	Decapoda	Penaeidae	NE	NE
			Crab			
43	*Scylla olivacea*	Kakra	Decapoda	Portunidae	NE	NE
44	*Portunus pelagicus*	Kakra	Decapoda	Portunidae	NE	NE
45	*Portunus sanguinolentus*	Kakra	Decapoda	Portunidae	NE	NE

SL	Scientific Name	Local Name	Order	Family	IUCN Threat Status	
					National (IUCN BD-2000)	Global
Source: Field investigation; 2022 *Note: NE= Not Evaluated, LC = Least Concern, NT= Not Threatened, T= Threatened, VU= Vulnerable, DD=Data Deficient, En=Endangered*						

	
Spotted Sea Catfish (*Arius maculatus*)	Flatmouth Sea Catfish (*Arius Arius platystomus*)
	
Scaly Hairfin Anchovy (*Setipinna taty*)	Bombay Duck (*Harpodon nehereus*)
	
Hilsa Shad (*Tenualosa ilisha*)	Panna Croaker (*Panna microdon*)

Goldspot Grenadier Anchovy (*Colia dussumieri*)


Paradise Threadfin (*Polynemus paradiseus*)


Tiger-toothed Croaker (*Otolithes ruber*)


Giant Tiger Prawn (*Penaeus monodon*)

Plate 4-20: Different Species of Fish Identified from the Bay Terminal Area

249. **Hilsa Fishery**. Hilsa shad (*Tenualosa ilisha*) is largely an anadromous, fast swimming, euryhaline pelagic fish and occur in the river, estuarine and marine ecosystems, depending on their life stages. The broods of Hilsa migrate from saline water to estuaries and rivers for spawning where the eggs hatch into larvae (Rahman and Cowx, 2006). The national fish of Bangladesh, *Tenualosa ilisha* was also found as a common fish like most part of the Bay of Bengal. In a study Hossain et al. (2014) assessed the breeding ground of Hilsa in Bangladesh and found that the river estuary of Meghna, Shahbazpur, Tetulia, Ander Manik and channels of Sandwip are most suitable for Hilsa spawning whereas the coastline of the southeastern part of the country is moderately suitable. The project area is about 9.0km away from the spawning ground and probably will be less impacted (**Figure 4-55**).

Figure 4-55: Hilsa Breeding Grounds in the Coastal Area

250. **Karnaphuli River**. The strong tidal characteristics result in great fluctuations of salinity and dissolved oxygen, which create an unstable environment. According to Khan (2005), about 51 species under 23 families were found in the Karnaphuli River Estuary. Hossain (2006) reported that about 23 species of fish were found in the Karnaphuli River during 1975-76. During the fish market survey, some photos are captured which represent common fish species in the Karnaphuli River. The most abundant fish species in the river were Poa, Galda, Phaisa, Ilish, Kechki, and Baila. **Plate 4-21** shows the photographs of common fish species of the Karnaphuli River.

			
Poa	Galda	Phaisa	Ayre
			
Ilish	Kechki	Baila	Boal
Source: Fish Market Survey, 2022			

Plate 4-21: Photographs of Common Fish Species of the Karnaphuli River

251. **Halda River**. The Halda River is an exclusive river in Bangladesh that is widely recognized as the natural breeding ground for Indian major carps (i.e. *Labeo rohita, Catla catla, Cirrhinus cirrhosus, Labeo calbasu*). This is the only tidal river in Bangladesh which produce fertilized eggs of major carps. The river contributes around 6.7% of total national natural fertilized eggs (DoF, 2017). The river is also one of the major sources of brood and PL (post-larvae) of *Macrobrachium rosenbergii*.

252. The Halda River once was rich and diversified with various freshwater fish species due to its favorable environment for spawning, many deep pools (Kum) and good habitat condition. According to Azadi and Arshad-ul-Alam (2013), a total of 63 fin fish species were recorded in the Halda River. However, local fishers reported that around 50-60 fish species are found in the Halda River in different seasons of year. Among the fish species mostly abundant ones are Ayre (*Sperata apor*), Rita (*Rita rita*), Ruhit (*Labeo rohita*), Catla (*Catla catla*), Mrigel (*Cirrhinus cirrhosus*), Kalighoni (*Labeo calbasu*), Boal (*Wallago attu*), Pabda (*Ompok pabda*), Bacha (*Eutropiichthys vacha*), Phaisa *(Setipinna phasa*), Baim (Mastacembelus armatus), Soiya Icha (*Macrobrachium rosenbergii*), Pangas (Pangasius pangasius), etc.

Table 4-28: List of Common Freshwater Fish Species in the Study Area Habitat

Scientific Name	English Name	Local Name	Habitat	IUCN Status
Wallago attu	Freshwater shark	Boal	River	VU
Sperata aor	Long-whiskered Catfish	Ayre	River	VU
Labeo rohita	Rohu	Ruhit	River, Pond	LC
Catla catla	Catla	Catol	River, Pond	LC
Cirrhinus cirrhosus	Mrigal carp	Mrigal	River, Pond	NT
Labeo calbasu	Black Rohu	Kalighuni	River	LC
Lates calcarifer	Sea Bass	Koral	River	-
Pangasius pangasius	Pungas Catfish	Pangas	River	EN
Rita rita	Rita	Rita	River	EN
Macrobrachium rosenbergii	Giant River Prawn	Soiya Icha	River	LC
Nematopalaemon tenuipes	Spider Prawn	Gura Icha	River, Khal	DD
Setipinna phasa	Gangetic Hairfin Anchovy	Phasa	River	LC
Corica soborna	Ganges River-sprat	Kechki	River	LC
Eutropiichthys vacha	Batchwa Vacha	Bacha	River	LC
Ompok pabda	Pabda catfish	Pabda	River	EN
Mystus cavasius	Gangetic Mystus	Tengra	River, Khal	NT
Ctenopharyngodon idella	Grass Carp	Grass Carp	River, Pond	-
Oreochromis mossambicus	Tilapia	Tilapia	Pond	-
Mastacembelus armatus	Tire-trackSpinyeel	Baim	River	EN
Macrognathus aculeatus	One-stripe Spinyeel	Tara Baim	River	NT
Glossogobius giuris	Fresh Water Goby	Baila	River	LC
Johnius coitor	Big-eyed Jewfish	Poa	River	LC
Tenualosa ilisha	River Shad	Ilish	River	LC
Polynemus paradiseus	Paradise Threadfin	Ramchos	River	LC
Mystus gulio	Gulio Catfish	Guilla	River, Khal	NT
Sillaginopsis panijus	Tulardandi	Tulardandi	River	LC
Sperata seenghala	Giant River catfish	Guizza Ayre	River	VU
Chitala chitala	Humped Featherback	Chital	River	EN
Gudusia chapra	Indian river shad	Chapila	River	VU
Pseudapocryptes elongatus	Goby	Chiring	River	LC
Source: Field Survey, 2022				

253. **Fishermen Community and Fishing Practices:** About 300 fishermen families live in the Akmal Ali Ghat and rani Rashmoni Ghat fishermen community. In most of the fishermen families (69.57%) about 1 -3 family members are involved in fishing while in 28.26% families 4-7 family members are involved. They are involved in fishing for 6-9 months in a year. Per day income of most of the fishermen (97%) are 1000-2000 Taka per day in the active fishing time. There are three fishermen co-operative societies in the Bay Terminal Area. Most of the fishermen (41.30%) are the member of Halishahar Co-operative Multipurpose Society

followed by 30.43% of Fishermen Co-operative Society and remaining 28.26% of Uttar Chattala fishermen Jaldas Co-operative Kalyan Fedaration. Most of the fishermen (91.30%) do fishing both in the coast and off shore (marine) while a few (8.70%) only catch fish in the off shore (marine). About 46% fishermen catch fish within 1-10 km from the coast while another 46% catch fish within 1-20 km, only 8% fishermen go beyond 20km from the coast. The fishermen of Bay Terminal Area only use two kind of fishing gears, Behundi net and Tong net. Most of the fishermen (59%) use 21–40-meter Behundi net and rest of them (41%) use up to 20-meter length Behundi net while 59% fishermen use up to 20-meter length Tong net. They keep the fishing net in water for 6 hours (hauling time).

254. The fishermen mentioned that they do fishing throughout the year except the three fishing ban periods, 20 May to 23 July (65 days) and 12 October to 2 November (22 days). They also mentioned that they get more fishes in the rainy season, autumn and winter. Most of the fishermen (41.30%) mentioned that they get 11 -20 species of fish per hauling while 32.61% mentioned that they usually get 31-40 species of fish per hauling. Most of the fishermen (80%) get about 31-40kg of fish per hauling while 17% fishermen mentioned that they get 46-60kg per hauling. The fishermen mentioned that they regularly get Hilsha, Poa, Faisha, Laitya, Shrimp, Chewa, Churi, Bele, Surma and Rita in this coast. They also mentioned that this coast is famous for Hilsha, Laitya, Chewa and Shrimp. Once upon a time Ray fish (Shapla pata), Shark, Red Shrimp, Poa, Big Batasio and Laitya were abundant in this coast but now a day abundance of these fishes was decreased in an alarming rate. All the fishermen agreed that overall fish production has decreased in this coast. Most of the fishermen thought that pollution from different sources such as industrial waste, EPZ waste, dockyard waste and ship waste are responsible for this. They emphasized on the waste management, implementation of law and restriction of fish catching which could increase the fish production.

255. **Fish Management**. During the field visit, the study team discussed with the local fishermen, and it was identified that there are no fisheries management activities in the study area. The Department of Fisheries (DoF) has limited activity (confined to billboard/sign board) for fisheries resource conservation and management in this region. Some NGOs are working, but they are very much limited in micro-credit rather than extension services and aquaculture training.

256. **Recommendations**: The baseline survey tried to accomplish all the information but still had some limitations of time and logistics. Plankton and benthic survey was not conducted. As the project activities will primarily affect the producer level of the food chain, and ultimately on the other biota, it is necessary to conduct plankton and benthic survey. The following steps would be taken in future-

- Detailed plankton, benthic and invasive alien species survey will be conducted in the next phase.
- Detail analysis of bathymetric survey will be conduct in the next phase.
- Detailed fish catch per survey will be conducted on field.
- Marine Spatial Plan (MSP) will be prepared.
- Monitoring of shore birds, marine turtles breeding ground and dolphins in the changed environment will be monitored.

4.3.3. Location of Ecologically Critical Areas (ECAs)

257. It is to be noted that none of the Ecological Critical Areas (ECA), wildlife sanctuary, national parks, or reserve forest areas, including their corridors, are found within a 17-kilometer buffer distance of the study area. The nearest Ecological Critical Area (ECA), Sonadia Island, is about 90 km south of the study area. **Figure 4-56** shows the ECA map of Bangladesh, demarking the proposed project area.

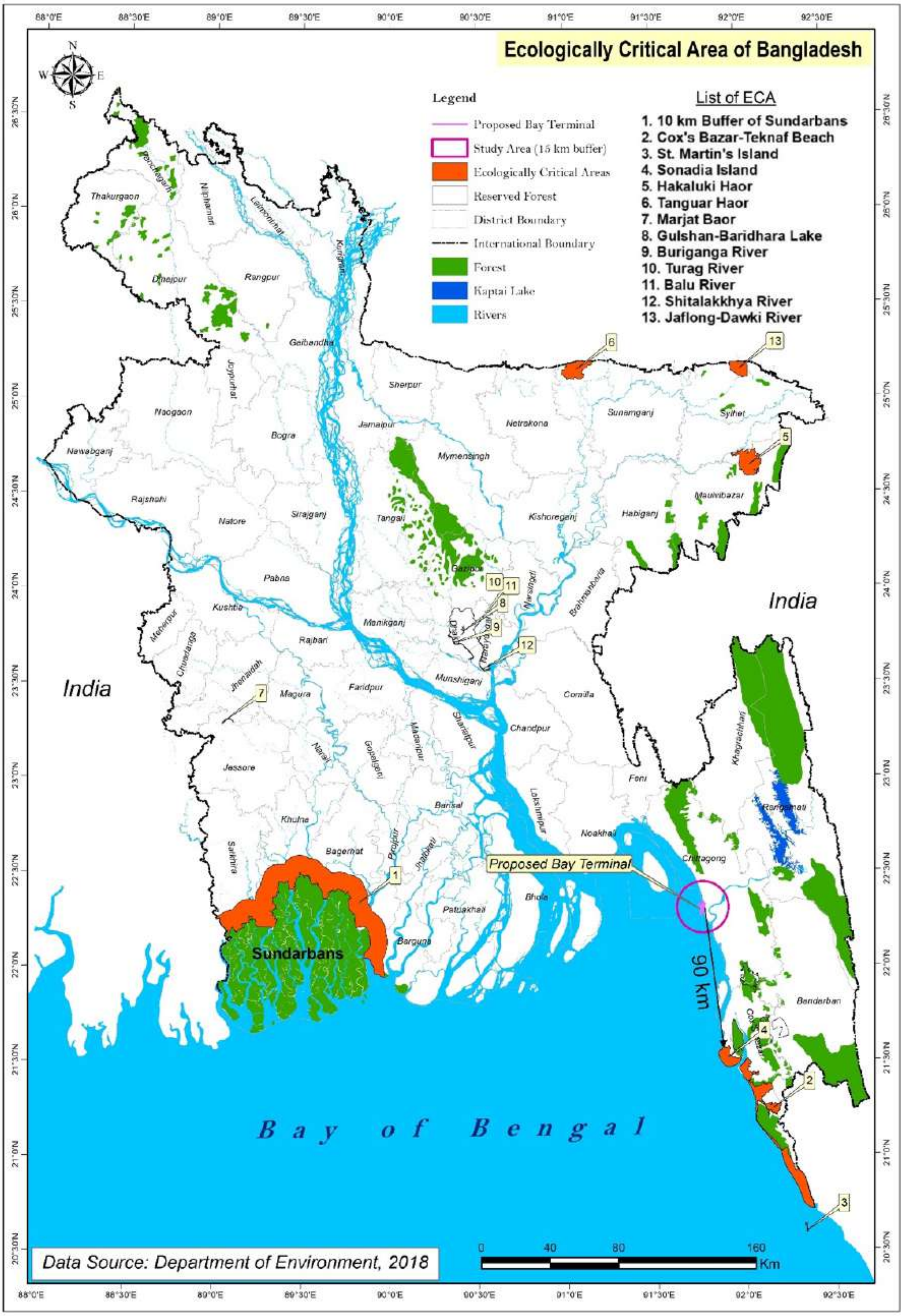
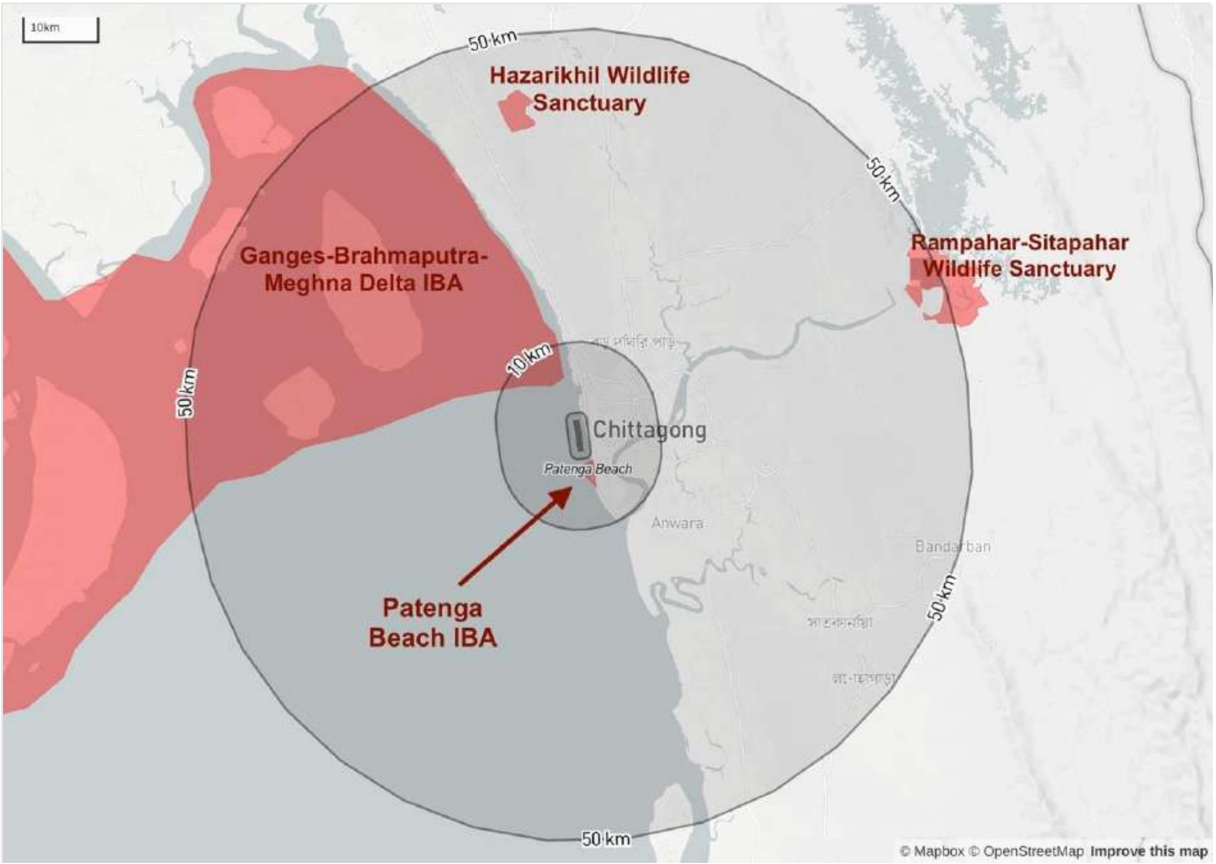


Figure 4-56: Ecologically Critical Area Map of Bangladesh

258. The IBAT report generated for the project revealed various legally protected and internationally recognized areas of high biodiversity value (collectively referred to as protected areas) in the greater vicinity. No UNESCO World Heritage Sites, MAB Biosphere

Reserves, or Alliance for Zero Extinction (AZE) sites are known to occur within the vicinity of the project area.

259. Patenga Beach IBA (important bird area) and Ganges-Brahmaputra-Meghna Delta IBA are considered to have relevance to the project. **Figure 4-57** shows the locations of KBA in the vicinity of the project area.



Source: IBAT

Figure 4-57: Location of KBAs in the Vicinity of the Project Area

260. The Patenga Beach IBA covers an area of approximately 500 ha, although boundaries are not defined. The IBA is recognized for populations of globally threatened species and waterbird congregations. The Ganges-Brahmaputra-Meghna Delta IBA is large, covering an area of over 75,000 ha, and is recognized for globally threatened species and large congregations of waterbirds.

261. The project footprint is in the Patenga Beach IBA. About 50% of the IBA area will be physically occupied by the project, and the remaining 50% will be situated within 1 km of the direct impact area of the project.

4.3.4. Critical Habitat Assessment (CHA)

262. ESS6 defines critical habitat as an area of high biodiversity importance or value that is qualified by any one of the following criteria:

- Criterion (a) Habitat of significant importance to critically endangered or endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;
- Criterion (b) Habitat of significant importance to endemic or restricted-range species;
- Criterion (c) Habitat supporting globally or nationally significant concentrations of migratory or congregator species;
- Criterion (d) Highly threatened or unique ecosystems;

- Criterion (e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

4.3.4.1. Approach to Critical Habitat Assessment

263. **Critical Habitat Area of Analysis**. Critical habitat is defined for an area, which for this study is defined as the critical habitat area of analysis (AoA). The AoA for this project is bordered on the east by a large urban area and to the west by the open sea of the Bay of Bengal. The critical habitat AoA is within a 6 km radius for terrestrial biota and an 18.52 km radius from the project area into the Bay of Bengal for marine biota.

264. **Key Data Sources**. The IUCN Red List was used as a key source of the globally threatened status of species. The IBAT-generated report was considered one of the vital data sources for the assessment. The IUCN Red List of Bangladesh (2015) provides detailed national threatened status assessments and distribution data spread over seven volumes for mammals, birds, reptiles and amphibians, freshwater fish, crustaceans, and butterflies considered for the national status of the species. Regional data is also available for many waterbirds in online databases like eBird. National experts working on different species from different organizations were also consulted. Fisheries information was checked with available books, manuals, reports, and other documents.

265. **Structured Approach for Critical Habitat Determination**. A list of 43 critically endangered (CR) and Endangered (EN) species were extracted from IBAT data and supplemented with an additional 83 CR and EN species provided by the Red List of Bangladesh (2015) to provide a consolidated list of 126 species. An additional nine species with congregation behavior recorded from Patenga Beach IBA were also considered for the assessment.

266. Species Likelihood of Occurrence (LOO) was assessed based on habitat requirements and the availability of habitats within the critical habitat AoA. Species were excluded when habitats within the AoA were unsuitable to meet their requirements or unlikely to occur due to sensitivity to disturbance or disappearance from the area. Species known to be present or with a possible LOO were assessed against the critical habitat criteria based on known ecological data.

4.3.4.2. Results of Critical Habitat Determination

267. Consolidation of CR, EN, and RR species from IBAT, IUCN Bangladesh Red List (2015) yielded 126 species. A LOO analysis produced eight species potentially present within the critical habitat AoA. An additional nine species of congregation behavior recorded from Patenga Beach were also considered. These species were assessed against the ESS6 criteria.

268. Criterion (a)

- Analyses of critical habitat revealed that the Irrawaddy Dolphin (*Orcaella brevirostris*) qualifies as a critical habitat feature. Irrawaddy Dolphin is a globally endangered species, and Bangladesh is a stronghold of the species. This species prefers freshwater-influenced coastal waters. There is a high possibility of this species occurring near the estuary of the Karnaphuli and Sangu and within the ten nautical miles impact areas.
- The Great Knot (*Calidris tenuirostris*) is both a nationally and globally endangered species and qualifies as a critical habitat feature, as the entire known population within Bangladesh (55 individuals) was observed on 23 February 2023 at the Patenga Beach IBA, just 500 m from the project boundary. The Spotted Greenshank (*Tringa guttifer*) is nationally critically endangered and globally endangered. It was last observed in the critical AoA in 2015. There is a possibility this bird still uses the critical habitat AoA, and a single individual would be a significant observation and is therefore included as a critical habitat feature based on a precautionary approach.
- The Green Sea Turtle (*Chelonia mydas*) is nationally critically endangered and globally endangered. The nesting sites of this species were recorded from Saint Martin Island,

Sonadia Island, and Shahporir Dweep. The local fishermen have observed this species in the vicinity of the project area. There is no record of nesting of this species nearby, and there is insufficient evidence that they occur within the AoA but are included as critical habitat features under this criterion following a precautionary approach.

269. Criterion (b)

- No species qualified as restricted-range features under this criterion.

270. Criterion (c)

- Common Shelduck (*Tadorna tadorna*) is an important congregatory species for the Ganges-Brahmaputra-Meghna Delta IBA and Patenga Beach IBA. During the baseline survey, a flock of 60 individuals was recorded on 05 February 2023 in the critical AoA. This number of ducks exceeds the ±1% threshold quoted for the regional population, and this species qualifies as a critical habitat feature.
- The Black-tailed Godwit (Limosa limosa) is another important congregatory species in Patenga Beach IBA. A flock of over 200 individuals was recorded in critical AoA during a baseline survey on 03 February 2023. The number of birds exceeds the ±1% threshold of the national population and qualifies as a critical habitat feature.
- The Black-headed Ibis (Threskiornis melanocephalus) is an important migrant to the mudflats on the coasts of Bangladesh. Only 564 individuals were recorded from different habitats in Bangladesh. A flock of 16 birds was recorded in critical AoA during a baseline survey on 03 February 2023. The number of birds exceeded the ±1% threshold of the national population and qualifies as a critical habitat feature.

271. Criterion (d)

- No evidence suggests that habitats within the critical habitat AoA should qualify as highly threatened or unique.

272. Criterion (e)

- The Ganges River Dolphin (*Platanista gangetica*) is a significantly important population within the adjacent Karnaphuli River, representing approximately 25% of the national population. The dolphins of the river Karnaphuli locally migrate to the river Sangu and vice versa through the Sikalbaha-Chandkhali canal (Smith et al. 2001). Dolphin experts confirmed that the movement of the Ganges River Dolphin from Karnaphuli to Sangu through the coastline is impossible as the species could not tolerate saline water. There will not be any activity of the Bay Terminal project in the Karnaphuli and Sikalbaha-Chandkhali canal, which is out of the cumulative impact area of the project. Thus, it does not qualify as a critical habitat.

273. **Table 4-29** represents the final screening of critical habitat features

Table 4-29: Final Screening of Critical Habitat Features Against Potential Project Impacts

Species English (total of 239) **and Scientific Name**	**Threat. Status**		**Documented Threats**	**Potential Project Risks and Impacts**
	Nat.	**IUCN**		
Mammals (1 species)				
Irrawaddy Dolphin *Orcaella brevirostris*	NT	EN	Habitat destruction due to different anthropogenic activities Over exploitation of fish Pollution Increase movement of vessels	Increased movement of ships and other vessels Dredging of channel
Birds (5 species)				

Species English (total of 239) and Scientific Name	Threat. Status		Documented Threats	Potential Project Risks and Impacts
	Nat.	IUCN		
Great Knot *Calidris tenuirostris*	EN	EN	Habitat alteration and anthropogenic disturbance Cattle grazing to the foraging areas Hunting	Physical occupancy of habitat Habitat alteration Increased movement of vessels
Spotted Greenshank *Tringa guttifer*	CR	EN		
Black-tailed Godwit *Limosa limosa*	NT	NT		
Common Shelduck *Tadorna tadorna*	LC	LC		
Black-headed Ibis *Threskiornis melanocephalus*	VU	NT		
Reptile (1 species)				
Green turtle *Chelonia mydas*	CR	EN	Alteration of breeding habitats Increased tourist activities in breeding sites Killing in fishing net Pollution	Increased movement of ships and vessels

Note: CR – Critically Endangered, EN- Endangered, VU-Vulnerable, NT- Near Threatened, LCLeast Concern.

4.4. Socio-Economic Information and Profile

274. It is important to follow the social-safeguard issues for any development works to ensure that the people residing inside and near the project area are not negatively impacted, and if any displacement happens or the project affects the livelihood of the people, based on the situation, the project needs to have mitigation measures. Considering this, the study assessed the socio-economic conditions of the people living within the project area and the project influence area (1–3 kilometers surrounding the project boundary).

275. This section describes the current socioeconomic situation within the project area and within one to three kilometers of the proposed project boundary. Primary data was gathered from field studies utilizing a variety of Rapid Rural Appraisal (RRA) approaches, such as transact walk observation, public consultation, key informant interviews (KIIs), focus group discussions (FGDs), and household surveys. The field survey was undertaken from August 10 to 18, 2022, October 15 to 19, 2022, January 13, 2023, and September 12 to 14, 2023, with a total man-day coverage of roughly 66. Since no recent secondary household survey data was available from the Bangladesh Bureau of Statistics (BBS), the study team conducted a field survey to collect primary data. Therefore, the survey has been done in two folds: 1) inside the proposed project area, and 2) 1-3 km surrounding the proposed project area from the project boundary. This survey data reflects the actual present household and socioeconomic condition of the community inside the proposed project area and within 1 to 3 kilometers surrounding the project boundary.

276. Inside the project area survey, it was found that presently there are only twelve 12 farms (dairy, poultry, and fisheries) inside the project area where 38 people are working in these twelve farms. Besides, three fishermen villages—South Kattoli jelapara, Kathgor jelapara, and Akmol Ali Road jelapara—have been identified from 1-3 km from the project boundary during the socio-economic survey, as shown in **Plate 4-22**. **Figure 4-58** shows the location of the household survey near the project area. Fishermen who live and work within 1-3 km of the proposed project boundary and fish in the sea appear to have the most influence, according to our first understanding of the project's location and the current operational nature of the residents. A total of 239 households were polled (about 7.7% of the total population of 1-3 km) as a sample to gain a sense of their socioeconomic situation. **Figure 4-59** shows the twelve farms (dairy, poultry, and fisheries) inside the proposed project area.

The socio-economic baseline situation within the project area and within 1-3 km of the proposed project boundary is described in the following sections.

Plate 4-22: Photograph of the Social Survey

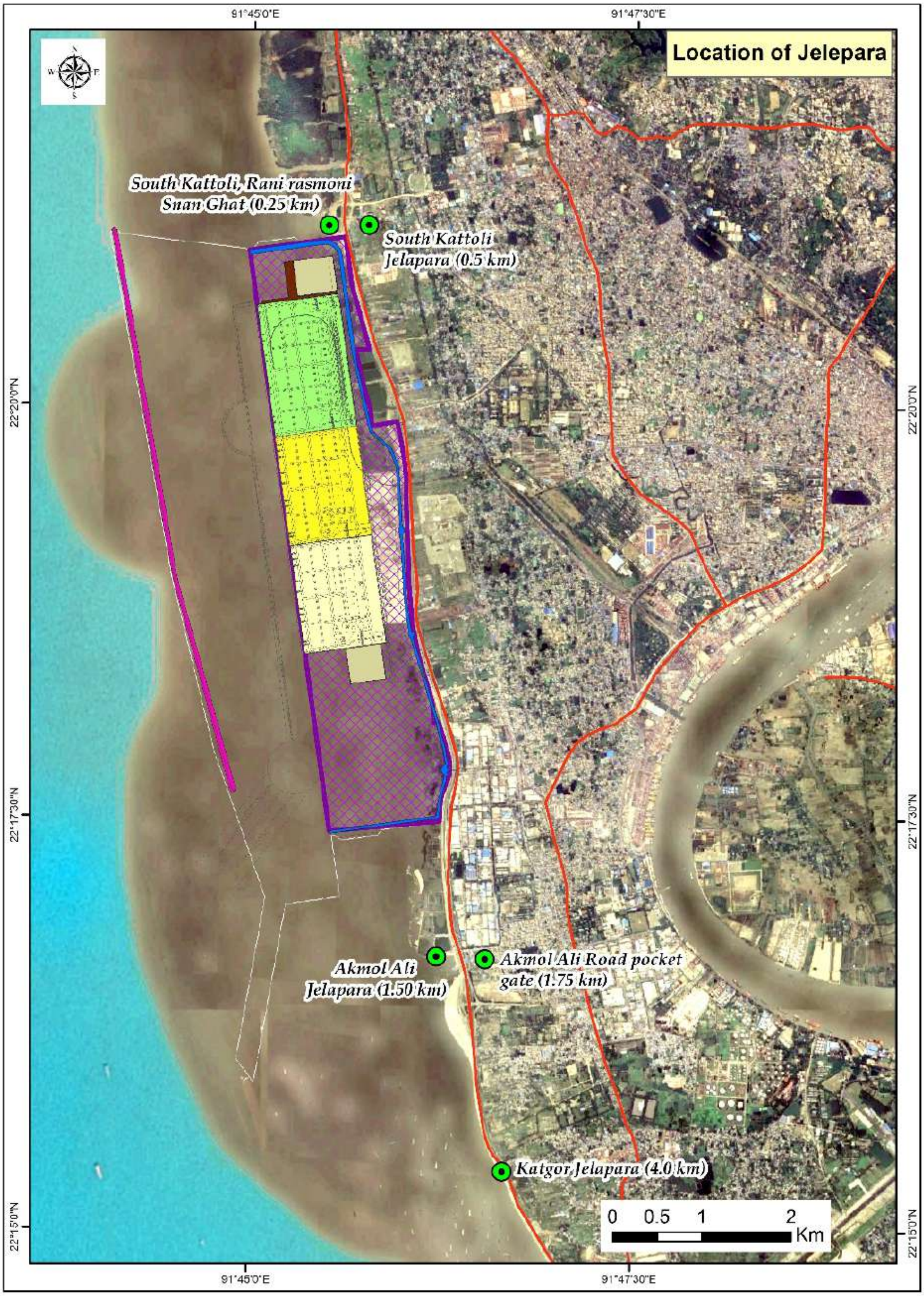


Figure 4-58: Location of Household Survey Near the Project Area

Figure 4-59: Location of Farms Inside the Project Area

4.4.1. Demography

277. From the farm survey, it was found that a total of 37 male people are employed on the Twelve (12) farms inside the project area. The farm owners are mainly living outside the

project area. Apart from the 12 farms, about 87 fish traders along with tenants and wage laborers are also affected by the project. Socioeconomic profile of the potential affected people has been collected through a questionnaire survey. Such information will be used and further analyzed in the Resettlement Action Plan.

278. The survey team has collected the approximate population of the three fishing villages within 1 to 3 km surrounding the project area through Focus Group Discussion (FGD) and the relevant ward office. The survey indicates that about 3,100 households are living in three fishermen villages. The data are given in **Table 4-30**.

Table 4-30: Number of Household in Three Fishing Villages Around the Project Area

Ward Name	Village Name	Fishermen Household in the village	Total Household in the village
Ward No-11	South Kathtoli	1400	2100
Ward No-39	Akmol Ali Ghat	300	450
Ward No-40	Katghar Jelepara	400	550
	Total	**2100**	**3100**

Source: 2023 FGD and Ward Office of CCC

279. **Average household size**. Based on the household survey, the average household size is 5.4 which is much higher than the national average household size 4.26 in 2022 (HIES 2022). About 28.5% have 5 persons per household, 20.5% have 4 persons, 17.2% have 6 persons, 15.9% have 8+ persons, 8.4% have 3 persons, and 5.4% have 7 persons. **Figure 4-60** shows the percentage of household size in the study area.

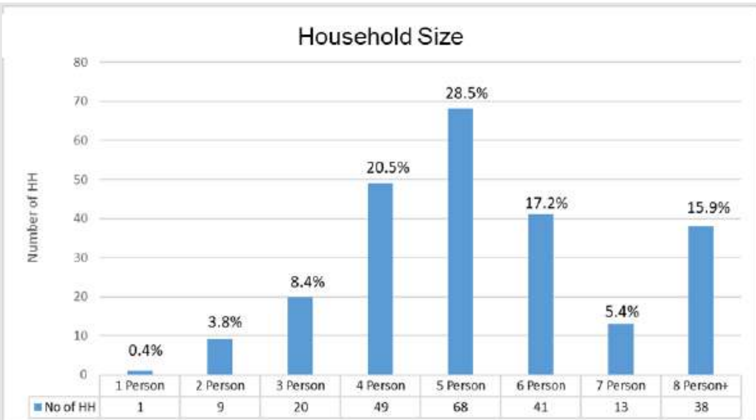


Figure 4-60: Household Size in the Study Area

280. **Quality of Life Indicators**. The quality-of-life indicators (literacy rate, housing condition, WATSAN facilities, and electricity coverage) depict the socio-economic condition of the study area. The present situation of the quality-of-life indicators is described as follows:

281. **Drinking Water**. Approximately 100% of the farm workers inside the project area purchase water from vendors for drinking purposes. For other uses, such as washing, bathing, and cleaning, the workers use pond water, which is located inside firms.

282. According to the household survey in 2022, it was observed that about 60% of households within 1 to 3 kilometers of the project area purchase water, as shown in **Figure 4-61**. The vendor collected water from the CWASA and sold it to the local community. Besides, about 40% of households farm workers inside collect drinking water from the nearest tube well. There are several ponds at the seaside, and some people use this source for washing and bathing.

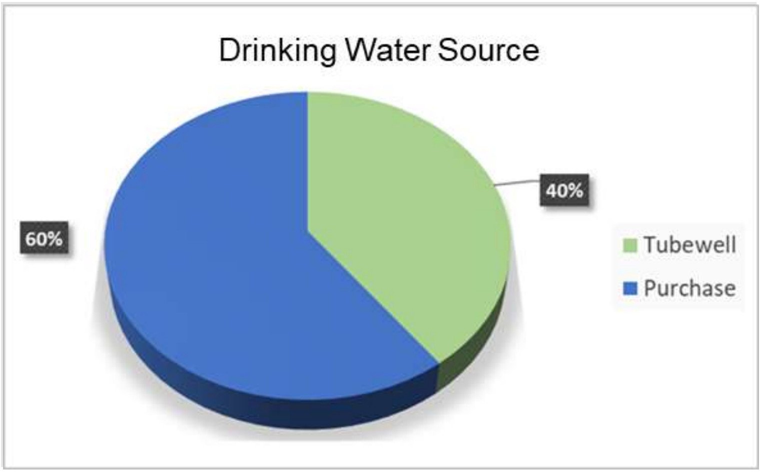


Figure 4-61: Drinking Water Sources of the Households within 1 to 3 Kilometers of the Project Area

283. **Sanitation**. Approximately 100% of the farm workers inside the project area have hygenic (water-sealed) sanitation facilities. The overall sanitation facilities inside the project area are satisfactory.

284. The sanitation facilities of the households within 1 to 3 kilometers of the project area are presented in **Figure 4-62**. It shows that only 51% of households have a hygenic sanitation facility (water-sealed), 23% have a non-water-sealed sanitation facilities, and 26% have non-sanitary sanitation facilities. Overall, sanitation facilities are moderate, and the practice of sanitation is increasing day by day.

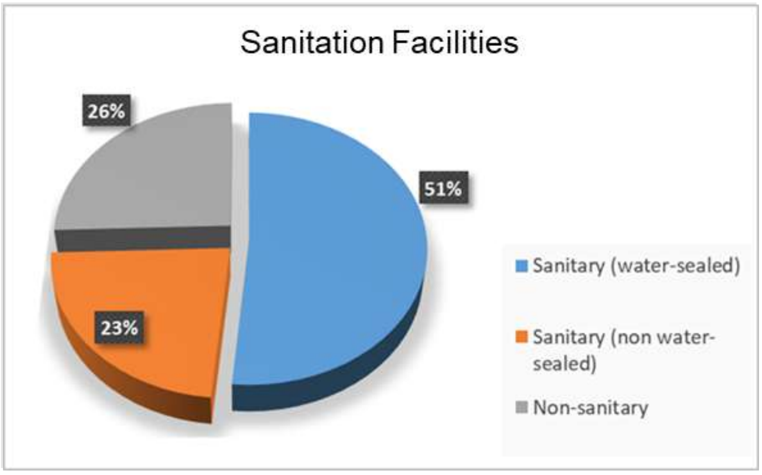


Figure 4-62: Sanitation Facilities of the Households within 1 to 3 Kilometers of the Project Area

285. **Access to Electricity**. 100% of the farm inside the project area uses an electricity connection from BPDB.

286. At present, the power division has declared that Bangladesh has achieved almost 100 percent electricity coverage as a single country in South Asia. However, according to the field survey data, it was observed that about 76.3% of the households within 1 to 3 kilometers of the project area have an electricity connection from BPDB. Other households use solar electricity (9.7%) and generators (15.3%). **Figure 4-63** shows the access to electricity in the study area.

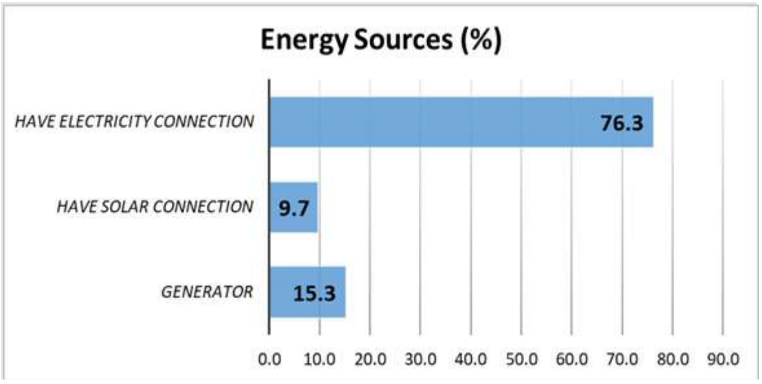


Figure 4-63: Access to Electricity of the Households within 1 to 3 Kilometers of Project Area

287. **Education**. The literacy rate in the study area is 46.70% which is much below than the Chattogram District (58.9%), national level (74.66%) and Chattogram Division (80.90%) (age over 7 years) in 2022. . Comparison of literacy rate at national level, Chattogram district, Chattogram Division and in the study, area is shown **Figure 4-64**.

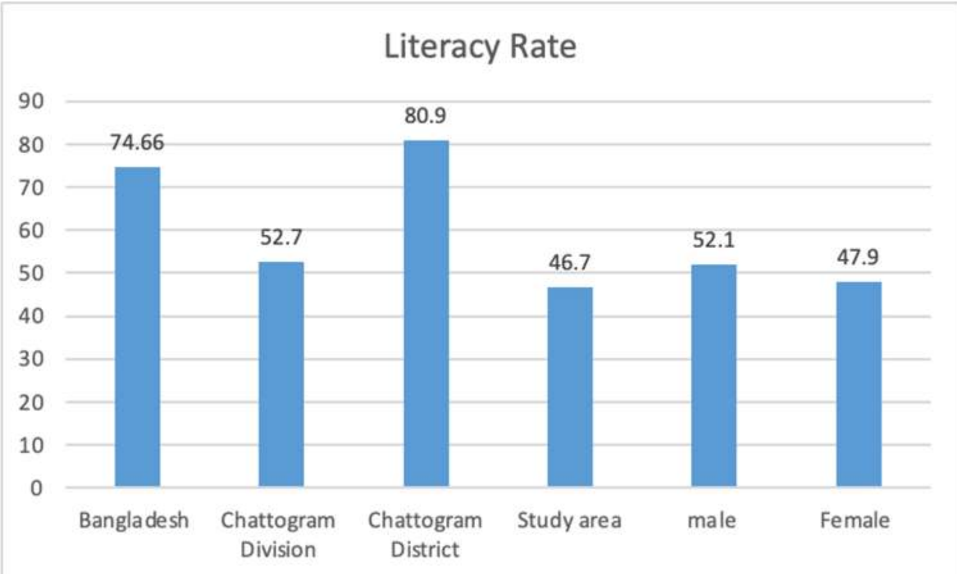


Figure 4-64: Comparison of Literacy Rate with the Study Area

288. **Household Structure**. There are farm structures inside the project area. Approximately 90% of the structures are semi-pucka, and 10% are kutcha structures.

289. According to the household survey, 36% of the houses within 1 to 3 kilometer s of the project area are pucka, 28% are semi pucka, 32% are kutcha (made of wood/bamboo, and other local materials), and 4% of the houses are Thatched *(Jhupri)*, as shown in **Figure 4-65**.

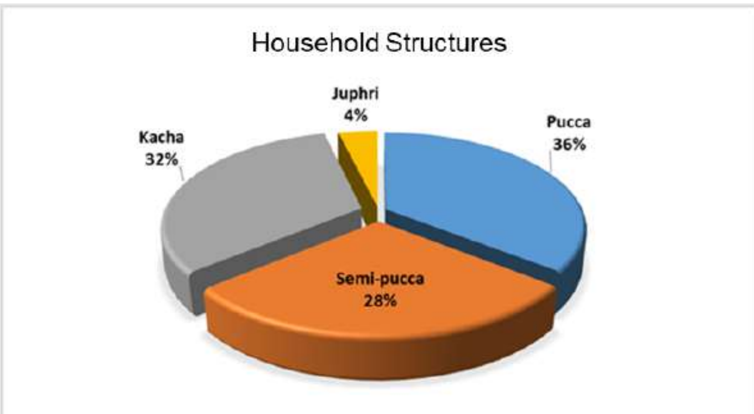


Figure 4-65: Household Structure within 1 to 3 Kilometers of the Project Area

4.4.2. Income and Poverty

290. **Occupation**. Income is an important indicator for assessing the socioeconomic condition of people. As discussed above, inside the project area, there are 37 workers working in the twelve farms on a monthly basis. They are mainly involved in managing, cleaning, feeding, and other work for cattle, poultry, and fisheries.

291. Occupation and income pattern of the affected businessmen (87), tenants, wage laborers are also collected at South Kattoli fish market. Although the market operated seasonally for about 4 months but many of the businessmen, tenants, wage laborers become involved in the fish market. A census and socioeconomic survey have been conducted for the affected structure owners, tenants and wage laborers in the South Kattoli fish market. Profile of the affected people will be presented in the RAP.

292. It was found that about 65.6% of people within 1 to 3 kilometers of the project area are engaged in fishing in the sea, aquaculture, fishing gear manufacturing, and other fish-related businesses. The occupation of the people in the study area is shown in **Figure 4-66**.

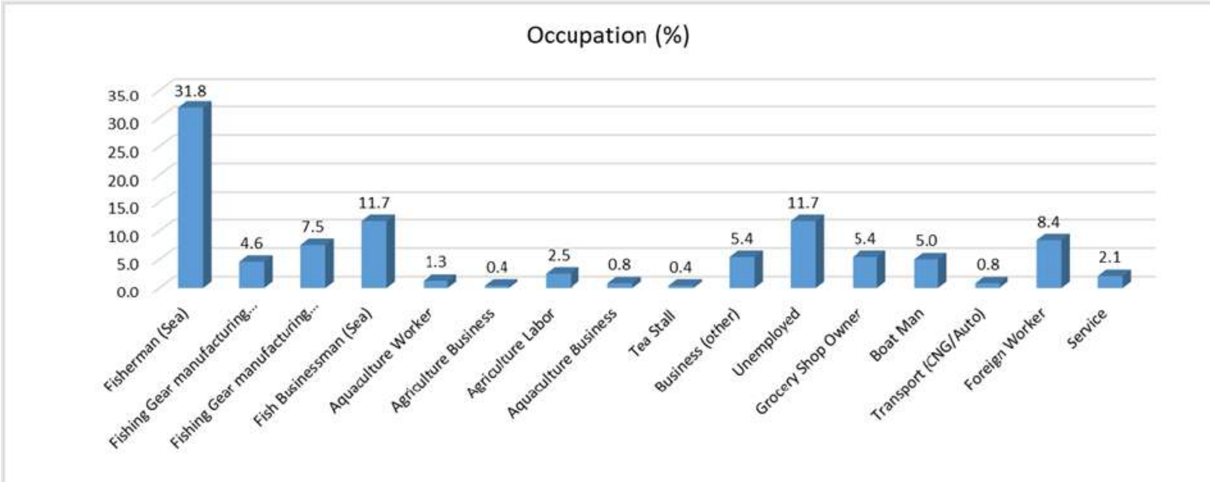


Figure 4-66: Occupation of the People within 1 to 3 Kilometers of the Project Area

293. **Monthly Income**. About 73.3% of people inside the project area has income ranges from 10,000 BDT to 20,000 BDT, 15.56% from 20,000 BDT to 30,000 BDT, 8.89% are below 10,000 BDT, and 2.2% from 50,000 BDT to 60,000 BDT. **Table 4-31** presents the monthly income of the workers inside the project area.

Table 4-31: Monthly Income of the Workers Inside the Project Area

Household income (BDT) in 2023		
<10,000	4	8.89%
10,000≤ <20,000	33	73.3%
20,000≤ <30,000	7	15.56%
30,000≤ <40,000	2	4.44%
40,000≤ <50,000	0	0
50,000≤ <60,000	1	2.2%
60,000≤ <80,000	-	-
80,000 or above	-	-
	45	

294. **Table 4-32** presents the monthly income of the people within 1 to 3 kilometers of the project area. The income of about 80% of people ranges from 10,000 BDT to 30,000 BDT (**Figure 4-67**). During the consultation with the local people, it was identified that the wage varies between 700 Tk and 900 Tk. per day, depending on the field of activity. Sampled respondents were 239 (7.7% of the population living in 1-3km area) whose' income range presented in the table underneath.

Table 4-32: Monthly Income of the Workers Within 1 to 3 Kilometers of the Project Area

Household income (BDT) in 2023 of the workers		
<10,000	10	4.2%
10,000≤ <20,000	114	47.7%
20,000≤ <30,000	82	34.3%
30,000≤ <40,000	25	10.5%
40,000≤ <50,000	3	1.3%
50,000≤ <60,000	2	0.8%
60,000≤ <80,000	-	0.0%
80,000 or above	3	1.3%
	239	

Figure 4-67: Monthly Income of Workers Within 1 to 3 Kilometers of the Project Area

295. The estimates of head count ratio[4] in 2016 for the Chattogram division using the lower poverty line are 8.7% and 18.4% using the upper poverty line. Households receiving benefits from social safety net programs by the Chattogram division are 17.6%. (HIES, 2016).

296. The household survey findings show that the average monthly household income is Tk. 10,000 to Tk. 20,000. According to the survey, about 38% of households can save money from their monthly income, and 62% of households are unable to save. **Table 4-33** presents the monthly savings of the people within 1 to 3 kilometers of the project area.

Table 4-33: Monthly Savings of the People Within 1 to 3 Kilometers of the Project Area

Saving	Household	% of Total Household
0-500	14	6
501-1000	35	15
1001-2000	33	14
2001-5000	8	3
Above 5000	2	1
Total =	92	38

[4] *The population proportion that exists, or lives, below the poverty threshold.*

4.4.3. Gender and Women

297. The survey shows that all of the 37 workers working in the 12 Farms inside the project footprint are male. No female workers are involved in farm activities. Among the 12 Farm owners two are female and 10 male. These workers are mainly involved in feeding the cattle & fish, and cleaning. Within the footprint of the project site, all of the affected entities are economically operated by male businessmen. There are two female headed HHs operating business. Apart from these 12 farms, there are 87 fish traders in the South Kattoli fish market have been affected by the project. A census and socioeconomic survey of the affected entities have been conducted. No female business operators are found affected in the South Kattoli fish market.

298. The male-female ratio within 1 to 3 kilometers of the project area was 52.9, as presented in **Table 4-34**. The literacy rate for the female population is 47.9%.

Table 4-34: Male Female Ratio Within 1 to 3 kilometers of the Project Area

	Male	Female	Total (1)
Adult	350	284	634
Child	335	326	661
Total (2)	685	610	1,295

299. In addition, the male-female ratio indicates a lower disparity for the girl child. However, women in the study area may still be classified as vulnerable because a large fraction of them are not allowed to work, earn a living, or pursue higher-level education due to cultural and religious beliefs. They are mostly relegated to household chores, raising families, and domestic work like raising cattle, etc. They are also occasionally attributed to social evils like child marriage, polygamy, and domestic violence.

300. In general, the population in the project influence area falls into poor and vulnerable categories as most of them have no regular source of income and employment. Many households lack male members as male members of the family died in the sea while finishing. Due to lack of education and skills and in absence of any social safety net programs, these women are solely responsible for taking care of the rest of the household members. In general, women in surrounding project areas are found mostly unemployed and homemakers as there is little job opportunities other than working at the farm. While living in an isolated area and being at the bottom of the socio-economic ladder make these women most vulnerable.

301. The major livelihood risk for women in the project areas is the lack of suitable work for uneducated and unskilled groups of women who are mostly homemakers. There are garments industries around the area, however, women tend not to work in the garment sector due to the lack of skills, mobility restriction and social norms and values. Unemployed and a lack of opportunities for work are more exposed to social problems, which is a matter of concern for women in fishermen's villages and farms. Women in the project area also lack credit and the capacity to develop and manage small-scale economic activities, which could hinder the benefits they could get from the project.

302. Women from Hindu communities preferred locality-based income-generating activities. Some of the Muslim women from the fishermen's village run small shops or tea stalls. Many women from the fishermen villages are not part of any government's Social Safety Net programs, such as widow allowances, maternity allowances, and old age allowances.

4.4.4. Ethnic Minority

303. During the household survey, no ethnic minority population or community was found inside the project area or within the study area.

4.4.5. Common Property Resources

304. A portion of the study area falls under the Bay of Bengal. It is regarded as a common property resource under the ownership of the People's Republic of Bangladesh.

4.4.6. Conflict of Interest & Law and Order

305. The Bangladesh Army appears to have some land adjacent to the project boundary on the southern end, according to a billboard that has been put up at the existing Bay Terminal site. The land's boundary wall may be a point of contention with the Army. If there is any disagreement, it may be resolved through a meeting with the Bangladesh Army. Invite the Bangladesh Army's authorized representative to the stakeholder consultation meeting as well, and address all of their specific questions about the development plan. During the development and operation period, all law and order issues will be managed by CPA, the same as their existing operation at Chattogram Port.

4.4.7. Historical, Cultural and Archaeological Sites

306. Main cultural heritage is "Baruni Snan" is a revered religious bathing festival observed predominantly by Hindus in the Indian subcontinent. This sacred event revolves around the veneration of Lord Shiva and takes place on specific auspicious dates within the Hindu lunar calendar, typically falling in the month of Kartik, which usually corresponds to November. The term "Baruni Snan" derives from Sanskrit and signifies "bathing on the day of Baruni," with "Baruni" being the goddess associated with this occasion. Devotees partake in rituals, including taking a purifying dip in holy rivers or water bodies, to cleanse their souls and seek the blessings of Lord Shiva. Baruni Snan is a profound expression of faith and devotion, fostering a sense of unity and celebration among its participants.

307. In Bangladesh, the Hindu devotees around the Chittagong area gather in large numbers at Kattali Beach to participate in the sacred ritual of 'Baruni Snan.' This significant event involves people of all ages, along with their families, coming together with great enthusiasm to take a holy bath in the sea, aiming to cleanse themselves of sin. Devotees bring various fruits such as coconuts, green coconuts, cucumbers, and bananas, which they ritually throw into the sea, believing it will alter their destiny. This annual ritual occurs during the 'Madhu Krishna Tithi' of Chaitra, the final month of the Bengali calendar. The atmosphere is filled with festivity and devotion as the faithful seek spiritual purification and blessings.

308. The location of Kattali Beach is situated just to the north of the Bay Terminal project boundary. On the day of Baruni Snan, devotees reach the Kattali Beach area by using several routes, including the Rani Rashmoni Snan Ghat sand road (approximately 0.25 km from the north side of the project boundary), the earthen foot road beside Rani Rashmoni Ghat (approximately 0.9 km from the north side of the project boundary) on both sides of the canal, and other available pathways that lead to Kattali Beach.

309. According to Hindu believers, 'Ganga Snan' helps people cleanse themselves of the misdeeds and sins they may have committed. After cleansing themselves, people look forward to a new beginning. The Hindu believes "Ganga Snan helps people relieve themselves of the vicious cycle of birth, life, and death". Hindu believers take a holy dip in Ganga Snan Ghats in the month of Kartik in the Bangla calendar. During the FGD with Hundu community leaders, it was mentioned that the Ganga Snan Ghat (approximately 4.2 km from the south side of project boundary) has been present in the area since 1948.

310. Photos of cultural heritage and the location map (access location & bathing location) are shown on **Plate 4-20** and **Figure 4-68**, respectively. There is no archaeological site found inside the project site.

Photos of Baruni Snan & Rani Rashmoni Snan Ghat

Photos of Ganga Snan Ghat

Plate 4-23: Photographs of Cultural Heritage

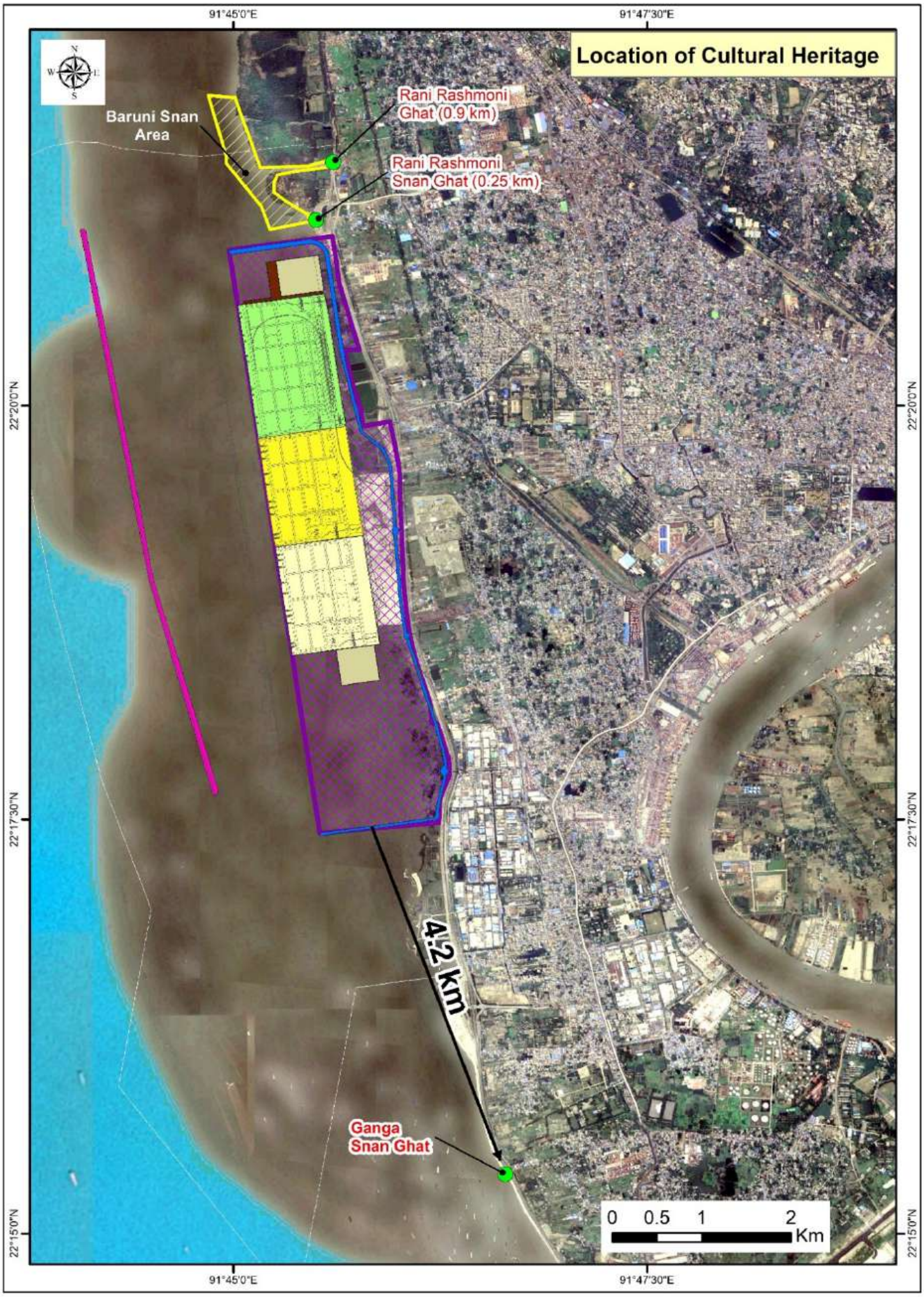


Figure 4-68: Location of the Cultural Heritage

5. Analysis of Alternatives

5.1. Introduction

5.2. Alternative Development (Breakwater)

311. Breakwater structures can adopt types of circular cofferdam or rubble mound breakwater in consideration of the bearing capacity of the underlying soils, marine environment, etc. **Figure 5-1** shows a circular cofferdam breakwater structure, while **Figure 5-2** shows a Rubble Mound Breakwater structure.

312. The capacity resistance of the Cofferdam breakwater is significantly higher than that of the rubble mound breakwater. However, the service life of the rubble mound structure is longer than the cofferdam breakwater, and less maintenance is required for the rubble mound. The rubber mound breakwater requires a lot of stone for its construction. The optimum option is not yet decided at this stage of the study.

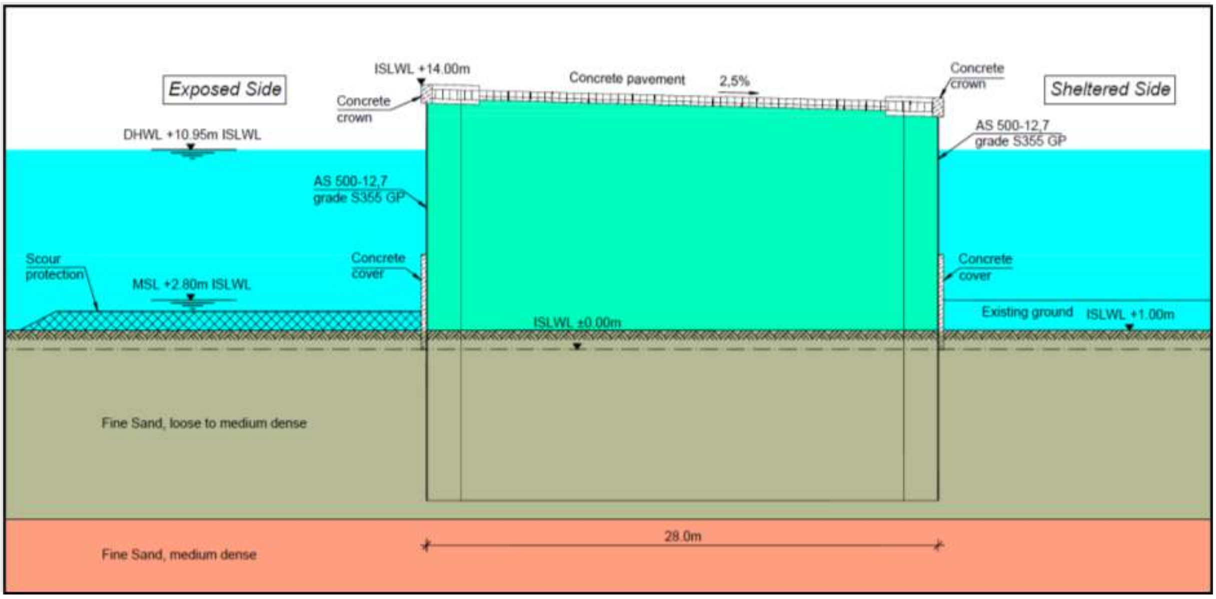


Figure 5-1: Circular Cofferdam Breakwater

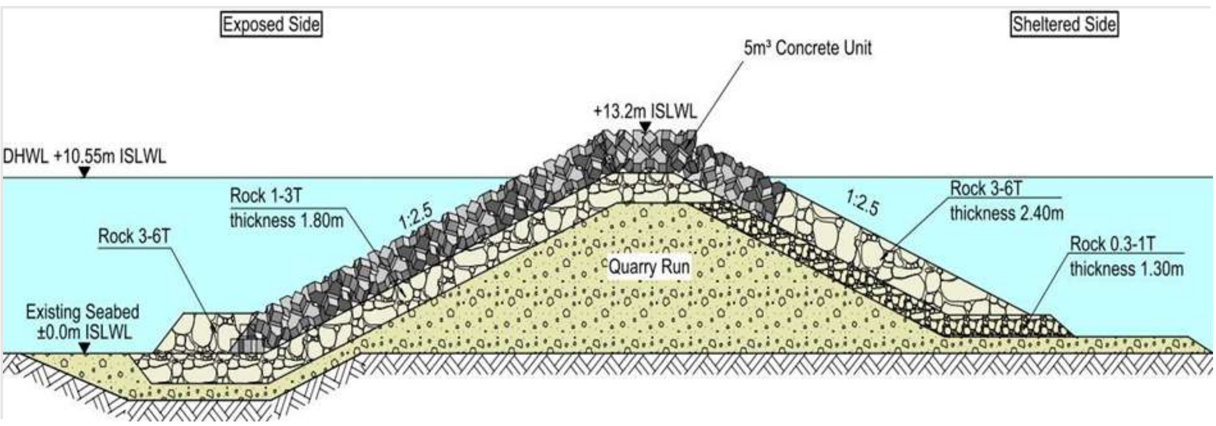


Figure 5-2: Rubble Mound Breakwater

5.3. Alternative Sites

5.3.1. Site Alternative 1 – The Laldia Area

313. **Figure 5-3** shows the Laldia area's location between the river and the airport road. The illegal settlements occupy the area, and construction of a new terminal will require the relocation of the illegal settlers, which raises social and political concerns. It will need consultation and compensation of affected stakeholders. The cumulative impact of noise on the community will be significant. Measures are needed to minimize noise and other nuisances. Lastly, the high density of vessels in the Karnaphuli River Channel will result in more air pollution. **Table 5-1** summarizes of this alternative's advantages and disadvantages.

Table 5-1: Advantages and Disadvantages of the Laldia Area

Advantages	Disadvantages
• It will use the same access channel as the current Chattogram Port, which requires minimal maintenance dredging. • Natural wave assault protection, which doesn't require a breakwater. • There is no length restriction for ships. • Road connectivity.	• Insufficient yard width for the container terminal. • There is insufficient land to build a port terminal to accommodate the anticipated demand. • Require the relocation of the illegal settlers, which raises social and political concerns (impact on ESS5). It also needs consultations and compensations of affected stakeholders. • No connection to rail transport. • Only a 9.2 m draft vessel can move if the existing CPA channel is used. • The Karnaphuli River will experience traffic congestion. • Height restrictions for container cranes during construction due to proximity to the airport will require more expensive handling equipment. • The cumulative impact of noise on the community will be significant (impact on ESS4). Measures are needed to minimize noise and other nuisance to nearby community. • The high density of vessels in the Karnaphuli Channel will result in more air pollution (impact on ESS3).

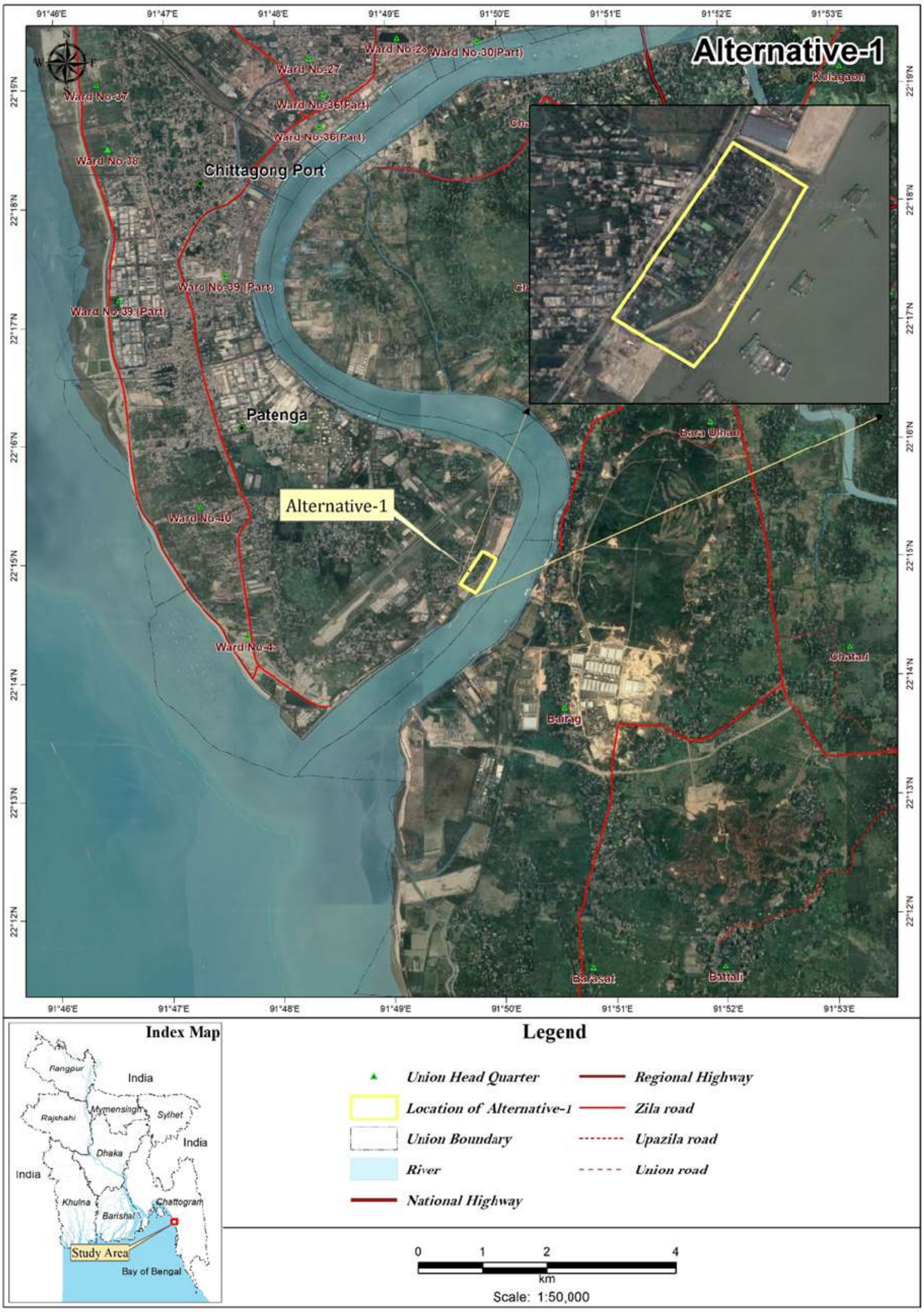


Figure 5-3: Location of the Laldia Area

5.3.2. Site Alternative 2 – Left Bank of the Karnaphuli River

314. **Figure 5-4** shows the left bank of the Karnaphuli River. Alternative 2 is at the estuary between the river's mouth and the KAFCO jetty. The area is currently overlapping with the Bangabandhu Sheikh Mujibor Rahman Tunnel. The cumulative impact of noise on the CUFL factory will be significant. The high density of vessels in the Karnaphuli River Channel will result in more air pollution. Lastly, high-traffic activity has an impact on aquatic organisms. This alternative will increase the tunnel's traffic volume. **Table 5-2** summarizes of this alternative's advantages and disadvantages.

Table 5-2: Advantages and Disadvantages of the Left Bank of the Karnaphuli River

Advantages	Disadvantages
• It will use the same access channel as the current Chattogram Port, which requires minimal maintenance dredging. • There is no length restriction for ships.	• A significant portion (eastern side) is overlapping with the Bangabandhu Sheikh Mujibor Rahman Tunnel • Increase the tunnel's traffic volume • No railway connectivity • Insufficient yard width for the container terminal. • Future expansion is not possible due to the CUFL factory and the Bangabandhu Sheikh Mujibor Rahman Tunnel • There is insufficient land to build a port terminal to accommodate the anticipated demand. • Only a 9.2 m draft vessel can move if the existing CPA channel is used. • The Karnaphuli River will experience traffic congestion. • The cumulative impact of noise on the CUFL factory will be significant (impact on ESS4). Measures are needed to minimize noise and other nuisance to nearby establishments. • The high density of vessels in the Karnaphuli Channel will result in more air pollution (impact on ESS3). • Impact on aquatic organisms due to high traffic activity (impact on ESS6) • Lack of available space for plantation and habitat restoration

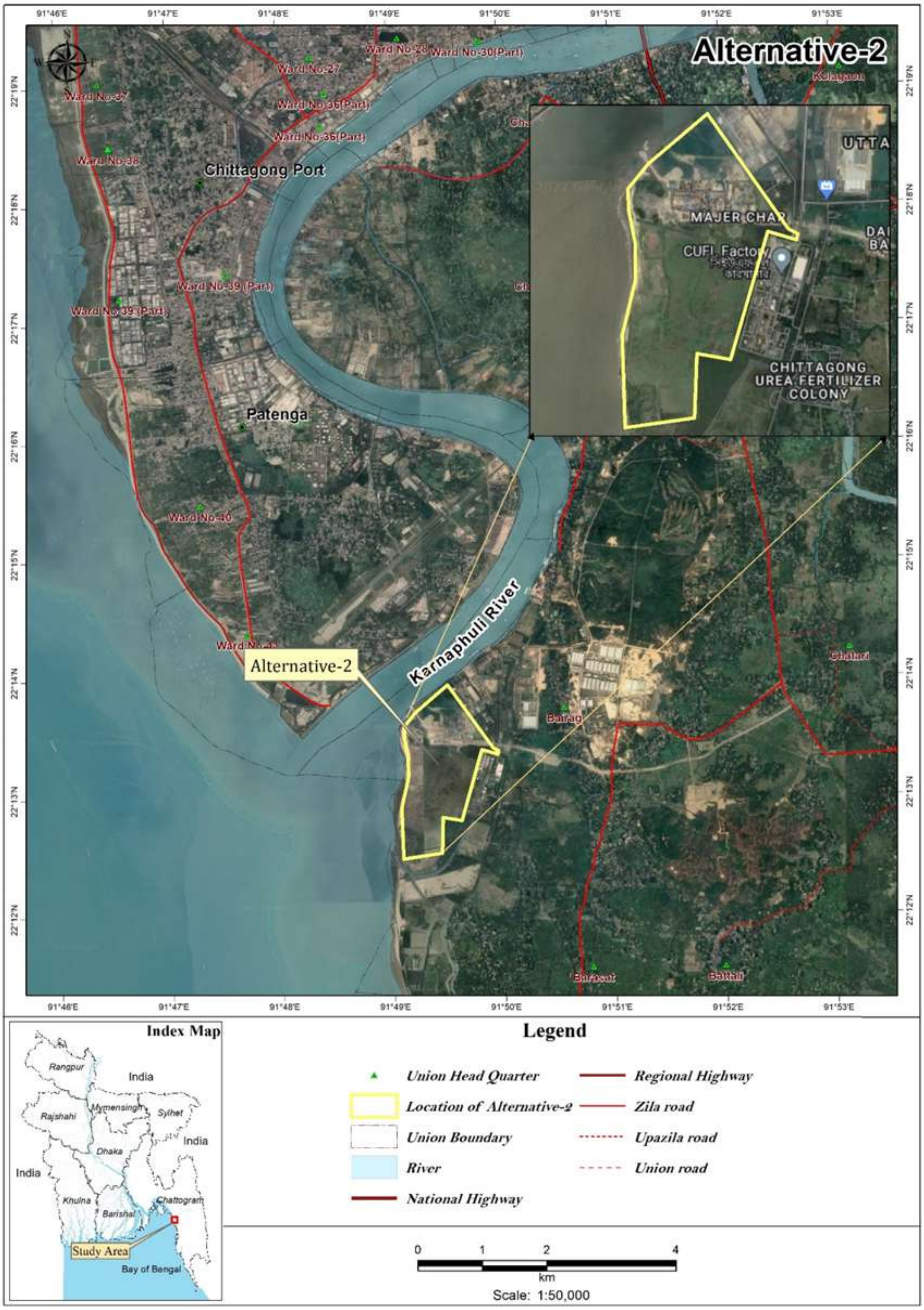


Figure 5-4: Left Bank of the Karnaphuli River

5.3.3. Site Alternative 3 – Bay Terminal Area to the West of Port Link Road

315. Around 2,500 acres of land are available (66.85 private land, 803.17 Khas land, and 1,630 reclaimed land), which can handle the projected demand. Approximately 8 to 10 miles north of the Karnaphuli River estuary and west of the Port Link Road. **Figure 5-5** shows the Bay Terminal area's location. It is close to the Chattogram-Dhaka railway line. It can handle larger vessels of the Panamax and Post-Panamax types (i.e., fourth generation with up to 5,000 TEU). It has a stable natural sandbar about 2 km from the shoreline, which will be used as a breakwater through further development using reclaimed capital dredged materials from the access channel. **Table 5-3** summarizes of this alternative's advantages and disadvantages.

Table 5-3: Advantages and Disadvantages of the Bay Terminal Area

Advantages	Disadvantages
• The majority of the land is non-agricultural land and inter-tidal area. No physical displacement is required. No land acquisition is required for the access road and other utility development. • Sufficient area for development that can handle the projected demand and further expansion • Connectivity to the national road and railway network • There is no length restriction for ships. • It has a stable natural sandbar about 2 km from the shoreline that could protect waves. • Sufficient yard width for the container terminal • It can handle larger vessels of the Panamax and Post-Panamax types. • Less traffic congestion in the Karnaphuli River • Around 9.0 km from the airport runway • The cumulative impact of noise on the community will be less. • Adequate dispersion area for air emission •	• Capital and maintenance dredging are required. • The area overlapped with the Patenga IBA (Interntional Bird Area) for which a Critical Habitat Assessment (CHA) needs to be carried out, and based on which a detail biodiversity management and monitoring plan along with conservation of a compensated protected area would be needed. • For capital channel dredging activities, CPA has to develop a well-planned dredge material management plan.

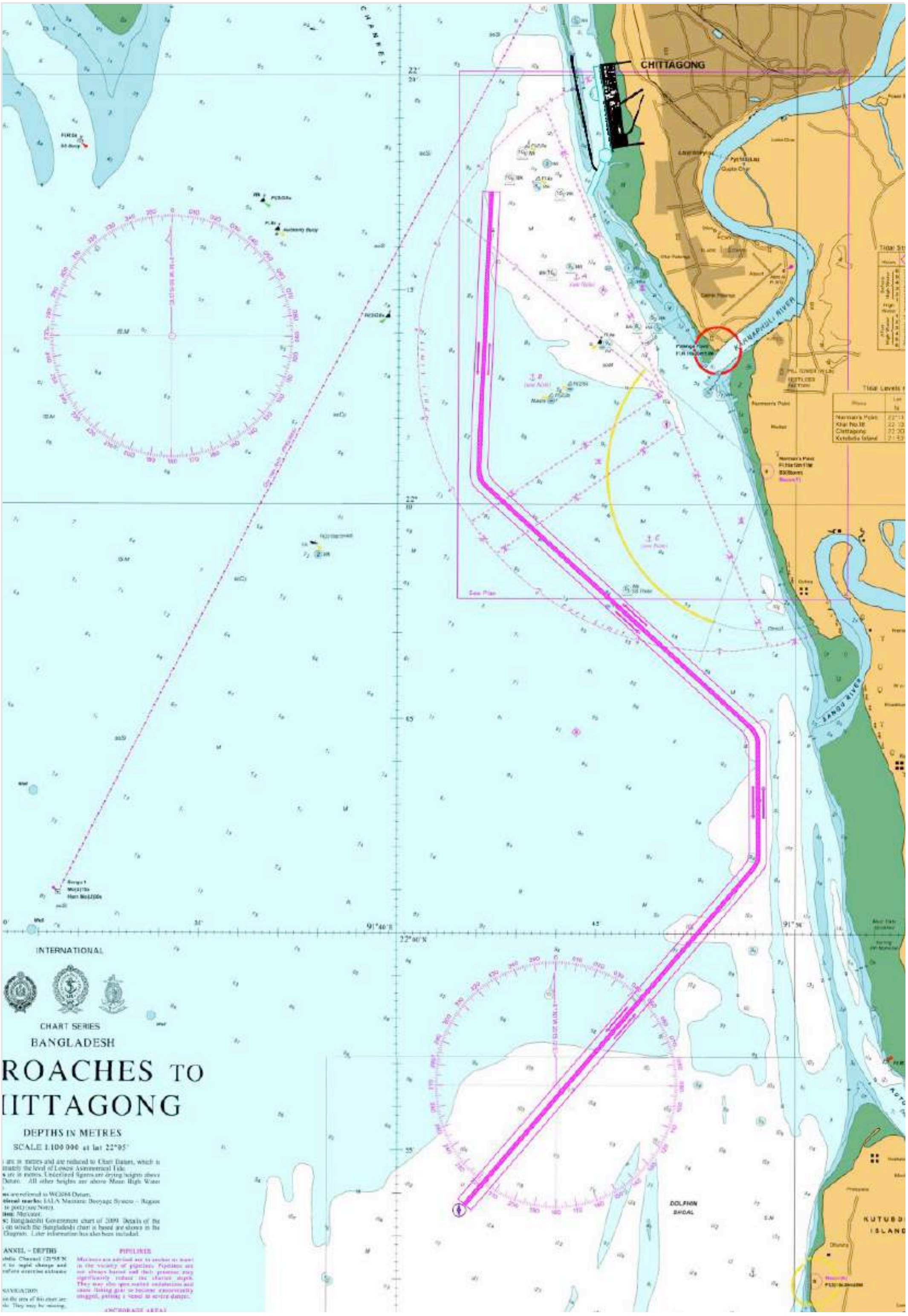
Figure 5-5: Location of Bay Terminal Area

316. Alternative 3 is chosen considering the future demand, economic, environmental, social, and operational considerations.

5.4. Alternative Access Route

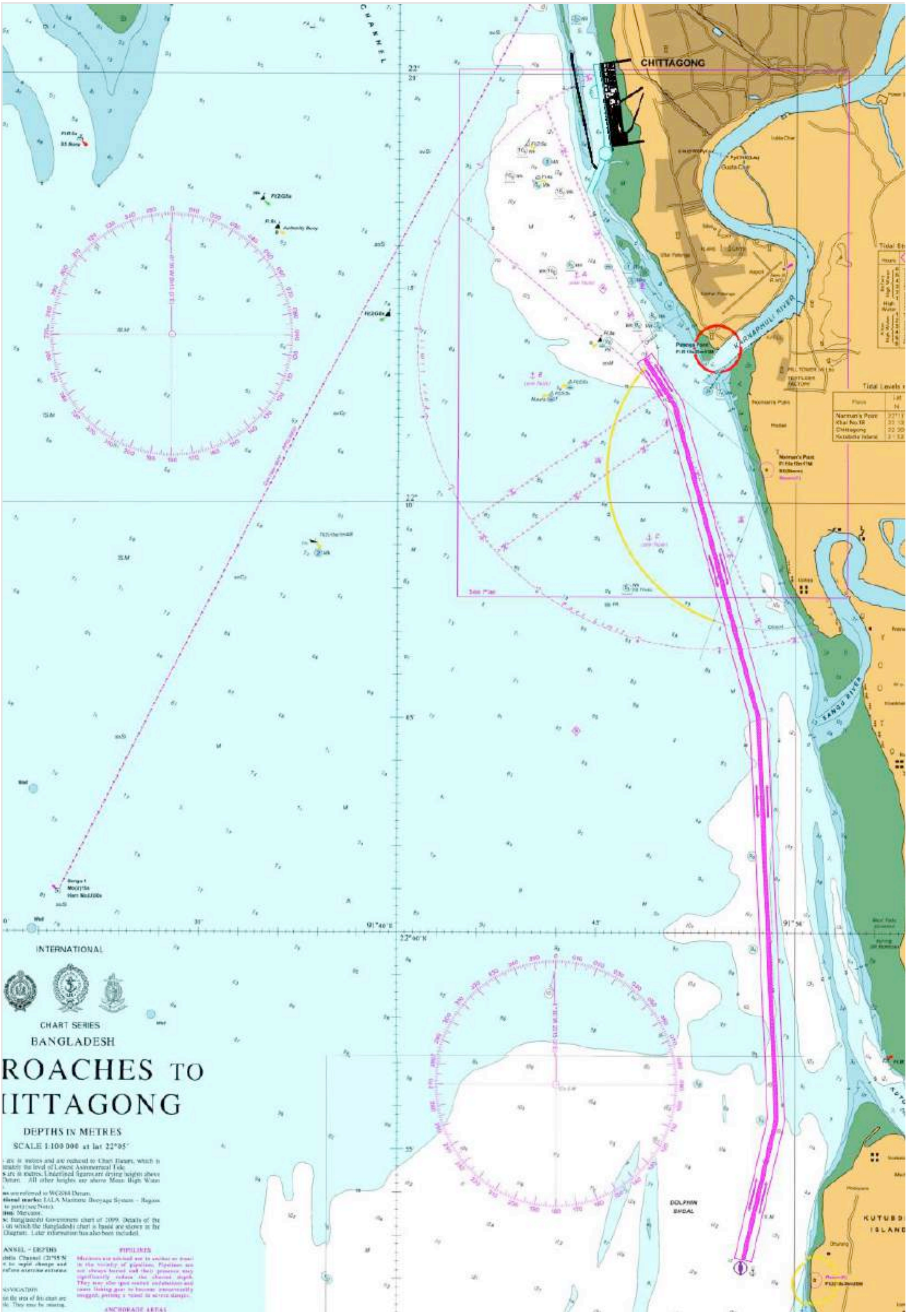
5.4.1. Site 3 Access Route Alternative 1 – CPA's Proposed Access

317. CPA's proposed access will have a lot of disadvantages and limitations thus it must be avoided.



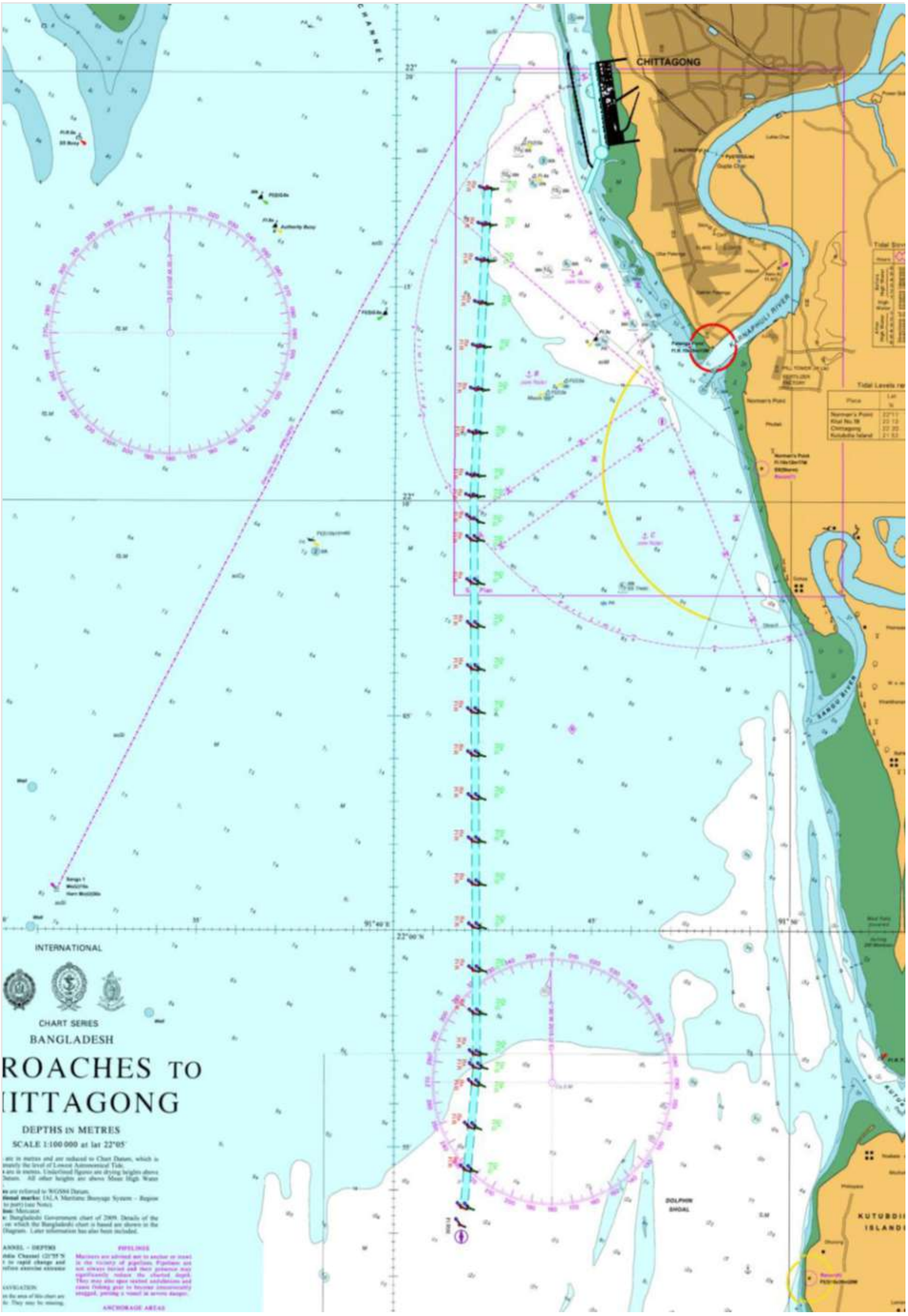
5.4.2. Site 3 Access Route Alternative 2

318. There are shoals at the east side of the access route, which is only a nautical mile away and will have to cross the bow of the inbound and outgoing vessels, which must be avoided.



5.4.3. Site 3 Access Route Alternative 3

319. It is considered the best option. It avoids all sorts of disadvantages in handling approaching and leaving ships.



5.5. Alternative Resources (Power Source)

320. There are two options for receiving the incoming power from the electricity supply company/provider. The first option is Chattogram Bay Terminal shall receive power through its incoming line for each terminal (CT-1, CT-2, and MT), and the second option is to receive power through a single incoming line to a main substation, from which the power will be distributed to each terminal. The second option is adopted for Bay Terminal.

5.6. No Project Alternative

321. The no-project alternative will have a lower environmental and social impact. However, the problem with the Chattogram port having the current maximum draft of the port of just 9.2 meters, which needs to be deeper for many modern container ships, will not be resolved. It will still require a time-consuming and costly transfer operation, as smaller ships must transport cargo to and from big ocean freighters anchored out in the bay.

6. Environmental and Social Impacts and Mitigating Measures

6.1. Introduction

322. This preliminary ESIA study aims to identify the potential environmental and social impacts of the project during each of its development phases and specify the areas that are likely to be affected due to the project's implementation. Impact identification starts early in scoping when the project, environment, and social data are available. The anticipated impacts are determined by thorough scientific analysis and the logical opinion of the experts and analyzed on a temporal and spatial basis. The impacts of the proposed project activities may be beneficial or negative, temporary or permanent in nature.

6.2. Assessment of Impact

323. **Table 6-1** summarizes the assessment of impact during the pre-construction, construction, and operation phases. The project activities are presented against the resources or receptors.

Table 6-1: Summary of Impact Assessment for the Project

No.	Project Activity / Potential Sources of Impact	ESS1 and ESS3					ESS2			ESS4		ESS5	ESS6	ESS8	ESS10
		Soil and Sediment Quality	Coastal Morphology	Surface Water Quality	Ambient Air Quality	Noise Level	Additional Income/Employment Opportunity	Fishing Activities	Occupational Health and Safety	Community Health and Safety	Road and Vessel Traffic and Transport	Land Acquisition and Involuntary Resettlement	Terrestrial and Marine Ecology	Archaeological and Cultural Sites	Stakeholder Engagement
A.	**Pre-Construction and Construction Phase**														
A.1	Site development (reclamation, leveling, and compaction)	√			√	√			√	√			√		
A.2	Accidental spillage of fuel from storage areas, machines, transport vehicles, diesel generators, dredgers, and vessels	√		√					√	√			√		
A.3	Storage and disposal of construction and demolition (C&D) debris and municipal solid waste (MSW)	√													
A.4	Accidental spillage of hazardous waste from the storage area	√							√				√		
A.5	Capital dredging and reclamation		√	√				√					√		
A.6	Disposal of unsuitable soil at an offshore disposal site		√	√									√		
A.7	Dredging of sand from the sand extraction area and discharge in the reclamation area		√	√				√					√		
A.8	Contaminated surface runoff from a land-based construction area			√									√		
A.9	Discharge of untreated sewage from the construction area and untreated bilge and ballast water			√									√		
A.10	Transport of construction materials, equipment, and manpower and operation of heavy equipment and standby diesel generator sets.				√	√		√	√	√	√		√	√	
A.11	Piling Activity					√		√					√		
A.12	Sourcing of manpower for construction activity						√								
A.13	Sourcing of construction materials from local suppliers						√								
A.14	Opportunity for local enterprises						√								
A.15	Influx of non-resident workers to the area									√					
A.16	Land acquisition of private land/ Restrictions on land use											√			

No.	Project Activity / Potential Sources of Impact	ESS1 and ESS3					ESS2			ESS4		ESS5	ESS6	ESS8	ESS10
		Soil and Sediment Quality	Coastal Morphology	Surface Water Quality	Ambient Air Quality	Noise Level	Additional Income/Employment Opportunity	Fishing Activities	Occupational Health and Safety	Community Health and Safety	Road and Vessel Traffic and Transport	Land Acquisition and Involuntary Resettlement	Terrestrial and Marine Ecology	Archaeological and Cultural Sites	Stakeholder Engagement
A.17	Exclusion of vulnerable groups from stakeholder engagement and project benefits														√
B.	**Operation Phase**														
B.1	Discharge of operational wastewater			√									√		
B.2	Accidental spillage of fuel from dredgers and vessels			√					√				√		
B.3	Discharge of untreated sewage			√					√	√			√		
B.4	Maintenance dredging			√									√		
B.5	Transportation of container				√	√			√	√			√		
B.6	Operation of standby diesel generator sets				√	√									
B.7	Container handling activities					√			√	√					
B.8	Sourcing of manpower for operations						√								
B.9	Opportunity for local enterprises						√								
B.10	Influx of non-resident workers to the area								√	√					

Note: The positive impacts are green-colored.

6.3. Potential Impacts and Mitigating Measures during Pre-Construction and Construction Phase

6.3.1. Potential Impacts related to Assessment and Management of Environmental and Social Risks and Impacts (ESS1) and Resource Efficiency and Pollution Prevention and Management (ESS3)

6.3.1.1. Potential Impact to Soil and Sediment Quality

Potential Sources of Impact

- Site development (reclamation, leveling, and compaction)
- Accidental spillage of fuel from storage areas, machines, transport vehicles, diesel generators, dredgers, and vessels
- Storage and disposal of construction and demolition (C&D) debris and municipal solid waste (MSW)
- Accidental spillage of hazardous waste from the storage area

Impact Assessment

324. Site development. Importation of foreign fill material and compaction of the soil surface may cause disturbance to the soil.

325. Soil contamination due to accidental spillage of fuel. Soil contamination due to accidental spillage of fuel from storage areas and during handling. Accidental leakage and spillage of fuel from machinery and equipment have the potential to impact soil quality. Oil spills from dredgers and vessels during dredging and transportation may contaminate the soil.

326. Accidental spillage can occur due to errors in the manual handling of fuel and lubricants or due to the mixing of these substances with surface runoff generated during a rainfall event. The contamination of fuels and chemicals may affect soil microbes and bacterial growth, which can lead to a change in soil quality.

327. Soil contamination from C&D debris and MSW. The C&D debris is not chemically active and does not influence the chemical properties of the soil, but it can influence the physical properties of the soil if it is stored on the bare soil. Storage of MSW in non-designated areas and disposal on bare soil can influence the pH and nutrient level of the soil.

328. Soil contamination due to accidental spillage of hazardous waste. Hazardous waste that may be generated includes oily substances such as rags, gloves, spill pads, oily debris, lube oils, and non-oily substances such as batteries. Non-adherence to waste management procedures resulting in accidental spillage may affect the soil quality. Hazardous waste may be toxic to soil fauna and microbes. These substances are slow to decompose and persist in the affected area for an extended period of time.

Mitigating Measures

- Allocation of the protected sections or premises from external factors impacting the temporary disposal of waste.
- Hazardous wastes should be packed properly and have the relevant labels.
- Hazardous waste management should be undertaken by the contractor having the relevant permit for such activity and following good international practices and applicable local and international regulations.
- Strict control of the waste management process. To maintain the special logbook for the purpose of recording the quantity of the generated wastes, types, and further management processes;

- All rubbish, waste materials, and debris shall be systematically cleared from working areas as they accumulate; all such materials should be cleared at the end of each working day.
- If the removal of waste materials at the end of the working day is not possible, the materials should be covered with tarpaulin or something similar.
- Waste materials not removed directly from the site shall be temporarily stored at designated points and covered, pending removal from the site.
- Fuels will be stored in dedicated storage area having secondary containment.

6.3.1.2. Potential Impact to Coastal Morphology

Potential Sources of Impact

- Capital dredging
- Disposal of unsuitable soil at an offshore disposal site
- Dredging of sand from the sand extraction area and discharge in the reclamation area

Impact Assessment

The dredging activity may change the hydrodynamic pattern of the area, which could impact the coastal morphology of the area.

Mitigating Measures

- Implement a dredging technology that has the least impact on coastal morphology.
- Unsuitable soil from the reclamation area will be disposed of at the designated disposal site.
- Limit sand extraction to avoid the creation of scattered deep holes in the area.

6.3.1.3. Potential Impact on Surface Water Quality

Potential Impact Sources

- Capital dredging
- Disposal of unsuitable soil at an offshore disposal site
- Dredging of sand from the sand extraction area and discharge in the reclamation area
- Accidental spillage of fuel from dredgers and vessels used for transportation of dredge and construction materials.
- Contaminated surface runoff from a land-based construction area
- Discharge of untreated sewage from the construction area and untreated bilge and ballast water

Impact Assessment

329. As discussed in Section 4.2.4.3, most of the parameters except DO and total coliform in the primary monitoring stations were within the water quality standards.

330. Dredging and disposal of unsuitable soil. During dredging, the resuspension of bottom sediments may increase water turbidity. Excessive turbidity can cause attenuation of light in the water column, thus reducing the photosynthetic activity of marine plants, including algae, seagrasses, phytoplankton, and symbiotic algae (Zooxanthellae). The impacts of reduced light can deteriorate the health of aquatic plants and other species. As marine plants form an essential part of the structure of many marine communities, the impacts of excessive turbidity can extend beyond the direct impacts on the marine plants themselves to other assets such as fauna in the marine ecosystem. Suspended sediments in the water column can affect animals that use gills for breathing, as these can become clogged by

sediments, which reduces their ability to breathe and feed. Visual feeders reduce their ability to find food and other organisms that use visual cues for communication, which might lead to turbidity-induced behavioral disruption. When it settles, the suspended sediment will smother benthic organisms, corals, seagrasses, and other environmental assets, reducing their ability to grow and, in the worst case, leading to mortality.

331. Dredging of sand from sand extraction area. The dredging of sand will mobilize fine seabed sediments into suspension and increase the turbidity level.

332. Surface water contamination due to accidental spillage of fuel and hazardous waste. Oil spills from dredgers or vessels during dredging and transportation will impact the water quality. In addition, oil spill will reduce the light penetrating water affecting the photosynthetic efficiency of the marine phytoplankton and impact the aquatic ecology and benthos.

333. Surface runoff from land-based construction area. Surface runoff during rainfall will result to contamination of large amount of total suspended solids (TSS) levels at receiving waterbody. It will also increase the turbidity that may have impact to aquatic ecology and benthos.

334. Discharge of untreated sewage and bilge and ballast water. The accidental release of untreated sewage can happen in case of malfunctioning of septic tank. Untreated sewage discharge into nearby marine area will increase the organic load and bacterial load which lead to degradation of surface water quality (increase the BOD and E. Coli and decrease the DO level). In addition, the discharge of untreated bilge and ballast water may impact on surface water quality.

Mitigating Measures

- The fueling equipment should be equipped with breakaway hose connections that provide emergency shutdown of flow in case of connection failure.
- International standards for refueling dredgers should be followed.
- Absorbents should be present at places of refueling.
- Make bilge water pumping a requirement for all dredgers and vessels for internal transfers and transfers to the shore reception facility. Waste and bilge water from dredgers and vessels should be collected and further discharged at a designated discharge point. Collect the oily sludge for safe disposal or treatment using the existing established facilities at Chattogram Port.
- A thorough dredge management plan, including EHS components, that complies with international standards must be submitted by dredging contractors before the dredging is started and must be acknowledged and authorized by the CPA consultant team. Throughout the dredging, the dredging contractors must adhere to the authorized dredging plan.
- Accidental spills will be managed through the preparation and implementation of an emergency response plan to be prepared by the contractors as part of the OHS Plan.
- Monitoring of the implementation of the environmental and social management plan should be done by engaging monitoring mechanisms.
- Implement a dredging technology that has the least impact on surface water quality.
- Unsuitable soil from the reclamation area will be disposed of at the designated disposal site.
- All sewage generated from the construction area will be treated.

6.3.1.4. Potential Impact on Ambient Air Quality

Potential Impact Sources

- Fugitive dust emissions from site development activities like grading and leveling, construction activities like earthwork for the foundation of buildings and civil infrastructure, and the handling of construction materials like sand, cement, and aggregate.
- Emission during transport of construction materials, equipment, and manpower and operation of heavy equipment and standby diesel generator sets.

Impact Assessment

335. As discussed in Section 4.2.4.1, ambient air quality in Chattogram was categorized as "unhealthy" based on the CASE project under the DoE. The particulate matter based on the secondary data exceeded the standard but based on the ambient air quality monitoring in September 2022, the concentrations of PM_{10}, $PM_{2.5}$, SO_2, and NO_2 were well within the standard.

336. Fugitive dust from site development, earthwork, and civil work. Site development and construction activities will generate fugitive dust. The extent of potential impacts from dust will depend on the exact location of these activities and on the weather conditions. The vehicular movement on the roads may generate fugitive dust. Fugitive dust may be generated from the storage area of sand and cement. It may be generated during the handling of construction materials.

337. Emissions during the transport of construction materials, equipment, and manpower and the operation of heavy equipment and standby generator sets. Emission from vehicles due to the transportation of construction materials, equipment, and manpower to the site and the operation of heavy equipment and standby generator sets will contribute to the air pollution (primarily PM, NOx, SOx, and CO) in the ambient air.

Mitigating Measures

- Vehicle speed restrictions (e.g., 20 km/h) must be enforced to control dust generation.
- Construction materials must be covered to protect them from wind action.
- Spray water regularly to suppress fugitive dust.
- Provide pollution control devices in equipment and machinery emission stacks.
- Ensure proper and regular maintenance of engine-driven construction equipment.
- Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards.
- Conduct regular maintenance on dredgers.

6.3.1.5. Potential Impact on Noise Level

Potential Impact Sources

- Site development activities, construction activities, and handling of construction materials (site clearing and preparation, excavation and concrete placement, erection of structures, concrete mixing and aggregate production systems, construction camps and ancillary facilities, drilling of bored pile activities, and haulage and general vehicle movements.)
- Piling activity
- Transport of construction materials, equipment, and manpower and operation of heavy equipment and standby diesel generator sets (mostly vehicles involved in construction activities such as engine running, hydraulic horns, and loading and unloading activities).

Impact Assessment

338. Site development activities, construction activities, and handling of construction materials. Various construction activities will cause noise and vibration and can affect receptors near

the construction sites. The vibration may affect the stability of nearby structures. The noise during the construction phase depends on the stage of construction work and the equipment used at the site.

339. Piling activity. The noise level from piling driving activity is high depending on the piling method, and the impulsive nature of piling noise can cause a nuisance. The pile-driving activity is about 1.2 m in diameter and 60 m long. Using the "Hydraulic Push" system, approximately 3200 numbers of the pile in Bay Terminal sites could increase the ambient noise level for local communities' proximity to the sites. Piling acitivty can also generate high underwater and air noise levels.

340. Transport of construction materials, equipment, and manpower, and operation of heavy equipment and standby diesel generator sets. The transportation of construction materials, equipment, and manpower and the operation of heavy equipment will increase the noise level.

341. Noise Modelling. The Bay Terminal and Port Link Road operation is expected to raise the noise level. To understand the level of noise generated by project activities, noise propagation modeling has been performed for five different scenarios: i) noise propagation during the base condition (pre-project phase), ii) only during the construction phase of the proposed project, iii) during the construction phase of Bay Terminal with the base condition, iv) only during the operation of Bay Terminal, and v) noise propagation during the operation of Bay Terminal with Port Link Road, Marine Drive, and CEPZ. In general, prolonged exposure to high noise levels can have adverse health effects and increase stress levels in vulnerable communities. It can also permanently impair the hearing ability of those who are exposed. The details of the noise modeling output for the different scenarios and its cumulative impacts on noise are discussed in the following sections.

342. Sound will be created mainly from the proposed Bay Terminal, Marine Drive Road, CEPZ, and other sources. During the construction of the Bay Terminal, the sound will be generated by the movement of construction vehicles, pilling activities, concrete mixing machines, earth filling, dredging, etc. The motorized vehicle's movement vibrates and radiates energy as acoustic pressure or waves through a medium, such as air, water, or a solid. Sound and noise have many important characteristics for impacts, including loudness (energy intensity), frequency, and fluctuations over time.

343. Noise is often not constant and fluctuates over time because of the characteristics of the source. For example, road traffic noise will fluctuate due to changes in traffic volumes, vehicle types, and speeds. This fluctuation makes it difficult to adequately describe and classify them at the receiving point. During the operation of the Bay Terminal, containers will be transported through mother vessels and lighterage through the Bay of Bengal. During container transshipment, the cranes and generators will be run, and the main engine will generate noise. Major sources of noise generated from different activities are presented in **Table 6-2**.

Table 6-2: Generation of Noise from Different Sources in dBA

Source of Noise Generation	Noise level (dBA)	Source Type
Mother vessel	75-85	Line
Lighterage vessel	85-95	Line
Shipyard Crane	105-110	Area
Tugboat	100-110	Line
Helper tugboat	100-110	Line

344. Sound pressure levels are measured in units of decibels (dB). The dB scale is logarithmic. To illustrate this, two concurrent noise sources, each generating 60 dBA, will produce 63 dBA, estimating their cumulative effects. The noise impact assessment aims to determine whether noise levels at the sensitive receivers in the study area exceed the applicable noise level standards. If so, abatement measures will be required to reduce the impact at the

source level through engineering design, barriers, or providing PPE to the workers. The receptor points in the modeling study are selected based on social sensitivity. Moreover, the possible impacted areas or impact potentiality due to the operational activities of Bay Terminal, movement of the vehicle by the port link road and existing marine drive, and industrial activities from CEPZ are also accounted for in selecting the receptor point. The sensitive receivers are listed in **Table 6-3**.

Table 6-3: List of Sensitive Receivers

ID	Receiver name	Coordinates in meter (UTM)		Baseline Noise level (dBA)			Receivers Type
		X	Y	Day	Night	Lden	
R1	Bangladesh Railway Gov. High School	375465.2	2469354.9	48.9	55.3	55.3	Commercial (P. Mixed)
R2	Khalishahar Cant. Public School and College	374534.9	2470969.6	50.7	57.1	57.1	Commercial (P. Mixed)
R3	Halishahar Housing Estate High School	373894.6	2470600.4	51.0	57.4	57.4	Commercial (P. Mixed)
R4	Jarina Mafzal City Corporation College	374847.5	2468425.0	51.3	57.7	57.7	Commercial (P. Mixed)
R5	Halishohor Meher Afjal High School	374619.7	2467245.9	51.2	57.6	57.6	Commercial (P. Mixed)
R6	National Maritime Institute	375287.9	2466543.2	52.2	58.6	58.6	Commercial (P. Mixed)
R7	Halishahar Public School and College	373743.9	2470843.7	52.4	58.8	58.8	Commercial (P. Mixed)
R8	Dr. Fazlul Hazera Degree College	373785.5	2471665.3	53.0	59.4	59.4	Commercial (P. Mixed)
R9	Hazi Abdul Ali Gov. School	374712.9	2472524.5	54.2	60.6	60.6	Commercial (P. Mixed)
R10	Holy City Ideal School and College	374147.1	2471097.5	54.9	61.3	61.3	Commercial (P. Mixed)
R11	Bashonti Girls High School	373611.8	2472244.6	57.0	63.4	63.4	Commercial (P. Mixed)
R12	Abbas Para Primary School	373818.9	2470313.4	53.2	59.6	59.6	Industrial
R13	Chattogram Mohila Polytechnic Institute	374001.2	2469586.3	54.2	60.6	60.6	Industrial
R14	South Halishahar High School	374819.7	2464738.8	56.2	62.6	62.6	Industrial
R15	Halishahar Alhaj Mohabbat Ali City College	374038.7	2469294.9	61.1	67.5	67.5	Industrial
R16	Navy Colony Primary School	374390.8	2465616.9	60.9	67.3	67.3	Industrial
R17	Ananda Bazar Gov. Primary School	373820.6	2468553.4	70.2	76.6	76.6	Industrial
R18	Navy Anchorage School and College	374041.3	2464643.5	64.0	70.4	70.4	Industrial
R19	Port Colony Primary School	375401.1	2468984.4	70.3	76.7	76.7	Industrial

345. The sensitive receivers are mainly located on the east side of Marine Drive (coastal road) and CEPZ. However, the noise level data for those points was assumed to depend on the proximity, position, similarity, and nature of the receptors. Maximum areas of the receptor point are reported as mixed areas during field investigation. The standard values have been considered as per the Noise Control Rule (ECR, 2006) of the DoE.

346. At present, the ambient noise level at sensitive receptors ranges from 55 dBA to 65 dBA during the day and from 53 dBA to 60 dBA during the night. Marine drive roads, industrial areas, sea breeze, shoreline wave break, rustling, engine boats, transportation, and other sources are the major sources of the ambient noise level. During baseline noise level monitoring, ambient temperature has been considered at 320 °C and humidity at 78%.

347. iNoise is a noise modeling software that concentrates on the simulation of noise. It has a simplified, intuitive user interface. The level of surface noise generated from the river or sea vessels is accounted for through the iNoise software. Noise emitted from various sources propagates and disperses over a given terrain, following the laws of physics. The majority of environmental noise simulations are small to medium projects tasked with checking the legal compliance of a planned route or an expansion to an industrial facility. Noise modeling software suited for these projects must be specially designed to acquire the model data via an import interface quickly or to allow digitizing the essential data on top of an aerial map. Several standard processes can be calculated through this model. The calculations are based on the ISO 9613 method and the recommendations of the new quality standard ISO 17534. Different factors are considered for predicting the noise level, such as the amount of noise generated from the source, a number of vessels, frequency of movement, noise from cargo and container handling, vehicle movement by marine drive and port link road, ambient environment, transportation route width, etc. The ambient atmospheric conditions for the modeling study are identical to those for the baseline investigation, where a 250-m grid is considered for noise propagation assessment.

348. During the field visit, the noise level of the receiver (19 points) has been measured with the noise meter, and the model has been validated based on the measured values.

349. The noise modeling has been for three scenarios. The cases are as follows:

- Scenario I: Base condition (Marine Drive Road with CEPZ)
- Scenario II: Only the construction phase of Bay Terminal without considering the base condition (Marine Drive Road with CEPZ)
- Scenario III: Construction of Bay Terminal + Base Condition (Marine Drive Road with CEPZ)
- Scenario IV: Only Operation of Bay Terminal with Bay Terminal Access Road without considering the Base Condition (Marine Drive Road with CEPZ)
- Scenario V: Operation of Bay Terminal, including Bay Terminal Access Road and Base Condition (Marine Drive Road with CEPZ)

350. **Figure 6-1** to **Figure 6-10** show the noise modelling of each scenario. **Table 6-4** shows the comparison of base scenario with scenarios III and V.

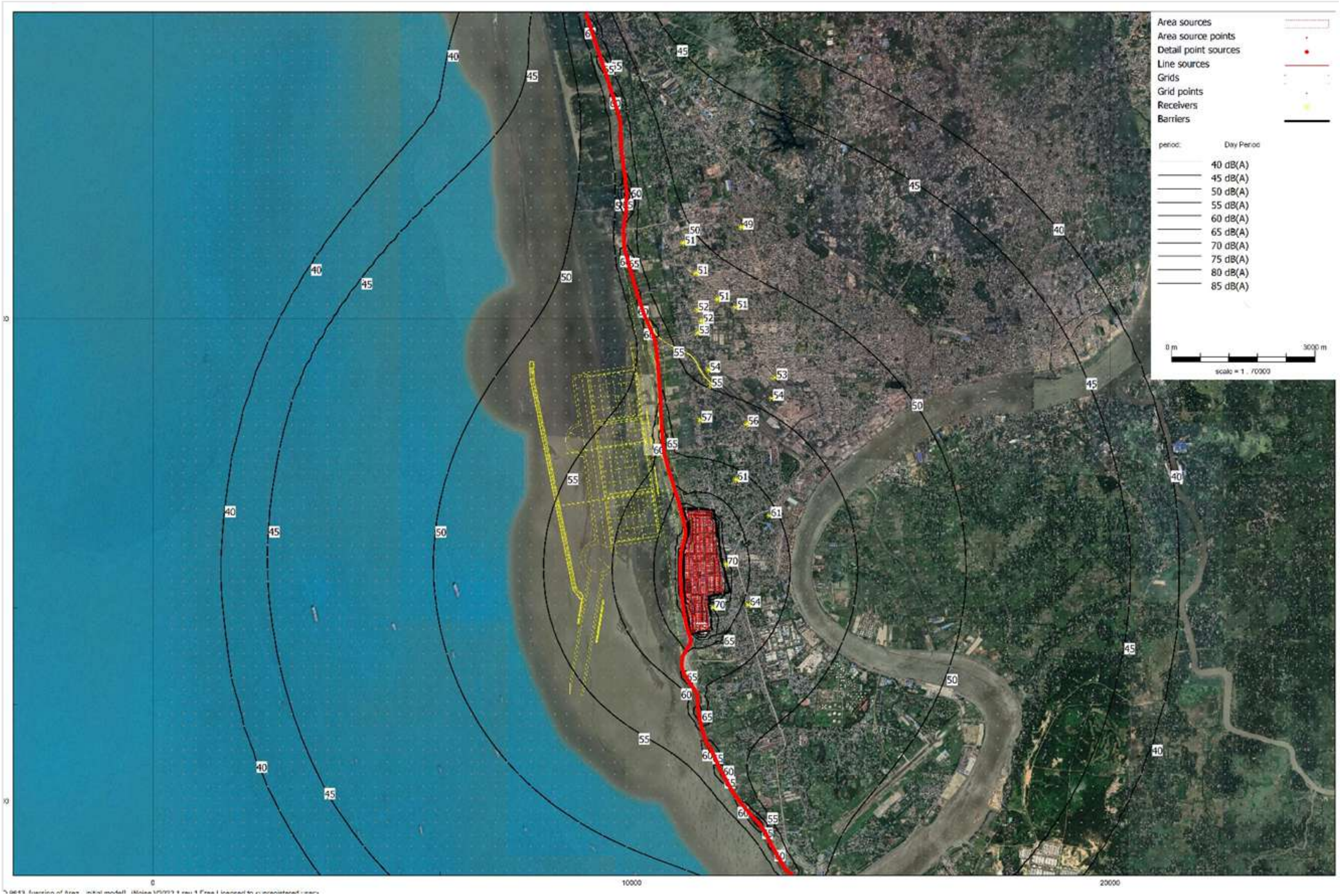


Figure 6-1: Scenario I: Base condition (Marine Drive Road with CEPZ) - Daytime

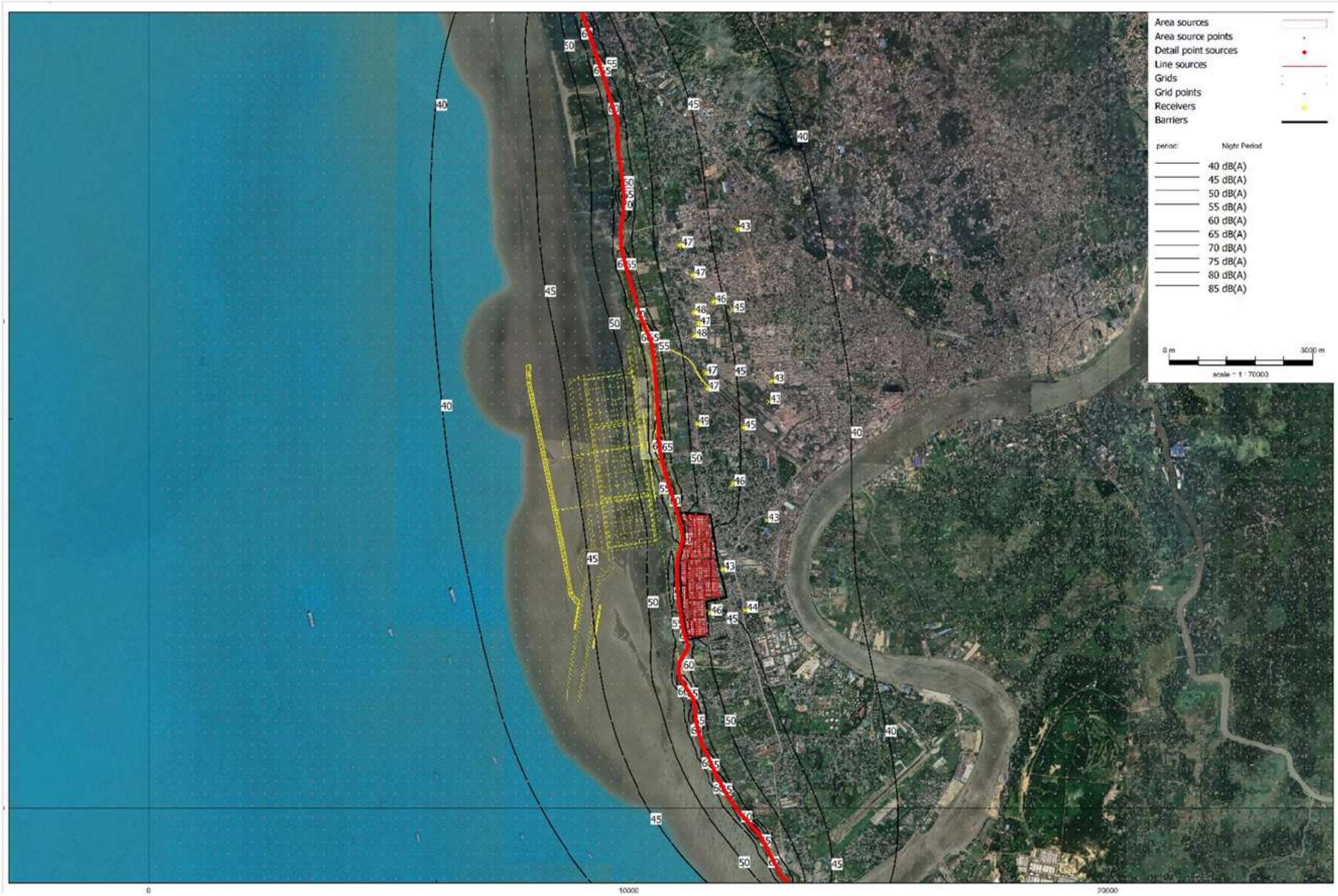


Figure 6-2: Scenario I: Base condition (Marine Drive Road with CEPZ) – Night time

Figure 6-3: Scenario II: Only the construction phase of Bay Terminal without considering the base condition (Marine Drive Road with CEPZ) – Daytime

Figure 6-4: Scenario II: Only the construction phase of Bay Terminal without considering the base condition (Marine Drive Road with CEPZ) – Night time

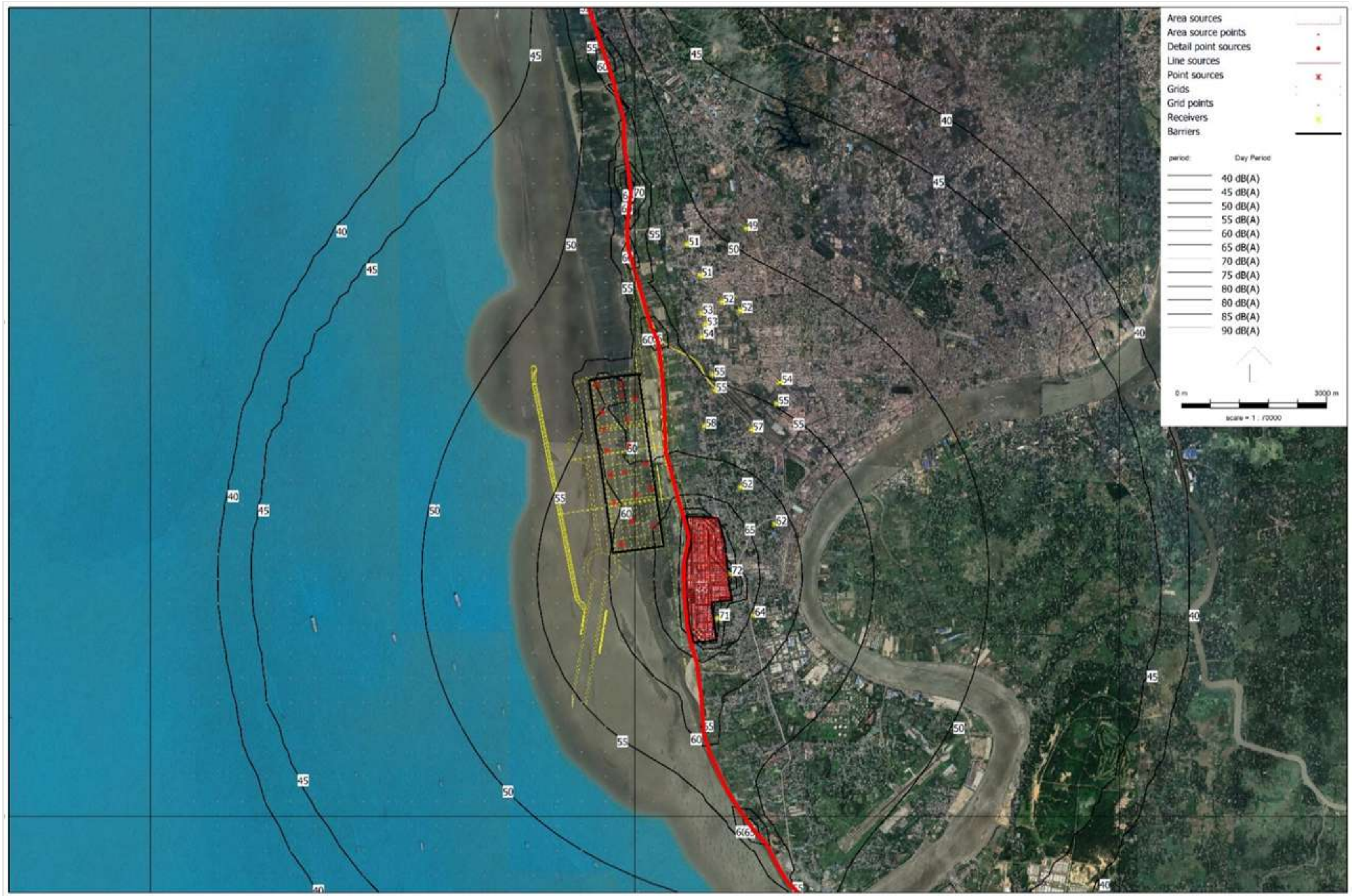


Figure 6-5: Scenario III: Construction of Bay Terminal + Base Condition (Marine Drive Road with CEPZ) - Daytime

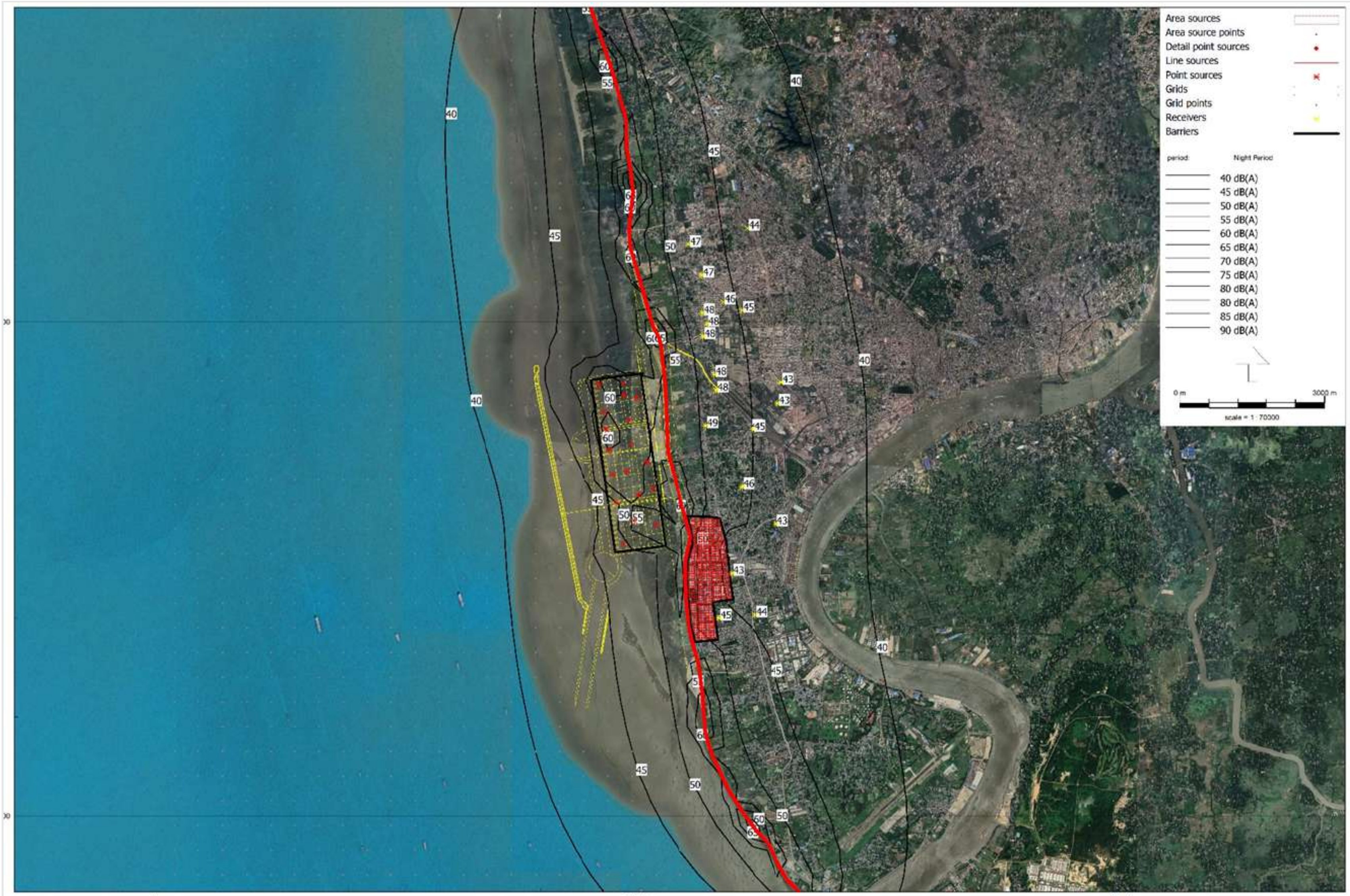


Figure 6-6: Scenario III: Construction of Bay Terminal + Base Condition (Marine Drive Road with CEPZ) – Night time

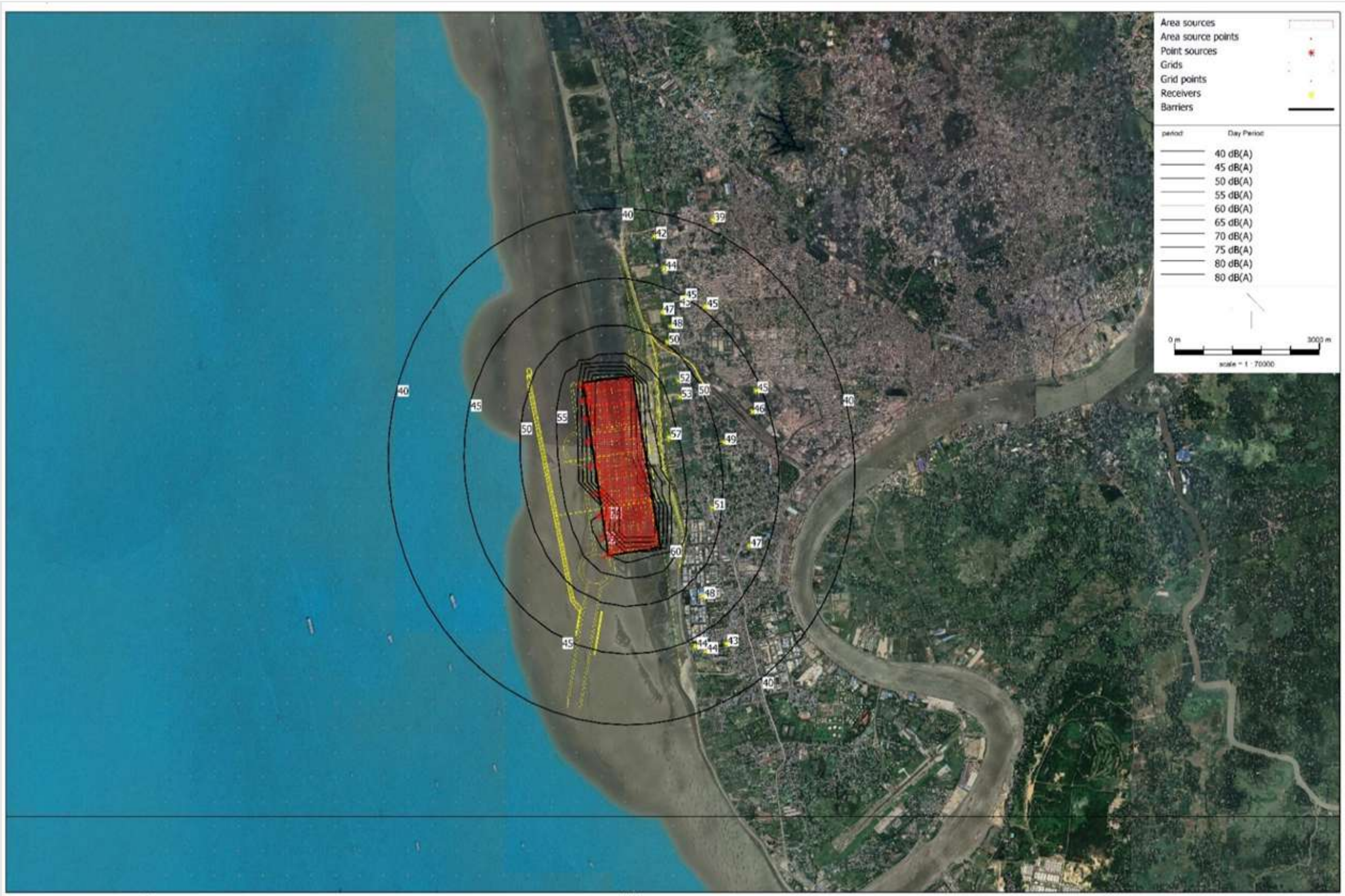


Figure 6-7: Scenario IV: Only Operation of Bay Terminal with Bay Terminal Access Road without considering the Base Condition (Marine Drive Road with CEPZ) – Daytime

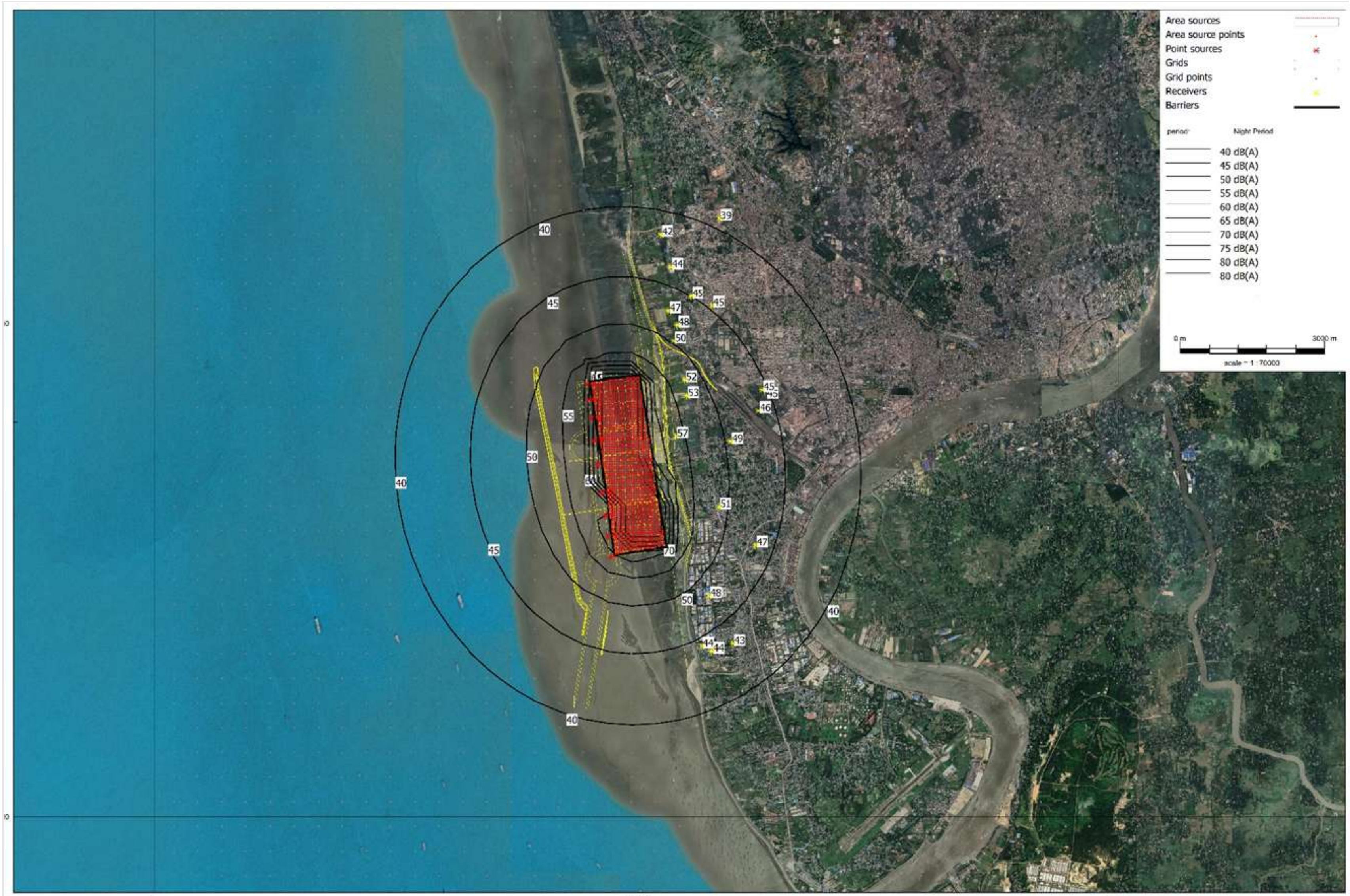


Figure 6-8: Scenario IV: Only Operation of Bay Terminal with Bay Terminal Access Road without considering the Base Condition (Marine Drive Road with CEPZ) – Night time

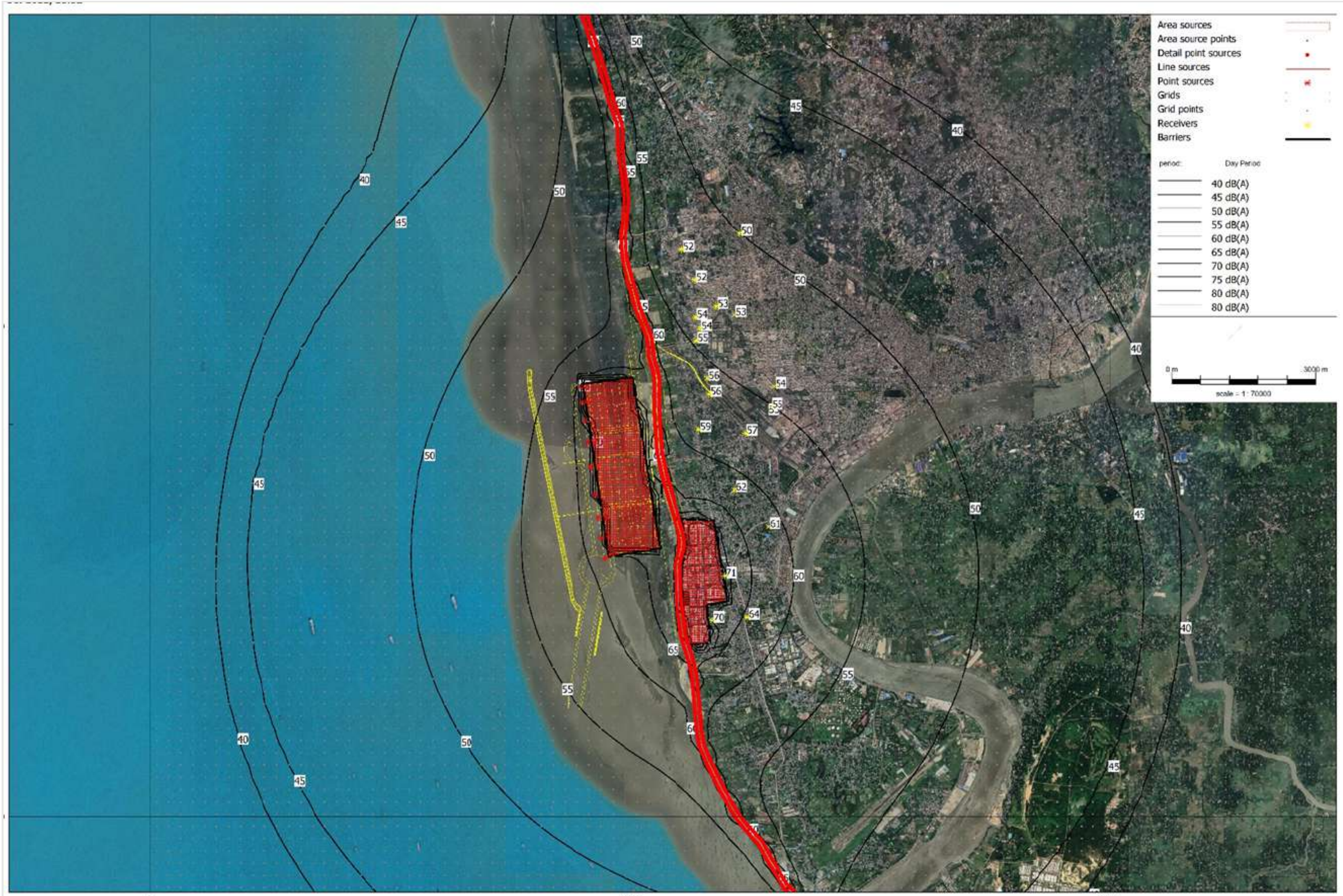


Figure 6-9: Scenario V: Operation of Bay Terminal, including Bay Terminal Access Road and Base Condition (Marine Drive Road with CEPZ) – Daytime

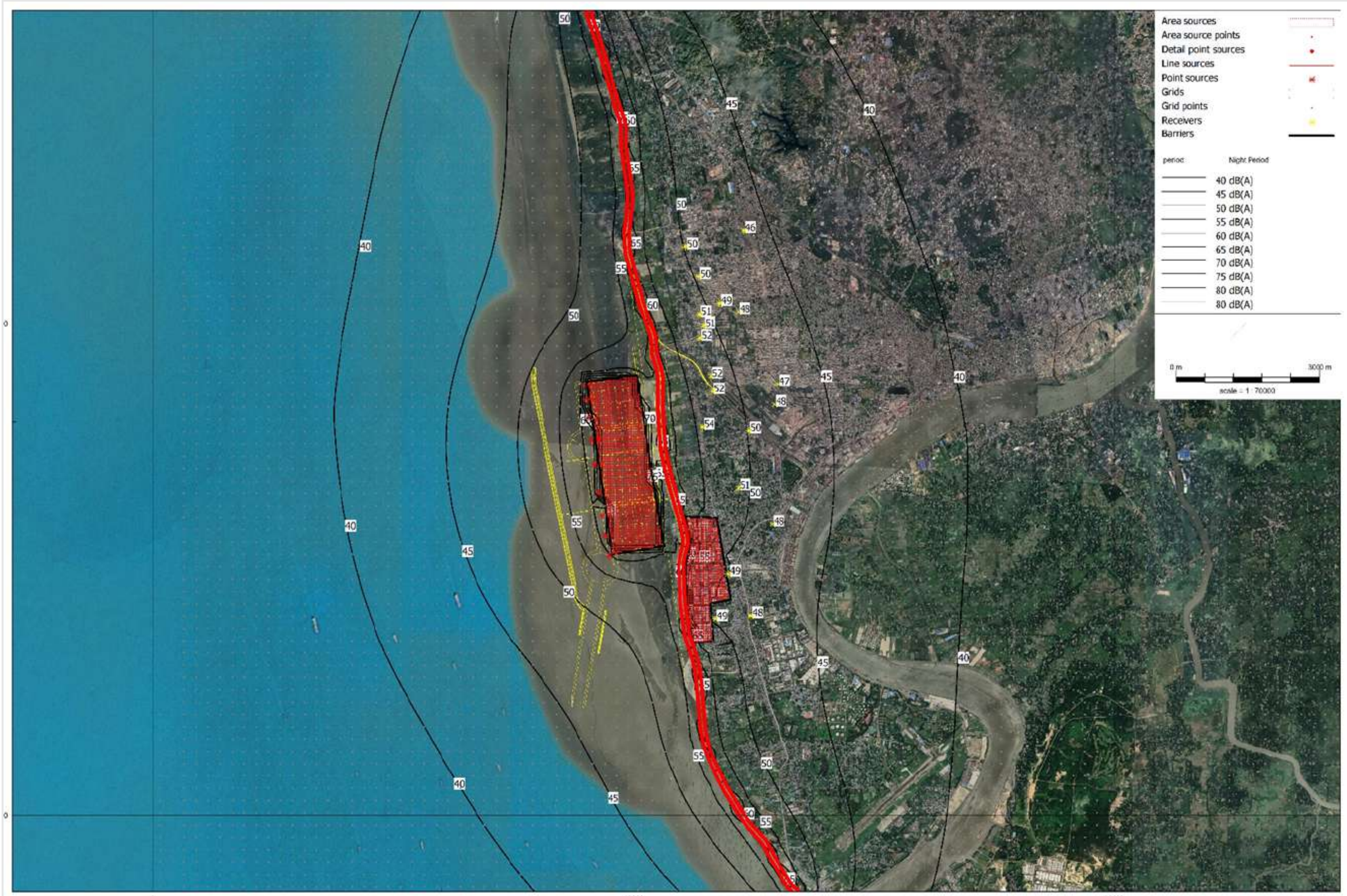
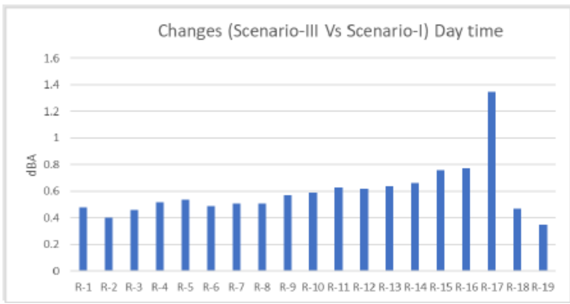
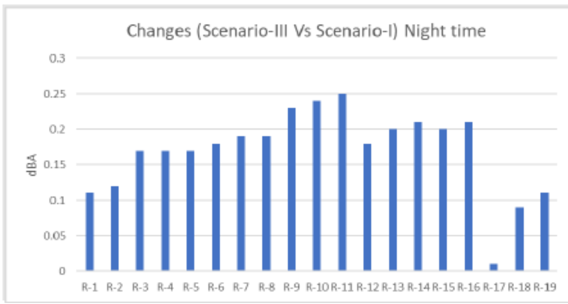


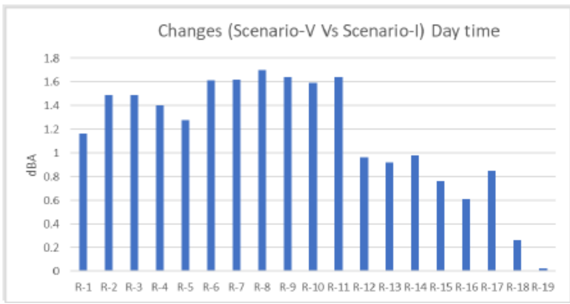
Figure 6-10: Scenario V: Operation of Bay Terminal, including Bay Terminal Access Road and Base Condition (Marine Drive Road with CEPZ) – Night time

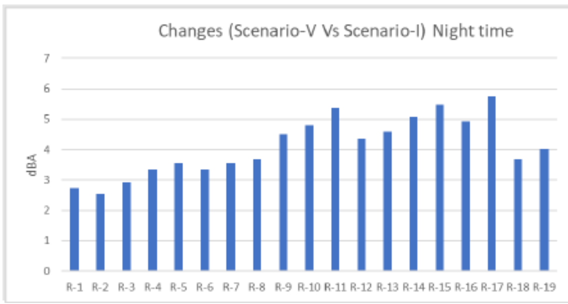
Table 6-4: Comparison of Base Scenario with Scenario-III and Scenario –V

Receiver	**Base Condition**		**Cumulative impact: Construction period**		**Cumulative impact: Operation period**		**Changes of Noise level During Construction**		**Changes of Noise level During operation**	
	Scenario-I (day)	Scenario-I (night)	Scenario-III (day)	Scenario-III (night)	Scenario-V (day)	Scenario-V (night)	Changes (Scenario-III Vs Scenario-I) Day time	Changes (Scenario-III Vs Scenario-I) Night time	Changes (Scenario-V Vs Scenario-I) Day time	Changes (Scenario-V Vs Scenario-I) Night time
R-1	48.85	43.45	49.33	43.56	50.01	46.17	0.48	0.11	1.16	2.72
R-2	50.65	47.32	51.05	47.44	52.14	49.85	0.4	0.12	1.49	2.53
R-3	51.01	46.75	51.47	46.92	52.5	49.67	0.46	0.17	1.49	2.92
R-4	51.3	45.66	51.82	45.83	52.7	49.02	0.52	0.17	1.4	3.36
R-5	51.23	44.59	51.77	44.76	52.51	48.14	0.54	0.17	1.28	3.55
R-6	52.18	47.51	52.67	47.69	53.79	50.86	0.49	0.18	1.61	3.35
R-7	52.44	47.36	52.95	47.55	54.06	50.91	0.51	0.19	1.62	3.55
R-8	53.0	48.01	53.51	48.2	54.7	51.69	0.51	0.19	1.7	3.68
R-9	54.17	47.47	54.74	47.7	55.81	51.97	0.57	0.23	1.64	4.5
R-10	54.85	47.44	55.44	47.68	56.44	52.24	0.59	0.24	1.59	4.8
R-11	56.96	48.8	57.59	49.05	58.6	54.17	0.63	0.25	1.64	5.37
R-12	53.19	43.01	53.81	43.19	54.15	47.35	0.62	0.18	0.96	4.34
R-13	54.19	43.27	54.83	43.47	55.11	47.85	0.64	0.2	0.92	4.58
R-14	56.24	44.77	56.9	44.98	57.22	49.85	0.66	0.21	0.98	5.08
R-15	61.1	45.54	61.86	45.74	61.86	51.02	0.76	0.2	0.76	5.48
R-16	60.88	43.21	61.65	43.42	61.49	48.15	0.77	0.21	0.61	4.94
R-17	70.16	43.42	71.51	43.43	71.01	49.18	1.35	0.01	0.85	5.76
R-18	64.03	44.3	64.5	44.39	64.29	47.97	0.47	0.09	0.26	3.67
R-19	70.25	45.35	70.6	45.46	70.27	49.38	0.35	0.11	0.02	4.03









351. The receptor points in the modeling study are selected based on social sensitivity; mainly, school and college have been selected as the sensitive receptors. The sensitive receivers are mainly located on the east side of Marine Drive and CEPZ. However, the noise level data for those points was assumed to depend on the proximity, position, similarity, and nature of the receptors. During the field visit, the noise level of each receiver (19 points) has been measured with the noise meter, and the model has been validated based on the measured values.

352. The receptors from R1 to R19 are located in a mixed area (combined residential, commercial, and industrial); however, R15 to R19 are situated mainly in industrial and commercially dominant areas.

353. From the noise prediction model and field verification, it is identified that the receptors R1 to R14 range from 48 dBA to 57 dBA in the daytime (DoE standard 60 dBA for the mixed area) and 43 dBA to 48 dBA in the nighttime (DoE standard 50 dBA for the mixed area). However, R15 to R19 show values from 53 dBA to 71 dBA in the daytime (DoE standard 60 dBA for the mixed area), which does not comply with the DoE guidelines during the day. At night, the receptors R15 to R19 show the noise level is from 43 dBA to 45.5 dBA, which complies with the DoE standard for the mixed area.

If we consider this area as a commercial area, in that case, the noise level complies with the DoE guideline (day: 70 dBA, night: 60 dBA). It is to be mentioned that the cumulative noise contribution due to the operation of the proposed Bay Terminal increases the predicted level from 0.2 dBA to 0.8 dBA (approx.) in the daytime and 3.5 dBA to 5.5 dBA (approx.) in the nighttime with the existing situation of the study area.

Mitigating Measures

- Equipment modifications or redesigns of a particular piece of equipment to achieve quieter noise levels.
- Sound aprons or a canopy are useful when the shielding must be frequently removed or if only partial covering is possible.
- Enclosures for stationary work may be constructed of wood or any other suitable sound-dampened material and typically surround the specific operation area and equipment.
- The use of electrically powered equipment is typically quieter than diesel, and hydraulically powered equipment is quieter than pneumatic power.

- Using vehicles and equipment in good conditions
- Monitor sound levels during piling activity to ensure that they do not exceed the DoE, WB, or any other internationally recognized criteria.
- Incorporate the use of clear "ramp-up" (i.e., "soft-start") procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause a significant behavioral impact on marine mammals to the full output necessary for the completion of the activity.
- Implement measures to attenuate the sound when sound pressure levels exceed the DoE, WB, or any other internationally recognized criteria. Methods to reduce sound pressure levels include, but are not limited to:
- Incorporate the use of fully enclosing or confined, encircling absorptive barriers (e.g., isolation casings) or other demonstrably effective noise reduction methods at the immediate works site in order to reduce underwater sound propagation from on-site operations. Studies have shown that such methods can provide a significant reduction in sound input to the wider aquatic environment in the order of 10–30 dB.
- The force of the hammer blow can be controlled with hydraulic hammers, and reducing the impact force will reduce the intensity of the resulting sound.
- Soft start, where piling starts at a low level and progressively builds in intensity through a piling session. There are concerns that the use of this method results in sensitive fauna still being present when piling noise increases in intensity and thus may still be exposed to high noise levels.

6.3.2. Potential Impacts related to Laborers and Working Conditions (ESS2)

6.3.2.1. Additional Income/Employment Opportunity

Potential Sources of Additional Income/Employment Opportunity

- Sourcing of manpower for construction activity
- Sourcing of construction materials from local suppliers
- Opportunity for local enterprises

Impact Assessment

354. <u>Sourcing of manpower for construction activities</u> During construction, workers will be employed in the projects in different forms: 'Direct Worker', 'Contracted Worker', 'Community Worker', and 'Primary Supply Worker.' Contractors will be involved in construction activities. Unskilled workers will be sourced locally. Some skilled and semi-skilled workers will be sourced by the contractors.

355. The project may employ women as laborers. When women work along with male laborers without proper labor management and gender strategy, they may face sexual exploitation and abuse/sexual harassment (SEA/SH). Besides, female workers may receive unequal wages compared to male workers.

356. There are existing labor laws in the country, including the standard labor code, which mentions all issues relating to labor deployment, wages, occupational health and safety, etc. Following the World Bank guidelines, international labor organization (ILO) conventions, and GOB laws, laborers are to be deployed and their wages to be paid. Deployment of children in a harmful working environment is strictly prohibited by law in Bangladesh. It is to be maintained in the workplace and supply chain.

357. <u>Sourcing of construction materials</u>. The construction materials will be sourced from local suppliers. The selected local suppliers will benefit by supplying the required materials.

358. Opportunity for local enterprises. Opportunity for local enterprises will arise due to the demand for necessities such as food, shelter, etc. The local enterprises will benefit by providing necessities to the workers.

6.3.2.2. Potential Impact on Fishing Activities

Potential Sources of Impact

- Capital dredging
- Discharge of dredging material in the reclamation area
- Piling activity and vessel transport of construction materials and equipment

Impact Assessment

359. Capital dredging and the movement of commercial and other vessels may impact the fish habitat and the movement and migration of captured fish in the surrounding area. In addition, the aquaculture activity will also be hampered on the project site due to the project's establishment. Therefore, the livelihood of the fishermen and fish farming laborers (both capture and culture fish) might decrease, and they might lose their regular earnings. About 40 people may lose income due to the acquisition and disturbance of existing aquaculture and dairy farm workers.

360. Fishing activities will be interrupted during dredging and vessel transport, which will cause the fishermen to find alternative fishing grounds and increase the operational cost of fishing operations.

Mitigating Measures

- Preparation of a plan to safeguard the fishermen. The plan will be effective and restricted for the period of project implementation for all registered fishermen.

6.3.2.3. Potential Impact on Occupational Health and Safety

Potential Sources of Impact

- Site development activities, construction activities, handling of construction materials, and operation of heavy equipment.
- Changes in environmental quality from emissions to air, water and noise from construction activities and different hazards in the workplace

Impact Assessment

- Site development activities, construction activities, handling of construction materials, and operation of heavy equipment. Accidents and injuries may result from high-risk activities such as operation of heavy equipment, and other construction activities. Over-exertion, ergonomic injuries, and illnesses, such as repetitive motion, manual handling are the most common causes of injuries in construction sites. In addition, unsafe conditions such as loose construction materials, liquid spills, uncontrolled use of electrical cords and ropes are the causes of lost-time accidents in construction sites. Falls from ladders, scaffolding and structures are the causes of fatality or permanent disability in construction sites.
- Changes in environmental quality from emissions to air, water and noise from construction activities and different hazards in the workplace. Health impacts associated with the changes in environmental quality and different hazard to workplace are physical, chemical, confined space, and exposure to dust and noise. These risks could create long-term impacts to the health and safety of the workers.

Mitigating Measures

- Prepare and implement an occupational health and safety plan (OHSP) prior to commencing work. This plan will include working methods, construction sequence and safety arrangements.
- Permit to work system will be established to ensure only authorized persons will work at site.
- Increase workers' awareness on the anticipated health hazards during the construction phase.
- Provide personal protective equipment (PPE) to protect workers from any incidents at the work site.
- Ensure water, sanitation, and hygiene (WASH) at the work site. Construction

6.3.3. Potential Impacts related to Community Health and Safety (ESS4)

6.3.3.1. Potential Impact on Community Health and Safety

Potential Sources of Impact

- Fugitive dust, air emissions, and increased noise levels from site development activities, construction activities, handling of construction materials, transport of materials, equipment, and manpower, and operation of heavy equipment and standby generator sets.
- Traffic movement during the transport of construction materials, equipment, and manpower
- Influx of non-resident workers to the area.

Impact Assessment

361. Fugitive dust and air emissions. Fugitive dust and air emissions will increase the pollutant in the ambient air quality and potentially impact the nearest receptor, settlements from the project area.

362. Increased noise level. Construction activities will increase the ambient noise level in the vicinity and potentially impact the nearest receptor, settlements from the project area.

363. Traffic movement. Transport of construction materials, equipment, and manpower will increase traffic movement in the existing road network as well as the waterways. It is possible to disrupt community usage of roads and increase inconvenience to time community in terms of air and noise pollution.

364. Influx of non-resident workers. Implementation of this large-scale investment project will require the deployment of huge numbers of wage laborers from home and abroad. Apart from the wage laborers, businessmen, suppliers, contractors' sub-contractors, drivers, etc. will be working on the project. In-migration of such a huge population will create various risks for local people, the food supply chain, accommodation facilities, civic amenities, and, above all, social security, and health-safety issues. **Figure 6-11** shows the major impacts of population influx.

Figure 6-11: Impact of Population Influx

365. *Social Conflict*. Since the in-migration employees will be working in the proposed Bay Terminal, social conflict among the host population and migrated workers may take place. Such a type of conflict will hamper social harmony and affect the local power structures if, if necessary, measures are not taken by the law-enforcing agencies.

366. *Health Hazard*. Population influx due to the project, particularly during the construction phase, may create health hazards, including sexually transmitted diseases (STDs), among the construction workers and local people if awareness campaigns and necessary preventive measures are not taken. Local people and workers will need to be aware of STDs, HIV/AIDS, etc. through billboards, posters, media, seminars, symposiums, etc.

367. *Transport and Communication*. Heavy equipment and machinery will move from or to the project site. The existing highway (port road and tunnel access road) will require further improvement to facilitate the proposed Bay Terminal. Besides, a railway line will be established to connect the proposed Bay Terminal. Such additional transportation facilities will have an impact on the local people due to land acquisition, displacement, and loss of livelihood. Necessary measures, including compensation, resettlement benefits, and an alternative livelihood restoration program, are to be taken by the project.

368. ***Gender Issues.*** Unemployed and a lack of opportunities for work are more exposed to social problems, which is a matter of concern for women in fishermen's villages and farms. Women in the project area also lack credit and the capacity to develop and manage small-scale economic activities, which could hinder the benefits they could get from the project. This can be overcome by enhancing and diversifying sustainable income-generating activities for unskilled women and capacity building of the women in the project area, especially those who will lose their livelihood and female headed household. Identifying infrastructure related impediments faced by women, this project can suggest activities for overcoming these constraints to enable gender-friendly land ports that would encourage greater participation of women in trade in the long run.

369. Due to the mobility restriction and conservative social norms, women tend to absence in public space, while men lead the public meeting and raise their voices/concerns, women stay behind/ silent. Frome field observation, it is more of an issue in the project sites, especially in the fishermen villages and in the farm. The project will enhance women's capacity to raise their voices and participate in decision-making by ensuring women's representation in community-based forums and inclusion in project GRM. The project also aims to build the capacity of the port authority to implement a gender-inclusive port management and increase knowledge sharing mechanism for effective gender mainstreaming.

370. The project's proposed activities involve the land acquisition and major construction works, which can have adverse impacts and exacerbate the potential risk of SEA/SH. SEA/SH, including gender-based violence (GBV), and more specifically, detailed gender-specific facilities will need to be ensured during the construction and operation phases of the project. To mitigate the project-related potential risk of GBV in the project-affected population, a survivor-centric approach will be followed - all through, victim/survivors' care and providing access to different referral mechanisms are considered key aspects of this plan. Gender-related facilities for women in general will also include pregnant women, lactating mothers, the elderly, and disabled people who will be in the waiting area or working in the proposed Bay Terminal. Necessary facilities for women and men, including disabled and elderly people, will need to be provided as follows:

- Separate toilets for male and female passengers, as well as laborers
- Separate toilets with facilities for physically challenged people
- Enough lighting and a visible location for female toilets, considering security and safety
- Water supply and usable condition must be ensured by proper maintenance.
- Space for breast-feeding mothers and pregnant women
- Separate prayer space for females with the required facilities
- No discrimination of wages for male and female laborers or workers for similar work
- Sensitization on SEA/SH risks at the workplace and at the community level.
- GRM for affected people and construction workers, including women, who are affected by this work.

371. A detailed Gender & SEA/SH prevention and mitigation measures is included in the Gender and SEA/SH Action Plan.

372. Population Influx Management: Many people, particularly wage laborers, will be working on the project. Many of the laborers will have immigrated from other countries or regions of the country and will be in a camp situation or in a residential area in rental houses.

373. Such gathering of people from various cross sections may lead to social conflict, health hazards, social crime, gender-based violence, and others. In the operationphase of the project, day laborers (koolee) will be working in the project activities.. The project will have to take the necessary steps to register the laborers with their address and identity cards so that local administration can safely deal with them.

Mitigating Measures

- Use low-sound and low-polluting construction equipment.
- Set up labor camps close to the work site and minimize hiring vacant accommodations in the neighborhood.
- Transportation of construction materials at night to minimize pressure on roads
- Set up the construction site at a location away from the settlement.
- Set up a grievance redress committee involving community leaders.
- Spraying water around the construction site
- Regular meetings with local people and community leaders
- Adopt mitigation measures proposed against noise, air quality, waste, etc.

6.3.3.2. Potential Impact on Road and Vessel Traffic and Transport

Potential Sources of Impact

- Road and vessel transport of construction materials, equipment, and manpower

Impact Assessment

374. Road transport. Transportation of construction materials, equipment, and manpower will increase the load on the coastal road, which is located on the eastern side of the project area.

375. Vessel transport. Different types of water vessels, including barges for lightening mother vessels, nonstandard vessels, fishing vessels, etc., will generate more traffic volume in the project area.

Mitigating Measures

- Provide induction/training to all drivers for safe driving.
- Avoid road transport during rush hours.

6.3.4. Potential Impacts related to Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement (ESS5)

6.3.4.1. Potential Impact on Land Acquisition and Involuntary Resettlement

Potential Sources of Impact

- Acquisition of private land and restrictions on land use
- Use of government land displacing shops

Impact Assessment

376. A substantial amount of land will be required for the development of the proposed Bay Terminal (2,500 acres), with most of the required land being reclaimed from the sea (1,630 acres). However, to meet the project's needs, about 803.17 acres, including about 500 acres of Khash land, and 254.85 acres (188+66.85 acres) of private land and litigation land (suits pending in the court among government vs private owners) are to be developed. The land acquisition process for 66.85 acres of private land is under way at the DC office, and the remaining 188 acres have been proposed to the DC office in December 2023 for the LA process. Out of the 66.85 acres, non-agricultural land is 58.41 acres, the garden is 0.9 acres, the pond is 6.68 acres, and the pond edge is 0.86 acres, as identified by the DC office during the joint verification survey. CPA has already deposited the required amount for the 66.85 acres with the Chattogram Deputy Commissioners' Office, but payment is not made to any of the landowners due to civil suits pending in the court of law between local people and government agencies (Forst Department, BWDB, etc.) Although CPA has submitted LA proposal for the 188 acres land but the land is record in the name of Deputy Commissioner. Local people have submitted petition against the record and the verdict is awaited. The transfer of Khas land to CPA has been processed through the concerned ministries and is awaiting approval from the highest authority. There are seven cattle farms within the project area; those are to be relocated. The livelihood of the farm owners and employees will be adversely affected because of the relocation.

377. About 87 fish traders have been identified in the far northern part within the project area (South Kattoli) whose structure and business will be affected by the project interventions. Most of the structures are CI sheet fenced and roofed with brick floor. Total quantity of structures to be demolished will be presented in the RAP under preparation. A considerable number of tenants business operators are also found affected in the fish market. Compensation for the structures, tenancy right and business will need to be assessed in the RAP. These businesses run in the monsoon for about four (04) months a year. Wage laborers are also involved in the fish market for their livelihood during the 4 months market operation period. So, taking into account of the seasonality and magnitude of impact on the business and wage along with vulnerability, the Resettlement Action Plan should keep necessary budgetary allocation following the RAP policy.

378. Physical Displacement. No physical displacement will take place in this project.

379. Economic Displacement. Economic displacement is expected due to the project interventions. Some cattle farms, fishponds on private or government land, and shops on government land will lose their business to the project. The displaced shops will need to be relocated in a clustered manner for their livelihood restoration. Displaced shops and farms will need financial support, including livelihood restoration assistance, to restore their livelihoods and uphold their standard of living.

380. Landowners and businessmen (farm and shop owners) will face challenges after displacement if they cannot utilize their money in alternative income-generating activities. Adverse impacts on the affected people (landowners, farmers, business owners, and vulnerable groups) will be mitigated through compensation and resettlement benefits, income, and livelihood restoration programs.

Mitigating Measure

- Implement the livelihood restoration plan for the affected people, especially vulnerable groups.
- Prepare a land acquisition plan (LAP) and resettlement action plan (RAP) following ARIPA 2017 and the World Bank ESF.
- Payment of compensation for land and other assets at replacement cost and resettlement benefits as per policy of the RAP

6.3.5. Potential Impacts related to Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6)

6.3.5.1. Potential Impact to Terrestrial and Marine Ecology

Potential Sources of Impact

- Capital dredging
- Disposal of unsuitable soil at an offshore disposal site
- Dredging of sand from the sand extraction area and discharge in the reclamation area
- Accidental spillage of fuel from dredgers and vessels used for transportation of dredge and construction materials.
- Contaminated surface runoff from a land-based construction area
- Discharge of untreated sewage from the construction area and untreated bilge and ballast water
- Piling activity and vessel transport of construction materials and equipment

Impact Assessment

381. The fisheries resources of the study area are enriching with major capture and culture fish habitat. The captured fish habitats are included in the Bay of Bengal, Karnaphuli River, and internal canals. The Bay of Bengal is situated on the west side of the proposed bay terminal. Diversified fish and other marine habitats intensively contribute to the natural ecosystem as well as the country's economy. But the proposed project will involve activities like construction activities, changes to the baseline environment, and increased lighting from ships and barges, which may cause disturbances to the surrounding fish biodiversity. The area is moderately rich in fish biodiversity. The fisheries sector is contributing a significant part to the local economy by improving local livelihoods. In addition, Hilsa shad (*Tenualosa ilisha*/*Hilsa ilisha*) are largely anadromous fast-swimming euryhaline pelagic fish and occur in river, estuarine, and marine ecosystems, depending on their life stages. The watershed area at and around the confluences of the Karnaphuli River functions as a Hilsa breeding

ground of moderate suitability. There could be a probability of impacts from the proposed Bay Terminal and associated transportation activities.

382. Dredging and disposal of unsuitable soil. Capital dredging in the berthing and approach channels during the development and construction phases will increase the turbidity of the water in the surrounding area. High water turbidity can adversely affect the visibility and, often, feeding behaviors of aquatic species. The natural movements and migrations of aquatic species could be disrupted. Some species will move to other undisturbed areas to avoid these consequences. Species remaining in the turbid environment may begin to be physically affected.

383. Contamination due to accidental spillage of fuel and hazardous waste, surface water runoff, untreated sewage, bilge, and ballast water. Oil spillage from the construction sites or vessels during the construction period will contaminate waterbodies and further affect the aquatic ecosystem. In addition, handling liquid bulks through pipelines increases the risk of leaks, pollutants, and spills.

384. The water can neutralize the contamination at a certain level, but if uncontrolled or at a high level, it will lose its intuitive ability. Uncontrolled and accidental contaminant release may cause severe biomass reduction in zooplankton and phytoplankton and adverse genetic effects. Fish communities will be disturbed, and their fertility rate may reduce. They will leave their natural habitats as well as change their behavioral states. Some mollusks and crustaceans are resistant to low levels of contamination, but higher-level aquatic vertebrates (e.g., reptiles, aquatic mammals) and sensitive species can be affected by low-level contamination.

385. Oil spills are fatal to most aquatic organisms since they uptake oxygen from the water body. Thus, it may destroy plant and animal species and the ecosystem. Many water birds and aquatic mammals may stick to oil spillages, which will elicit death because of breathing inability or oil poisoning.

386. Untreated ballast water could potentially introduce marine invasive species. Marine invasive species can have an impact on biodiversity, ecosystems, fisheries, and the mariculture of an area. The major impact is the loss of native biodiversity due to invasive species preying upon native species, decreased habitat availability for native species, additional competition with native species for resource utilization, parasites and diseases, smothering and overgrowth, and hybridization causing genetic dilution. Other impacts of invasive species include changes to ecosystem function and impacts on the nutrient cycle.

387. Piling activity and vessel transport. Noise from pile activity may impact the physiological health and well-being of coastal wildlife and have certain effects on aquatic animals. The underwater noise will disturb the fish habitat. The vessel transport could impact fish movement. In addition, vessel movement will impact fish migration in the surrounding area.

388. Impact on migratory birds. The intertidal area and sandy beaches are the major staging grounds for migratory birds within the project area. Disturbance could occur during the construction period if construction activities coincide with the migratory birds' habitat. Construction activities, such as pilling, dredging, and human traffic in the project area, could negatively affect the animals, including migratory birds. Air noise from piling activities, construction equipment, vehicles, and human traffic has the potential to disturb migratory birds, compelling them to leave these areas. Noise and workers' movements may also disturb the migratory birds, which may leave or change their flight routes until the activities are over. To reduce air noise levels, mitigation measures such as an acoustic enclosure can be placed to cover the hammer and the exposed pile to reduce the air noise level.

389. Impact on fish. The impact will also create flexural (or transverse) stress waves in the wall of the pile, which are coupled with the surrounding fluids (air and water) to radiate sound into both media. Moreover, the pulse propagating down the pile length may couple with the substrate at the water bottom, and the waves propagate outward through the bottom sediments. These substrate transient waves can be transmitted from the bottom into the

water body at some distance from the pile to create local areas of very low and/or very high sound pressure (Popper and Hastings, 2009). The favorable noise propagation conditions contributed to the ecological conditions at the terminal construction site, which could impact fish migration. A hypothesis exists that the sounds of 90–130 dB up to 140 dB above a fish's hearing threshold may have the potential to injure the inner ear of the fish, where an extensive injury probably would require more sound energy (Hastings et al., 1996; Nedwell et al., 2007).

390. Alteration of breeding behavior. Behavioral responses of animals are highly variable in light and sound effects, especially on breeding behavior. The responses associated with the breeding behavior of sensitive species, including nocturnal wildlife, include individual hearing sensitivity, activity pattern, and motivational and behavioral state. Behavioral alteration in breeding will vary depending on the species demographic factors (e.g., age, sex); the presence of dependent offspring; past exposure of the animal to light and noise; individual light and noise tolerance; environmental factors that influence sound and light transmission; and habitat characteristics (e.g., being in a confined location). The increase in sea traffic around the Bay Terminal area could change according to the above scenario.

391. The impacts of stray light on fauna may confuse natural behavior patterns, influence migration, deter fauna from established foraging areas, and affect breeding cycles by altering the natural patterns of light in space, time, and across wavelengths. Artificial lighting over marine areas has the potential to interfere with the behavior of marine organisms.

392. Extension of light periods into the night has the potential to reduce the success of turtles nesting by disorienting the turtles on their way to the nesting beach or while they are on the beach. Light over or in the water can deter turtles from nesting altogether, and once hatching has occurred, lighting can not only disorient the hatchlings but also allow them to be more visible to predators.

393. Light pollution is recognized as a major threat to seabirds (Weise et al., 2002). Many nocturnal seabirds, including gulls, shearwaters, and petrels, have been observed to have ecological disruptions because of increasing amounts of light (Montevecci, 2006; Raine et al., 2007). Light pollution can influence navigation, feeding behavior, reproduction, and habitat choice.

Mitigating Measures

- Keep conducting continuous inspections for leaks.
- Gradually ramp up the sound levels (pile diving) to scare marine life away before piling commences. Use pingers to chase away fish and other cetaceans. Monitor the area for these creatures to ensure they are well away from the piling site; scare them away if they are too close to the site using pingers.
- Lighting must be limited to the minimum area required to be lit.
- Make passages and waterways for aquatic animals away from navigation routes.
- Construction site runoff and drainage should be prevented or minimized in accordance with international best practices and standards. Sand/silt retaining Facilities such as traps and sediment basins should be provided to limit the runoff.
- Exposed slope or soil surface, dredged material in particular, should be covered to reduce the potential runoff. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of rain.
- Implement a dredging technology that has the least impact on marine ecology.
- Erect temporary fences or other barriers that encourage migrants to fly at some height over passing the project site

6.3.6. Impacts related to Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities (ESS7)

394. The proposed Bay Terminal is not expected to affect any indigenous peoples during its construction and operation phases. Indigenous people are living beyond the footprint of the proposed Bay Terminal within Chattogram City and will benefit from the project.

6.3.7. Impacts related to Cultural Heritage (ESS8)

6.3.7.1. Potential Impact on Archaeological and Cultural Sites

Potential Sources of Impact

- Transport of construction materials, equipment, and manpower

Impact Assessment

395. There is no archaeological site found inside the project site. Therefore, no direct impact is anticipated from the proposed Bay Terminal. If evidence of any other ancient heritage or any archaeological symbol is found during the execution of the project, actions will be taken in accordance with relevant acts and rules.

396. Transport of construction materials, equipment, and manpower. The nearest identified cultural heritage sites (*Rani Rashmoni* and *Ganga Snan Ghat)* are located approximately 5.0 kilometers to the north and approximately 6.5 kilometers to the south of the center of the proposed Bay Terminal. The construction work will not have a direct impact on these sites. About 100,000 people gather during the holy ritual day, which causes increased traffic flow through the Bay Terminal region.

Mitigating Measures

- Control the movement of traffic at Bay Terminal during the holy ritual day to ensure the traffic safety of the participating Hindu purnrathi (pilgrims).
- Consultation meeting with Snan Ghat ritual management team members before the holy ritual day of each year.

6.3.8. Impacts related to Stakeholder Engagement and Information Disclosure (ESS10)

6.3.8.1. Potential Impact on Stakeholders including affected people and others who will experience adverse or beneficial impacts (including the disadvantaged and the vulnerable)

Potential Sources of Impact

- Exclusion of vulnerable groups from stakeholder engagement and project benefits

Impact Assessment

397. Exclusion of vulnerable groups from stakeholder engagement and project benefits. The vulnerable groups, especially the fisherman living around the project site, the poor and landless, female-headed households, those under the poverty line, etc., have very limited capacity and power to get involved in the stakeholder engagement process, which is always led by the implementing agencies and local elites.

Mitigating Measures

- Implement an effective Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) to address complaints and grievances throughout the project's lifecycle to address issues and complaints efficiently, timely, and cost-effectively.

- Toll-free telephone hotline/Short Message Service (SMS) line, E-mail, Letter to Grievance focal points at local facilities. Walk-ins may register a complaint in a grievance logbook at a project site/facility or use the Complaint/Suggestion box at the project site.

6.4. Potential Impacts during Operation Phase

6.4.1. Potential Impacts related to Assessment and Management of Environmental and Social Risks and Impacts (ESS1) and Resource Efficiency and Pollution Prevention and Management (ESS3)

6.4.1.1. Potential Impact on Surface Water Quality

Potential Impact Sources

- Discharge of operational wastewater
- Accidental spillage of fuel from dredgers and vessels
- Discharge of untreated sewage
- Maintenance dredging

Impact Assessment

398. Discharge of operational wastewater. The operation of the terminal will involve the transfer, handling, and storage of containers. Operational equipment for handling containers will be maintained in a mechanical workshop. This workshop will be provided with an oil interceptor, and any oil water will be collected and taken away for treatment.

399. In addition, bilge water will be generated during port operation. Bilge water is the mixture of water, oily fluids, lubricants, cleaning fluids, and other similar waste that accumulate in the lowest part of a vessel from a variety of different sources, including the main and auxiliary engines; boilers, evaporators, and related auxiliary systems; equipment and related components; and other mechanical and operational sources found throughout the machinery spaces of a vessel. It is not uncommon for oil or water to leak into the bilge from these sources: various seals, gaskets, fittings, piping, connections, and related maintenance and activities associated with these systems. In addition to containing oil and grease, bilge water may contain solid waste such as rags, metal shavings, paint, glass, and a variety of chemical substances. Bilge water may also contain various oxygen-demanding substances, volatile organic compounds, semi-volatile organics, inorganic salts, and metals. Depending on the types of ships visiting ports, the amount of bilge water that is delivered could fluctuate between 50 and 30,000 L per service. The number of services can be estimated at 2.4–3 disposal services per ship per year, which means that about 9 m^3 of bilge water is produced annually. Bilge water regulations are contained in Annex I of the MARPOL 73/78 Convention. The bilge water contains high levels of oil and grease, BOD_5, COD, TSS, turbidity, etc., which increase marine pollution if it is not managed properly.

400. Accidental spillage of fuel from dredgers and vessels. Accidental spillage of fuel is anticipated during port operation. The vessel operation needs to fulfill the International Maritime Organization (IMO) convention. According to the International Maritime Organization (IMO) Convention on Marine Pollution, MARPOL 73/78 outlines measures aimed at eliminating the willful and intentional discharge into the seas of oil and noxious or hazardous substances—chemicals, packaging, sewage, and garbage. Specifically, Annexes I, II, III, IV, V, and VI of MARPOL 73/78 identify these sources, and by their provision, port authorities are obligated to provide reception facilities for the handling of a range of waste, including oil, chemicals, and garbage.

401. Discharge of untreated sewage. The principal international convention addressing discharge standards for vessel sewage is Annex IV of the International Convention for the

Prevention of Pollution from Ships (known as MARPOL 73/78, or simply MARPOL). MARPOL Annex IV contains regulations regarding the discharge of sewage into the sea, ships' equipment, and systems for the control of sewage discharge, the provision for facilities at ports and terminals for the reception of sewage, and the requirements for surveillance and certification. According to MARPOL Annex IV, ships must typically be fitted with a sewage treatment plant, a sewage comminuting and disinfection system, or a sewage holding. Establishing onshore treatment facilities at the port is necessary to stop contamination from ship sewage. In addition, it is anticipated that during port operations, 1000–1500 people would work in the port, and an additional 400–5000 people would visit the port office for a variety of purposes. These people are predicted to produce around 500 m^3/day of sewage (FS = 2). According to the Bangladesh Environmental Conservation Rule (ECR), the sewage produced by port office activities must be treated before being disposed of. To handle port and ship sewage, a 1000-m^3/day capacity sewage treatment plant (STP) will be built at the port, along with a tertiary treatment scheme for further usage of the treated wastewater.

402. Maintenance dredging. The impact of maintenance dredging does not differ from that of capital dredging. As discussed above, it may increase water turbidity, which can impact the health of aquatic plants and other species, but considering the volumes and intensity, the scale of the impact will be less significant and limited in time.

Mitigating Measures

- Use of sediment settling ponds: Dredging material can be deposited into sediment settling ponds, where the sediment can settle, and the clearer water can be returned to the ocean.
- Implementation of best management practices that can be used during dredging operations to minimize the release of sediment into the water, such as using turbidity curtains and silt screens.
- Dredging activities can be scheduled during times when water currents and tides are less likely to cause sediment to be dispersed.
- Regular monitoring of water quality, including turbidity levels, should be conducted after dredging activities to assess their impact and identify areas for improvement.
- Strict enforcement of regulations related to dredging and water quality can help to ensure that dredging contractors are following best practices to minimize the impact of dredging on the environment.
- The dredging contractors have to submit a dredging management plan before commencing the dredging work, which must be followed according to best management practices based on international standards.
- A sewage treatment plant (STP) with a capacity of 1,000 m3/day is required for the treatment of sewage from the port operations office, canteen, and ship.
- STP should comply with Department of Environment guidelines.
- STP-treated water quality parameters are monitored quarterly to check compliance with DoE guidelines.
- Make bilge water pumping a requirement for all vessels arriving at a shore receiving facility such as a WWTP. Collect the oily sludge for safe disposal or treatment at the planned Bay Terminal's established facilities.
- For the treatment of bilge water or oily wastewater generated from the ship, establish a Wastewater Treatment Plant (WWTP) with a capacity of 1000 m3/day and sludge handling facilities.
- WWTP should comply with Department of Environment guidelines.

- WWTP-treated water quality parameters are monitored quarterly to check compliance with DoE guidelines.

6.4.1.2. Potential Impact on Ambient Air Quality

Potential Sources of Impact

- Fugitive dust emission and cargo vapor emission from the operation of the terminal
- Emissions from the transportation of container and operation of standby diesel generator sets

Impact Assessment

403. Fugitive dust emissions from the operation of the terminal. Port terminals 1 and 2 and 2/3 of the multipurpose terminal will handle containers, so there is no dust pollution in the surrounding area from the container handling part of the terminals. One-third of the multipurpose terminal will handle the dry bulk cargo. The handling of dry bulk cargo, including grain, coal, iron ore, and China clay, may cause fugitive dust emissions. Another source of air pollution can stem from cargo vapor emissions from the handling of liquid bulks discharged through pipelines.

404. Emissions from the transportation of container and operation of standby diesel generator sets. Emissions from the standby diesel generator sets will contribute to the air pollution (primarily PM, NOx, SOx, and CO) in the ambient air.

Mitigating Measures

- Regular maintenance of port operation machinery, vehicles, and standby diesel generator sets in accordance with the manufacturer's specifications.
- Provide pollution control devices in equipment and machinery emission stacks.
- Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards.
- Conduct regular maintenance on dredgers.

6.4.1.3. Potential Impact on Noise Level

Potential Sources of Impact

- Container handling activities
- Transportation of container
- Operation of standby diesel generator sets and other machinery and equipment.

Impact Assessment

405. Container handling activities. Transshipment activities are unlikely to cause a significant increase in noise levels.

406. Transportation of container. Vehicular traffic on roads within and outside the proposed Bay Terminal premises is the predominant noise source during operation.

407. Operation of standby diesel generator sets and other machinery and equipment. Operation of standby diesel generator sets and other machinery and equipment such as payloaders, trucks, trailers, and lifting equipment are the other major sources of increased noise levels.

408. Noise Modelling. The noise modeling during the operation phase is discussed in Section 6.4.3.5. The cumulative noise contribution due to the operation of the proposed Bay Terminal increases the predicted level from 0.2 dBA to 0.8 dBA (approx.) in the daytime and 3.5 dBA to 5.5 dBA (approx.) in the nighttime with the existing situation of the study area.

Mitigating Measures

- Equipment modifications or redesigns of a particular piece of equipment to achieve quieter noise levels.
- Sound aprons or a canopy are useful when the shielding must be frequently removed or if only partial covering is possible.
- Enclosures for stationary work may be constructed of wood or any other suitable sound-dampened material and typically surround the specific operation area and equipment.
- The use of electrically powered equipment is typically quieter than diesel, and hydraulic-powered equipment is quieter than pneumatic power.
- Using vehicles and equipment in good conditions
- Incorporate the use of clear "ramp-up" (i.e., "soft-start") procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause a significant behavioral impact on marine mammals to the full output necessary for the completion of the activity.
- Implement measures to attenuate the sound when sound pressure levels exceed the DoE, WB, or any other internationally recognized criteria. Methods to reduce sound pressure levels include, but are not limited to:
- Incorporate the use of fully enclosing or confined, encircling absorptive barriers (e.g., isolation casings) or other demonstrably effective noise reduction methods at the immediate works site in order to reduce underwater sound propagation from on-site operations. Studies have shown that such methods can provide a significant reduction in sound input to the wider aquatic environment in the order of 10–30 dB.
- Ships, when in port, stop their engines and derive their power supply from a direct connection to the local electricity grid from the port. This reduces emissions and noise emanating from the ships themselves while in port.

6.4.2. Potential Impacts related to Laborers and Working Conditions (ESS2)

6.4.2.1. Additional Income/Employment Opportunity

Potential Sources of Additional Income/Employment Opportunity

- Sourcing of manpower for operations
- Opportunity for local enterprises

Impact Assessment

409. Sourcing of manpower for operations. The operation of the terminal will require skilled, semi-skilled, and unskilled manpower. Unskilled workers will be sourced locally.

410. Opportunity for local enterprises. Opportunity for local enterprises will arise due to the demand for necessities such as food and shelter during the operation of the terminal. The local enterprises will benefit by providing necessities to the workers.

6.4.3. Potential Impacts related to Community Health and Safety (ESS4)

6.4.3.1. Potential Impact on Community Health and Safety

Potential Sources of Impact

- Increased noise level due to the operation of machinery and equipment and container handling activities
- Traffic movement during the transport of the container
- Influx of non-resident workers to the area and the risk of SEA/SH at the community.

Impact Assessment

411. Increased noise level. The operation of machines and equipment used for loading and unloading operations in the terminal and the operation of transport vehicles will increase the ambient noise level in the vicinity and potentially impact the nearest receptor and settlements in the project area.

412. Traffic movement. The transport of containers will increase traffic movement in the existing road network as well as the waterways. It is possible to increase the risk of accidents and disrupt community usage of roads and increase inconvenience to the community in terms of air and noise pollution

413. Influx of non-resident workers. The influx of workers will impact public health and increase the prevalence of diseases. The inflow of migrant workers will cause the spread of infectious and communicable diseases including the risk of SEA/SH. Other impacts of the influx of workers are discussed above.

Mitigating Measures

- Set up a workstation at a designated place.
- Transportation of containers outside rush hours to minimize pressure on roads
- Set up a grievance redress committee involving community leaders.
- Regular meetings with local people and community leaders
- Adopt the mitigation measures proposed against noise.
- Adopt the proportionate mitigation meausre as per the risk level.

6.4.4. Potential Impacts related to Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6)

6.4.4.1. Potential Impact to Marine Ecology

Potential Sources of Impact

- Discharge of operational wastewater and untreated sewage
- Accidental spillage of fuel from dredgers and vessels
- Maintenance dredging
- Vessel movement

Impact Assessment

414. Discharge of operational wastewater and untreated sewage. Discharge of wastewater and untreated sewage will impact water quality, which affects marine ecology.

415. Accidental spillage of fuel from dredgers and vessels. Accidental spillage will impact marine ecology. Fish will move away from polluted areas, resulting in a reduction in abundance. Additional impacts include the contamination of sandy shores, preventing fishing activities such as boat landings.

416. Vessel movement. An increase in vessel movement during operation will increase the underwater noise. Underwater noise generation will affect the marine ecology.

417. Maintenance dredging. Maintenance dredging, as discussed above, may increase water turbidity, which can impact the health of aquatic plants and other species.

Mitigating Measures

- The vessel must be refueled off-site, where possible.

- Fueling of vessels must be undertaken in bunded areas, and all fueling equipment must be regularly (yearly) inspected and serviced.
- Implementation of best management practices that can be used during dredging operations to minimize the release of sediment into the water, such as using turbidity curtains and silt screens.
- Treatment of sewage and bilge water and ensuring that STP and WWTP comply with Department of Environment guidelines.

6.4.4.2. Summary findings of the Critical Habitat Assessment (CHA)

418. CHA report has identified various species that qualify as critical habitat features. Where critical habitat features are impacted by a project, ESS6 requires that net gain outcomes are demonstrated for the specific biodiversity features for which the critical habitat is designated, which is yet be determined.

419. Irrawaddy Dolphin

- Irrawaddy Dolphins are included as a critical habitat feature. Fishermen have confirmed their presence in the greater area but their occurrence in the direct area of impact is not certain. If present, this species would be impacted by increased movement of ships and other vessels, while water contamination from ships could impact these dolphins and fish populations which serve as their source of food. The project area is subject to severe shipping congestion which is expected to discourage the presence of Irrawaddy Dolphins. Implementation of the project will alleviate much of the congestion of ships which could benefit marine mammals and turtles, although increased passage of larger ships is likely to occur. So, impacts to Irrawaddy Dolphins are uncertain but the likelihood of significant impacts is low. The regular monitoring of potential dolphin occurrence in the vicinity of the project should be conducted. Monitoring should involve direct observation and consultation with knowledgeable stakeholders (fishermen, boat operators, ship crews and others) to establish patterns of occurrence and record any evidence of impacts to the species (such as carcasses or live individuals with signs of injuries, juveniles separated from the herd). Should monitoring reveal there are significant impacts to Irrawaddy Dolphins, then future mitigation needs to be developed to avoid and/or minimize those impacts in collaboration with marine cetacean specialists.

420. Ganges River Dolphin

- Ganges River Dolphin is included as a critical habitat feature due to its presence in the Karnaphuli River, but there is a consensus among specialists that this species does not venture into marine environments. Therefore this dolphin will not be adversely affected by the project. Instead this dolphin may benefit from the reduced shipping activity in the Karnaphuli River as a result of the project.

421. Green Turtle

- Green Turtle have been included as a critical habitat feature as local fishermen reported their presence in the greater vicinity of the project. There is no evidence that this species is breeding in the vicinity of the project but may be impacted in an indirect manner through increased shipping activity similar to Irrawaddy Dolphin . Significant impacts are not expected. However regular monitoring should be conducted through expansion of the monitoring proposed for Irrawaddy Dolphin to also include Green Turtles. Should monitoring efforts reveal there are significant impacts to Green Turtles, then future mitigation needs to be developed to avoid and/or minimize those impacts in collaboration with sea turtle conservation organizations.

422. Shorebirds associated with the Patenga Beach IBA

- Various shorebirds, namely Great Knot, Spotted Greenshank, Common Shelduck, Black-tailed Godwit and Black-headed Ibis are included as critical habitat features. The tidal mudflats and coastal grasslands have significant importance for these birds as a winter foraging ground. This habitat will be lost through development of the Bay Terminal, these birds will be adversely impacted.

- Baseline surveys recorded the entire national population of Great Knot (55 individuals) in the AoA. This observation suggests a high-level seasonal dependence on these habitats and unlikely that alternative areas suitable to the species can be found. The affected habitat continues north of the project site and securing this area from future development may represent the only feasible option for saving this group of shorebirds.

423. The following measures are proposedfor the various shorebirds identified as critical habitat features:

- Declaring a no-go zone around the Bay Terminal may be necessary for the security of the project which provides an opportunity for the area to be protected in a manner that is beneficial for shorebirds. A 12.3 sq km bird conservation area could be declared at about 4 km north of the Bay Terminal boundary. The sea shore in this area is comparatively undisturbed and comprised of mud flats and grasslands that provide suitable foraging ground for shore birds. The habitats (Figures 7 & 8) are similar to former habitats within the footprint of the Bay Terminal Port, and this area presents an opportunity as a like-for-like offset for the project. Mangrove vegetation covers about 3.17 sq km while the mudflat habitat is about 9.13 sq km. Results reveal this 12.3 sq km area offers suitable shore bird habitat although presence of the critical habitat qualifying shore birds has not been demonstrated due to the timing of a field survey. Weekly bird monitoring needs to be conducted after mid-winter (January-February) when critical habitat shore birds are expected to be present and extended for at least for five years to establish preliminary trends in the use of the area by shore birds. BirdLife International should be invited to review the monitoring data, assess the area and revise or extend the boundaries of the Patenga Beach IBA.

7. Cumulative Impact Assessment

424. As a key component of the ESIA process for the project, a Cumulative Impact Assessment (CIA)[5] will be undertaken concurrently with the updating of the ESIA, focusing on identified Valued Environmental and Social Components (VESCs), which may be affected by the project and other past, present, and foreseeable development activities planned or underway within the project area, including but not limited to other existing or planned urban development and transport developments in the project area, and recommending to CPA the project-level as well as regional planning-level recommendations for minimizing negative cumulative impacts and maximizing positive cumulative impacts associated with the development at the project area.

425. Inputs from the ESIA will help inform the CIA and vice versa and be used to focus the selection of VESCs and the direction of the CIA. The CIA follows the process as described in the IFC Guidance on Cumulative Impact Assessment and Management (2013). The specific subtasks are discussed below.

426. Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as "developments") when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities.

Steps for Rapid Cumulative Impact Assessment (RCIA):

427. For the purpose of this project, a Rapid Cumulative Impact Assessment (RCIA) was undertaken. The steps for Rapid Cumulative Impact Assessment are as follows:

[5] *The Consultant is advised to refer to the following guidance documents in developing the CIA:*

- *IFC (2013). Good Practice Handbook, "Cumulative Impact Assessment and Management Guidance for the Private Sector in Emerging Markets" (https://www.ifc.org/content/dam/ifc/doc/mgrt/ifc-goodpracticehandbook-cumulativeimpactassessment.pdf)*
- *Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling, and D. Stalker. (1999). "Cumulative Effects Assessment Practitioners Guide," Prepared for the Canadian Environmental Assessment Agency by the Cumulative Effects Assessment Working Group and AXYS Environmental Consulting Ltd. (https://publications.gc.ca/site/eng/9.647223/publication.html),*

1. Identify and propose geographic and temporal boundaries for the RCIA based on the screening of potential impacts on key valued components. The geographic context should include administrative boundaries (municipal or city boundaries). Valued Components (VCs) should be selected for the cumulative impact assessment.
2. Identify other projects and activities that could result in cumulative impacts on key VCs within established geographic and temporal boundaries.
3. Assess the status and condition of each VC.
4. Assess the level of cumulative effects on each VC.
5. Determine the significance of cumulative effects on each VC.
6. Provide recommendations as to how cumulative impacts on each VC can be managed.

7.1. Identification of Preliminary Valued Components

428. Valued environmental and social components, or valued components, VCs, are environmental and social attributes that are subject to cumulative impacts. VCs may be: physical features, habitats, wildlife populations (e.g., biodiversity), ecosystem services, natural processes (e.g., water and nutrient cycles, microclimate), social conditions (e.g., health, economics), or cultural aspects (e.g., traditional spiritual ceremonies) (IFC, 2013).[6]

429. The ESIA for Phase 1 of the Bay Terminal Project has identified the following key issues and impacts associated with the construction and operation of the proposed project:

- Impacts on biodiversity and habitats
- Impacts on water quality
- Impacts related to resettlement and livelihood displacement
- Impacts due to dredging activity and disposal of dredged materials
- Impacts on the livelihood of fishermen
- Visual and aesthetic impacts

7.2. Site Visits and Consultations to Prioritize VCs

430. A comprehensive assessment of proposed project development activities, such as those affecting Valued Components (VCs), typically involves a combination of desktop studies, site visits, and stakeholder consultations. Each of these components plays a crucial role in ensuring sustainable development.

431. The desktop study lays the groundwork by reviewing existing Feasibility Studies (FS) and Environmental and Social Impact Assessment (ESIA) reports, conducting a preliminary

[6] *For the purpose of the CIA, valued components are used*

assessment of potential VCs, understanding regulatory frameworks, and identifying risks. Site visits are critical for gaining a more accurate and detailed understanding of the local environment. This hands-on approach provides an in-depth understanding of both environmental and social valued components, essential for accurate impact assessment. Stakeholder consultations are crucial for incorporating diverse perspectives. Engaging with local communities, government agencies, and environmental experts ensures a holistic view, integrating local knowledge and expert insights into the assessment process.

432. During the site visits to the Bay Terminal area, effective consultations were conducted with key local stakeholders. These included the local fishing communities, who are directly impacted by the project and possess valuable insights into the marine environment and its dynamics. Additionally, engagement with the local NGO, Shopnile Foundation, working in Fishing Villages provided a deeper understanding of the socio-economic aspects and environmental concerns pertinent to these communities. Consultations were also held with relevant government agencies, such as the Chattogram Port Authority (CPA), Chattogram City Corporation, Bangladesh Water Development Board (BWDB), Chattogram City Development Authority (CDA), and Chattogram Water and Sewage Authority (CWASA), to align the project's objectives with regulatory requirements and to garner institutional support. Input from other stakeholders, including NGOs and academics from Chattogram University and Jahangirnagar University, further enriched the understanding of the project's potential impacts and opportunities. These consultations, forming an integral part of the site visit phase, significantly enhanced the depth and accuracy of the findings.

433. Six valued components (4 environmental, 2 social) were identified as follows:

Environmental

- Mudflats;
- Water Quality;
- Marine Fish;
- Noise

Social

- Community Safety (including traffic safety);
- Employment.

7.3. Determining the Spatial and Temporal Boundaries of the Cumulative Impact Assessment (CIA)

434. The spatial boundaries for the CIA are determined by analyzing environmental and social factors such as the physical, biological, and socioeconomic status of the project area. The CIA boundaries have been defined as the 6 km of the project for physical and social factors. For ecological aspects, the CIA considered a radius up to 10 nautical miles (18.52 km) or more due to the nature of the impacts from the center of the project. For economic aspects, the spatial boundary extends up to the national level. **Figure 7-1** and **Figure 7-2** shows the cumulative impact assessment maps.

435. As the proposed project's expected lifetime is 50 years, the temporal boundaries have been considered as the project's time period.

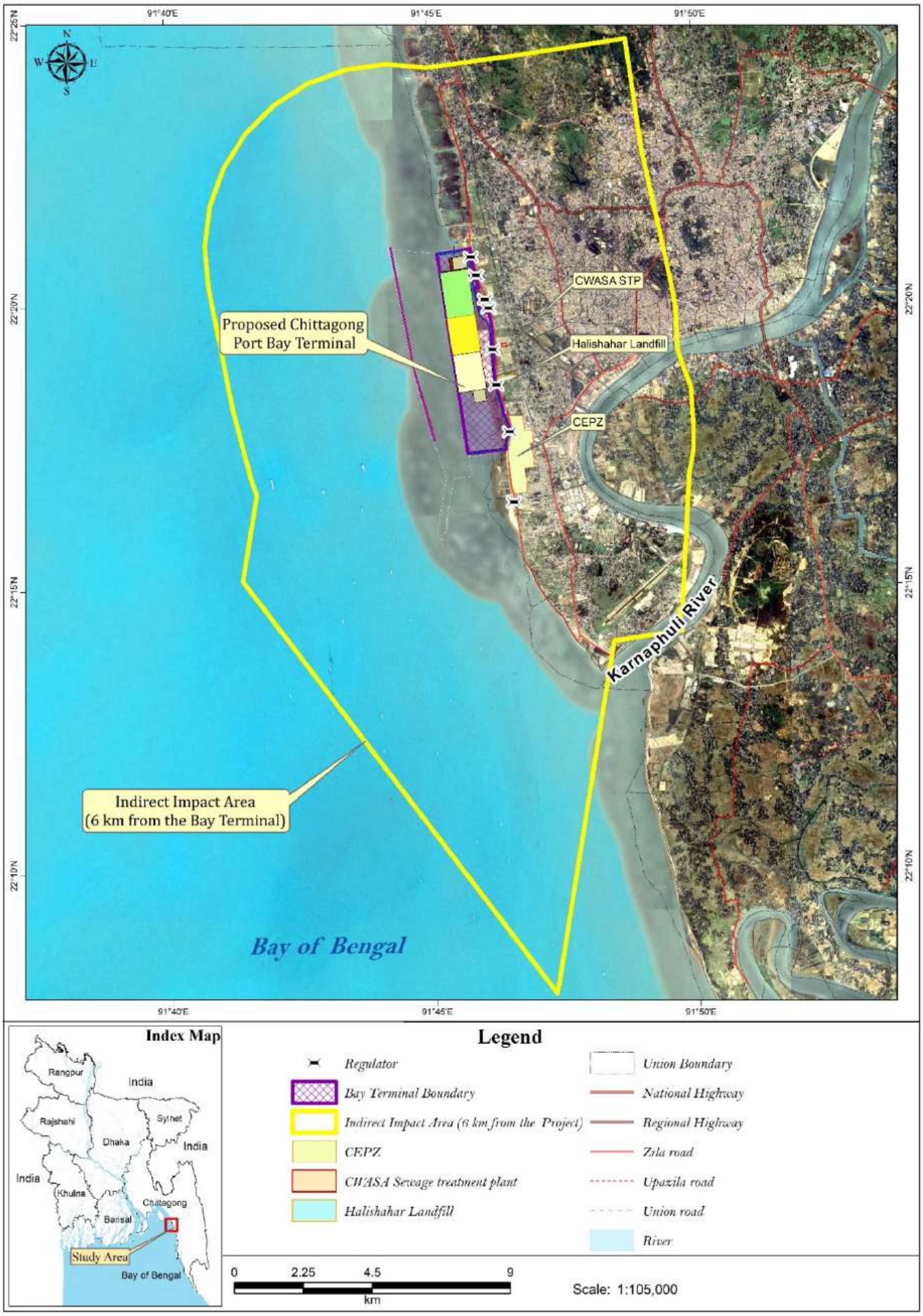


Figure 7-1: CIA Map (6 km from the Project Boundary)

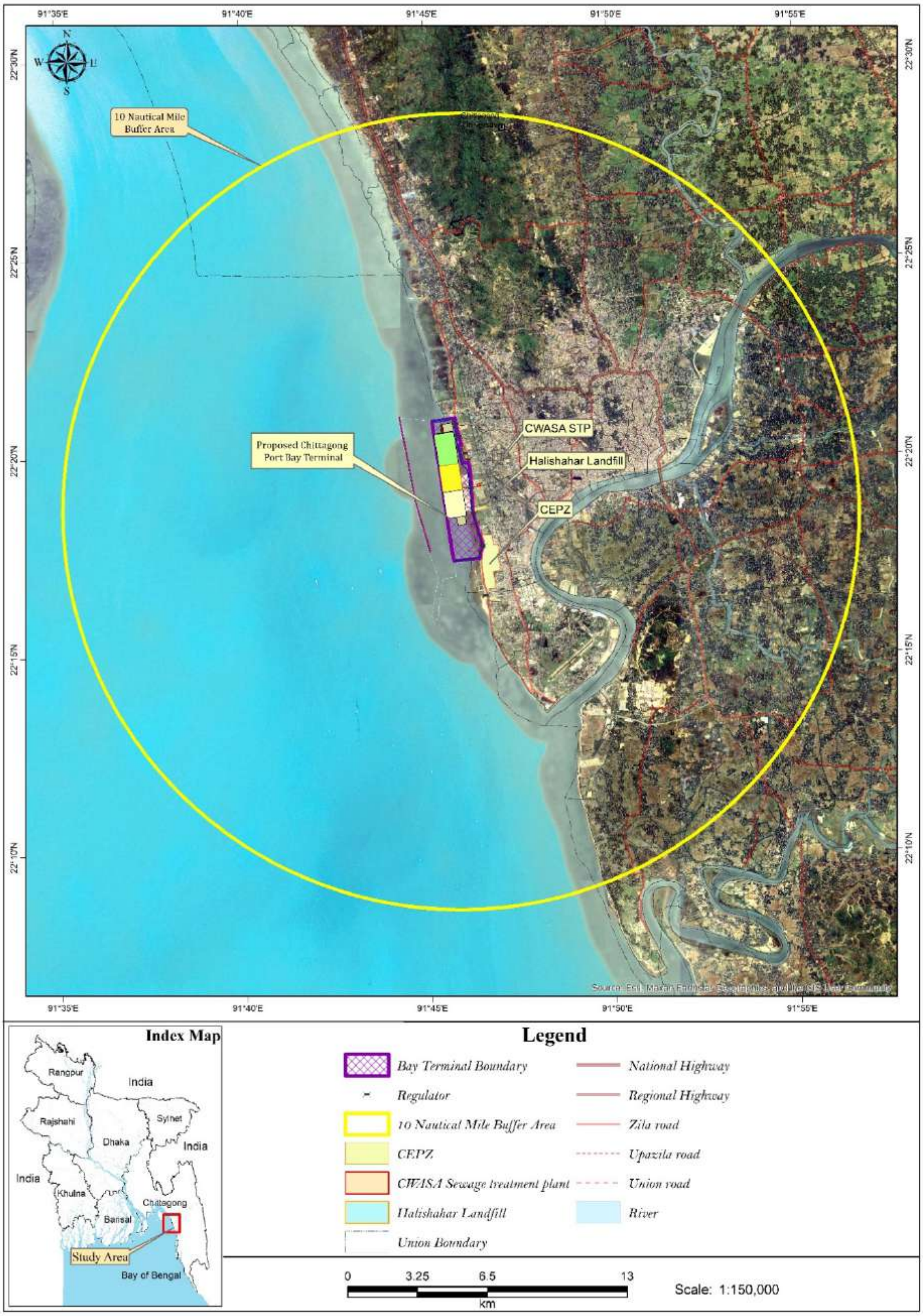


Figure 7-2: CIA Map (18.52 km from the Center of the Project) for Marine Fish.

7.4. Scope and Scale of Past, Existing, or Planned Developments and Other Activities in Addition to the Project

7.4.1. The Land Use Changes of the Bay Terminal Site from Year 1985 to 2023

436. The available satellite imagery from 1985 to 2023 has been collected to observe the surroundings of the proposed project, highlighting urbanization changes over the last 38 years. This period offers a comprehensive insight of the land use changes in the proposed area.

437. **Figure 7-3** shows the map of the change pattern of the project area from the year 1985 to 2023. These images are obtained from the Google Earth Engine and Google Earth Pro.

	
Image December 1985	Image 1995

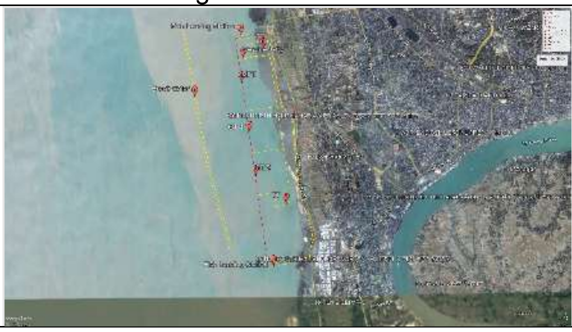



Image December 2000	Image December 2005
	
Image February 2010	Image April 2015
	
Image February 2017	Image October 2017

	
Image October 2018	Image February 2019
	
Image March 2020	Image May 2021

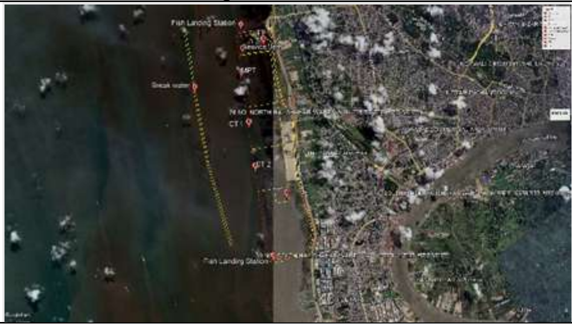
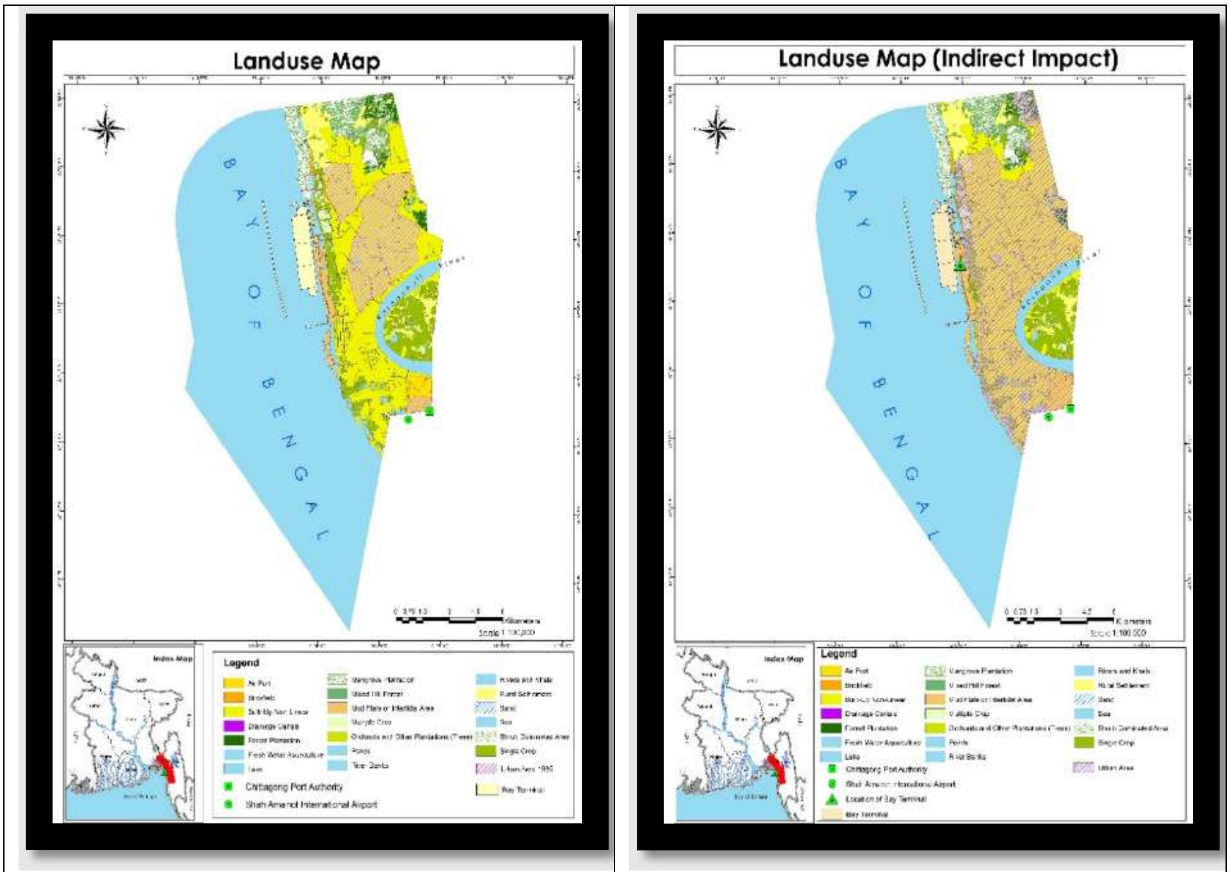



Image May 2022	Image May 2023

Figure 7-3: Satellite Images of the Project Area, 1985-2023

438. **Figure 7-4** shows the urbanization comparison between 1985 and 2022 using satellite images. About 40% of the green area on the eastern side of the proposed project has been lost during this period.



1985	2022

Figure 7-4: Urbanization Comparison Between 1985 and 2022

7.4.2. Existing Site Condition Bay Terminal Site & Development Plan

439. A substantial portion of the project site is mud flat. In the present situation, approximately 138.11 acres of the area have already been filled with sand, and there are twelve (12) farms—comprising dairy, poultry, and aquaculture—located on the southern side of the project. No agricultural activity has been found in the proposed project area. **Plate 7-1** shows the existing condition of the proposed project site.

Plate 7-1: Existing Site Condition

7.4.3. Other Activities Around the Bay Terminal Site

440. There are several activities present around the proposed Bay Terminal Area, which are as follows:

- Chattogram Export Processing Zone (CEPZ)
- Chattogram Water Supply and Sewage Authority (WASA) Sewage Treatment Plant-1
- Halishar landfill
- Truck stand
- Stone crushing yard
- Three fishermen villages

7.5. Assessment of Cumulative Impacts on VCs

7.5.1. Mudflats

441. Mudflats are unique coastal ecosystems characterized by their intertidal nature, composed of fine sediments, and constantly shaped by the ebb and flow of tides. These areas serve as vital hubs of biodiversity, supporting a diverse range of plant and animal species that have adapted to the challenging conditions of the mudflats. Birds, fish, invertebrates, and microorganisms thrive in these environments, utilizing mudflats as feeding and breeding grounds. Mudflats also play a crucial role in nutrient cycling, trapping and storing organic matter that contributes to coastal food webs. Human activities, such as clam and oyster harvesting, as well as recreational pursuits like birdwatching, are closely tied to these dynamic ecosystems. However, mudflats are not without their vulnerabilities, as they are susceptible to pollution, habitat destruction, and environmental threats that can have detrimental effects on their biodiversity and ecological health. As transitional zones between

land and water, mudflats exemplify the delicate balance between nature's resilience and its susceptibility to human impacts.

7.5.1.1. Project Activities

442. The project activities are enumerated below:

- Construction of jetty, terminal, and associated infrastructure: construction of infrastructure and associated facilities will need more area to occupy, and ultimately the remaining mudflats will be occupied.
- Increased noise: the noise of terminal construction, operation, and sirens of the ships will create a noise level that will ultimately disturb birds and other wild animals in this area.
- Light pollution: the lights of the terminal will create disturbance for the nocturnal animals and nesting sea turtles to come to the shore.
- Increased sea traffic: the additional facilities of the bay terminal will also increase sea traffic and ultimately occupy more areas of the seashore.
- Water pollution: the sewage and bilge water (oily wastewater) could create water pollution if they are discharged to the sea without treatment.

7.5.1.2. Other Projects and Activities

443. Chattogram Export Processing Zone (CEPZ)

- The major industries of CEPZ are textiles and ready-made garments (RMG), which generate wastewater containing high BOD5 (400-600 mg/l), COD (1500-2000 mg/l), and color compounds. During the consultation with CEPZ, the industrial establishment of CEPZ contributes 50,000 m^3/day of wastewater, which is treated by a Central Effluent Treatment Plant (CETP). Within the next 8-10 years, this wastewater volume is expected to increase to 100,000 $m^{3/}$day. If the wastewater treatment is not effective enough, it could spread harmful chemicals, nutrients, and contaminants into mudflats. These pollutants can disrupt the natural balance of the ecosystem by interrupting the food chain and food web, harm aquatic life, and degrade water quality.

444. Chattogram Water Supply and Sewage Authority (WASA)

- At present, there is no established treatment facility in the Chittagong City area. According to the CWASA masterplan, the centralized sewerage system was planned in 2017. Chattogram city has been divided into six zones, including Halishahar, Kalurghat, East Bakalia, Fatehabad, North Kattli, and Patenga. The masterplan suggested that the Halishar area will generate about 100 million liters of sewage per day, which will be treated by the proposed STP-1, and the entire treated sewage will be discharged through Regulator-4 (3V, 1.5m x 1.8m) to the proposed Bay Terminal's drainage canal.
- Normally, untreated sewage contains organic compounds approximately with BOD (Biochemical Oxygen Demand) of 200-250 mg/l, COD (Chemical Oxygen Demand) of 500-700 mg/l, and a high concentration of suspended solids, more than 200 mg/l. This might have a negative impact on mudflats if it is discharged onto them.

445. Runoff from adjacent Urban area

- In a normal condition throughout the whole year, a substantial amount runoff of both city wastewater and storm water is discharged in the vicinity of the bay terminal via the existing four canals inside the proposed project area. In addition, during the heavy rainfall, the urban runoff will generate about 60.78 m^3/s and be discharged through the proposed Bay Terminal's canals. The drain management is part of the work of the Chattogram City Corporation. In coordination with the city corporation, a water quality treatment system needs to be established in the canal before discharge of wastewater to the sea water around the bay terminal area; otherwise, it will negatively impact the mudflats.

446. Seepage water from Halishar landfill

- There is an uncontrolled municipal solid waste yard at Halishar, which is located about 300 m east of the proposed Bay Terminal. It is known as Halishar landfill, and the area is about 9.0 hectares. The runoff of seepage water from the landfill was discharged through Regulator-3, negatively impacting the mudflats. The quantity and quality of the seepage water depend on the pattern of dumping, decomposing period, and nature of the solid waste, which is difficult to quantify for this landfill.

7.5.1.3. Natural Stressors

447. The natural stressors are sea-level rise, storm surge and tidal flooding.

- Sea-level rise: The mudflat of the proposed project site is vulnerable to sea level rise due to its topography, which is only a few meters above sea level. Therefore, the mudflats can become submerged, leading to habitat loss for many species around the proposed project site.
- Storm surge and tide flooding: As per the location of the proposed project site, it is extremely vulnerable to storm surge and tide flooding, which may erode mudflats and alter the structure and habitats. Storm surges can dramatically reshape the physical landscape of mudflats and significantly alter their ecological balance. These changes can lead to habitat loss and disruption, affecting the diverse species that rely on mudflats. Additionally, the surge-induced influx of seawater alters salinity levels, impacting organisms adapted to stable conditions.

7.5.1.4. Future Stressor

448. The future stressors are sea-level rise, the occupancy of mudflats due to the construction of infrastructure, and future urbanization.

- Occupancy of mudflats due to the construction of infrastructure: Due to the construction of the proposed bay terminal, the existing mudflat area within the project boundary will be occupied. If the bay terminal expands further north and south in the future, it will occupy a substantial portion of the mudflat area.
- Future urbanization: Due to the proposed Bay Terminal activity, there is a possibility of development in the near future along the coastline and urbanization on the east side of the Bay Terminal, which can lead to habitat destruction and increased runoff of pollutants.

7.5.1.5. Cumulative Impacts to Mudflats

449. The location of the Bay Terminal project is on the coast of the Bay of Bengal, particularly near the Patenga beach area. The mudflats along the coast are very significant from a biodiversity perspective. These mudflats are rich with insects, shells, crabs, small fish, and other crustaceans, which serve as food for many creatures, especially birds. Every year, thousands of migratory birds use these mudflats as foraging and resting grounds. Patenga Beach IBA was designated as it meets criteria for IBA declaration due to the presence of globally threatened bird species, namely Lesser Sand Plover (*Charadrius mongolus*, IUCN LC), Spoon-billed Sandpiper (*Calidris pygmaea*, IUCN CR), and Spotted Greenshank (*Tringa guttifer*, IUCN EN). Patenga Beach is also recognized by the IUCN as a Key Biodiversity Area (KBA).

450. The footprint of the proposed Bay Terminal project is physically located within the central area of the Patenga Beach Important Bird Area (IBA), and the project's area of direct impacts occupies more than 60% of the IBA. Consequently, the project will lead to a substantial loss of habitat and cause the migratory bird species to lose their foraging and roosting grounds.

451. There will be a significant cumulative impact on the mudflats of this coast. The Bay Terminal Project itself will occupy a substantial portion of the mudflats in its vicinity. Moreover, there will be other associated development activities centered around this project. Improved terminal facilities will attract more vessels to use the port. During the operational phase and in the future, different kinds of infrastructure could be developed around the Bay Terminal. Therefore, a substantial portion of the mudflats are likely to be occupied in the near future.

452. The pollutants from the project activities and external stressors will initially change the primary and secondary producer level of the aquatic environment as well as the mudflats which will ultimately interrupt the energy flow from one tropic level to the another. Finally, the ecological imbalance might be created by breaking down the food chain and food web. All the dependent biota in this marine and mudflat ecosystem will be hampered. Food scarcity in the mudflats will cause the loss of foraging ground for mudflat dependent wader birds. All the mudflat dependent resident and migratory bird community will be hampered.

453. The increased light pollution from the project activities and external stressors may create unsuitable habitat for marine turtle breeding ground. Increased light pollution will also hamper the night roost of migratory shore birds and as well as the night roost of resident waterbirds.

7.5.1.6. Mitigation & Monitoring

Mitigation during the construction phase

- Schedule construction activities to avoid sensitive periods for wildlife, such as breeding or migratory seasons, special care should be taken for migratory shore birds.
- Limit construction footprints to minimize the area of disturbance.
- Implement sediment control measures like silt curtains to prevent sediment runoff into mudflats.
- Use erosion control mats and vegetation (if possible) to stabilize the soil in construction areas.
- Treat any wastewater from the construction site before discharge.
- Implement restrictions on night-time lighting and noise to minimize disturbances to nocturnal and roosting birds.
- Use sound barriers and low-lighting techniques to reduce the lighting impact.
- Gradually ramp up the sound levels during the piling activities to minimize the shock or disturbance to marine life, particularly cetaceans like dolphins and whales, which rely heavily on sound for communication. Use pingers upstream and downstream to chase away dolphins and other cetaceans.
- Ensure proper disposal of construction waste.
- Prevent the spillage of hazardous materials and have spill response plans in place.
- Employ best practices in sustainable port construction and operation.
- Implement environmental awareness programs for workers and the local community about the importance of mudflats;
- Conduct a biodiversity study to identify significant species in the mudflats for management and establish a sanctuary for selected species based on the study's findings.

Monitoring during the construction phase

- Periodic monitoring of water quality is needed to detect and address contamination.

- Monitor the area for these creatures to ensure they are well away from the piling site; scare them away if they are too close to the site using pingers.
- Regular monitoring of the noise level;
- Conduct periodic monitoring of the local flora and fauna around the mudflat area especially the monitoring of migratory shore birds is necessary.

Mitigation during the operation phase

454. To address the cumulative impacts associated with future activities, the following initiatives should be taken to conserve the mudflats:

- Declaration of the Protected Area: Approximately 12.3 sq km of land, which includes around 9.13 sq km of mudflats and 3.17 sq km of coastal mangroves, is located about

4 km north of the proposed Bay Terminal (as shown in

- **Figure** 7-5). Since this land is government-owned (khas land), the CPA can urge the government to declare it a protected area, specifically highlighting the inclusion of the mudflats. These mudflats could serve as foraging and resting grounds for migratory birds, in addition to supporting other forms of biodiversity.
- Mangrove patches along the coastline should be conserved. New mangrove patches should be created in collaboration with the Forest Department of Bangladesh that will support resident birds and other wildlife species. It will also protect against cyclones. Mangrove trees would also provide a natural separation of the tidal mudflats from the

vast urban development, which would reduce noise and visual disturbances for the benefit of the shorebirds.

- Monitoring coastal mudflats and shorebirds is essential to assessing the cumulative impacts on these habitats and the overall biodiversity.
- Introduce nature-based solutions, such as creating mangrove barriers, to protect mudflats from storm surges, tidal flooding, and sea level rise.
- As of the latest information available, there is no specific record indicating that Bangladesh has ratified the International Maritime Organization (IMO) Convention for Ballast Water Management. This convention typically requires ships to treat their ballast water before discharging it, employing various methods to remove or neutralize the organisms it contains. However, the Bay Terminal Authority can still adhere to international best practices for ballast water management.

Monitoring during the operation phase

- Monitoring of water quality is needed to detect and address contamination.
- Monitor the area for these creatures to ensure they are well away from the piling site;
- Regular monitoring of noise levels;
- Conduct periodic monitoring of the local flora and fauna around the mudflat area. Monitoring migratory birds in the change habitat including the proposed bird conservation area should be monitored.
- Continuous monitoring and research are essential to understand the changing dynamics of mudflats and to develop effective conservation strategies.

Figure 7-5: Map of Proposed Bird Conservation Area Near the Bay Terminal Project

7.5.2. Cumulative Impacts on Water Quality

455. Each should begin with a brief description of baseline status of the VC.

7.5.2.1. Bay Terminal Project

456. During the construction period of the Bay Terminal, capital dredging will increase turbidity in the seawater adjacent to the dredging location. Additionally, runoff from the construction site may have an impact on water quality around the project area.

457. During the operational period, maintenance dredging will continue, creating a similar situation in the adjacent dredging area. Besides this, three types of wastewater will be generated: 1) sewage, 2) bilge water and 3) ballast water. The volume of sewage will be approximately 1,500 m^3/day (considering a 20% factor of safety) from the port operation, including ships, offices, and associated facilities and the volume of bilge water is approximately 1,000 m^3/day (considering a 20% factor of safety) will be generated from ship operations. Wastewater will be treated by treatment facilities that could be reuse by a tertiary treatment plant without discharging it to the sea. Moreover, the sea vessels arriving at the port may discharge ballast water containing non-native species. These invasive species can outcompete native species, impacting water quality and ecosystem health. As per the IMO convention, the ballast water needs to be treated before discharging to the sea at the arrival port.

7.5.2.2. Other projects and activities

458. CEPZ

- During the consultation with CEPZ, currently the industrial establishment of CEPZ contributes 50,000 m^3/day of wastewater, which could be increased to 100,000 m^3/day within the next 8–10 years.

459. CWASA

- According to the CWASA masterplan, the centralized sewerage system was planned in 2017. Chattogram city has been divided into six zones, including Halishahar, Kalurghat, East Bakalia, Fatehabad, North Kattli, and Patenga. The masterplan suggested that the Halishar area will generate about 100 million liters of sewage per day, which will be treated by the proposed STP-1, and the entire treated sewage will be discharged through Regulator-4 (3V, 1.5m x 1.8m) to the proposed Bay Terminal's drainage canal. The precipitation of wastewater from fecal sludge is nominal. Please clarify what this means.

460. Runoff from adjacent urban area

- In a normal condition throughout the whole year, a substantial amount of city wastewater is discharged in the vicinity of the Bay Terminal via the existing four canals inside the proposed project area. In addition, during the heavy rainfall, the urban runoff will generate about 60.78 m^3/s and be discharged through the proposed Bay Terminal's canals. The drain management is part of the work of the Chattogram City Corporation.

461. Seepage water from Halishar landfill

- There is an uncontrolled municipal solid waste yard at Halishar, which is located about 300 m east of the proposed Bay Terminal. It is known as Halishar landfill, and the area is about 9.0 hectares. The runoff of seepage water from the landfill was discharged through Regulator 3. The quantity and quality of the seepage water depend on the pattern of dumping, decomposing period, and nature of the solid waste, which is difficult to quantify for this landfill.

7.5.2.3. Natural Stressors

- Weather Events: Storms, heavy rains, and floods can lead to increased runoff, carrying pollutants and sediments into the water.
- Temperature Fluctuations: Changes in temperature can affect the solubility and reaction rates of chemicals in the water, as well as impact marine life.
- Storm surge and tide flooding: As per the location of the proposed project site, it is extremely vulnerable to storm surge and tide flooding, which may introduce pollutants into the sea and disrupt sediment layers on the ocean floor, potentially releasing contaminants into the water column.

7.5.2.4. Future Stressors

- Future urbanization adjacent to the Bay Terminal area will act as an external stressor.
- Besides, with the development of the proposed Bay Terminal and other industries, it is predicted that there will be substantial development on the east side of the coastal road. This urbanization will contribute additional wastewater, which may be discharged to the sea around the Bay Terminal area.

7.5.2.5. Cumulative Impacts to Water Quality

Impact during construction phase

462. During construction equipment mobilization, waste like oil, mud, dust, scrap metal, and paper may be generated. If disposed of in seawater, these pollutants can accumulate, causing seawater pollution. Dredging can increase water turbidity by re-suspending bottom sediments, which reduces light penetration and affects photosynthesis in marine plants. This can harm aquatic plant health and disrupt marine ecosystems. Turbidity can also impair gill-breathing animals, hinder visual feeders, and disrupt communication among organisms. Settling sediments can smother benthic organisms, corals, and seagrasses, potentially causing growth issues or mortality. Construction waste like bricks, wood, metal, and plastics, along with waste from labor sheds and dredgers, can contaminate surface water in nearby canals. Additionally, oil and lubricant spills during dredging, surveys, refueling, and transport can increase organic and inorganic pollutants in the water. When pile driving operations are conducted for construction purposes, especially near water bodies, they often involve driving large poles or pilings into the ground. This process can disturb the sediment at the bottom and release particles into the water, resulting in turbid water, which is water filled with suspended particles that reduce its clarity. This turbidity is not just an isolated problem. It becomes more concerning when the turbid water from pile driving mixes with other external factors that degrade water quality, such as industrial waste, agricultural runoff, or urban sewage. These additional stressors collectively amplify the adverse effects on the marine environment. The combination of increased turbidity and other pollutants can lead to a cumulative impact on aquatic ecosystems. This means that the overall effect is more damaging than each stressor would be individually. Marine organisms, ranging from small microorganisms to larger fish and plants, can suffer from this compounded impact. Their health, reproductive capabilities, and survival rates can be significantly affected, leading to broader ecological imbalances. Therefore, it's crucial to understand and mitigate these combined impacts to protect aquatic life and maintain the balance of marine ecosystems.

Impact during the operation phase

463. Sewage from vessels, or 'black water,' includes human waste from toilets. The key international regulation for vessel sewage is MARPOL Annex IV, part of the International Convention for the Prevention of Pollution from Ships. This annex mandates sewage discharge control, equipment on ships for managing sewage, and the provision of port reception facilities. Ships are typically required to have sewage treatment plants, comminuting and disinfection systems, or sewage holding tanks. To prevent contamination, onshore treatment facilities at ports are essential. During port operations, an estimated 1000–1500 workers and an additional 400–5000 visitors are expected, generating about 500 m3 of sewage daily. According to Bangladesh Environmental Conservation Rule (ECR)-1997 (updated March 2023), this sewage must be treated before disposal.

464. Maintenance dredging, necessary for port operation, can increase water turbidity by re-suspending bottom sediments. This rise in turbidity adversely affects aquatic plant health and degrades the marine ecosystem. The impact of maintenance dredging is similar to that of capital dredging.

465. Sea transportation activity may negatively deteriorate water quality from wastes (residue of ballast water, bilge water, oil, lubricant, garbage, etc.) from the ship and domestic waste, food and kitchen waste, sewage, etc. from office operations.

Impact due to existing & future projects during construction and operation phase

466. The industrial establishment in CEPZ currently produces 50,000 m^3/day of wastewater, which is predicted to increase to 100,000 m3/day in the near future. This wastewater, containing high levels of BOD, COD, suspended solids, color, and other chemical compounds, must be treated according to DoE guidelines, as stipulated by the ECR 2023, before being discharged into the nearest waterbody. CEZP has a Central Effluent Treatment Plant (CETP) with capacity of 45000 m^3/day, but the efficiency of the treatment plant has controversy. If the CETP of CEPZ's is not performed well the output of CETP could pollute the waterbody around the discharge location of Bay Terminal canal.

467. The Chattogram Water Supply and Sewerage Authority (CWASA) is constructing a Sewage Treatment Plant (STP) on the eastern side of the proposed Bay Terminal. This STP, with a capacity to treat 100 million liters of sewage per day, will collect sewage through a network from the adjacent Halishahar area. The plant will treat the sewage water according to the Department of Environment's (DoE) guidelines (ECR 1997 and updated March 2023) and then discharge it into the Bay Terminal's drainage canal. This process ensures no additional pollution load on the Bay Terminal's discharge canal. However, if the CWASA's STP fails to function properly, it will negatively impact the water quality in the discharge canals.

468. Urban runoff from a substantial portion of Chattogram City regularly discharges into the sea through four regulators. Additionally, during heavy rainfall, the designed urban runoff, amounting to 60.78 m^3/s, discharges through the proposed Bay Terminal's canals. The regular runoff contains high levels of BOD, COD, and suspended solids, while the runoff during heavy rainfall carries a high volume of suspended solids. This runoff pollutes the seawater.

469. The seepage runoff from the Halishar landfill contains a high volume of suspended solids, organic compounds, and toxic substances that contaminate the seawater adjacent to the Bay Terminal's area.

470. Future urbanization will contribute additional wastewater that may be discharged into the sea around the Bay Terminal area, creating an additional pollution load for water bodies if left untreated.

471. The combined discharge of existing external stressors—including untreated CWASA sewage, untreated CEPZ wastewater, urban runoff, landfill seepage, untreated sewage and bilge water from the proposed Bay Terminal, and high-turbidity seawater due to dredging (capital and maintenance)—would create a significant cumulative impact on the seawater quality in the Bay Terminal area. This issue needs to be properly with collaboration among the potential stakeholders (CDA, Chittagong City corporation, CPA, CWASA).

7.5.2.6. Mitigation and Monitoring

Mitigation

472. To address the cumulative impacts associated with project activities during construction and operation, alongside existing projects and future development activities, the following initiatives should be taken to minimize the cumulative impact on water quality:

- The impacts on water quality resulting from the construction and operation of the proposed Bay Terminal should be mitigated and monitored in accordance with the ESIA guidelines, as recommended in Chapter 8 of this report.
- Coordination arrangements should be made with the respective agencies for identified existing and future impacts to water quality. These arrangements aim to mitigate sources of water pollution and monitor the efficiency of the joint water quality and mitigation management system. For example:
    - CEPZ should ensure that wastewater generated from industries is treated through their Central Effluent Treatment Plant (CETP) before being discharged into the Bay Terminal's discharge canal. Additionally, they could

promote the concept of zero liquid discharge (ZLD) in their industrial zone to support sustainable environmental conditions.

- CWASA should ensure the effective and sustainable operation of the Sewage Treatment Plant (STP). Furthermore, in the near future, they should consider adopting tertiary treatment following the biological unit operation. This will enable substantial reuse of treated sewage, which can be utilized for industrial and agricultural purposes.
- Urban runoff, currently discharged into the sea through the proposed Bay Terminal's canals, is managed by the Chattogram City Corporation. In coordination with the city corporation, a wastewater treatment unit should be established in the canal. This unit will treat the wastewater to ensure it complies with the Department of Environment (DoE) water quality guidelines before being discharged into the sea around the Bay Terminal area.
- In coordination with the city corporation, it is necessary to establish an Effluent Treatment Plant (ETP) for treating the seepage from the Halishahar landfill before discharging wastewater into the sea around the Bay Terminal area.
- Future urbanization adjacent to the Bay Terminal will contribute an additional pollution load to the surrounding open sea water body, which needs to be addressed properly at the project planning stage.
- The Bay Terminal Authority can still adhere to international best practices for ballast water management, even though Bangladesh, as a country, has not yet ratified the International Maritime Organization (IMO) Convention for ballast water management.
- A Sewage Treatment Plant (STP) capable of handling 1,000 m^3/day, complete with a tertiary treatment scheme for reusing treated wastewater, needs to be established at the port.
- Bilge water often contains oil, grease, solid waste such as metal shavings and rags, and various chemicals, including oxygen-demanding substances and volatile organic compounds. A Wastewater Treatment Plant with a capacity of 1,000 m^3/day, capable of treating oily wastewater, will be installed at Bay Terminal.
- All incoming vessels to Bay Terminal are allowed to discharge their treated ballast water.

Monitoring

- A routine process of checking the water quality along the coast, specifically around the areas where a canal flows into the sea, on both its north and south sides i.e. two locations in seaside. In addition, the eastern side of the proposed Bay Terminal, seven discharged point at the regulators water quality will be monitored as shown in **Figure 7-6**.
- The goal of this monitoring is to find and respond to any pollution in these areas.
- Periodic monitoring of the water quality of project sources and activities addressing the effectiveness of mitigation of impacts to water quality.

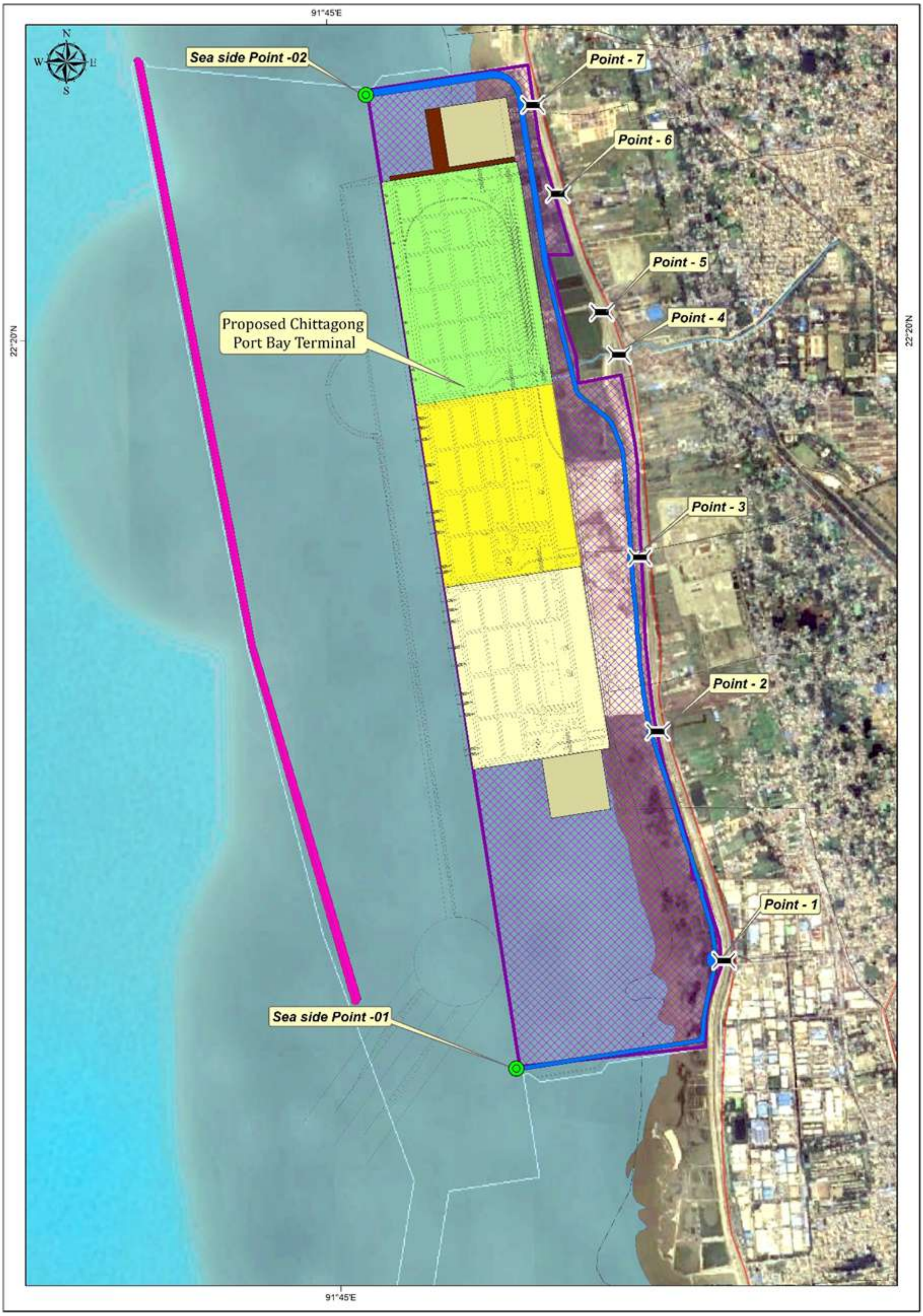


Figure 7-6: Location Map of Water Sample Monitoring

7.5.3. Marine Fish

473. The marine fisheries biodiversity has been observed to be declining over the years around Bay Terminal Area. Degradation of habitats caused by untreated industrial effluent, wastewater from urban areas, landfill seepage, etc. is responsible for the gradual decline of fish abundance and fish biodiversity adjacent to the Bay Terminal's area. The major fish species in marine water are shrimp (*Penaeus monodon*), black pomfret (*Parastromateus niger*), hilsa shad (*Tenualosa ilisha*), blackspotted croaker (*Protonibea diacanthus*), humphead thryssa (*Thryssa* sp.), tengra (*Glyptothorax cavia*), chitra (*Scatophagus argus*), flat head fish/bartail flathead (*Platycephalus indicus*), barramundi (*Lates calcarifer*), Chinese silver pomfret (*Pampus chinensis*), and Indian white shrimp (*Penaeus indicus*).

7.5.3.1. Project Activity

474. The health of marine ecosystems is closely linked to the quality of seawater. Every aspect of marine life is impacted by water quality; for instance, high turbidity can impair gill-breathing animals, hinder visual feeders, and disrupt organism communication. The water quality section of this chapter states that if the activities related to the construction and operation of the project near the Bay Terminal area are not properly managed, they could negatively impact water quality. Port development often involves dredging, channelization, and habitat modification, which can lead to the destruction or alteration of critical fish habitats such as estuaries, marshes, and seagrass beds. These habitats are essential for juvenile fish as nurseries and feeding areas.

7.5.3.2. Existing External Stressors

475. There are several external stressors, such as CEPZ's CETP, CWASA's STP, seepage from the Halishahar Landfill, and urban drainage.

Natural Stressors:

476. Marine fish can be significantly affected by various natural stressors and other factors in a port operation. These impacts can have both direct and indirect consequences for fish populations and the overall marine ecosystem.

- <u>Extreme Weather Events</u>: Severe storms, surges, and cyclones can dramatically alter fish habitats. These events can destroy mangroves and other ecosystems, which serve as crucial breeding and feeding grounds for many fish species. Loss of habitat can lead to a decline in fish populations.
- <u>Temperature Changes</u>: Marine fish are sensitive to temperature changes. Natural variations, such as seasonal shifts or those driven by climate change, can affect breeding cycles, migration patterns, and habitat suitability.
- <u>Invasive Species</u>: During the operation of the proposed Bay Terminal, untreated discharge of ballast water in the port territory may have significant environmental impacts due to its role in transferring invasive species from one part of the world to another. When a ship collects ballast water in one region and discharges it in another, the introduction of non-native species can disrupt marine fisheries and influence sea water quality by outcompeting native species, altering nutrient cycles, and impacting water clarity.

7.5.3.3. Future Projects

477. Future adjacent urbanization activities mentioned in the water quality section may degrade the seawater quality of the proposed Bay Terminal area if there are inadequate interventions for managing the generated wastewater.

7.5.3.4. Cumulative Impacts to Marine Fish

478. During the construction and operation phases of the proposed Bay Terminal, if the wastewater is not managed properly, that may cause a deterioration in water quality, which

might have long-term harmful effects on the marine ecosystem. Such degradation could also adversely affect marine fish populations over time.

479. The discharge from various external stressors, such as untreated sewage from CWASA, CEPZ's untreated wastewater, urban runoff, seepage from landfills, and adjacent future urbanization, could significantly affect seawater quality in the Bay Terminal area. This deterioration in water quality is likely to have detrimental effects on the marine fish population.

480. The cumulative impact of the proposed project activities and existing and future external stressors could significantly affect marine fish populations as well as habitat removal if not addressed with adequate interventions.

7.5.3.5. Mitigation and Monitoring

Mitigation

481. To address the cumulative impacts associated with project activities during construction and operation, alongside existing external stressors and future development activities, the following initiatives should be taken to minimize the cumulative impact on marine fish.

- The mitigation measures for water quality control, as described in the water quality section of this chapter, need to be properly implemented.
- Implementing sustainable fishing quotas, gear restrictions, and ensure the fishing restriction time to protect fish populations and minimizes disruption to the marine ecosystem.
- Increasing public understanding of the challenges faced by marine fish and the importance of ocean conservation can drive support for protective measures and sustainable practices by CPA and relevant multilevel stakeholders.
- Collaborating with fishing communities, coastal residents, and stakeholders in developing and implementing mitigation strategies fosters ownership and ensures long-term success.

Monitoring

- Deploying ocean observatories and monitoring systems allows for real-time tracking of environmental changes and their effects on fish populations, enabling proactive intervention.
- The implementation of water quality mitigation measures should be monitored effectively.
- The Chattogram Port Authority (CPA) should allocate funds to the Department of Fisheries (DoF) for conducting marine fish monitoring. This monitoring, which aims to evaluate the presence of marine fish species, will be conducted by the DoF in collaboration with universities and organizations specializing in marine fish conservation in Bangladesh. The assessment will utilize a range of techniques, including direct observation, consultations with port authorities, shipping personnel, fishermen, and other relevant stakeholders, as well as regular eDNA testing of water samples collected from the project cumulative impact area.

7.5.4. Noise

482. Noise pollution, often overlooked amid other environmental concerns, exerts a profound impact on human health, wildlife, and the ecosystem. Its effects infiltrate various aspects of life, ranging from physical and psychological health to social and economic spheres.

483. On a personal level, exposure to excessive noise can result in numerous health issues. Prolonged exposure to high decibel levels can lead to hearing impairment or loss.

Additionally, it has been linked to heightened stress levels, disturbed sleep patterns, increased blood pressure, and even cardiovascular problems.

7.5.4.1. Project Activities

During the construction phase

484. Various construction activities use different types of equipment that increase noise and can affect receptors near the construction sites (construction activities and operation of heavy equipment) and along the transportation routes of the construction materials. The noise during the construction phase depends on the stage of construction work and the equipment used at the site.

485. The project encompasses civil and mechanical interventions for jetty and terminal construction, including dredged material deposition for land reclamation. Specifically, the use of a 'Hydraulic Push' system for driving approximately 3200 piles, each 1.2 meters in diameter and 60 meters long, at the Bay Terminal sites may elevate the ambient noise levels for nearby local communities as well as marine species nearby the piling location.

During the operation phase

486. During the operation of the Bay Terminal, container transhipment through vessels will increase the noise in the project area. In addition, during container transshipment, cranes, generators, and other associated machinery will be run, which will generate noise in the port area. Moreover, the trailers will generate noise in the vicinity of the proposed Bay Terminal area during the transportation of goods from the port to the delivery end.

7.5.4.2. Other Projects and Activities

487. <u>CEPZ</u>

- Chattogram Export Processing Zone (CEPZ), also known as Chattogram EPZ, is the first and one of the eight export processing zones in Bangladesh, located at South Halishahar in Chattogram, which is on the eastern side of projects. The backside of the CEPZ is very close to a coastal road (marine drive road). There are 501 industrial plots here. Different types of industrial activities, especially garments and associated factories, have been operating in the EPZ since 1983. Industrial activities like machine operation, vehicle movement, captive generator etc. in the zone contribute to the high noise level in the surrounding communities.

488. <u>CWASA</u>

- According to the CWASA masterplan, the centralized sewerage system was planned in 2017. Chattogram city has been divided into six zones, including Halishahar, Kalurghat, East Bakalia, Fatehabad, North Kattli, and Patenga. The masterplan suggested that the Halishar area will generate about 100 million liters of sewage per day, which will be treated by the proposed STP-1. The location of STP-1 is on the eastern side of the Bay terminal. Where land development activities are ongoing. According to FDG with CWAS STP-1, the project director mentioned that the project will be completed by the end of 2025. During the construction of the STP, the construction activities will contribute to an increase in noise levels in the surrounding area.

489. <u>Coastal Road (Marine Drive Road)</u>

- The project site can be accessed by the Port Link Road and 4-lanes of the coastal roads to the east and the Bay of Bengal to the west. Traffic movement on the coastal road will contribute to the high noise level in the proposed bay terminal surroundings.

7.5.4.3. Natural and Other Stressors

- High winds, storms, and heavy rain can amplify or distort sounds, contributing to overall noise levels.
- Rough seas can increase noise levels due to the sound of waves and water movement.

7.5.4.4. Future Projects

- The future urbanization adjacent to the Bay Terminal area and the expansion of the Bay Terminal as well as the coastal road from 4 to 6 or 8 lanes due to increased traffic volume will act as external stressors, contributing to increased noise levels around the Bay Terminal area.

7.5.4.5. Cumulative Impacts of Noise

490. Predicting the cumulative impacts of noise levels is crucial to understanding how various sources of noise collectively affect an environment or a community over time. Noise from the combined effects of the activities during construction and port operations (road and waterway traffic, cargo handling equipment, standby generators, etc.) and proposed Bay Terminal existing external stressors like Coastal Road (Marine Drive Road), CEPZ (industrial zone), upcoming construction and operation CWASA STP, and future development might have significant consequences on human health, wildlife, and overall well-being in the cumulative impacts area.

491. A noise model has been conducted to assess the cumulative impact of the noise level in the proposed Bay Terminal area, where five scenarios have been considered. The scenarios are as follows:

- Scenario I: Base condition (Marine Drive Road with CEPZ)
- Scenario II: Only the construction phase of Bay Terminal without considering the base condition (Marine Drive Road with CEPZ)
- Scenario III: Construction of Bay Terminal + Base Condition (Marine Drive Road with CEPZ)
- Scenario IV: Only Operation of Bay Terminal with Bay Terminal Access Road without considering the Base Condition (Marine Drive Road with CEPZ)
- Scenario V: Operation of Bay Terminal, including Bay Terminal Access Road and Base Condition (Marine Drive Road with CEPZ)

492. The details of noise modeling have been discussed in Appendix 6: Noise Modeling in Ambient Air. The model result shows the following:

- As this area is considered a commercial area, the noise level complies with the Noise Pollution Control Rule - 2006 (day: 70 dBA, night: 60 dBA).
- It is to be mentioned that the cumulative noise contribution due to the operation of the proposed bay terminal increases from 0.2 dBA to 0.8 dBA (approx.) in the daytime and 3.5 dBA to 5.5 dBA (approx.) in the nighttime with the existing situation of the project area. However, the increased nighttime noise level is complies with the Noise Pollution Control Rule – 2006 standard.
- According to the findings, the cumulative contribution of noise level is minimal as a result of the proposed bay terminal's construction and operation. However, the residual impact can be reduced further if proper mitigation measures are implemented during both the construction and operation stages.

7.5.4.6. Mitigation and Monitoring

Mitigation

- The ship's engine may be turned off while it is berthed, and it will utilize the port's energy supply.
- Restrict the blowing of whistles or impulse noise;
- Turn off or throttle down all equipment when not in use.

- Development of a green belt around the project, particularly in the eastern part of the project (4 layers of tree plantation);
- The road traffic speed limit inside the port link road is between 20 and 30 km/hr.
- 2 layers of tree plantations on both sides of the coastal road;
- Establish a coordination arrangement with the respective agencies for identified existing and future external stressors. These arrangements aim to mitigate sources of noise pollution and monitor the efficiency of the joint noise mitigation management system.
- Dense vegetation acts as a natural sound barrier, effectively dampening noise levels in the surrounding area.

Monitoring

- Periodically monitor noise in the Bay Terminal area to detect sources and implement mitigation measures.

7.5.5. Community Safety

7.5.5.1. Project Activities

493. During the construction and operation of the Bay Terminal, a significant amount of activity will occur in the project area. To support the project activity, a number of people at different levels will accumulate in the project area. Therefore, a number of community safety concerns will arise in the project cumulative impact area. Among various safety concerns, the most prominent issues include labor influx, increased vehicle movement, and public nuisances and disturbances caused by construction activities.

494. The influx of labor, often from outside the local community, can have multiple social impacts, including increased demand on local services such as healthcare, housing, and transportation. Economically, while the boost in workforce can benefit local economies, it may also drive up prices and rents, adversely affecting local residents. As the increased population density could strain local health services and elevate the risks of accidents and communicable diseases.

495. The project will likely result in increased vehicle movement, leading to traffic congestion, higher risks of accidents to the pedestrians. This escalation in vehicular activity can also heighten air and noise pollution, negatively impacting the health and quality of life of nearby residents.

496. Moreover, public nuisances and disturbances may occur by the construction activities, characterized by their noisy nature and sometimes round-the-clock operations, can cause substantial noise and light pollution, disrupting the daily lives and sleep patterns of nearby residents. The generation of dust and other pollutants from construction sites poses additional health risks, particularly for individuals with respiratory issues. Furthermore, the visual landscape of the area can be drastically altered during construction, leading to a loss of amenities, greeneries and creating an obstruction for a seaside scenery view for local residents.

7.5.5.2. Other Projects and Activities

497. The external stressors for community safety are the influx of workers from the CEPZ and construction workers from the CWASA STP-1 site. The increased vehicle movement for construction and operation activity of the CWASA STP-1, EPZ worker movement, and vehicle movement from Chattogram port through coastal roads. Besides, the construction activity of the CWASA STP-1, pollution, especially noise, dust, solid waste, and wastewater, and visual obstruction cause community disturbance and nuisance.

7.5.5.3. Natural and Other Stressors

- Storm surge and tidal flooding: Coastal areas are often susceptible to storm surge and tidal flooding, which can cause significant damage to port infrastructure, disrupt operations, and endanger the surrounding community. High winds and heavy rains can lead to flooding, power outages, and structural damage. Flooding can disrupt port operations and pose risks to nearby communities, including damage to homes and critical infrastructure.
- Tsunamis: In the proposed Bay Terminal area, there is a significant probability of tsunamis, which can be triggered by earthquakes and cause catastrophic damage to port facilities and surrounding areas.
- Rising Sea Levels: Due to climate change, rising sea levels are a long-term concern for seaports and adjacent communities. Increased sea levels can lead to more frequent and severe flooding, erosion, and the potential displacement of populations.
- Earthquakes: The earthquakes can damage port infrastructure, disrupt operations, and pose risks to the safety of the community.
- Erosion and Coastal Changes: Natural erosion and changes in coastal geography can impact seaport operations and community safety by altering shorelines, affecting navigational routes, and potentially undermining the structural integrity of port facilities.

7.5.5.4. Future Projects

- Future adjacent urbanization activities could generate potential risks to community safety by increasing the population density and create pressure to the local services like healthcare, housing, and transportation.

7.5.5.5. Cumulative Impacts on Community Safety

498. Due to the large labor influx from the proposed project and the existing external stressor, there will be an increase in the likelihood of exploitive and coercive sexual relations with community members and the risk of sexual exploitation by project workers, female domestic workers, and vendors those people who are directly engaged with the project activity within the project influence area.

499. Because communicable diseases, spread rapidly through human interactions, outside laborers may spread diseases unknown to the community due to their ignorance, unwillingness to follow health protocol, and intermixing with local communities. Eventually, the entire community may be affected.

500. Due to the increased traffic movement during the construction and operation of the project, along with the external stressors, the probability of a traffic accident of the pedestrian in the surrounding cumulative impact area will increase.

501. Pollution, especially noise, dust, waste, and wastewater, and visual obstruction due to construction activities and external stressors cause community disturbance and nuisance. This concern has a significant impact on community safety.

7.5.5.6. Mitigation and Monitoring

Mitigation

502. The mitigation measures are as follows:

503. Labour Influx

- A Code of Conduct (CoC) submitted by the contractor for use in the project should include provisions for addressing the risks of sexual exploitation and abuse (SEA) and sexual harassment (SH) and prohibitions against any illegal sexual activity.

- Establish worker camps inside the project area which will be separated from local communities with strict protocols for interaction to mitigate project impacts due to the labor influx.
- The contractor shall organize an extensive awareness program for workers at the site before construction begins. This will cover sensitization to local community norms regarding SEA and SH risks and workers' responsibilities under the CoC.
- Separate toilets and washrooms must be provided for male and female workers.
- The grievance redressal mechanism should be extended to include local community roles and responsibilities for recording, acknowledging, and acting on grievances.
- The applicable grievance mechanism needs to be disclosed to concerned stakeholders and made accessible for reporting grievances. A register or record of grievances should be maintained at the site.
- Third-party vendors, particularly those associated with transport and site cleaning, must not be allowed to enter the premises without valid ID cards or gate passes.
- Exercise strong control over labor movements with regular health checkups.
- Provide health-related equipment such as masks and sanitizers.
- Follow health-related protocols at work sites and accommodation areas.
- Provide medicine and consultation services.
- Ensure health insurance coverage for laborers.
- Offer leave facilities for medical conditions.

504. Increased vehicle movement

- Ensure continuous monitoring of traffic and pedestrian interfaces in the project area.
- Promote traffic safety awareness in communities in the direct area of influence and along the transportation route.
- Contractors should install the required signage and reflectors at the site to prevent potential accidents, issue proper advisories for vehicle mobility, implement effective dust suppression measures, and allocate funds for post-construction road maintenance to avoid conflicts with the host community.
- Project vehicular movement will be restricted to defined access routes.
- Proper signage will be displayed at critical traffic junctions along the vehicular access routes used during the construction phase. This signage will help prevent diversions from designated routes and ensure appropriate speed limits are maintained near residential areas.
- Project contractors should develop and enforce a “no drug, no alcohol” policy to prevent road accidents and incidents.
- Drivers will receive induction training on road safety and the traffic management policy.
- All vehicles entering the access roads and port must have valid Pollution Under Control (PUC) certificates.
- Advance notice will be given for any road diversions and closures to project vehicles using the aforementioned routes. The use of horns by project vehicles will be restricted near sensitive areas such as schools and settlements.
- Temporary parking facilities should be provided within the work areas and construction sites to avoid road congestion.

- Vehicular movement near sensitive locations such as schools, colleges, and hospitals identified along designated vehicular transportation routes must be carefully controlled.
- Routine maintenance of project vehicles will be conducted to prevent abnormal emissions and excessive noise generation.
- Adequate training on traffic and road safety operations will be provided to the drivers of project vehicles. Road safety awareness programs, in coordination with local authorities, will be organized to educate target groups, such as schoolchildren and commuters, about traffic safety rules and signage.
- Regular maintenance of project vehicles must be ensured by the contractors.

505. Public nuisance

- Use construction equipment that produces low sound and pollution.
- Establish a workstation at a designated location.
- Transport construction materials at night to minimize pressure on the roads.
- Locate the construction site away from residential areas.
- Set up a grievance redress committee that includes community leaders.
- Spray water around the construction site to reduce dust.
- Hold regular meetings with local residents and community leaders.
- Implement mitigation measures against noise, air quality issues, and waste management.
- Disturbance due to construction activities
- Managing the disturbance due to the construction activities requires a comprehensive approach involving careful planning and the implementation of safety measures.
- Regular communication with the community;
- Adherence to safety and environmental regulations to minimize the impact on community safety during the construction of the proposed Bay Terminal.

Monitoring

- Workforce Registration and Tracking: Implement a registration system for all workers, including personal, origin, skills, and duration details, and regularly update this database.
- Collaboration with Local Authorities: regularly collaborate with local government bodies for insights and resources to effectively monitor and manage labor influxes.
- Regular Reporting and Audits: Establish a system for routine reporting and auditing of workforce numbers and movements, involving surveys and contractor reports.
- Community Feedback Mechanisms: Create channels for community reports on the labor influx, such as meetings, suggestion boxes, or online platforms.
- Coordination with Contractors: Ensure contractors and subcontractors comply with workforce limits and standards and provide adequate facilities for workers.
- Utilizing Technology for Monitoring: Employ technology like GPS, biometric systems, and digital tools to track laborer presence and movement.
- Labor Market Analysis: Continuously analyze the local labor market to understand capacity and influx impacts, aiding in hiring practice adjustments.
- Health and Safety Monitoring: Monitor health and safety incidents among the workforce, including disease spread, accidents, and other health incidents related to project activity.

7.5.6. Employment

7.5.6.1. Project Activities

506. The proposed Bay Terminal project will use around 2,500 acres of land, which is situated along a 6.15-kilometer coastal stretch on the west side of the coastal ring road. The project footprint area is mainly an intertidal zone that is submerged during high tide. It is situated in four mouzas: South Kattali, North Halishahar, Middle Halishahar, and South Halishahar. The soil in the majority of the project area is saline and unsuitable for agricultural activities, leading to an absence of agriculture farming in this area. However, the project footprint includes eleven dairy, poultry, and fish farms, employing about 50 people. The implementation of the Bay Terminal project requires the relocation of these firms, posing potential financial and livelihood challenges for the firm owners and their employees.

507. During the construction of the proposed Bay Terminal, it involved extensive construction activities, including capital dredging, land reclamation, and the construction of various infrastructure such as terminals, warehouses, roads, bridges, water and wastewater treatment plants, as well as the installation of port equipment.

508. During the operation of the proposed Bay Terminal, a wide range of activities are essential for efficient cargo handling and overall management. These include loading and unloading of various cargo types, managing storage and warehousing, container organization, and facilitating the docking and berthing of ships. Additionally, the Bay Terminal handles customs and clearance procedures, enforces stringent security measures, and conducts regular maintenance of facilities and equipment. Logistics coordination for transporting goods, providing ship services, and implementing environmental management practices are also crucial.

7.5.6.2. Other Projects and Activities

- Three fishermen villages—South Kattoli Jelapara, Kathgor Jelapara, and Akmol Ali Road Jelapara—have been identified within 1-3 km of the project boundary during the socio-economic survey. These villages are home to about 2,000 fishermen who are fishing within a 5-7 km range from the coastline of the proposed project.
- As of fiscal year 2022-2023, the Chattogram Export Processing Zone (CEPZ) employs around 1,72,880 people in various garment and textile manufacturing processes.
- The construction of CWASA STP-1 is ongoing, located just east side (countryside) of the proposed Bay Terminal project. Approximately 400–500 construction workers and support staff are engaged in construction activities, which are expected to be completed by the end of 2025.
- There are some truck stands situated on the east side of the proposed Bay Terminal area, where 100–200 people are employed for logistical support to the CPA and other areas.
- 2-3 crushed stone storage yards are located on the east side of the proposed project area, employing approximately 100–150 people.
- Additionally, there are temporary grocery and tea stalls beside the coastal road, engaging a number of people.

7.5.6.3. Natural Stressors and Other Factors:

- Climate Change and Extreme Weather: Rising sea levels, increased frequency of cyclones, storm surges, and other climate change impacts can affect port operations and the safety of relevant workers;
- Biodiversity Loss: The destruction of natural habitats due to port activities may lead to a decline in biodiversity, affecting fisheries, which impacts the employment of fishermen.

- Market Fluctuations: Changes in global trade dynamics can affect the volume of goods handled by a port, impacting employment in port-related industries;
- Technological Changes: Automation and technological advancements in port operations can lead to a reduction in the need for manual labor, affecting employment.
- Competition: Competition from other ports can lead to a decrease in cargo volume, impacting jobs related to port activities and logistics;
- Changes in Local Economy: The port can change the local economic situation, possibly leading to a decline in traditional employment.

7.5.6.4. Future Projects

- Future Urbanization and Development: Due to the proposed Bay Terminal activity, there are possibilities for development in the near future along the coastline and urbanization on the east side of the Bay Terminal, which will create substantial employment opportunities around the project area.

7.5.6.5. Cumulative Impacts on Employment

Impact during construction phase

509. The construction phase of Bay Terminal generates a significant number of job opportunities for both skilled and unskilled workers. Skilled workers employed in these projects typically include welders, electricians, heavy equipment operators, and civil engineers. Meanwhile, unskilled laborers are hired for various tasks, including earthmoving, concrete pouring, and site cleaning. Additionally, the involvement of contractors, subcontractors, and suppliers throughout the construction phase further expands the range of job opportunities, contributing to the overall employment growth in the region.

Impact during operation phase

510. During the operation of the proposed Bay Terminal a dedicated workforce will be required for its daily operations, maintenance, and security. This includes port workers and equipment operators for cargo handling. Administrative staff play a crucial role in managing customs clearance, documentation, and customer service, ensuring the smooth functioning of port activities. Security personnel are essential for ensuring the safety and security of the port facilities, protecting both the infrastructure and the cargo. Additionally, maintenance crews, comprising technicians and engineers, are employed to keep all equipment and infrastructure in working order. These diverse roles are vital for the efficient and secure operation of the Bay Terminal and will employ approximately 2000 people.

- Indirect employment: The proposed Bay Terminal will act as a catalyst for economic activity in the surrounding area. This is often evidenced by warehousing and logistics companies establishing operations nearby, leading to job creation in inventory management, transportation, and distribution. The influx of Bay Terminal workers and visitors can also boost demand for local services and amenities, such as restaurants, hotels, and retail businesses, further stimulating the local economy. Additionally, service providers like banks, insurance companies, and legal firms may find opportunities to expand in order to support Bay Terminal-related activities, thereby creating additional jobs in these sectors. This overall increase in economic activity and job creation contributes to the growth and vitality of the region surrounding the proposed project area.
- Supply Chain Employment: The proposed Bay Terminal will serve as a major attraction for shipping companies and manufacturers, who are drawn to the efficiency of transportation and access to global markets that such ports offer. This influx of businesses can significantly boost the local economy, leading to the creation of jobs in both the shipping and manufacturing industries. As these companies expand or relocate to the area to capitalize on the Bay Terminal's services, they bring with them a range of employment opportunities. This not only enhances the economic vitality of the region

but also diversifies its industrial base, making it an attractive destination for further business investments.

- Long-Term Economic Growth: Successful Bay Terminal Development can be a major driver of long-term economic growth in the region. By enhancing trade efficiency and providing access to global markets, the Bay Terminal can attract a wide range of businesses and investments. This influx of commercial activity can create job opportunities across various sectors, not just in shipping and transportation but also in industries like manufacturing, retail, and services. The Bay Terminal acts as a catalyst, stimulating the local economy and fostering an environment conducive to business growth. As the region becomes an increasingly attractive location for investment, this sustained economic expansion can lead to a prosperous and diverse economic landscape, benefiting the community as a whole.

Impact due to existing & future projects during construction and operation phase

- The construction and operation of the Bay Terminal will have a multifaceted impact on the region. While it promises economic growth and job creation, it also necessitates careful consideration of the needs and livelihoods of local communities, especially the fishing villages, and the sustainable management of environmental resources. The construction and operation of the proposed Bay Terminal project are poised to have significant impacts on the surrounding region, considering several key factors:
- Impact on Local Communities: The presence of three fishermen villages—South Kattoli Jelapara, Kathgor Jelapara, and Akmol Ali Road Jelapara—within 1-3 km of the project boundary indicates a substantial impact on local livelihoods. These villages, housing around 2,000 fishermen who fish within a 5-7 km range from the coastline, may face disruption in their traditional fishing activities due to the construction and operation of the sea port.
- Employment Generation: The Chattogram Export Processing Zone (CEPZ), employing approximately 1,72,880 people in garment and textile manufacturing, suggests a robust industrial base in the area. The development of the proposed Bay Terminal could further boost these industries by improving logistics and market access, potentially leading to more employment opportunities.
- Construction Workforce: The ongoing construction of CWASA STP-1, located near the proposed Bay Terminal project, with 400–500 workers engaged, highlights the immediate employment benefits during the construction phase. This also indicates the capacity for large-scale infrastructure projects in the area and the availability of a construction workforce.
- Logistics and Ancillary Services: The existence of truck stands and crushed stone storage yards employing between 100 and 150 people, respectively, alongside temporary grocery and tea stalls, points to a well-established network of logistics and support services. The development of the proposed Bay Terminal could expand these sectors, providing more employment and business opportunities.
- Economic Diversification and Growth: The proposed Bay Terminal's operation will likely lead to increased economic diversification. By improving trade access and logistics, it can attract new businesses and investment, further stimulating the local economy. This could lead to job creation across various sectors, from manufacturing to services.
- Potential Challenges: While the proposed Bay Terminal presents opportunities for economic growth, it also poses challenges. The construction may temporarily disrupt local businesses and the livelihoods of those in the fishing villages. Additionally, environmental concerns, such as the impact on marine life and water quality, need to be carefully managed to ensure sustainable development.

Impact due to natural stressors during construction and operation phase

511. Natural stressors and changes in global and local dynamics significantly influence the construction and operation of Bay Terminal. These factors not only affect the physical infrastructure and operations of the Bay Terminal but also have profound implications for the employment and livelihoods of those in the surrounding areas, particularly those in industries directly tied to the port's activities.

- Climate Change and Extreme Weather: The effects of climate change, including rising sea levels and an increased frequency of cyclones and storm surges, pose serious challenges to Bay Terminal operations. These conditions not only threaten the safety of workers but also the structural integrity of the port, requiring enhanced resilience measures and potentially leading to temporary closures or reduced operations during extreme weather events.
- Biodiversity Loss: The proposed Bay Terminal activities, especially construction and expansion, can disrupt natural habitats, leading to a decline in biodiversity. This loss significantly impacts fisheries, which are crucial for the livelihood of local fishermen. The reduction in fish populations due to habitat destruction can result in decreased catches, adversely affecting the employment and income of those reliant on fishing.
- Market Fluctuations: Global trade dynamics directly influence the volume of goods handled by the proposed Bay Terminal. Shifts in international trade patterns or economic downturns can reduce cargo throughput, leading to a potential decrease in employment opportunities in port-related industries, including logistics, cargo handling, and customs processing.
- Technological Changes: Advancements in automation and technology in port operations can streamline processes but also reduce the need for manual labor. While this enhances efficiency, it can lead to a decrease in certain types of jobs, particularly for unskilled or semi-skilled workers, necessitating a shift in workforce skills and training.
- Competition with other ports: The competitive environment of global shipping can affect a Bay Terminal's cargo volume. Competition from other ports, offering better facilities or lower costs, can result in a loss of business and, consequently, a reduction in employment opportunities related to port activities and logistics.
- Changes in Local Economy: The establishment or expansion of the proposed Bay Terminal can significantly alter the local economic pattern. While it can lead to growth in some sectors, it might also cause a decline in traditional forms of employment, such as small-scale fishing or local retail, as the economy shifts towards more port-centric activities.

7.5.6.6. Mitigation and Monitoring

Mitigation

512. To effectively address the employment-related impacts of the Bay Terminal project, the following measures should be implemented in a logical and structured manner:

- Comprehensive Resettlement Plan: Develop a comprehensive Resettlement Action Plan (RAP) along with sustainable Livelihood Restoration Plan(LRP) for the twelve farm workers and owners within the project footprint who have completely lost their livelihoods. This plan should focus on adequately compensating and supporting these affected individuals.
- Skill Development and Training Programs: Invest in skill development and training programs specifically targeting the directly affected workers, farm owners, and local unskilled laborers. This will enable them to acquire the necessary skills for participating in various roles within the project.
- Adaptation to Technological Changes: Conduct training programs for the local workforce to adapt to technological changes in port operations, ensuring a smooth transition for workers into new roles as required.

- Prioritization of Local Hiring: Give priority to hiring directly affected workers, farm owners, and local residents for both skilled and unskilled positions throughout the construction and operation phases of the project.
- Support Programs for Affected Fishermen: Implement programs to support fishermen affected by the project, including offering alternative livelihood options, training in sustainable fishing practices, and compensation for losses due to reduced fish populations.
- Fisheries Management Plan: Develop and execute a fisheries management plan that promotes sustainable fishing practices and mitigates the project's impact on local fishermen.
- Job Creation for Local Residents: Ensure that a significant proportion of the new jobs created during both the construction and operation phases are allocated to local residents, fostering community support and economic benefits.
- Diversification of Cargo and Trade: Diversify the types of cargo and trade handled by the Bay Terminal to mitigate the impacts of global market fluctuations on local employment and operations.
- Community and Stakeholder Engagement: Actively engage with local communities, relevant stakeholders, and environmental groups to collaboratively address the challenges posed by natural stressors and the changing dynamics of the project.

Monitoring

- Periodic monitoring of the implementation of the resettlement plan. Is plan needed?
- Periodic monitoring of the status of skill development and training programs.
- Periodic monitoring of the status Support Programs Support Programs Affected Fishermen: Implement programs to support fishermen affected by the project, including offering alternative livelihood options, training in sustainable fishing practices, and compensation for losses due to reduced fish populations.
- Fisheries Management Plan: Develop and execute a fisheries management plan that promotes sustainable fishing practices and mitigates the project's impact on local fishermen.
- Job Creation for Local Residents: Ensure that a significant proportion of the new jobs created during both the construction and operation phases are allocated to local residents, fostering community support and economic benefits.
- Diversification of Cargo and Trade: Diversify the types of cargo and trade handled by the Bay Terminal to mitigate the impacts of global market fluctuations on local employment and operations.
- Community and Stakeholder Engagement: Actively engage with local communities, relevant stakeholders, and environmental groups to collaboratively address the challenges posed by natural stressors and the changing dynamics of the project.

8. Stakeholders' Engagement

8.1. Introduction

513. Stakeholder engagement is a process that engages stakeholders in consultations throughout the project life cycle. It is a regulatory process per ECR-2023 of the DoE, where an open and transparent engagement with all relevant stakeholders during project planning and throughout the project cycle is needed to determine the environmental and social impacts of project planning and implementation. According to ESS10, "effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and significantly contribute to successful project design and implementation".

8.2. Objective/Description of SEP

514. The overall objective of this SEP is to define a program for stakeholder engagement, including public information disclosure and consultation throughout the entire project cycle. The SEP outlines how the project team will communicate with stakeholders and includes a mechanism by which people can raise concerns, provide feedback, or make complaints about project activities or any activities related to the project.

8.3. Stakeholder Identification

8.3.1. Methodology

515. To meet best practices, the project will apply the following principles for stakeholder engagement:

- *Openness and life-cycle approach:* Public consultations for the project(s) will be arranged during the whole life cycle, carried out openly, free of external manipulation, interference, coercion, or intimidation.
- *Informed participation and feedback:* information will be provided to and widely distributed among all stakeholders in an appropriate format; opportunities are provided for communicating stakeholder feedback and for analyzing and addressing comments and concerns.
- *Inclusiveness and sensitivity:* Stakeholder identification is undertaken to support better communications and build effective relationships. The participation process for the projects is inclusive. All stakeholders at all times are encouraged to be involved in the consultation process. Equal access to information is provided to all stakeholders. Sensitivity to stakeholders' needs is the key principle underlying the selection of engagement methods. Special attention is given to vulnerable groups that may be at risk of being left out of project benefits, particularly women, the elderly, persons with disabilities, displaced persons including children, women, the elderly, the mentally and physically impaired, women-headed households, etc. migrant workers and communities, and the cultural sensitivities of diverse ethnic groups.

516. For the Bay Terminal Project, the following stakeholders have been identified and analyzed per project component:

8.3.2. Affected Parties

517. Local inhabitants namely women, children, the elderly, the mentally and physically impaired one and the women led households surviving on fishing, shopkeeping and related petty businesses in the project footprint, i.e, , Kathgor Sea Beach, Anandobazar Beach, and North

Kattoli Beach are most adversely impacted by environmental pollution in and around the project area, in particular during the implementation and operation of the Bay Terminal Project.

518. Local and migrant fishermen who make a living by fishing in the bay west of the bay terminal would be adversely affected and would need to move to other places and settle, and this would require the livelihood restoration of some 1200–1500 fishermen families or those related to fishing from the sea.

519. Shopkeepers, restaurant owners, etc. located at Kathgor Sea Beach, Anandobazar Beach, and North Kattoli Beach and serving the fishermen in the area will need to vacate CPA land, resettle elsewhere, and start their business afresh.

520. Women, adolescents, and minor children may fall prey to SEA/SH, STD, and GBV-related incidents due to the presence of migrant workers at the project site.

521. The devotees of the Sanatan religion who visit the three Rani Rashmoni Ganga Snan Ghats (Holy Shower to cleanse sins) sites along the beach in the project area during the Bangla Calendar month of Chaitra 10–12, along with the village fair, will have difficulty performing their religious rituals as these sites would become restricted areas due to port construction and operation.

522. Local people who used the beach area for grazing their cattle heads would have to move their cattle heads elsewhere for grazing.

523. Transport owners and transport workers plying commercial vehicles along the port connecting road or the coastal road would have difficulties plying their transports due to the construction of Bay Terminal and the movement of many construction-related machines, plants, and vehicles.

524. Local commuters who commute along these roads would have difficulty commuting safely due to the increased number of vehicles plying in the project area.

8.3.3. Other Interested Parties

525. The other interested parties are the individuals, groups, or entities that may not experience direct impact from the project but who consider or perceive their interests as being affected by the project and who could affect the project and the process of its implementation in some way. The other interested parties include the following:

- Chattogram Customs House
- Chattogram Development Authority (CDA)
- Chattogram City Corporation (CCC)
- Private entrepreneurs operating domestic and international shipping agencies,
- Clearing and forwarding agencies,
- Large business houses involved in the import and export of goods,
- Various business federations,
- Labor organizations working at the port,
- Transport associations and related business entities operating in the port,
- Cargo handling organizations,
- Private container yards,
- Bangladesh Garments Manufacturers and Exporters Association (BGMEA),

- Chattogram Chamber of Commerce and Industries (CCCI), Chattogram Women Chamber of Commerce and Industries
- Overseas importers of Bangladeshi products would ship goods directly from Bay Terminal to the destination countries without visiting Singapore or Colombo ports, as the cost of shipping would be reduced along with a shortened voyage period.
- Local and international contractors and dredging companies interested in having a share in the construction work of the project
- Local manufacturers and bulk suppliers of construction materials
- Local construction machinery suppliers and vendors
- Department of Environment, Chattogram (doe.Chattogram.gov.bd)
- Roads and Highways Department, Chattogram
- Bangladesh Railway, Chattogram
- Bandar Police Station, Chattogram
- Civil Society Organizations (CSOs), Community-Based Organizations (CBOs), and Think Tanks on Environmental, Women's, Labor, and HR Issues
- Print and electronic media
- Local NGOs working on HR, gender, labor, the environment, waste management, etc.
- Job seekers for employment in the Bay Terminal Project include unemployed youth, women, members of the minority, and the transgender community.
- Other DPs and private entrepreneurs interested in financing the Bay Terminal Project
- Ministry of Finance
- Finance Division,
- Banking Division,
- Planning Commission
- Economic Relations Division
- Ministry of Environment, Forest, and Climate Change (MOEFCC)
- Department of Environment (DOE)
- Ministry of Road Transport and Bridges (MORTB)
- Ministry of Railways
- Ministry of Shipping (MoS)
- Prime Minister’s Office (BEPZA and BEZA)

8.3.4. Disadvantaged/Vulnerable Individuals or Groups

526. In the context of the Bay Terminal project, vulnerability stems from persons, fishermen, shopkeeper entities, and non-titled holders residing primarily within the project footprint and adjacent area whose temporary homestead and livelihood would be adversely affected. These also include the local and migrant fishermen (1200–1500 families) who make a living by fishing in the bay west of the Bay Terminal in the designated fishing areas (named FAR in the local language) who would be adversely affected as they would have to vacate the land and their fishing areas would also have to be shifted owing to dredging and construction activities.

527. Local inhabitants in the project footprint, including children, women, the elderly, the mentally and physically impaired, women-headed households, pregnant women, etc., are most adversely impacted by environmental pollution (dust, noise, and light) in and around the project area, during the implementation and operation of the Bay Terminal Project.

528. Women, adolescents, and minor children may fall prey to SEA/SH, STD, and GBV-related incidents due to the presence of migrant workers at the project site, labor camp, or other living areas.

529. Local and migrant fishermen (1200–1500 families) who make a living by fishing in the bay west of the Bay Terminal would need to move to other places and resettle their livelihood.

530. Shopkeepers, restaurant owners, etc. located at Kathgor Sea Beach, Anandobazar Beach, and North Kattoli Beach serving the fishermen and local tourists in the area will need to vacate CPA land, resettle elsewhere, and start their business afresh. The shopkeepers getting affected by the project within the footprint have to be surveyed and included in the RAP.

531. The devotees of the Sanatan religion who visit the three Rani Rashmoni Ganga Snan Ghats (Holy Shower to cleanse sins) sites along the beach in the project area during the Bangla Calendar month of Chaitra 10–12, along with the village fair, will have difficulty performing their religious rituals as these sites would become restricted areas due to port construction and operation.

532. Local people who used the beach area for grazing their cattle heads would have to move their cattle heads elsewhere for grazing.

533. Local commuters who commute along these roads would have difficulty commuting safely due to the increased number of regular and construction-related transports plying in the project area.

534. Private and commercial vehicle owners, transport services, and the Transport Workers Association would find difficulty using the coastal road for carrying goods to and from the port owing to various project-related activities at the Bay Terminal.

535. It is yet to be ascertained whether the project footprint includes the LGBTQ+ community. When identified, these groups would also need special handling and livelihood restoration support.

8.4. Stakeholder Engagement Program

8.4.1. Summary of Stakeholder Engagement Conducted During Project Preparation

8.4.1.1. Focus Group Discussion (FGD)

536. A total of 12 focus group discussions (FGD) were held by the ESIA team with the various occupational groups within and around the project area. About 120 people participated in the FGD, including members of vulnerable groups (women, children, and people with disabilities), fishermen, and stakeholders engaged in aquaculture and cattle farming inside the project site. The stakeholders' viewpoint was considered in the project's development. Most of the residents near the project site have low incomes. Opinion of the people were sought about the potential impact on them and mitigation measures. Focus groups were formed with homogenous groups of people. The FGD documentation report will be attached to the SEP under preparation.

8.4.1.2. Stakeholder Consultations

537. Three public consultation meetings were held: (1) on April 1, 2017, at 10:30 a.m. in Munshipara, Munir Nagar (Ward 37, Chattogram City Corporation) with 24 participants; (2) on April 1, 2017 at 5:30 p.m. in South Kattuli (Ward 11, Chattogram, City Corporation), with

27 participants; (3) on September 21, 2022, in CPA Shaheed Md. Fazlur Rahman Munsi Auditorium, with 152 participants. Apart from these, informal on-the-spot small group consultation meetings were held throughout the study period. Opinon of rhe people were taken into account to prepare the safeguard documents.

8.4.1.3. In addition, nine face-to-face consultation meetings were held with the Chattogram Development Authority (CDA), Chattogram City Corporation, Chattogram WASA, Bangladesh Water Development Board (Chattogram), and neighborhood residents to gather stakeholder feedback for identifying the affected area and improving the project drainage plan. The stakeholder consultation documentation report would be part of the Stand-alone SEP which is being developed. iStakeholder Concerns and Responses

538. The key concerns raised during the meetings are: (i) impact of city drainage; (ii) traffic congestion management on coastal roads; (iii) land acquisition payment issue; (iv) loss of livelihood and limited alternative sources for support and survival; (v) land reclamation issues; and (vi) details of the activity of port operations.

539. The environmental and social reports and plans were disclosed by circulating hard copies and uploading these reports to the dedicated Bay Terminal website. Feedback received during consultations was taken into account by the CPA.

8.4.2. Summary of Project Stakeholder Needs and Methods, Tools, and Techniques for Stakeholder Engagement

540. Different engagement methods are proposed and cover different stakeholder needs, as stated below. Examples may include (i) structured agendas, (ii) focus group meetings and discussions, (iii) community consultations, (iv) formal meetings, (v) one-on-one interviews, (vi) site visits, etc. **Table 8-1** shows a preliminary SEP summary to be further detailed, especially for the project construction and post implementation stages, in the standalone SEP which is being developed.

Table 8-1: Stakeholder Engagement Plan Summary

Project stage	Target Stakeholders	Topic of Consultation /Message	Method Used	Responsibilities	Frequency / Timeline
Preparation stage	CPA	Details design (master plan, terminal & Break Water design), ESIA report preparation.	Meeting	Design & ESIA Team	Regularly on need basis though-out the design period
	WB	WB-ESF/Terminal and Breakwater Design.	Meeting and Discussion	MoS, CPA & ESIA Team	June.2022-Continue
	PAP/PAHs Fish Trader Landowner Farmer	Compensation Rehabilitation. Livelihood Restoration.	Meeting FGD Interview PCM/SCM	CPA & ESIA Team	June2022-Continue
	Adjacent village fisherman, fish trader Fishing boat owner	Livelihood Restoration	Meeting FGD Interview		June 2022-Continue

Project stage	Target Stakeholders	Topic of Consultation /Message	Method Used	Responsibilities	Frequency / Timeline
	Devotees of the Sanatan religion who visit the three Rani Rashmoni Ganga Snan Ghats	Heritage site	Meeting & Discussion	CPA & ESIA Team	June.2022-till date
	Chattogram City Corporation (CCC)	About community drainage canal which is passing over the project & future management. Rehabilitation existing drainage outlet.	Meeting & Discussion	ESIA Team	June-August 2022
	Chattogram Development Authority (CDA)	Rehabilitation existing drainage outlet. And about expansion of future development plan in the surrounding of project area,	Meeting & Discussion	ESIA Team	June-August 2022
	Water Development Board, Chittagong Division	Functionality of existing Sluice Gate	Meeting & Discussion	ESIA Team	June-August 2022
	CWASA	About community drainage canal. CPA water demand & supply scope of drinking water, STP development in the Bay Terminal area. Unintercept Uninterrupted drainage outlet.	Meeting & Discussion	ESIA Team	June-August 2022
	Roads and Highways Department, Head Office	About future expansion of coastal road & Dhaka-	Meeting & Discussion	ESIA Team	June 2022 to continue

Project stage	Target Stakeholders	Topic of Consultation /Message	Method Used	Responsibilities	Frequency / Timeline
		Chittagong Highway. Expansion of road services to Bay Terminal			
	Power Development Board (PDB), Chittagong	Electricity demand & connection requirement	Meeting & Discussion	ESIA Team	June 2022 to continue
	BEPZA Chittagong unit.	Wastewater volume & future expansion.	Tele conversation	ESIA Team	June-August 2022
	Bangladesh Railways	Railway connectivity	Meeting & Discussion	ESIA Team	June-August 2022
	District Commissioner office Chittagong	Land procurement, Hand over & Compensation payment to the PAPs.	Meeting & Discussion	ESIA Team	June.2022-continue
	Bay Terminal users	Expectation of the user	Stakeholder meetings, Discussion	CPA	June 2022-continue
Implementation stage (Construction)	CPA	Successful Implementation	Meetings - Formal meetings - Virtual discussions or surveys - Site visits	PIU of ESOHS	July 2024-June2027
	Contactor	Ensure ESOSH guide line compliance	Meetings - Formal meetings - Virtual discussions or surveys - Site visits	Contractor EHS team and monitoring done conducted by PIU of ESOHS	July 2024-June2027
	Suppliers	Ensure ESOSH guide line complaince	Meetings - Formal meetings - Virtual discussions or surveys - Site visits	Contractor EHS team and monitoring done conducted by PIU of ESOHS	July 2024-June2027
	Workers	Complaince ESOSH Guideline		Contractor EHS team and monitoring done conducted by PIU of ESOHS	July 2024-June2027

Project stage	Target Stakeholders	Topic of Consultation /Message	Method Used	Responsibilitie s	Frequency / Timeline
	Governmental Agencies				
	Law enforcement Agency,				
	PAPs,				
	DoE,				
	MoL,				
	MoS,				
	MoF,				
	PPA,				
	WB				
Post implementation stage	*Examples may include: General Public, Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Communities, persons with disabilities.*	*Examples may include: - Present the project and receive feedback on project activities. - Inform on progress, - Consult on key risks - Note public events to disseminate the results - Give information on GM*	*Examples may include: - Focus Group Meetings/ Discussions - Community consultation s - Formal meetings - Virtual discussions or surveys - One-on-one interviews - Site visits*	*Name the agency/ministry in charge of stakeholder engagement activities*	*Add either specific dates or a given frequency (either MM/YY, or "monthly" / "quarterly" / "twice a year")*

8.4.3. Proposed Strategy to Incorporate the Views of Vulnerable Groups

541. The project will seek the views of the vulnerable or disadvantaged groups identified through Socio-economic survey. The following measures will be taken to remove obstacles to full participation and access to information, as indicated in **Table 8-2**.

Table 8-2: Strategy to Incorporate the Views of Vulnerable Groups

Vulnerable Groups and Individuals	Characteristics/Needs	Preferred Means of Notification/Consultation
Extreme Poor Fishermen	- Financial assistance - Credit support - Fishing logistic Support	- Official Letter - Tele communication - Personal Communication
Female Headed Household	- Financial assistance - Produce skill development training and job placement	- Official Letter - Tele communication - Personal Communication
Person with disabled family	- Financial assistance - Linking with governmental SafetyNet program.	- Official Letter - Tele communication - Personal Communication

8.5. Resources and Responsibilities for Implementing Stakeholder Engagement

8.5.1. Implementation Arrangements and Resources

542. To effectively coordinate stakeholder participation, MoS has established a Project Steering Committee (PSC) for strategic guidance under the leadership of Secretary, MoS, with representatives from the Ministry of Finance (Finance Division, Banking Division, Economic Relations Division), Ministry of Road Transport and Bridges, Ministry of Railway, CDA, and CCC. Additional representatives from other ministries may be included as appropriate. PSC will meet twice a year to (a) review the implementation results of a given year and the proposed implementation plans for the next year at the end of an implementation year; and (b) review implementation progress and approve adjustments needed in the middle of an implementation year. As appropriate, additional PSC meetings may be organized at the request of PSC members. The PSC will make key decisions related to the implementation of this project.

543. CPA has established an independent Project Implementation Unit (PIU) and Project Implementation Committee (PIC) for coordination, implementation, and other support functions. The stakeholder engagement activities will be documented through the CPA PIU.

544. The CPA PIU will be in charge of stakeholder engagement activities. The entities responsible for carrying out stakeholder engagement activities are Project Director (PD) Bay Terminal Project, Project Implementation Unit (PIU), Social and Communication Specialist, when deployed, and Director PIC. The overall responsibility for SEP implementation lies with the Director PIU. The project's stakeholder engagement implementation arrangement would be developed as indicated in **Table 8-3**.

Table 8-3: Stakeholder Engagement Implementation Arrangement

Project Stage	Target Stakeholders	Topic of Consultation/Message	Method Used	Responsibility	Frequency/Timeline
	CPA MoS MoF WB				

545. The stakeholder engagement activities will be documented through a press note, brochure, and write-up in registers at the field level with relevant video clips and still pictures. This data should be periodically uploaded to the dedicated website developed for the Bay Terminal Project. The nature, scope, and frequency of stakeholder engagement will be proportionate to the nature and scale of the project and its potential risks and impacts.

546. The budget estimate for preparing and implementing SEP is USD 50,000. The budget breakdown is presented in **Table 8-4** and will be further detailed in the SEP.

Table 8-4: Estimated Budget for the Preparation of Stakeholder Engagement Plan

Budget categories	Quantity	Unit costs	Times/ Years	Total costs
Manpower Communications Management cost	-	Lump-sum	45 months	50,00,000

8.6. Grievance Redress Mechanism

547. A grievance redress mechanism is a system that allows not only grievances but also queries, suggestions, positive feedback, and concerns of project-affected parties related to the environmental and social performance of a project. The main objective of a project manager is to assist in resolving complaints and grievances in a timely, effective, and efficient manner that satisfies all parties involved.

8.6.1. Description of Grievance Redress Mechanism (GRM)

548. CPA will have **three** levels of Grievance Redress Committees (GRCs), one at the Ministry level, one at the PIU level, and one at the PIC/Field level. Composition of the committees are:

549. **PIC/Field Level**

- Senior Field Level Officer **of** the Project **-** Convener**;**
- Local UP Member/Ward Councilor;
- Member from local Fishermen Association**;**
- a **r**epresentative from Local Women's Group /Local NGO;
- Community Leader from the PAP/ VG/ Business community and
- a **F**ield level officer nominated by the Convener as Member-Secretary;

550. **PIU level:**

- Project Director (PD) of PIU – Convener,
- Convener of Field Level GRC,
- Local UP Member/Ward Council,
- a female representative from Community/NGO working in the area (On need basis),
- a representative from affected community,
- and Social Management Specialist as Member Secretary;

551. **Ministry Level**: If a decision at the CPA level is found unacceptable by the aggrieved person(s), the CPA can refer the case to the ministry-level GRC with the minutes of the hearings at the project level and CPA level. For all the unsolved cases at the CPA level, GRC, decisions on unresolved cases, if any, will be made in no more than four weeks by an official designated by the secretary of the respective ministry. The ministry-level GRC would be steered by the Secretary of the MoS. Other members are: PD, Social Specialist, Gender

and GBV Specialist (if any), representative from 3rd party monitor, and any other member (on a need basis).

552. The modus operandi of lodging a complaint and the timeframe and hierarchy of addressing those suiting the activities of various components of the project would be explicitly defined in the stand-alone SEP. **Table 8-5** would be followed in addressing grievances.

Table 8-5: Grievance Redress Mechanism Process

Step	Description of Process (e.g.)	Timeframe	Responsibility
Step 1: Uptake	[*Describe, for example, GM structure at national, regional, and local levels*]		
Grievance uptake	Grievances can be submitted via the following channels [*select and specify as appropriate*] • Toll-free telephone hotline: [*include number*] operated by [*insert*] • Short Message Service (SMS) to [*include number*] • E-mail to [*insert*] • Letter to [*insert*] • In-person at a physical facility [*specify where*] • Grievance or suggestion boxes located [*insert locations*] • Social media [*insert relevant social media accounts*] • Tablet/smartphone application [*specify*] • Online form on the following website: [*insert*]		
Sorting, processing	Any complaint received is forwarded to [*insert*]; logged in [*insert*]; categorized according to the following complaint types: [*insert*]	Upon receipt of complaint	PIU of ESOHS grievance focal points
Acknowledgement and follow-up	Receipt of the grievance is acknowledged to the complainant by [*insert*]	Within 2 days of receipt	PIU of ESOHS grievance focal points
Verification, investigation, action	Investigation of the complaint is led by [*insert*] A proposed resolution is formulated by [*insert*] and communicated to the complainant by [*insert*]	Within 10 working days	Complaint Committee composed of in field level (Social & Gender Expert), Mid Level (Manager ESOHS) and Top level (PIU Head and upper level)
Monitoring and evaluation	Data on complaints are collected in [*insert*] and reported to [*insert*] every [*insert*]		
Provision of feedback	Feedback from complainants regarding their satisfaction with complaint resolution is collected [*insert*]		
Training	Training needs for staff/consultants in the PIU, Contractors and Supervision Consultants are [*insert*]		

Step	Description of Process (e.g.)	Timeframe	Responsibility
If relevant, payment of reparations following complaint resolution	[*If relevant, describe how payment of reparations will be handled including amounts, recipients, etc.]*		
Appeals process	[*Describe how appeals will be handled when/if the complainants are not satisfied with the proposed resolution of the complaint]*		

553. It is to be noted that there would be a dedicated GM for the labor and workforce of the project following ESS 2, which would be described in detail in the Labor Management Procedures and other project documents.

554. SEA/SH-related complaints, if any in the project, will be handled in a survivor-centric manner in line with the World Bank guidelines provided in the WB good practice note on gender-based violence[7]. SEA/SH-related complaints will be dealt with with strict confidentiality, based on the wishes of the SEA/SH survivor. Any SEA/SH survivor will be referred to an NGO assigned for the project by the CPA to manage and respond to SEA/SH cases. This NGO will support SEA/SH survivors in accessing service providers and guiding them through the options of lodging a complaint. Necessary measures must be put in place by DSHE to deter and arrest GBV-related cases.

555. There would be a female representative at the GRC for SEA/SH issues. At the field level, a female representative from a local NGO and a representative of the affected people to represent the women who have been subjected to SEA/SH or any other form of GBV. This NGO will support SEA/SH survivors in accessing service providers and guiding them through options for lodging a complaint.

556. Most of the labor for the project would come from different parts of Bangladesh. To mitigate the moderate risk, the project will prepare a comprehensive SEA/SH action plan that will include prevention interventions and mitigation measures. Preventive interventions include awareness campaigns and capacity building for the Implementing Agency through in-depth and sustained trainings, developing Codes of Conduct for workers, mapping of GBV service providers, SEA/SH awareness raising in the communities and among workers, setting up a SEA/SH sensitive GRM with linkage to the service provider, and hiring a gender or social specialist with a SEA/SH/GBV background. Moreover, procurement documents will adhere to compliance with SEA/SH risk management. PIU must not lose sight of this issue and maintain strong liaison and communication with the local people where the workers are residing and coordinate closely with the government officials and other development organizations involved in GBV response services, who have standard rules and follow protocol for GBV response that is consistent with the World Bank Good Practice Note on Gender-based Violence. All these factors benefit the project by reducing the GBV risks for service providers, service recipients, and the surrounding communities.

557. The Toll-Free Number **(109)** for receiving GBV-related complaints under the Ministry of Women and Children Affairs (MoWCA) Multi-Sectoral Program on Violence Against Women (MSPVAW) program has telephone operators round the clock who can speak in Bangla and English so that the complainants feel at ease while communicating. This number is not Bay Terminal Project-specific but nonetheless can be used to report any SEA/SH-related complaints. GBV victims can use this toll-free number for lodging complaints. The 'Toll-Free

[7] *The World Bank (2018): Good Practice Note Addressing Gender-Based Violence in Investment Project Financing involving Major Civil Works. http://documents.worldbank.org/curated/en/399881538336159607/Environment-and-Social-Framework-ESF-Good-Practice-Note-on-Gender-based-Violence-English.pdf* and

Number' should be displayed at different sites within the project area so that all are aware of this supporting tool.

558. For further details, please refer to the GBV action plan at https://www.worldbank.org/en/news/press-release/2017/11/08/new-action-plan-addresses-gender-based-violence-in-world-bank-operations.

559. The World Bank and the borrower do not tolerate reprisals and retaliation against project stakeholders who share their views about bank-financed projects.

9. Environmental and Social Management Plan (ESMP)

9.1. Introduction

560. The Environmental and Social Management Plan (ESMP) will be integrated into the project design for the project's sustainable development. Integrating the ESMP into the project design will minimize the effects of the negative impacts and increase the benefits of the positive impacts in the pre-construction, construction, and post-construction phases.

561. The objective of the ESMP is to manage adverse impacts and risks of proposed project interventions in a way that minimizes the impact and risk on the environment, workers, and community during the construction and operation stages of the project. The specific objectives of the ESMP are to:

- Facilitate the implementation of the mitigation and control measures discussed earlier in the document.
- Maximize potential project benefits, mitigate negative impacts, and control risks;
- Address occupational and community health and safety hazards and corresponding control measures during construction and operation stages;
- Draw responsibilities for implementing agencies (CPA), contractors, consultants, and other members of the project team for the environmental, health, safety, and social management of the project;
- Define a monitoring and supervision mechanism and identify monitoring and inspection parameters to:
- Ensure the complete implementation of all mitigation and control measures,
- Ensure the effectiveness of the mitigation and control measures; and
- Assess environmental, health, and safety training requirements for different stakeholders at various levels.

562. **Table 9-1** presents the ESMP matrix for the project.

Table 9-1: Environmental and Social Management Plan

Potential Impact	Mitigating Measures	Responsibility
Pre-construction and Construction Phase		
ESS1 and ESS3	▪	
Soil and Sediment Quality ▪ Site development (reclamation, leveling, and compaction) ▪ Accidental spillage of fuel from storage areas, machines, transport vehicles, diesel generators, dredgers, and vessels ▪ Storage and disposal of construction and demolition (C&D) debris and municipal solid waste (MSW) ▪ Accidental spillage of hazardous waste from the storage area	▪ Allocation of the protected sections or premises from external factors impacting the temporary disposal of waste. ▪ Hazardous wastes should be packed properly and have the relevant labels. ▪ Hazardous waste management should be undertaken by the contractor having the relevant permit for such activity and following good international practices and applicable local and international regulations. ▪ Strict control of the waste management process. To maintain the special logbook for the purpose of recording the quantity of the generated wastes, types, and further management processes; ▪ All rubbish, waste materials, and debris shall be systematically cleared from working areas as they accumulate; all such materials should be cleared at the end of each working day. ▪ If the removal of waste materials at the end of the working day is not possible, the materials should be covered with tarpaulin or something similar. ▪ Waste materials not removed directly from the site shall be temporarily stored at designated points and covered, pending removal from the site. ▪ Fuels will be stored in dedicated storage area having secondary containment.	EHS Team of Contractor
Coastal Morphology ▪ Dredging at the reclamation area for unsuitable soil ▪ Disposal of unsuitable soil at an offshore disposal site ▪ Dredging of sand from the sand extraction area and discharge in the reclamation area	▪ Implement a dredging technology that has the least impact on coastal morphology. ▪ Unsuitable soil from the reclamation area will be disposed of at the designated disposal site. ▪ Limit sand extraction to avoid the creation of scattered deep holes in the area.	EHS Team of Contractor
Surface Water Quality ▪ Dredging at the reclamation area for unsuitable soil ▪ Disposal of unsuitable soil at an offshore disposal site	▪ The fueling equipment should be equipped with breakaway” hose connections that provide emergency shutdown of flow in case of connection failure.	EHS Team of Contractor

Potential Impact	Mitigating Measures	Responsibility
▪ Dredging of sand from the sand extraction area and discharge in the reclamation area ▪ Accidental spillage of fuel from dredgers and vessels used for transportation of dredge and construction materials. ▪ Contaminated surface runoff from a land-based construction area ▪ Discharge of untreated sewage from the construction area and untreated bilge and ballast water	▪ International standards for refueling dredgers should be followed. ▪ Absorbents should be present at places of refueling. ▪ Make bilge water pumping a requirement for all dredgers and vessels for internal transfers and transfers to the shore reception facility. Waste and bilge water from dredgers and vessels should be collected and further discharged at a designated discharge point. Collect the oily sludge for safe disposal or treatment using the existing established facilities at Chattogram Port. ▪ A thorough dredge management plan, including EHS components, that complies with international standards must be submitted by dredging contractors before the dredging is started and must be acknowledged and authorized by the CPA consultant team. Throughout the dredging, the dredging contractors must adhere to the authorized dredging plan. ▪ Accidental spills will be managed through the preparation and implementation of an emergency response plan to be prepared by the contractors as part of the OHS Plan. ▪ Monitoring of the implementation of the environmental and social management plan should be done by engaging monitoring mechanisms. ▪ Implement a dredging technology that has the least impact on surface water quality. ▪ Unsuitable soil from the reclamation area will be disposed of at the designated disposal site. ▪ All sewage generated from the construction area will be treated.	
Ambient Air Quality ▪ Fugitive dust emissions from site development activities like grading and leveling, construction activities like earthwork for the foundation of buildings and civil infrastructure, and the handling of	▪ Vehicle speed restrictions (e.g., 20 km/h) must be enforced to control dust generation. ▪ Construction materials must be covered to protect them from wind action. ▪ Spray water regularly to suppress fugitive dust.	EHS Team of Contractor

Potential Impact	Mitigating Measures	Responsibility
construction materials like sand, cement, and aggregate. ▪ Emission during transport of construction materials, equipment, and manpower and operation of heavy equipment and standby diesel generator sets.	▪ Provide pollution control devices in equipment and machinery emission stacks. ▪ Ensure proper and regular maintenance of engine-driven construction equipment. ▪ Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards. ▪ Conduct regular maintenance on dredgers.	
Noise Level ▪ Site development activities, construction activities, and handling of construction materials (site clearing and preparation, excavation and concrete placement, erection of structures, concrete mixing and aggregate production systems, construction camps and ancillary facilities, drilling of bored pile activities, and haulage and general vehicle movements.) ▪ Piling activity ▪ Transport of construction materials, equipment, and manpower and operation of heavy equipment and standby diesel generator sets (mostly vehicles involved in construction activities such as engine running, hydraulic horns, and loading and unloading activities).	▪ Equipment modifications or redesigns of a particular piece of equipment to achieve quieter noise levels. ▪ Sound aprons or a canopy are useful when the shielding must be frequently removed or if only partial covering is possible. ▪ Enclosures for stationary work may be constructed of wood or any other suitable sound-dampened material and typically surround the specific operation area and equipment. ▪ The use of electrically powered equipment is typically quieter than diesel, and hydraulically powered equipment is quieter than pneumatic power. ▪ Using vehicles and equipment in good conditions ▪ Monitor sound levels during piling activity to ensure that they do not exceed the DoE, WB, or any other internationally recognized criteria. ▪ Incorporate the use of clear "ramp-up" (i.e., "soft-start") procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause a significant behavioral impact on marine mammals to the full output necessary for the completion of the activity. ▪ Implement measures to attenuate the sound when sound pressure levels exceed the DoE, WB, or any other internationally recognized criteria. Methods to reduce sound pressure levels include, but are not limited to: ▪ Incorporate the use of fully enclosing or confined, encircling absorptive barriers (e.g., isolation casings)	EHS Team of Contractor

Potential Impact	Mitigating Measures	Responsibility
	or other demonstrably effective noise reduction methods at the immediate works site in order to reduce underwater sound propagation from on-site operations. Studies have shown that such methods can provide a significant reduction in sound input to the wider aquatic environment in the order of 10–30 dB. ▪ The force of the hammer blow can be controlled with hydraulic hammers, and reducing the impact force will reduce the intensity of the resulting sound. ▪ Soft start, where piling starts at a low level and progressively builds in intensity through a piling session. There are concerns that the use of this method results in sensitive fauna still being present when piling noise increases in intensity and thus may still be exposed to high noise levels.	
ESS2	▪	
Income/Employment Opportunity ▪ Sourcing of manpower for construction activity ▪ Sourcing of construction materials from local suppliers ▪ Opportunity for local enterprises	▪ Unskilled workers will be sourced locally. ▪ Follow existing labor laws including the standard labor code, which mentions all issues relating to labor deployment, wages, occupational health and safety following the World Bank guidelines, international labor organization (ILO) conventions, and GOB laws, laborers ▪ Source the construction materials from local suppliers	Human Resources of CPA/ EHS dept. of CPA/ PIU of ESOHS
Fishing Activities ▪ Dredging at the reclamation area for unsuitable soil ▪ Discharge of dredging material in the reclamation area ▪ Piling activity and vessel transport of construction materials and equipment	▪ Preparation of a plan to safeguard the fishermen. The plan will be effective and restricted for the period of project implementation for all registered fishermen.	Community Relations of CPA/PIU of ESOHS
Occupational Health and Safety ▪ Site development activities, construction activities, handling of construction materials, and operation of heavy equipment. ▪ Changes in environmental quality from emissions to air, water and noise from construction activities and different hazards in the workplace	▪ Prepare and implement a occupational health and safety plan (OHSP) prior to commencing work. This plan will include working methods, construction sequence and safety arrangements. ▪ Permit to work system will be established to ensure only authorized persons will work at site.	EHS Team of Contractor

Potential Impact	Mitigating Measures	Responsibility
	▪ Increase workers' awareness on the anticipated health hazards during the construction phase. ▪ Provide personal protective equipment (PPE) to protect workers from any incidents at the work site. ▪ Ensure water, sanitation, and hygiene (WASH) at the work site. Construction	
ESS4	▪	
Community Health and Safety ▪ Fugitive dust, air emissions, and increased noise levels from site development activities, construction activities, handling of construction materials, transport of materials, equipment, and manpower, and operation of heavy equipment and standby generator sets. ▪ Traffic movement during the transport of construction materials, equipment, and manpower ▪ Influx of non-resident workers to the area.	▪ Use low-sound and low-polluting construction equipment. ▪ Set up labor camps close to the work site and minimize hiring vacant accommodations in the neighborhood. ▪ Transportation of construction materials at night to minimize pressure on roads ▪ Set up the construction site at a location away from the settlement. ▪ Set up a grievance redress committee involving community leaders. ▪ Spraying water around the construction site ▪ Regular meetings with local people and community leaders ▪ Adopt mitigation measures proposed against noise, air quality, waste, etc.	EHS Team of Contractor
Road and Vessel Traffic and Transport ▪ Road and vessel transport of construction materials, equipment, and manpower	▪ Provide induction/training to all drivers for safe driving. ▪ Avoid road transport during rush hours.	EHS Team of Contractor
ESS5	▪	
Land Acquisition and Involuntary Resettlement ▪ Land acquisition of private land / Restrictions on land use	▪ Implement the livelihood restoration plan for the affected people, especially vulnerable groups. ▪ Prepare a land acquisition plan (LAP) and resettlement action plan (RAP) following ARIPA 2017 and the World Bank ESF.	Land Acquisition and Involuntary Resettlement Specialist of CPA/ PIU of ESOHS
ESS6	▪	
Terrestrial and Marine Ecology ▪ Dredging at the reclamation area for unsuitable soil ▪ Disposal of unsuitable soil at an offshore disposal site	▪ Keep conducting continuous inspections for leaks. ▪ Gradually ramp up the sound levels (pile diving) to scare marine life away before piling commences. Use pingers to chase away fish and other cetaceans. Monitor the area for these creatures to ensure they	EHS Team of Contractor

Potential Impact	Mitigating Measures	Responsibility
▪ Dredging of sand from the sand extraction area and discharge in the reclamation area ▪ Accidental spillage of fuel from dredgers and vessels used for transportation of dredge and construction materials. ▪ Contaminated surface runoff from a land-based construction area ▪ Discharge of untreated sewage from the construction area and untreated bilge and ballast water ▪ Piling activity and vessel transport of construction materials and equipment	are well away from the piling site; scare them away if they are too close to the site using pingers. ▪ Lighting must be limited to the minimum area required to be lit. ▪ Make passages and waterways for aquatic animals away from navigation routes. ▪ Construction site runoff and drainage should be prevented or minimized in ▪ accordance with international best practices and standards. Sand/silt retaining ▪ Facilities such as traps and sediment basins should be provided to limit the runoff. ▪ Exposed slope or soil surface, dredged material in particular, should be covered to reduce the potential runoff. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of rain. ▪ Implement a dredging technology that has the least impact on marine ecology. ▪ Erect temporary fences or other barriers that encourage migrants to fly at some height over passing the project site	
ESS8		
Archaeological and Cultural Sites ▪ Transport of construction materials, equipment, and manpower	▪ Control the movement of traffic at Bay Terminal during the holy ritual day to ensure the traffic safety of the participating Hindu purnrathi (pilgrims). ▪ Consultation meeting with Snan Ghat ritual management team members before the holy ritual day of each year.	Cultural Heritage Specialist of PIU of ESOHS
ESS10		
Stakeholders Engagement (including the disadvantaged and the vulnerable) ▪ Exclusion of vulnerable groups from stakeholder engagement and project benefits	▪ Implement an effective Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) to address complaints and grievances throughout the project's lifecycle to address issues and complaints efficiently, timely, and cost-effectively. ▪ Toll-free telephone hotline/Short Message Service (SMS) line, E-mail, Letter to Grievance focal points at local facilities. Walk-ins may register a complaint in a	Stakeholder Engagement of CPA/ PIU of ESOHS

Potential Impact	Mitigating Measures	Responsibility
	grievance logbook at a project site/facility or use the Complaint/Suggestion box at the project site.	
Operation Phase		
ESS1 and ESS3		
Surface Water Quality ▪ Discharge of operational wastewater ▪ Accidental spillage of fuel from dredgers and vessels ▪ Discharge of untreated sewage ▪ Maintenance dredging	▪ Use of sediment settling ponds: Dredging material can be deposited into sediment settling ponds, where the sediment can settle, and the clearer water can be returned to the ocean. ▪ Implementation of best management practices that can be used during dredging operations to minimize the release of sediment into the water, such as using turbidity curtains and silt screens. ▪ Dredging activities can be scheduled during times when water currents and tides are less likely to cause sediment to be dispersed. ▪ Regular monitoring of water quality, including turbidity levels, should be conducted after dredging activities to assess their impact and identify areas for improvement. ▪ Strict enforcement of regulations related to dredging and water quality can help to ensure that dredging contractors are following best practices to minimize the impact of dredging on the environment. ▪ The dredging contractors have to submit a dredging management plan before commencing the dredging work, which must be followed according to best management practices based on international standards. ▪ A sewage treatment plant (STP) with a capacity of 1,000 m3/day is required for the treatment of sewage from the port operations office, canteen, and ship. ▪ STP should comply with Department of Environment guidelines. ▪ STP-treated water quality parameters are monitored quarterly to check compliance with DoE guidelines. ▪ Make bilge water pumping a requirement for all vessels arriving at a shore receiving facility such as a WWTP. Collect the oily sludge for safe disposal or	EHS Team of CPA

Potential Impact	Mitigating Measures	Responsibility
	treatment at the planned Bay Terminal's established facilities. ▪ For the treatment of bilge water or oily wastewater generated from the ship, establish a Wastewater Treatment Plant (WWTP) with a capacity of 1000 m3/day and sludge handling facilities. ▪ WWTP should comply with Department of Environment guidelines. ▪ WWTP-treated water quality parameters are monitored quarterly to check compliance with DoE guidelines.	
Ambient Air Quality ▪ Fugitive dust emission and cargo vapor emission from the operation of the terminal ▪ Emissions from the transportation of container and operation of standby diesel generator sets	▪ Regular maintenance of port operation machinery, vehicles, and standby diesel generator sets in accordance with the manufacturer's specifications. ▪ Provide pollution control devices in equipment and machinery emission stacks. ▪ Regular air monitoring will be carried out near the sensitive receptors to ensure ambient air quality remains within the limits defined by national standards. ▪ Conduct regular maintenance on dredgers.	EHS Team of CPA
Noise Level ▪ Container handling activities ▪ Transportation of container ▪ Operation of standby diesel generator sets and other machinery and equipment.	▪ Equipment modifications or redesigns of a particular piece of equipment to achieve quieter noise levels. ▪ Sound aprons or a canopy are useful when the shielding must be frequently removed or if only partial covering is possible. ▪ Enclosures for stationary work may be constructed of wood or any other suitable sound-dampened material and typically surround the specific operation area and equipment. ▪ The use of electrically powered equipment is typically quieter than diesel, and hydraulic-powered equipment is quieter than pneumatic power. ▪ Using vehicles and equipment in good conditions ▪ Incorporate the use of clear "ramp-up" (i.e., "soft-start") procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause a significant	EHS Team of CPA

Potential Impact	Mitigating Measures	Responsibility
	behavioral impact on marine mammals to the full output necessary for the completion of the activity. ▪ Implement measures to attenuate the sound when sound pressure levels exceed the DoE, WB, or any other internationally recognized criteria. Methods to reduce sound pressure levels include, but are not limited to: ▪ Incorporate the use of fully enclosing or confined, encircling absorptive barriers (e.g., isolation casings) or other demonstrably effective noise reduction methods at the immediate works site in order to reduce underwater sound propagation from on-site operations. Studies have shown that such methods can provide a significant reduction in sound input to the wider aquatic environment in the order of 10–30 dB. ▪ Ships, when in port, stop their engines and derive their power supply from a direct connection to the local electricity grid from the port. This reduces emissions and noise emanating from the ships themselves while in port.	
ESS2	▪	
Income/Employment Opportunity ▪ Sourcing of manpower for operations ▪ Opportunity for local enterprises	▪ Unskilled workers will be sourced locally. ▪ Follow existing labor laws including the standard labor code, which mentions all issues relating to labor deployment, wages, occupational health and safety following the World Bank guidelines, international labor organization (ILO) conventions, and GOB laws, laborers	Human Resources of CPA
ESS4	▪	
Community Health and Safety ▪ Increased noise level due to the operation of machinery and equipment and container handling activities ▪ Traffic movement during the transport of the container ▪ Influx of non-resident workers to the area	▪ Set up a workstation at a designated place. ▪ Transportation of containers outside rush hours to minimize pressure on roads ▪ Set up a grievance redress committee involving community leaders. ▪ Regular meetings with local people and community leaders	Community Relations of CPA

Potential Impact	Mitigating Measures	Responsibility
	▪ Adopt the mitigation measures proposed against noise.	
ESS6	▪	
Marine Ecology ▪ Discharge of operational wastewater and untreated sewage ▪ Accidental spillage of fuel from dredgers and vessels ▪ Maintenance dredging ▪ Vessel movement	▪ The vessel must be refueled off-site, where possible. ▪ Fueling of vessels must be undertaken in bunded areas, and all fueling equipment must be regularly (yearly) inspected and serviced. ▪ Implementation of best management practices that can be used during dredging operations to minimize the release of sediment into the water, such as using turbidity curtains and silt screens. ▪ Treatment of sewage and bilge water and ensuring that STP and WWTP comply with Department of Environment guidelines.	EHS Team of CPA

9.2. Environmental and Social Management Plan (ESMP) (Construction and Operation)

9.2.1. Noise Management Plan

Performance indicator: ▪ Absence of complaints regarding noise levels from people directly affected during the construction and port operation period ▪ Compliance with the national legal/stakeholders requirement Monitoring: ▪ Maintain a record of any noise complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up; ▪ Where required, upon receipt of a noise complaint, monitoring will be undertaken within 1 to 2 working days. If exceedances are detected, the source will be investigated, and equipment and operational procedures will be reviewed to identify means of reducing noise to acceptable levels. ▪ Monitoring noise level, with sampling undertaken every quarter at the site to fulfill local (DoE) legal requirements. ▪ Audits of the ESMP quarterly during operation and monthly during construction. Responsibility: *During the construction period:* ▪ The contractor EHS manager is responsible for logging and responding to all noise complaints during construction. ▪ The consultant EHS Team will verify the monitoring condition monthly. *During the operation period:* ▪ The CPA EHS manager logs and responds to all noise-related complaints during port operations. Reporting: ▪ All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operation, the CPA EHS manager and his team will report and maintain a record of any noise pollution issues and complaints in a log book. Corrective Action: ▪ All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS); ▪ Maintain all equipment so noise levels do not exceed specified guidelines of DoE/stakeholders requirements and modify operational practices where appropriate. ▪ Install/develop appropriate abatement where practicable.

9.2.2. Air Emission Management Plan

Performance indicator: ▪ Absence of complaints regarding dust pollution from people directly affected during the construction and port operation period ▪ Compliance with the legal requirement. Monitoring: ▪ Maintain a record of any dust complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up; ▪ Where required, upon receipt of a noise complaint, monitoring will be undertaken within 1 to 2 working days. If exceedances are detected, the source will be investigated, and equipment and operational procedures will be reviewed to identify means of reducing dust to acceptable levels. ▪ Air quality monitoring, with sampling undertaken every quarter at the site to fulfill local (DoE) legal requirements. ▪ Regular review of the efficiency of air quality and greenhouse gas management measures to ensure implementation of continuous improvement ▪ Visual inspections of dust deposition in surrounding areas will be undertaken periodically. ▪ Visual inspections will be undertaken during activities likely to cause dust releases to assess the effectiveness of mitigation measures and the need for increased dust suppression.

- Audits of the ESMP quarterly during port operation and monthly during construction.

Responsibility:

During the construction period:

- The contractor EHS manager is responsible for logging and responding to all air pollution-related complaints during construction.
- The consultant EHS Team will verify the monitoring condition monthly.

During the operation period:

- The CPA EHS manager logs and responds to all air pollution-related complaints during port operations.

Reporting

- Environmental incident reporting, including incident investigation and the inclusion of corrective and preventative actions
- The dust management and monitoring program results will be documented in the Bay Terminal's annual report.
- Any complaints will be documented and managed through to resolution via the terminal incident reporting procedure.
- Where an incident causing air pollution occurs, the MoENRP will be informed within 24 hours.

Corrective actions

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Maintain all equipment so dust levels do not exceed specified guidelines of DoE/stakeholders requirements and Modify operational practices where appropriate.
- Install/ develop appropriate abatement where practicable.

9.2.3. Water Quality Management Plan

Performance indicator:

- Absence of complaints regarding water quality from people directly affected during the construction and port operation period
- Compliance with the legal requirement.

Monitoring:

- Maintain a record of any water quality complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up;
- Where required, upon receipt of a noise complaint, monitoring will be undertaken within 1 to 2 working days. If exceedances are detected, the source will be investigated, and equipment and operational procedures will be reviewed to identify means of reducing noise to acceptable levels.
- Monitoring water quality in front of the jetty area, with sampling undertaken every quarter at the site to fulfill local(DoE) legal/stakeholder requirements.
- Audits of the ESMP quarterly during operation and monthly during construction

Responsibility:

During the construction period:

- The contractor EHS manager is responsible for logging and responding to all water quality-related complaints during construction.
- The consultant EHS Team will verify the monitoring condition monthly.

During the construction period:

- The CPA EHS manager logs and responds to all water quality-related complaints during port operations.

Reporting:

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operation, the CPA EHS manager and his team will report and maintain a record of any water quality issues and complaints in a log book.

Corrective Action:

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Maintain all equipment so water quality does not exceed specified guidelines of DoE/stakeholders requirements and modify operational practices where appropriate.
- Install/develop appropriate abatement where practicable.

9.2.4. Biodiversity and Ecosystem Plan

Performance indicator:

- Absence of complaints from the community about the worsening state of flora and fauna, as well as other species-related concerns that were directly affected throughout the construction and port operating operation period
- Compliance with local legal/stakeholder requirements

Monitoring:

- Maintain a record of any deteriorating condition of flora & fauna and other species-related issues and complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up;
- Where required, upon receipt of a solid waste handling or disposal complaint, monitoring will be undertaken within 1 to 2 working days. If exceedances are detected, the source will be investigated, and equipment and operational procedures will be reviewed to identify means of reducing noise to acceptable levels.
- Monitoring biodiversity and ecosystem management in every quarter at the site to fulfill local(DoE) legal/stakeholder requirements.
- Audits of the ESMP quarterly during operation and monthly during construction.

Responsibility:

During the construction period:

- The contractor EHS manager is responsible for logging and responding to the worsening flora & fauna and other species complaints during construction.
- The consultant EHS Team will verify the monitoring condition monthly.

During the construction period:

- The CPA EHS manager logs and responds to all worsening states of flora & fauna and other species complaints during port operations.

Reporting:

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operation, the CPA EHS manager and his team will report and maintain a record of the deteriorating condition of flora & fauna and other species-related issues and complaints in a logbook.

Corrective Action:

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Maintain all equipment so water quality does not exceed specified guidelines of DoE/stakeholders requirements and modify operational practices where appropriate.
- Install/develop appropriate abatement where practicable.

9.2.5. Wastewater Management Plan

Performance indicator:

- Absence of complaints regarding water quality from people directly affected during the construction and port operation period
- Compliance with the legal requirement.

Monitoring:

- Maintain a record of any water quality complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up;
- Where required, upon receipt of a noise complaint, monitoring will be undertaken within 1 to 2 working days. If exceedances are detected, the source will be investigated, and equipment and operational procedures will be reviewed to identify means of reducing noise to acceptable levels.
- Monitoring water quality in front and surrounding the jetty area, with sampling undertaken every quarter at the site to fulfill local (DoE) legal/stakeholder requirements.
- Audits of the ESMP quarterly during operation and monthly during construction

Responsibility:

During the construction period:

- The contractor EHS manager is responsible for logging and responding to all water quality-related complaints during construction.
- The consultant EHS Team will verify the monitoring condition monthly.

During the construction period:

- The CPA EHS manager logs and responds to all water quality-related complaints during port operations.

Reporting:

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operations, the CPA EHS manager and his team will report and maintain a record of any water quality issues and complaints in a logbook.

Corrective Action:

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Maintain all equipment so water quality does not exceed specified guidelines of DoE/stakeholders requirements and modify operational practices where appropriate.
- Install/develop appropriate abatement where practicable.

9.2.6. Solid Waste Management Plan

Performance indicator:

- Absence of complaints regarding the solid waste disposal-related issue from people directly affected during the construction and port operational operation period
- All waste materials are handled and stored safely and appropriately.
- Compliance with local legal/stakeholder requirement

Monitoring:

- Maintain a record of any solid waste handling or disposal complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action is taken and follow-up;
- Where required, upon receipt of a solid waste handling or disposal complaint monitoring will be undertaken within 1 to 2 working days. If exceedances are detected, the source will be investigated and equipment and operational procedures reviewed to identify means of reducing noise to acceptable levels.
- Monitoring of solid waste handling or disposal situation in every quarter at the site to fulfillment of local(DoE) legal/ stakeholders requirements.
- Audits of the ESMP quarterly during operation and monthly during construction

Responsibility:

During the construction period:

- The contractor EHS manager is responsible for logging and responding to all solid waste-related complaints during construction.
- The consultant EHS Team will verify the monitoring condition monthly.

During the operation period:

- The CPA EHS Manager logs and responds to all solid waste-related complaints during port operations.

Reporting:

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operations, the CPA EHS manager and his team will report and maintain a record of any solid waste handling or disposal complaints in a logbook.
- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operation, the CPA EHS manager and his team will report and maintain a record of any solid waste handling or disposal issues and complaints in a logbook.

Corrective Action:

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Maintain all equipment so soil and water quality do not exceed specified guidelines of DoE/stakeholders requirements and modify operational practices where appropriate.
- Install/develop appropriate abatement where practicable.

9.2.7. Spill Prevention and Control Plan

<u>Performance indicator:</u>

- Maintain a training register for all staff and contractors.

<u>Monitoring:</u>

- The contractor EHS supervisor will regularly monitor the area around the construction site for hydrocarbon spillages.
- The consultant EHS team will regularly monitor the performance of the staff of the contractors in terms of compliance with the Spill Prevention and Control Plan.
- Audits of the ESMP quarterly during operation and monthly during construction.

<u>Responsibility:</u>

During the construction period:

- The contractor EHS manager logs all oil and chemical spillage-related issues/complaints during construction.
- The consultant EHS team will verify the monitoring condition monthly.

During the construction period:

- The CPA EHS manager logs and responds to all oil and chemical spillage-related complaints during port operations.

<u>Reporting:</u>

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operations, the CPA EHS manager and his team will report and maintain a record of any oil and chemical spillage-related complaints in a log book.
- All spills will be reported immediately to the port project engineer and cleaned up, with the contaminated materials removed and disposed of at an approved site.

<u>Corrective Action:</u>

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Maintain all equipment so soil and water quality do not exceed specified guidelines of DoE/stakeholders requirements and modify operational practices where appropriate.
- Install/develop appropriate abatement where practicable.

9.2.8. Dredging and Dredge Disposal Management Plan

<u>Performance indicator:</u>

- Absence of complaints regarding deteriorating conditions due to dredging and dredging disposal-related issues from people directly affected during the construction and port operation period

<u>Monitoring:</u>

- The contractor EHS supervisor will regularly monitor the area around the dredging area to ensure that the activities do not create hazards to the surrounding environment and community.
- The consultant EHS team will regularly monitor the performance of the contractor EHS team.
- Audits of the ESMP quarterly during operation and monthly during construction

<u>Responsibility:</u>

During the construction period:

- The contractor EHS manager logs and responds to all dredging and dredging disposal-related complaints during construction.
- The consultant EHS Team will verify the monitoring condition monthly.

During the construction period:

- The CPA EHS manager logs and responds to all dredging and dredging disposal-related complaints during port operations.

<u>Reporting:</u>

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operation, the CPA EHS manager and his team will report and maintain a record of any dredging and dredging disposal complaints in a logbook.

<u>Corrective Action:</u>

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);

• Install/develop appropriate abatement where practicable.

9.2.9. Road Transport Management Plan

Performance indicator:

- Absence of complaints regarding traffic congestion and accidents from people directly affected during the construction and port operation period

Monitoring:

- Maintain a record of any traffic congestion complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up;
- Upon receipt of a traffic congestion complaint, monitoring will be undertaken within one working day.
- Traffic control and congestion monitoring along the coastal road, Bay Terminal area, and neighboring areas during construction and port operation.
- Audits of the ESMP monthly during operation and construction.

Responsibility:

During the construction period:

- The contractor EHS manager logs and responds to all traffic congestion complaints during construction.
- The contractor ensures adequate internal traffic design capacity and functionality during construction.
- The contractor EHS team ensures the implementation of the traffic management system.
- The consultant EHS team will verify the monitoring condition monthly.

During the operation period:

- The CPA EHS manager logs and responds to all traffic congestion complaints during port operations.
- The terminal EHS team ensures the implementation of an intelligent traffic management system during the operation of the port terminal and resolves any traffic-related concerns raised by local stakeholders.

Reporting:

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during the construction. During port operation, the CPA EHS manager and his team will report and maintain a record of any traffic congestion issues and complaints in a log book.

Corrective Action:

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Establish appropriate abatement where practicable.

9.2.10. Water and Energy Consumption/Management Plan

Performance indicator:

- Percentage of reduction energy & water uses from the selected baseline condition during the construction & port operation period.

Monitoring:

- Maintain a record of energy and water use during project construction and operation.
- Maintain the track record of the operation or area where the consumption has increased or decreased.
- Audits of the energy and water management issues quarterly during operation and construction.

Responsibility:

During the construction period:

- The Contractor EHS Manager logs the water and energy used during construction.
- The consultant EHS Team will verify the monitoring condition quarterly.

During the operation period:

- The CPA EHS manager logs the water and energy used during the operation.

Reporting:

- The contractor EHS manager will identify the energy and water use trend and the issues behind the trend (+/-) reporting and will inform the CPA Consultant EHS-Team members. The CPA EHS manager and his team will do the same during port operations.

Corrective Action:

- All findings will be responded to within 1 to 2 working days after identifying their reason.
- Establish appropriate abatement where practicable.

9.2.11. Occupational Health and Safety Plan

Performance indicator:

- Absence of complaints regarding occupational H&S-related issues from workers during the construction and port operation period

Monitoring:

- Maintain a record of any occupational health and safety-related complaints in a logbook, including the date and time of the reporting of incident, accident and near-miss, , name of the complainant, nature of the complaint, action taken, and follow-up;
- Upon receipt of an occupational health and safety-related complaint, monitoring will be undertaken within 1 to 2 working days.
- Audits of the ESMP quarterly during operation and monthly during construction

Responsibility:

During the construction period:

- Follow OHS risk mitigation hierarchy (elimination, substitution, engineering controls, administrative controls and PPE) to mitigate all risks.
- The contractor EHS Manager logs and responds to all occupational health and safety-related complaints, incidences, accidents and near misses during construction.
- The contractor EHS teams are responsible for ensuring the implementation of the occupational health and safety management system during construction, including the development of a Risk Assessment.
- The consultant EHS Team will verify the monitoring condition monthly.

During the operation period:

- The CPA EHS manager logs and responds to all occupational health and safety-related complaints & issues during port operations.

Reporting:

- All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during construction. During port operations, the CPA EHS manager and his team will report and maintain a record of any occupational health and safety-related complaints & issues in a logbook.

Corrective Action:

- All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS);
- Establish appropriate abatement where practicable.

9.2.12. Community Health and Safety Plan

Performance indicator:

- Absence of complaints and all incidents/accidents/ near misses. regarding community H&S-related issues from people directly affected during the construction and port operation period

Monitoring:

- Maintain a record of any community health and safety-related complaints in a logbook, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up;
- Upon receipt of a community health and safety-related complaint, monitoring will be undertaken within 1 to 2 working days.
- Audits of the ESMP quarterly during operation and monthly during construction

Responsibility:

During the construction period:

- The contractor EHS Manager logs and responds to all community health and safety-related complaints during construction.

• The contractor EHS teams are responsible for ensuring the implementation of the community health and safety management system during construction. • The consultant EHS Team will verify the monitoring condition monthly. *During the operation period:* • The CPA EHS manager logs and responds to all community health and safety-related complaints during port operations. Reporting: • All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the consultant EHS team during construction. During port operations, the CPA EHS manager and his team will report and maintain a record of any community health and safety-related complaints in a logbook. Corrective Action: • All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS); • Establish appropriate abatement where practicable.

9.2.13. Laborers Management Plan

Performance indicator: ▪ Absence of complaints regarding laborers employment and laborers management-related issues from local people or employed workers directly affected during the construction Monitoring: ▪ Maintain a record of any laborers-related complaints in a log book, including the date and time of the complaint, name of the complainant, nature of the complaint, action taken, and follow-up; ▪ Upon receipt of a laborers management-related complaint, monitoring will be undertaken within 1 to 2 working days. ▪ Audits of the LMP during the construction monthly. Responsibility: *During the construction period:* ▪ The contractor EHS manager logs and responds to all laborers management-related complaints during construction. ▪ The contractor EHS teams are responsible for ensuring the implementation of laborers management procedures during the construction. ▪ The consultant EHS Team verifies the monitoring condition monthly. Reporting: ▪ All complaints are to be received by the contractor's EHS manager before and after corrective action. The contractor will inform the Consultant EHS team during the construction. Corrective Action: ▪ All complaints are to be responded to within 1 to 2 working days of receiving the complaint and under terminal Environment Social Management System (ESMS); ▪ Establish appropriate abatement where practicable.

9.2.14. Emergency Preparedness and Response Plan

563. Emergency Response Plans address the unplanned hazard scenarios and emphasize the tasks required to respond to an emergency. The Emergency Response Plan for the project has been developed, listing various actions to be performed in a predetermined sequence of major and minor accidents to be dealt with effectively and efficiently. During the construction period, the contractor will manage all emergencies with the help of the CPA concern department. The contractor should submit an emergency response plan to the CPA before commencing the work. During the operation period, CPA will manage all emergencies.

564. The Emergency Action Plans will meet the following objectives:

- Providing clear lines of authority and communication during the incident and crisis events

- Authorities of an emergency.
- Provide a means of notifying employees, customers, and locals.
- Provide a safe and orderly evacuation method for employees and customers from Terminal premises.
- Account for all employees and customers who occupied Terminal premises during evacuation, should one occur.
- Provide emergency first aid treatment or emergency medical assistance for injured individuals.
- Provide training and needed information to those employees responsible for taking action in an emergency.

565. Possible emergency events include fire and explosion; immediate medical emergency due to injuries; spillage of refueling operations and other hazardous materials; natural disasters and; civil disturbance/terrorist activities.

566. In the event of an emergency, the project site's Incident Response Team (IRT) would be activated, with the Emergency Response Group (ERG) (chaired by the Chairman of CPA) coordinating and overseeing arrangements to ensure that the IRT meets its emergency management obligations. The Incident Management Team (IMT) is activated in the case of incidents.

9.2.14.1. Incident Response Team (IRT)

567. The Incident Response Team (IRT) is trained and responsible for dealing with all envisaged incidents and emergencies that may occur at or around the project location and on the associated vessel transportation route. The IRT may require additional support through resources and advice at a remote location. It will be requested through and provided by the Emergency Response Group (ERG). When an IRT is mobilized due to an incident or emergency, the ERG Leader must be notified immediately.

568. The chief electrical engineer will head the IRT and include senior staff from the Human Resources (HR), Security, Medical, Finance, and Logistics departments within the proposed Bay Terminal.

9.2.14.2. Emergency Response Group (ERG)

569. The Chairman of the CPA will chair the Emergency Response Group (ERG). He will also nominate an Emergency Response Coordinator to coordinate with representatives from various agencies and senior staff from HR, Finance, HSE, Logistics, Security, IT, and public affairs departments within the CPA Office. ERG will provide a tactical response, support, assistance, and advice to all incidents and emergencies at the site/location. It will provide an operational response to any emergency that may occur. The function of the ERG is to coordinate and oversee arrangements to ensure that the IRT meets its emergency management obligations. In consultation with the EHS manager, ERG should develop a plan to describe how to handle the "technical" crises, e.g., fire, explosion, oil spill, and "social" crises, e.g., illness, injury, kidnap, and civil unrest. On all occasions that the ERG is mobilized due to an incident or emergency, the IMT must be notified immediately.

9.2.14.3. Incident Management Team (IMT)

570. The Incident Management Team (IMT) defines and controls major incidents' strategies. A strategic response is a situation arising from a single or multiple incidents or emergencies that escalate to a point beyond which significant damage could result, including commercial and reputation damage, significant financial loss, shareholders' lossof confidence, and damages resulting from litigation. When a potential strategic situation appears, the IMT will be mobilized to manage issues about the reputation and the continued commercial well-being of the Bay Terminal.

571. The Member Engineers of CPA chair the IMT and includes high-level representation from the Ministry of Shipping, Army, Police Department, Fire Department, Department of Environment (DoE), Forest Department, District Commissioner's Office, and the Disaster Management Bureau (DMB) of the Bangladesh Government.

9.2.14.4. Safety Training

572. A safety training program is essential for people involved in port operations to reduce the risks associated with accidents, internal and external threats, and natural disasters. Regular safety training programs should be for workers to raise their awareness and reduce risks. The provision of yearly professional health and safety training would improve the effectiveness of safety. Safety training should be planned for the project area residents so that they know the risks associated with port operations and can take appropriate precautions. **Table 9-2** presents the proposed safety training.

Table 9-2: Safety Training

Target trainee	Training Schedule
Port Employee	Four trainings per year
Prot Engineering Team	Two trainings per year
Local people	Two trainings per year
Port Drivers	Two trainings per year
EHS Team Member	Two trainings per year

573. Employees will conduct toolbox meetings and job safety analyses regularly. The IRT will bring in professionals from Fire Services, the Disaster Management Bureau (DMB), the Department of Environment, and other agencies. Furthermore, information about emergency response awareness will be displayed on billboards in front of the project site to benefit port users

9.2.15. Gender and SEA/SH Action Plans

574. The action plans to provide an overview of the gender situation at national and local levels, identify project-related impacts/risks and gender gaps, propose specific actions to address gender gaps and provide indicators to monitor progress in addressing identified gender gaps. The gender and SEA/SH action plan includes activities aimed at reducing the social vulnerabilities of women and children, enabling local women to have a voice, and creating an environment in which women can benefit from the project, access employment opportunities, develop their capacities for income-generating activities and prevent and mitigate SEA/SH.

9.2.15.1. Gender Action Plans

575. The gender plan addresses the underlying constraints that contribute to gender disparities in women's labor force participation, including women's lower access to skills training, lack of infrastructure that responds to women's priorities,sexual harassment, safety concerns, limited mobility, and lack of access to professional networks. It aims to scale up the following activities towards promoting gender equality in accessing jobs and increasing the number of women entrepreneurs through improved facilitation packages for creating opportunities and integrating more women in trade. The Plan will address the following activities:

- Employment Opportunity: The action plan supports the enhancement and diversification of sustainable income-generating activities and capacity building of the women in the project area, especially those who will lose their livelihood and lack skills. The plan will identify infrastructure-related impediments faced by women and suggest activities addressing these constraints to enable gender-friendly land ports that would encourage greater participation of women in trade.
- Women's Participation in Decision Making: To enhance women's capacity to raise their voices and participate in decision-making. Activities in the GAVP to attain this objective

and close the gap, the project will support women's representation in community-based forums and organizations and ensure women's participation in project GRM.

- Capacity building of the IA: To ensure that the structure is inclusive and that women participate and benefit from it to the same extent as men. To ensure that the project will conduct an assessment, it will review existing policies, strategies, and provisions on gender inclusion in port facilities and overall women in trade. It will also carry out stakeholder consultation to prioritize activities for sensitization and building the capacity of the port authority for gender mainstreaming and inclusiveness.

9.2.15.2. SEA/SH Action Plan

576. The project is preliminarily assessed with a 'moderate' risk rating on SEA/SH based on the Bank's Good Practice Note (GPN) on sexual exploitation and sexual harassment in major civil works. However, the project's proposed activities involve the land acquisition and major construction works, which can have adverse impacts and exacerbate the potential risk of SEA/SH. The purpose of this action plan is to identify the issues, stakeholders, and possible service providers and assess their capacity to aid in accessing grievance redress. The action plan will focus on some corresponding mitigation measures—sensitizing the communities and other stakeholders and strengthening the institutional capacities— to mitigate the project-related potential risk of GBV in the project-affected population. A survivor-centric approach will be followed - all through, victim/survivors' care and providing access to different referral mechanisms are considered key aspects of this plan.

9.2.16. Livelihood Restoration Plan

577. The Livelihood Restoration Plan (LRP) will be part of the Resettlement Action Plan. LRP is not required as a standalone document. Upon identification of the vulnerable groups during RAP study, a livelihood restoration program will be developed under the RAP.

578. The livelihood restoration section will clearly delineate facilities to be provided to the eligible vulnerable people under long term LRP (i.e. compensation, training on IGA, seed money, market linkage, loan arrangement, etc.) or short term LRP (i.e. compensation and training on IGA).

9.2.17. Land Acquisition Plan

579. A land acquisition plan will need to be prepared for about 250 acres of private land (including 188 acres litigation land) following the Acquisition and Requisition of Immovable Property Act, 2017 (ARIPA 2017). The LAP includes the latest published Mouza maps duly georeferenced and digitized, a project footprint to identify on the maps, indications of plots to be affected, Khatians, a plot schedule, and a 'Cha' form. The CPA has submitted land acquisition proposals to the DC office for the acquisition of 188 acres litigation land in December 2023. This is due to the land ownership is not yet confirmed although it is recorded in the name of DC (Khash Land). In the meantime, the land acquisition process for 66.8535 acres of private land has been started. The DC office has completed all procedures and is now waiting for the disbursement of payment. Due to court cases and ownership problems among co-sharers, payment is kept pending. Based on the LA proposal for 188 acres land , the DC office will conduct a reconnaissance visit to the site, hold a district land allocation committee (DLAC) meeting, open the LA case number, serve notice under Section 4, conduct joint verification of the affected properties within the project footprint, invite complaints from persons interested or potential landowners, resolve complaints,

580. Common major steps of the land acquisition process by the DC office according to ARIPA 2017 law are shown in **Table 9-3** for easy reference.

Table 9-3: Common Steps of LA Process as per ARIPA 2017

Step	Description
Administrative approval from the line ministry	The requiring body (in this case RHD) needs to take administrative approval from the line ministry (in this case Ministry of Road Transport and Bridges)
Prior consent from Ministry of Land	As per Article 18 and 19 of the 1997 LA Manual, for any land acquisition within some designated areas, prior approval is needed from Land Ministry (This Project is not within those designated areas)
LA proposal (Land Acquisition Plan: LAP) submission by Project owner to respective DC office	LA proposal document includes: • facilities layout plan, • proposed acquisition area shown on Mouza maps (indicating the project boundary in hand writing on a cloth map), • list of affected plots (known as Plot Index), • amount of land in each plot and land required (known as Land Schedule), • general running video of the affected area, • filled up “CHA” Form showing names of the owners as per Khatians (ownership records), • administrative approval from the Line Ministry, The first 6 items will be obtained from the Land Acquisition Plan (LAP) to be prepared by the CPA
Document check and Reconnaissance survey	DC office will check if all required documents are submitted. The representative of the DC office will make a preliminary reconnaissance survey
Meeting of District Land Allocation Committee (DLAC) and allocation of case number by DC office	The submitted documents are sent to DLAC to allocate an LA case number (**within 21 working days** of LA proposal submission). This marks official recognition of the LA proposal. DLAC meeting may be omitted, when prior approval from Land Ministry is available
Notice of Acquisition under Sec 4	The official start of the LA process Also acts as a legal “Cut-off Date” for titleholders
Joint Verification Survey (JVS) as per Sec 4 (3) (Kha)	A joint verification survey should start **within 7 working days** of serving Sec-4 notice, jointly conducted by the acquiring body (DC office) and the requiring body (in this case, RHD), but must be completed before Sec 7. Joint video filming for asset confirmation is conducted.
Objection against JVS as per Sec 4 (8)	To be submitted to Divisional Commissioner **within 7 working days** after publication of JVS report
Decision on objection as per Sec 4 (9)	To be solved by Divisional Commissioner **within 15 working days** after the Sec 4-8 time limit.
Objection against acquisition (Sec 5-1)	To be submitted to DC office **within 15 working** days of Sec 4 notice
Decision on the objection (Sec 5-2)	To be solved by DC office **within 30 working days** after the Sec 5-1 time.
Submission for approval (Sec 5-3)	Depending on the acquisition amount, the LA proposal is sent to either Divisional Commissioner or Central Land Acquisition Committee (CLAC) **Within 30 working days** after Sec 5-2-time limit
Final approval by Divisional Commissioner or CLAC (Sec 6)	**Maximum 60 working days** after Sec 5-3-time limit It may be omitted when prior approval from Land Ministry is available
Final notice of acquisition to persons of interest (Sec 7)	Official recognition of PAPs. PAPs should submit their all documents **within 15 working days** of notice issuance.
Preparation of cash Compensation under Law (CUL)	The compensation amount should be prepared **within 30 working days** after Sec 7. Land register prepares land value, Public Works Department (PWD) prepares structure values, Department of Agriculture Extension (DAE) prepares crops values, Forestry prepares tree values, etc.

Step	Description
Notice of compensation amount (Sec 8)	After CUL preparation, notice is to be served within 7 working days.

9.2.18. Resettlement Action Plan

581. A resettlement action plan (RAP) will be prepared for the affected people, both private and government, following ARIPA 2017 and the World Bank ESF. Following the RAP policy, the affected people will be paid compensation and other resettlement benefits. A detailed census and inventory of losses, a socioeconomic survey, consultation meetings with various stakeholders, focus group discussions with affected people, a property valuation survey to assess the replacement cost of the affected properties, and video filming of the project area are to be carried out for the preparation of the RAP. The RAP will contain project description and background, adopted methodology, socioeconomic information and household demographic profile, land acquisition and resettlement impact, consultation outcomes, legal framework and policy principles, entitlement and eligibility, relocation strategy, grievance redress mechanism, implementation arrangement, cost estimate and budget, and monitoring and evaluation. Livelihood restoration program (LRP) will be a chapter of the RAP. The RAP will include the LRP with special focus on the vulnerable people including fishermen, HHs living under poverty line, wage laborers, poor female headed households and the eldery people. The LRP section will contain indication of need assessment study for the elijible vulnerable people to obtain alternative livelihood options, design livelihood restoration program, develop training courses for alternative income generating activities. Separate LRP document is not required in this project.

582. The CPA will implement the RAP with assistance from an experienced consulting firm or NGO. The RAP will need to be approved by the World Bank and approved by the Government of Bangladesh prior to starting implementation.

9.2.19. Breakwater Management Plan

583. In the case of Bay Terminal, Breakwater Management Plan is a specialized management strategy or document designed to oversee and maintain the breakwaters within a sea port or harbor. These breakwaters are essential structures that protect the port from the effects of waves, tides, and currents, ensuring safe and efficient maritime operations. Here's a description of the key elements and objectives typically included in a Sea Port Breakwater Management Plan:

- Introduction and Port Overview:
    - Provide an introduction to the sea port, its location, size, and importance in terms of trade and commerce.
    - Describe the role of breakwaters within the port's infrastructure and the necessity for their effective management.
- Breakwater Inventory:
    - Detail the various breakwaters within the port, including their names, locations, dimensions, and construction materials.
    - Categorize breakwaters based on their primary functions, such as entrance channel protection, wave attenuation, or sediment control.
- Objectives and Goals:
    - Define the primary objectives and goals of the management plan, such as ensuring navigational safety, protecting vessels and infrastructure, and minimizing downtime due to maintenance.
- Inspection and Maintenance:

- Establish a comprehensive schedule for regular inspections and maintenance activities for each breakwater.
- Specify the scope of inspection, which may include visual assessments, structural integrity checks, and monitoring of coastal erosion and sedimentation.
- Outline maintenance procedures, including repair protocols, equipment requirements, and personnel responsibilities.
- Allocate a budget for ongoing maintenance and potential rehabilitation or reconstruction projects.

- Environmental Considerations:
    - Conduct environmental impact assessments to understand the effects of breakwaters on the local ecosystem, including marine life, water quality, and sedimentation patterns.
    - Develop mitigation measures to minimize environmental impacts and enhance the ecological value of the breakwaters.
- Emergency Response:
    - Establish emergency response plans to address damage or structural failures of breakwaters during extreme weather events, such as hurricanes or storms.
    - Ensure that resources, personnel, and funding are readily available to implement emergency repairs and restore port operations quickly.
- Stakeholder Engagement:
    - Identify and engage with key stakeholders, including port authorities, shipping companies, environmental agencies, and local communities.
    - Foster communication and collaboration to address concerns, share information, and make informed decisions regarding breakwater management.
- Regulatory Compliance:
    - Ensure that the operation and maintenance of breakwaters comply with relevant maritime regulations, safety standards, and environmental laws.
- Data Collection and Monitoring:
    - Implement a robust monitoring program to collect data on wave conditions, sediment transport, water quality, and structural integrity of breakwaters.
    - Use collected data to inform decision-making, track performance over time, and identify potential issues proactively.
- Long-Term Planning:
    - Develop a long-term strategy for the sustainable management of breakwaters within the sea port, considering factors such as sea-level rise, changing climate conditions, and evolving maritime industry needs.

584. A well-crafted Breakwater Management Plan is essential for maintaining the functionality and safety of the Bay Terminal breakwater infrastructure, ensuring the efficient flow of maritime traffic, and minimizing disruptions to trade and commerce. It also promotes environmental stewardship and collaboration among all relevant stakeholders.

9.2.20. Ballast Water Management Plan

585. The Chittagong Port Authority (CPA) should control international vessels using the facilities of the Bay Terminal to ensure compliance with Ballast Water Management Plan (BWMP) practices within the territory of Chittagong Port

586. A Ballast Water Management Plan (BWMP) is a critical document for ships to ensure the proper management of ballast water, which is essential to prevent the spread of invasive species and maintain environmental compliance. Below is a checklist of items that should typically be included in a BWMP:

- Introduction and Vessel Information:
    - Introduction to the plan.
    - Vessel name, IMO number, and flag state.
    - Name and contact information of the vessel's owner/operator.
- Regulatory Compliance:
    - Statement of compliance with international and national regulations related to ballast water management.
- Ballast Water Management Responsibilities:
    - Roles and responsibilities of crew members involved in ballast water management.
    - Designation of a Ballast Water Management Officer (BWMO).
- Vessel Specifics:
    - Description of the vessel's ballast water system.
    - Ballast water capacity.
    - Description of ballast water pumps and treatment systems.
- Ballast Water Management Procedures:
    - Procedures for ballasting and de-ballasting.
    - Detailed instructions for ballast water exchange (if applicable).
    - Procedures for ballast water treatment (if applicable).
- Ballast Water Record Keeping:
    - Record-keeping procedures for ballast water operations.
    - Forms for recording ballast water activities.
- Ballast Water Sampling and Testing:
    - Procedures for collecting and analyzing ballast water samples.
    - Criteria for determining the effectiveness of ballast water treatment.
- Emergency Response:
    - Procedures for responding to ballast water system failures or emergencies.
    - Reporting requirements for incidents or non-compliance.
- Training and Awareness:
    - Training requirements for crew members related to ballast water management.
    - Awareness campaigns and materials for crew education.

- Communication and Reporting:
  - Procedures for reporting to port authorities and relevant agencies as required by regulations.
  - Communication procedures with shore-based personnel regarding ballast water management.
- Documentation and Certificates:
  - A checklist of required certificates and documents related to ballast water management.
  - Procedures for obtaining and renewing certificates.
- Maintenance and Inspection:
  - Maintenance schedule for ballast water treatment equipment.
  - Inspection procedures to ensure proper functioning of the ballast water system.
- Waste Management:
  - Procedures for the handling and disposal of ballast water residues and sediments.
- Record Archiving:
  - Procedures for the long-term storage and archiving of ballast water management records.
- Review and Updating:
  - Procedures for reviewing and updating the BWMP as needed to ensure compliance with changing regulations or operational requirements.

9.2.21. Critical Habitat Assessment (CHA): Proposed Management Plan Management Plan

9.2.21.1. Irrawaddy Dolphin and Green Turtle Monitoring

587. Section 3.1.1 of the CHA report proposes monitoring for Irrawaddy Dolphin and Green Turtle. Monitoring needs to assess the presence of these species within the cumulative impact area of the Bay Terminal. Monitoring can be achieved through various techniques including (i) direct observation; (ii) consultation with port authorities, shipping personnel, fisherfolk and other stakeholders; and/or (iii) regular eDNA testing of water samples from the project area.

588. Chittagong Port Authority (CPA) should allocate funds to the Forest Department of Bangladesh (BFD) to conduct the monitoring. BFD would collaborate with universities conservation organizations involved in cetacean and turtle conservation in Bangladesh for the operation of monitoring. At least ten years of monitoring is proposed.

9.2.22. Address impacts to the Patenga Beach IBA

589. Section 1.2.2 of the CHA report identifies the ESS6 requirements to address impacts to the Patenga Beach IBA, which emphasize consultation regarding appropriate management of the area. The IBA is designated for the conservation of bird species which will require protection. Section 3.1.3 proposes that coastal habitats north of the project area are secured in a manner that allows their continued use by shorebirds and establishment of mangrove vegetation to stabilize the habitats from adverse weather patterns. The following steps will be required:

- Consultation is required with the CPA regarding the future use of the tidal mudflats north of the project area. The proposed bird conservation area (12.3 sq km) should be declared and managed in collaboration with Forest Department of Bangladesh.
- Engagement with Forest Department of Bangladesh (FDB) regarding mangrove restoration, with an emphasis on selection of appropriate areas, restoration methods, establishing timelines, identification of indicators and other parameters necessary to compile a term of reference for development of a mangrove restoration plan.
- Consultation with international ornithological institutions is required to investigate the impacts to the IBA and associated bird species and establish a plan of action to safeguard and/or redevelop the Patenga Beach IBA, implemented by the FDB with support from the CPA.
- The ornithological institution shall also develop a long-term monitoring program focused on the identified critical habitat species and other avifauna affected by the loss of the IBA. The monitoring program must however be implemented by local ornithologists with CPA support and supervision by the FDB.

9.3. Environmental and Social Monitoring Plan (Construction and Operation)

590. The ESIA requires an environmental and social monitoring plan (ESMoP) at all project stages. It ensures that the commitments made in the ESIA are implemented. ESMoP verifies the effectiveness of the proposed mitigation measures in reducing impacts and allows mitigation measures to be refined or developed as needed to address the actual effects.

591. The objectives of the ESMoP are:

- To record project impacts during construction and operation and assess the changes in environmental conditions;
- To monitor the implementation and evaluate the effectiveness of the mitigation measures;
- To indicate potential problems and identify any shortcomings to allow prompt implementation of corrective actions, refinement, and enhancement of mitigation measures;
- To meet legal and relevant stakeholder requirements, corporate commitments, and community obligations;
- To allow the development of mitigation measures to deal with unforeseen issues or changes in operations;
- ESMoP includes the parameters to be monitored, the activities to be executed, locations, time and frequency of monitoring activities, and the collection, analysis, and reporting of monitoring data. It includes the
- Baseline monitoring, which may be carried out over seasons or years to quantify ranges of natural variation and directions and rates of change that are relevant to impact prediction and mitigation,
- Compliance monitoring, which aims to check that specific regulatory standards and conditions are met (e.g., about pollution emissions);
- Impact and mitigation monitoring aims to compare predicted and actual (residual) impacts and, hence, determine the effectiveness of mitigation measures.

592. The contractor, qualified environmental staff, and consulting company (third-party) will be responsible for all monitoring activities. The results will be reported to CPA, DoE, and other stakeholders.

593. **Table 9-4** provides the ESMoP matrix for the project.

Table 9-4: Environmental and Social Monitoring Plan Matrix

Components Monitoring	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
					Monitoring	Supervision
PRE-CONSTRUCTION PHASE						
Land Acquisition	Compensation	Project site	Before construction	Consultation with the land and structure owners, informal settlers, other affected people, and relevant authorities like the District Commissioner's office.	Third-party (Consultant) Submit report to the project authority.	PD/PIU (ESOHS)
Livelihood and Employment	No. of employment	Project area and adjacent project area (within 1-3 km)	As needed	Household survey and FGD	Third-party (Consultant) Submit report to the project authority.	PD/PIU(ESOHS)
CONSTRUCTION PHASE						
Air Quality	TSP, $PM_{2.5}$, PM_{10}, SO_x, NO_x, CO	Construction site, nearby sensitive receptors	Quarterly	24 hours	Third-party (Contractor)	Consultant ESOHS Team
Water Quality	pH, Ammonium Nitrogen, BOD_5, COD, Oil and Grease, Turbidity, TSS, TDS, TSS, etc.	Construction site, Near baseline water sampling station	Monthly	Grab sampling	Third-party (Contractor)	Consultant ESOHS Team
Noise	Daytime (6:00 – 21:00) and Nighttime (21:00 – 6:00)	Construction site, construction camp Nearby sensitive receptors	Weekly	Six samples during the daytime and one sample during the night, 15 min each monitoring.	EHS Team of Contractor	Consultant ESOHS Team
Disaster Risk	Recent disaster related information Disaster risk awareness,	Construction sites and nearby area	As needed	Survey, satellite image, FGD, KII	Third-party (Contractor)	Consultant EOHS Team
Traffic Congestion	Traffic congestion on the local road	Coastal Road	Weekly/As needed	30 min	EHS Team of Contractor	Consultant ESOHS Team
Livelihood and Employment	No. of employment	Construction site	Quarterly	Household survey and FGD	Third-party (Consultant) Submit report to the project authority.	Consultant ESOHS Team

Components Monitoring	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
					Monitoring	Supervision
Gender and SEA-SH	Implementation of the SEA-SH action plan	Subproject sites	Monthly	Both quantitative and qualitative assessment	Third-party (Consultant)	Consultant ESOHS Team
Occupational Health and Safety	First-aid Cases Medical Treatment Cases Lost Time Injury Number of near misses Number of Walk-through Inspections by Project Managers, Construction Managers, Health and Safety Officer and OHS supervisors	Construction site and construction camp	Daily	Walkthrough, inspections, and incident reporting	EHS Team of Contractor	Consultant ESOHS Team Team
Community Health, Safety, and Security	Rates of communicable disease (Chikungunya and Dengue, and other vector-borne diseases), Project related safety and security incidents, Number of grievances or claims of Project related impacts on the community.	Construction site, construction camp and nearby communities	Daily	Inspection and interview of laborers, project personnel and community members followed by a checklist	EHS Team of Contractor	Consultant ESOHS Team
Health and Sanitation	Availability of potable water, drinking water quality, availability of hygienic toilet	Construction camp	Monthly	Inspection and interview of laborers, project personnel	EHS Team of Contractor	Consultant ESOHS Team
Grievance Mechanism	Operation, procedures, records, and documents	Construction site	Monthly	Visual inspection and inquiry to know the grievance mechanism	EHS Team of Contractor	Consultant ESOHS Team
Fish Habitat, Species Diversity, and Production	Shoreline habitat condition	Jetty site and nearby coastal area	During dry season for 5 years	In-situ investigation and monitoring	Third-party (Consultant)	Consultant ESOHS Team
Migratory Bird	No. of migratory birds	Construction site	Yearly	Visual observation	Third-party (Consultant)	Consultant ESOHS Team Team

Components Monitoring	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
					Monitoring	**Supervision**
Sensitive Fauna (Dolphin, Turtle, etc.)	No. of sensitive terrestrial and marine fauna	Construction site	Yearly	Visual observation	Third-party (Consultant)	Consultant ESOHS Team Team
PORT OPERATION/POST-CONSTRUCTION PHASE						
Air Quality	TSP, $PM_{2.5}$, PM_{10}, SO_x, NO_x, CO	Port facility and nearby community	Quarterly	24 hours	EHS Team of CPA	EHS Manager of CPA and DoE
Water Quality	Total alkalinity, Ammonium Nitrogen, BOD_5, COD, EC, Oil and Grease, Turbidity, TSS, TDS, TSS, etc.	Coastal area near port facility	Monthly	Grab sampling	EHS Team of CPA	EHS Manager of CPA and DoE
Noise	Day time (6:00 – 21:00) and Nighttime (21:00 – 6:00)	Sensitive receptors along the navigational routes and terminal areas	Monthly	Three samples during daytime and one sample during night, 15 min each monitoring	EHS Team of CPA	EHS Manager of CPA and DoE
Disaster Risk	Flood level, flood duration, flooding depth, erosion and accretion, disaster risk awareness,	Piloted sites, upstream area, especially charlands area near the piloted sites	As needed	Survey, satellite image analysis, FGD, KII	EHS Team of CPA	EHS Manager of CPA/ Shipping Ministry
Ship Pollution	Emission from ships, Incident of waste and wastewater discharge, Oil spillage from ship, etc.	Terminal areas, Coastal area along the navigational routes	Quarterly	Exhaust monitoring (randomly selected sample ships)	EHS Team of CPA	EHS Manager of CPA and DoE
Ship Inspection	Ship conditions Waste management facilities Wastewater management facilities Emission, energy efficiency, OHS, etc.	Ship	Daily	Inspection and Auditing	EHS Team of CPA	EHS Manager of CPA/ Shipping Ministry

Components Monitoring	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
					Monitoring	Supervision
Ship Terminals	Site Condition Operation efficiency of ship waste collection and management facilities Operation efficiency of ship waste and wastewater collection and management facilities	Ship Terminals	Quarterly	Inspection and Auditing	EHS Team of CPA	EHS Manager of CPA/ Shipping Ministry
Grievance Mechanism	Operation, procedures, records, and documents	Port facility	Monthly	Visual inspection and Inquiry to know the Grievance Mechanism	EHS Team of CPA	EHS Manager of CPA
Traffic Congestion	Movement of cargo carrying vehicles on the local road will cause traffic congestion	Coastal Road	Weekly/As needed	30 min	EHS Team of CPA	EHS Manager of CPA
Occupational Health and Safety	First-aid Cases Medical Treatment Cases Lost Time Injury Number of near misses Number of Walk-through Inspections by Project Managers, Health and Safety Officer and OHS supervisors	Port Facility	Daily	Walkthrough, inspections, and incident reporting	EHS Team of CPA	EHS Manager of CPA
Fish Habitat	Shoreline habitat condition	Jetty Site	During dry season for 5 years	In-situ investigation and monitoring	EHS Team of CPA	EHS Manager of CPA
Migratory Bird	Shoreline around project	Port facility	Yearly	Visual observation	EHS Team of CPA	EHS Manager of CPA

9.4. Environmental and Social Capacity Assessment

594. The preliminary ESIA didn't include the institutional assessment of the CPA and how the arrangement will be made for the implementation, supervision, and monitoring of different components and related ESMPs between CPA and concessionaires. The updating and finalization of the ESIA will also investigate the capacity needs and building requirements of CPA in terms of environment, social, and health and safety staffing, based on the institutional capacity assessment carried out as a part of the ESIA. The updating and finalization process will require an understanding of the involvement of private concessionaire and their role in E&S risk management, recommendations on a well-justified ES organogram, detailed for implementation of environmental and social mitigation measures, supervision, monitoring, reporting, quality assurance, and corrective actions. In addition, the detailed cost estimates will be required for each element. The findings of the assessment will be integrated into the revised ESIA/ESMP.

9.5. Implementation Arrangements

9.5.1. Roles and Responsibilities of Environmental Social Occupational Health and Safety (ESOHS)Management Organogram

595. **Figure 9-1** shows the indicative environmental, health and safety management organogram.

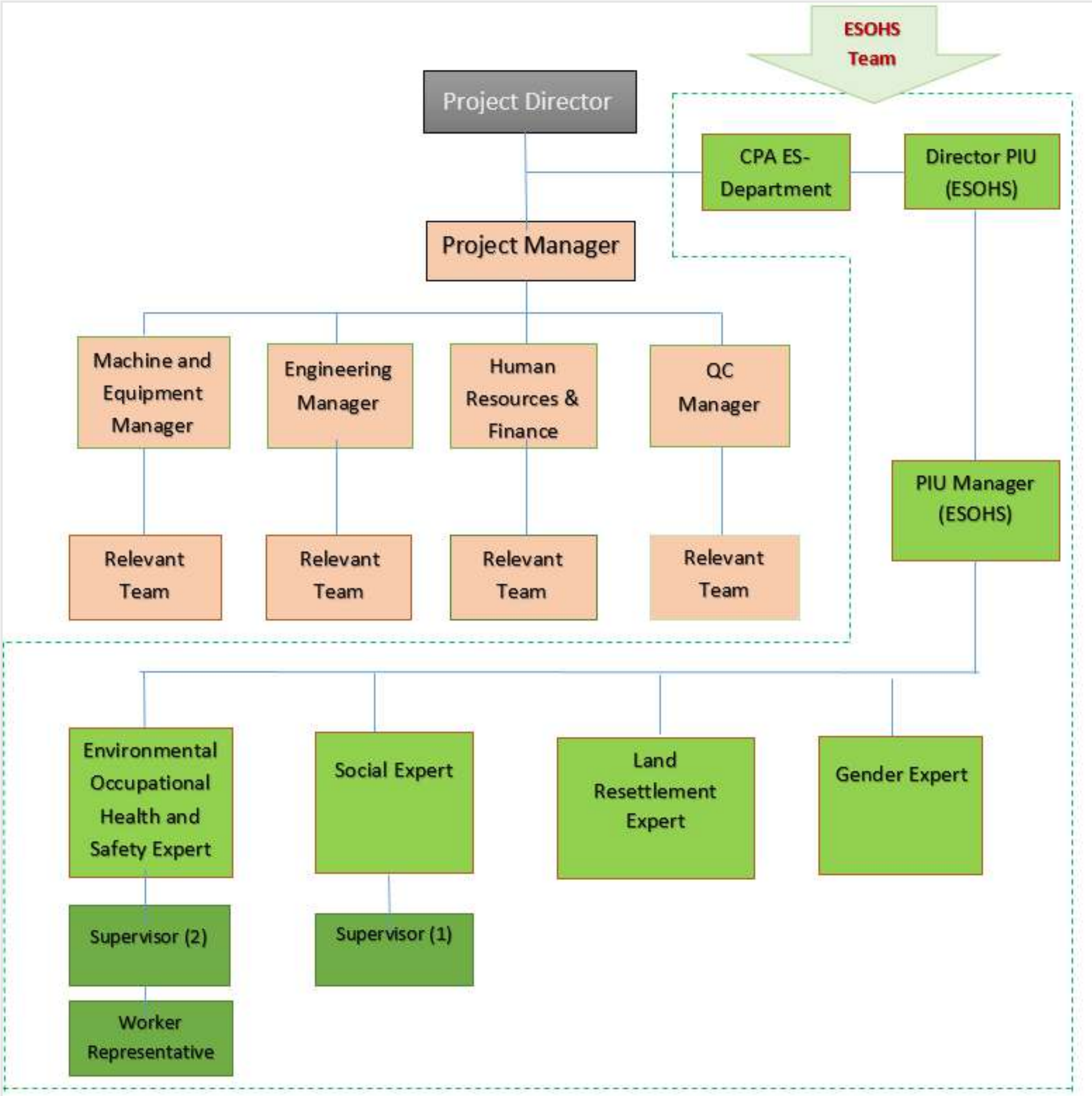


Figure 9-1: Environment, Social, Occupational Health and Safety Management Organogram

596. **Table 9-5** enumerates environmental, social, occupational health, and safety management roles and responsibilities.

Table 9-5: Environmental, Social, Occupational Health and Safety Management Roles and Responsibilities

Environmental and Social Management	Roles and Responsibilities
Director PIU Environment Social Occupational Health and Safety (ESOHS)	• Overall accountability for the development, implementation, and maintenance of the Environment Social Occupational Health and Safety (ESOHS) plan. • Accountable for the allocation of sufficient resources for the execution of the plan. • Ensure that empowered and competent personnel are available for the execution of the plan. • Ensure that all concern, Managers, and other Line Management personnel are fully aware of their responsibilities per the processes and SOPs of the ESOHS (Environment Social Occupational Health and Safety) plan.

Environmental and Social Management	Roles and Responsibilities
	• Discourage achievement of operational results at the cost of safety violations. • Develop a culture where it is safe to speak up and provide the time, people, and resources to respond to ESOHS concerns identified by their workers. • Review the summary of incidents to ensure that root causes are identified, and resources are provided for the closure of preventive and corrective actions. • Resolve the Grievance Redressed mechanism at top level if is not resolve in the field level or mid-level.
PIU Manager (ESOHS)	• Involved in and also resolves community health and safety issues. • Demonstrate visible leadership and walk-to-talk behavior to reinforce the implementation of the ESOHS plan. • Attend monthly committee/progress review meetings and monitor the performance through leading and lagging indicators. • Develop a culture where personnel are authorized to *STOP unsafe work without fear of retribution. • Ensure the work observation program is utilized and all incidents are thoroughly investigated. • Encourage reward and recognition where personnel demonstrate safe behavior, identify hazards, and fairly apply disciplinary processes when personnel is cut short.
Environment Occupational Health and Safety Expert	• Environmental Compliance: Continuously monitor the construction activities to ensure that they comply with all environmental permits, regulations, and requirements set by local, state, and federal authorities. • Construction Site Supervision: Oversee and inspect the construction site regularly to ensure that environmental protection measures are being implemented correctly, such as erosion control, sediment management, and pollution prevention. • Environmental Mitigation: Implement mitigation measures to minimize the impact of construction activities on the environment. This may include modifying construction techniques, using environmentally friendly materials, and adjusting work schedules to reduce noise and disruption. • Waste Management: Monitor the proper handling, recycling, and disposal of construction waste and hazardous materials. Ensure that waste disposal practices align with environmental regulations. • Air Quality Control: Monitor and manage dust emissions and air quality on the construction site. Implement dust control measures and manage construction equipment emissions to minimize air pollution. • Water Management: Manage and monitor stormwater runoff to prevent soil erosion and protect nearby water bodies. Ensure that sediment and pollutants are not discharged into rivers, lakes, or other water sources. • Noise Control: Implement measures to control construction-related noise, particularly in residential areas, to minimize disruption to the community. • Wildlife Protection: Implement measures to protect local wildlife and their habitats, especially in ecologically sensitive areas. This may involve creating buffer zones and using wildlife-friendly construction techniques. • Emergency Response: Develop and implement emergency response plans for environmental incidents, such as spills or accidents that could impact the environment. Ensure that the construction team is trained to respond effectively.

Environmental and Social Management	Roles and Responsibilities
	• Data Collection and Reporting: Continuously collect and document environmental data, including air and water quality measurements, site inspections, and compliance reports. Provide regular updates to regulatory agencies and project stakeholders. • Stakeholder Communication (Environmental Issue): Maintain open communication with local communities, environmental organizations, and project stakeholders. Address concerns, provide information, and seek feedback to maintain transparency and foster goodwill. • Sustainable Practices: Promote and ensure the use of sustainable construction practices, such as energy-efficient building methods, renewable energy sources, and green construction materials. • Problem Solving: Address environmental challenges and issues that may arise during construction promptly. Propose solutions and coordinate with the construction team to implement necessary changes. • Continuous Improvement: Identify opportunities for improvement in environmental performance throughout the construction phase and implement corrective actions as needed. • Documentation and Records Keeping: Maintain detailed records of all environmental activities, incidents, and compliance documentation for future reference and reporting.
Social Expert	• Stakeholder Engagement: Identify and engage with key stakeholders, including local communities, residents, businesses, NGOs, and government agencies. Establish effective communication channels to gather input, address concerns, and maintain transparency throughout the project. • Community Needs Assessment: Identify the needs and priorities of the local community and develop strategies to address them. This may involve providing infrastructure improvements, job opportunities, or other community benefits. • Community Consultation: Organize public meetings, workshops, and surveys to gather community feedback and input. Use this information to shape project plans and mitigate negative impacts. • Cultural Preservation: Assess and protect cultural heritage sites and traditions that may be impacted by the construction project. Develop strategies for preserving and respecting local culture and history. • Job Creation and Local Hiring: Develop plans to maximize local employment opportunities, including hiring from the local workforce and promoting job training and skill development programs. • Social Risk Assessment: Identify potential social risks associated with the project and develop strategies to mitigate them. This could include addressing issues related to land acquisition, resettlement, and displacement of communities. • Social Performance Monitoring: Continuously monitor the project's social impacts and performance, track community feedback, and assess the effectiveness of mitigation measures.

Environmental and Social Management	Roles and Responsibilities
	• Conflict Resolution: Mediate and resolve conflicts or disputes that may arise between the project and the local community, ensuring that issues are addressed promptly and fairly. • Education and Awareness: Develop and implement education and awareness programs to inform the community about the project, its benefits, and any potential disruptions. Promote understanding and cooperation. • Reporting and Documentation: Maintain detailed records of all social impact assessments, stakeholder engagement activities, and mitigation measures. Prepare and submit reports as required by regulatory agencies and project stakeholders. • Sustainability and Legacy: Work to leave a positive legacy in the community by implementing sustainable practices, supporting local capacity building, and fostering long-term relationships.
Land Resettlement Expert	• Legal and Regulatory Compliance: Ensure that the land acquisition and resettlement processes adhere to local and national laws, regulations, and international standards, such as the World Bank's guidelines on involuntary resettlement. • Impact Assessment: Conduct a thorough social impact assessment to understand the potential impacts of the project on affected communities, including the displacement of households, loss of livelihoods, and disruption of social structures. • Consultation and Engagement: Establish effective communication and consultation mechanisms with affected communities and stakeholders. Facilitate meaningful and transparent consultations to gather input, address concerns, and inform affected individuals about the project and the resettlement process. • Resettlement Planning: Develop and implement a comprehensive resettlement plan that outlines the compensation, relocation, and rehabilitation strategies for affected households and individuals. Ensure that the plan is equitable and tailored to the specific needs of each community. • Valuation and Compensation: Oversee the valuation of affected land and assets and ensure that affected individuals receive fair and just compensation for their losses. Ensure that compensation is provided in a timely manner. • Relocation Assistance: Provide assistance and support to affected households during the relocation process. This may include helping them find suitable housing, access basic services, and restore their livelihoods. • Livelihood Restoration: Develop strategies to restore and enhance the livelihoods of displaced communities. This may involve providing training, access to credit, and income-generating opportunities. • Vulnerable Groups: Identify and provide additional support for vulnerable groups, such as women-headed households, the elderly, and disabled individuals, to ensure they are not disproportionately affected by the resettlement process. • Grievance Redressal: Establish a grievance mechanism to address concerns and complaints related to the resettlement process. Ensure that affected individuals have a means to voice their grievances and seek resolution. • Monitoring and Evaluation: Continuously monitor the implementation of the resettlement plan to ensure that it is

Environmental and Social Management	Roles and Responsibilities
	effectively carried out and that the well-being of affected communities is improved as a result. • Documentation and Reporting: Maintain comprehensive records of all resettlement activities, including documentation of agreements, payments, and actions taken. Prepare regular progress reports for project stakeholders and regulatory authorities. • Capacity Building: Provide training and capacity-building programs for project staff, contractors, and affected communities to enhance their understanding of the resettlement process and their roles within it. • Sustainability and Community Integration: Work to ensure that the resettlement process contributes to the long-term well-being and integration of affected communities into the broader society. • Cultural Preservation: Respect and protect the cultural heritage, traditions, and identity of affected communities throughout the resettlement process
	• Gender Analysis: Conduct a comprehensive gender analysis to understand how the construction project may impact men, women, and other gender identities differently. Identify potential gender-specific challenges and opportunities. • Gender-Responsive Planning: Collaborate with project teams to integrate gender considerations into the project's design, planning, and implementation. Ensure that gender equality is a core aspect of the project's objectives and strategies. • Gender Mainstreaming: Promote the mainstreaming of gender considerations in all project activities and decision-making processes. Encourage the adoption of gender-sensitive policies and practices. • Inclusivity: Ensure that the project provides equal opportunities and benefits for individuals of all gender identities, including addressing gender-based discrimination and biases in employment, training, and participation. • Equal Access to Resources: Work to ensure that both men and women have equal access to project resources, such as employment opportunities, training programs, and financial benefits. • Safety and Security: Assess and address safety and security concerns specific to gender, especially for female workers and community members. Implement measures to reduce gender-based violence and harassment. • Empowerment: Promote the economic empowerment and capacity building of women in the project area. Support initiatives that enhance women's skills, access to credit, and leadership opportunities. • Consultation and Participation: Facilitate the active participation of women and other marginalized gender groups in project decision-making processes, consultations, and community engagement activities. • Gender-Responsive Infrastructure: Ensure that project infrastructure and facilities, such as sanitation facilities and accommodation, are designed and constructed in a way that considers the specific needs and safety of women and other gender identities. • Data Collection and Monitoring: Collect gender-disaggregated data to track the project's impact on different genders. Monitor and evaluate the project's gender-related outcomes and make necessary adjustments.

Environmental and Social Management	Roles and Responsibilities
	• Gender Sensitization: Conduct gender sensitization and training programs for project staff, contractors, and community members to raise awareness about gender issues and foster a gender-inclusive environment. • Reporting and Accountability: Ensure that gender-related progress and challenges are documented and reported to project stakeholders and relevant authorities. Hold project teams accountable for meeting gender-related targets. • Collaboration and Partnerships: Collaborate with local organizations and agencies working on gender-related issues to leverage expertise and resources for the project's benefit. • Legal Compliance: Ensure that the project complies with local and international gender-related laws and regulations, including those related to workplace gender equality. • Community Engagement: Engage with the local community and conduct gender-sensitive community consultations to address concerns, gather input, and build trust.
Environmental, Occupation Health and Safety Supervisor	• Be a subject matter expert (SME) on the EHS plan. Provide training and awareness regarding implementing the EHS plan, which includes multiple processes and SOPs. • Be familiar with all local, national, and international laws that apply to the operations. • In the monthly committee/progress review meeting, raise concerns regarding implementing controls stipulated in the EHS plan. • Provide training to staff on the EHS plan. Conduct regular sessions for all project team members to teach the requirements of the EHS plan. • Report to the contractor's management team on implementation progress and monthly KPIs. • Ensure that sufficient training and induction of all personnel is being provided and maintained. • Ensure that visit induction is given to all visitors before they are allowed to visit the site. • Develop the EHS awareness of all personnel employed on the project and ensure their participation. • Guide the purchase of personal protective equipment (PPE) • Regular inspection of safety and security as per PR09: Work Observation Process • Guide employees regarding their emergency response responsibilities. • Decide whether a potential rescue service or team is adequately trained and equipped to perform permit space rescues needed at the facility and whether such rescuers can respond promptly and organize drills. • Review of EHS plan annually.
Site Supervisor	• Allocate tasks and check that the project workers are implementing EHS requirements to standard. They provide feedback and guidance on EHS implementation. • Ensure that the controls stipulated in PTW (Permit to Work) are implemented and stop the work when critical controls are missing or compromised. • Discuss Job Hazard Analysis (JHA) and conduct effective toolbox talks with all project workers. Ask questions to ensure that they have a good understanding. • Ensure all new employees receive training per PR01: Induction Process and PR05: Short Service Worker Process.

Environmental and Social Management	Roles and Responsibilities
	• Conduct worksite observations and discuss safety concerns with project workers. • Develop a culture where it is safe to speak up and provide the time, people, and resources to respond to EHS concerns identified by their workers. They are also responsible for escalating issues that can't be resolved by the project workers or at the supervision level to the EHS Team or senior management. • Responsible for making an incident scene safe and secure and ensuring that hazards, near misses, and incidents are entered into the reporting system. • Ensure all project workers use appropriate PPEs and train them on how to use PPEs.
Worker	• Conduct Personal Risk Assessment Take 5 (Stop, Look, Assess, Control, and Monitor) and do not proceed to work if unsafe. • Use authority to stop work if unsafe work by a fellow worker. • Report hazards and at-risk behavior and help management to develop an environmentally friendly, healthy, and safe culture. • Use PPE as provided. • Conduct a visual inspection of equipment at the beginning of the operation and ensure that equipment is de-energized before working on a piece of equipment. • Wear appropriate PPE for the activity that they undertake. • Be aware and mindful of hazards related to any work activity; do not undertake a job or task if physically or mentally unfit. • Seek clarification for uncertainty relating to a task. • Only undertake a job if competent to do so. • Raise improvement opportunities. • Report near misses and actual incidents immediately to the supervisor.

9.5.2. Reporting

597. Reporting on environmental, health, and safety quarterly helps the contractor demonstrate that its management is committed to improving the workplace. The quarterly report indicates that the contractor's management recognizes sound EHS performance as contributing to overall business success. Moreover, it should demonstrate how hazards and injuries are systematically managed in the organization. It will promote the development of strategies to improve EHS performance. The contractor EHS team is responsible for preparing the report r. The report will include the following: the performance of the measures implemented and commitment to improving the EHS within the organization.

9.6. ESMP Cost

598. The ESMP implementation and land acquisition/resettlement, livelihood restoration, and social development cost of the Project are provided in **Table 9-6** and **Table 9-7**.

Table 9-6: ESMP Implementation Cost

No.	Item	Estimated cost in Million BDT
1	DoE Clearance	4.00
Construction Work		
2	EHS Management System Development for Construction Site	694.00
3	Establishment STP for Laborers Camp	
4	Purchase PPE for all workers	
5	EHS Staff of the contractor	
6	ESMP monitoring	
7	CPA EHS Consultant engagement cost	

8	Capacity Building and Training of CPA	
TOTAL ESTIMATED BUDGET		**700.00 MILLION**

Table 9-7: Land Acquisition/Resettlement, Livelihood Restoration, and Social Development Cost

No.	Item	Estimated cost in Million BDT
1	Land Acquisition/Resettlement*	
	Land Acquisition of 66.8 Acres Private land	3,649
2	Livelihood restoration and social development plan	600
3	Stakeholders Consultation and GRM	40
TOTAL ESTIMATED BUDGET		**4,289 MILLION**
*Note: *No resettlement is required because there are no settlements in the acquired 66.8 Acres Private land)*		

10. Conclusion and Recommendations

599. The proposed Bay Terminal Project is projected to considerably expand the Chattogram Port's ability to handle containerized cargo. Furthermore, it is expected to greatly improve the turnaround time, draft, dead weight tonnage (DWT), container carrying capacity, berthing facilities, and connection of vessels calling at the port.

600. This Preliminary ESIA study looked into the proposed port development activities and port operations in terms of managing specific environmental and social issues. The issues considered were based on the potential for impacts on matters of national environmental significance and included practices to manage water and sediment quality, coastal processes and hydrology, noise, lighting, aesthetic impacts, direct ecosystem impacts, air quality, and different species. The most prominent environmental issues that international ports are focusing on are water quality (particularly due to dredging impacts), noise, and air emissions. Air quality is generally treated as a human health issue with limited consequences.

601. All environmental and social issues that arise during the construction and operation of the port will be managed by the implementation of the measures mentioned in the ESMP.

602. The overall outcome of this Preliminary ESIA study for the proposed Bay Terminal Project is the establishment of green, sustainable, and legally compliant ports in the country, where it will be ensured: (i) compliance with all applicable legal requirements regarding the environment, health, and social issues; (ii) development, implementation, and maintenance of a comprehensive environment and social impact management system; (iii) minimization or substitution of resource use, like the use of solar energy, rainwater harvesting, and reuse of wastewater from the sewage treatment plant; (iv) use of surface water and rainwater beside the ground for a source of the water treatment plant; (v) sub-surface recharge through the development infiltration gallery; (vi) habitat development in the breakwater for migratory and other birds; (vii) green belt development around the project area; (viii) development of sustainable urban community drainage with garbage collection and silt traps around the proposed Bay Terminal area. (ix). ensure safe and sustainable working throughout the project lifecycle; (x) ensure appropriate laborers management during construction; (xi) effective community health safety management system; (xii) establishment of an effective GRM; (xioi) provide an idea about the current status of land acquisition; (xiv) provide the socioeconomic baseline condition of the project surroundings; (xv) reduce the cumulative impact of additional traffic movement on existing coastal roads during port construction and operation, an eight-lane road in front of the Bay Terminal will be designed to run parallel to the coastal road, and all point coastal road junctions will be alleviated by creating flyovers at all exits and entries to the Bay Terminal of an intelligent traffic control system and limit the truck's direct access to and exit from the coastal road as well.

603. The proposed Bay Terminal Project will create a potential for economic and social development in the locality to provide priority to the local people in skilled-based employment opportunities besides in the national economy as a foreign currency-earning company. The project's potential benefits will compensate for the negative impact if the prescribed EMP is implemented.

604. The specific recommendations of this Preliminary ESIA study are:

- All activities (construction and post-construction stage) will be implemented along with the implementation of ESMP.
- Environmental compliance monitoring activities will be ensured during the construction and operation phases of the project to determine the compliance of the measures identified in the ESMP.
- The project will be operated, ensuring all pollution abatement measures.

- Establishing institutional arrangements with proper logistics and training for environment, health, and safety in the project management unit during the construction and operation phases of the project

Annex List

Annex 1 – Bay Terminal Terms of Reference for Updating and Finalization of Preliminary Environental and Social Impact Assessment (ESIA)

Annex 1 – Bay Terminal Terms of Reference for Updating and Finalization of Preliminary Environental and Social Impact Assessment (ESIA)

Government of the People's Republic of Bangladesh

CHATTOGRAM PORT AUTHORITY (CPA)

TERMS OF REFERENCE[8]

Updating of
Preliminary Environmental and Social Impact Assessment (ESIA)

for
BANGLADESH: CHATTOGRAM BAY TERMINAL PROJECT

January 23, 2024

[8] *Note: It is an indicative ToR and will be further updated during the Call for Proposal.*

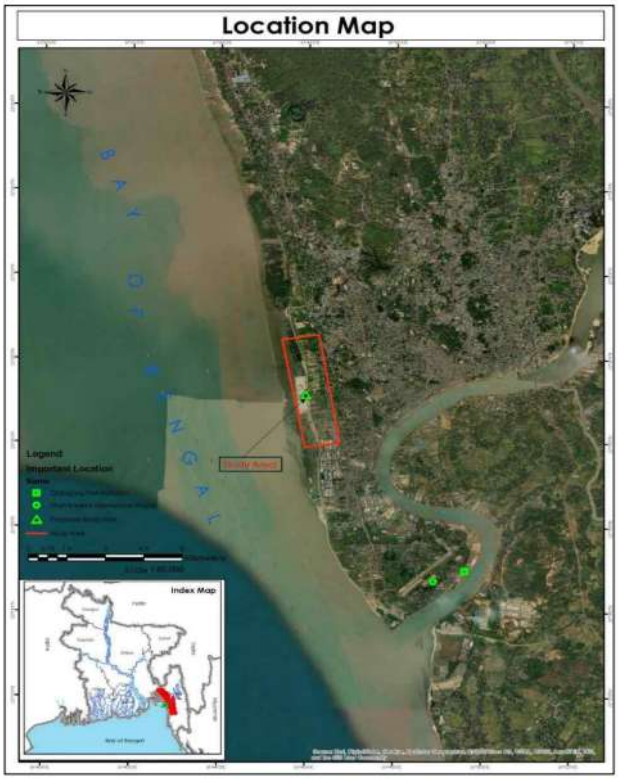
1. INTRODUCTION, BACKGROUND AND CONTEXT

INTRODUCTION

The CHATTOGRAM PORT AUTHORITY (CPA) seeks to engage a qualified and experienced firm (the Consultant) to update and finalize the Preliminary Environmental and Social Impact Assessment (ESIA) of BANGLADESH: CHATTOGRAM BAY TERMINAL PROJECT (the Project). In undertaking this assignment, the Consultant will (i) further identify gaps and deficiencies in the report; (ii) carry out additional field data collection and analysis; (iii) review all technical studies carried out and interpret the study findings relevant to environmental and social risk management; (iv) carry out additional consultations; (v) strengthen the assessment and management plan specific to different project component; (vi) developing environmental and social management plan (ESMP) implementation framework including institutional capacity strengthening, supervision, monitoring, reporting, quality assurance, and corrective actions; and (vii) updating and finalization of the ESIA. The final ESIA must meet the policy and legal requirements of the Government of Bangladesh (GoB) and all financing agencies including the World Bank.

PROJECT BACKGROUND, DESCRIPTION AND COMPONENTS

The Bay Terminal Project will be a greenfield expansion of the Chattogram Port. Phase 1 will include one container terminal envisioned for private development and one multi-purpose terminal, which the CPA will build and operate with public funding, a navigation channel including breakwater and capital dredging, supporting infrastructure, and technical assistance. In Phase 2, another terminal will also be built.



Source: Final Report of FS Update (Volume 2), January 2024

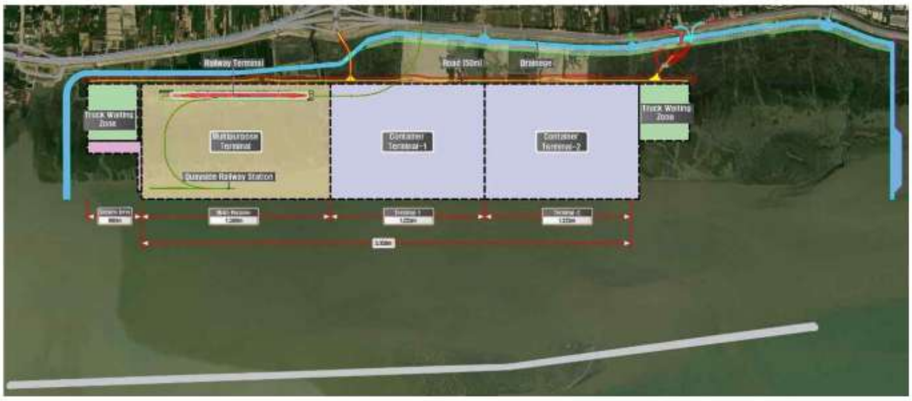
Figure A-1: Proposed Project Area Satellite Image

This is a nationally important project (expected to be the first private terminal concession in Bangladesh, i.e., the concession of the phase-1 container terminal), which will contribute to more efficient trade flows for Bangladesh and improve connectivity with the regional economy. It will also help to enhance the capacity of the Chattogram Port, which will reduce congestion at the port.

The proposed location of the Bay Terminal is in the Anandanagar / Sandwip Channel. Moreover, the location provides linkage to the Dhaka-Chittagong-Cox's Bazar highway, railway, and waterways. The Bay Terminal is planned to be built to accommodate vessels with 12 m draft or above and > 300 m lengths. Bay Terminal would allow for larger ships to come directly into the port compared to the other terminals inside the river channel. The capacity and efficiency of Chittagong Port will contribute significantly to the efficiency and competitiveness of the country's economy. Thus, extensive development of the Bay Terminal has been proposed in the Bay of Bengal off the coast of Patenga in the city's Halishahar Ananda Bazar area. It is near Chittagong Port and Chittagong Export Processing Zone.

Chittagong Bay Terminal positioned a little way up to the Karnaphuli River mouth on the northeast curve of the Bay of Bengal, has always been the largest and by far most important seaport in Bangladesh. The problem with Chittagong port is that the current maximum draft of the port river channel is just 9.2 meters, not deep enough for many modern container ships. This requires a time-consuming and costly transfer/lighterage operation, as smaller ships must be used to transport cargo to and from big ocean freighters that are anchored out in the bay. One proposal to remedy this problem is the construction of a new port in the Bay of Bengal off the coast of Patenga and in proximity to Chittagong, dubbed the Bay Terminal.

The Bay Terminal project will be implemented in different phases and segments. Construction of the breakwater and access channel of Bay Terminal will be done by CPA. There will be 3 terminals, namely Multipurpose Terminal (1.5 km of quay length), Container Terminal 1 (1.225 km of quay length), and Container Terminal 2 (1.225 km of quay length). Container Terminals 1 and 2 will be constructed and operated by foreign Global Operators. The Multipurpose Terminal will be constructed and operated by the Chittagong Port Authority (CPA). The proposed Chittagong Bay Terminal conceptual plan is shown in Figure A-2 and the bird's-eye view of Chittagong Bay Terminal is shown in Figure A-3.



Source: Final Report of FS Update (Volume 2), January 2024
Figure A-2: Chittagong Bay Terminal Conceptual Plan

Source: Final Report of FS Update (Volume 2), January 2024

Figure A-3: Bird's Eye View of Chittagong Bay Terminal

The major work components of the Project are: · Three terminals, namely Multipurpose Terminal, Container Terminal 1, and Terminal 2. Container Terminals 1 and 2 will be constructed and operated by foreign Global Operators; · The terminals are to be built side by side with one straight quay line of 3.5 km; Port Terminal with yard facilities, including utility services and all related structures; · Marine crafts and yard equipment; · Port Link road with trumpet-type interchange and railway connection; and · The breakwater and access channel of Bay Terminal will be done by CPA and expected to be financed by the World Bank.

The phase-1 container terminal(s) will include a storage (stacking) area for reefer containers, which are connected to electrical power during storage to control the temperature of perishable goods like fish, meat, etc. The quay and yard equipment at the container terminal(s) are expected to make use of large volumes of energy, either kWh or tons of diesel, depending on the selected types of equipment. The container terminal(s) will also include a storage (stacking) area for containers containing a variety of dangerous cargoes (IMDG containers).

At the phase-1 multi-purpose terminal, it is projected that the following cargoes will be handled:

- General cargo
- Break bulk (wood and other products);
- RoRo cargo (mainly passenger cars);
- Agricultural dry bulk (grain and sugar); and
- Mineral dry bulk (clinker, cement, and soda ash).

These different commodities will require different storage facilities: open storage areas as well as sheltered storage areas (warehouses) are planned for general cargo, break bulk (wood and steel), sugar, and grain. A cold store may be part of the storage facilities for break bulk. The warehouses for sugar and grain will be connected to the quayside by mobile conveyor systems to gain the highest operational flexibility at the quayside. Parts of the grain and sugar and the total volumes of mineral bulk will be unloaded from the vessels in direct delivery mode, and thus, for those volumes, no storage facility will be needed.

The project site is in the estuary of one of the largest freshwater discharge systems (the Ganga-Meghna-Brahmaputra Estuary) and approximately 10–12 km to the north of the Karnaphuli River estuary. The construction of the terminal associated road and rail connectivity, creation of an industrial zone, dredging, and reclamation of land area, etc. are expected to lead to the loss of coastal habitat (such as mud flats, sandy beaches, mangroves), and may even result in changes in the drainage pattern of local creeks as well as draining mangroves and mudflats. The construction of the breakwater, capital dredging, piling for laying foundations, and reclamation works during the construction phase are also expected to lead to loss of or disturbance to marine habitat.

The sand bar in front of the projected terminals of Bay Terminal has developed over the last 30 years (some data indicates it is more than 100 years old), which is an indicator of the strong morpho-dynamic activity in the area. From the surveys of the island over the years, the island appears to be relatively stable, with no significant accretion or erosion of the island over the last 10 years. However, if the conditions in and outside the project area (e.g., outflow and sediment concentration of the Meghna River) are changing, significant morpho-dynamic changes in the area may occur. The construction of the planned Bay Terminal will cause changes in the hydrodynamic conditions, particularly in the channel between the terminal and the breakwater (sand bar). The project activities may also lead to several social risks and impacts, including, but not limited to, issues with physical and economic displacement, labor influx, including OHS, sexual exploitation and abuse/sexual harassment (SEA/SH), impacts on ethnic minorities, vulnerable people, and those disadvantaged people who suffer impacts of the projects disproportionately and who are left out of consultation, community health and safety considerations, etc.

The construction and operation of this project's components, together with already existing and future developments planned in the area, will likely generate cumulative environmental and social impacts and risks that need to be assessed and managed.

2. STATUS OF PRELIMINARY ESIA

The Preliminary ESIA has been prepared with limited field data collection and parallel to several ongoing studies. The feasibility study of the breakwater and dredging of the access roads are ongoing and the preliminary ESIA does not have detailed information on these two components. The master plan and other feasibility study reports were received after the draft final preliminary report submission. Without modeling outputs from the Feasibility Study and the Detailed Design, the preliminary ESIA didn't capture the details of the environmental and social risks. The impacts of the proposed activities and the respective mitigating measures and Environmental and Social Management Plans (ESMPs) will be updated and finalized before initiating the contracting processes to incorporate the additional studies and modeling outputs.

As mentioned earlier the World Bank is expected to finance the breakwater and dredging of the access channel. The World Bank's Environmental and Social Framework (ESF) will apply to the project. As per the ESF, it will be applicable to the entire project and the non-bank funded activities will be considered Associated Facilities[9]. Since the World Bank's ESF is considered one of the Good International Industry Practices (GIIP), the preliminary ESIA followed the ESF.

COVERAGE OF PRELIMINARY ESIA

The Preliminary ESIA assessed potential risks and impacts related to all relevant standards (ESS1, ESS2, ESS3, ESS4, ESS5, ESS6, ESS7, ESS8, and ESS10) of ESF and national ECR'23 requirements based on the available information of the project and limited field study. The assessment of risks covered the identification and inclusion of vulnerable and disadvantaged groups (including women, people living under poverty, people with disabilities, etc.) and assessing the risks of SEA/SH following the World Bank's Good Practice Note (GPN).

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[9] Associated Facilities means facilities or activities that are not funded as part of the project but, in the judgment of the bank, are: (a) directly and significantly related to the project; (b) carried out, or planned to be carried out, contemporaneously with the project; and (c) necessary for the project to be viable and would not have been constructed, expanded, or conducted if the project did not exist. For facilities or activities to be associated facilities, they must meet all three criteria.

In addition, Critical Habitat Assessment (CHA) has been carried out, which determined several species of dolphins, turtles, and birds qualified for critical habitat criteria. Besides, a Rapid Cumulative Impact Assessment (R-CIA) was also prepared. Based on above, an Environmental and Social Management Plan (ESMP) was prepared accordingly as part of the Preliminary ESIA.

The Preliminary ESIA conducted initial scoping of the impacts of all E&S issues, and then, based on the initial analysis, further data were collected, and in-depth analysis was conducted to prepare various other E&S instruments. The Preliminary ESIA analyzed gender issues related to the project and saw how gender gaps in terms of employment, job opportunities, and entrepreneurship could be addressed. The ESMP recommendation focused on women's economic empowerment opportunities in the project (given the context in Bangladesh and the project area). In assessing E&S risks and impacts and management measures, the Consultant referred to the World Bank Group's General Environmental Health and Safety Guidelines (EHSG)[10] and the relevant Industry Sector Guidelines (for Ports, Harbors, and Terminals)[11] and those applicable to Toll Roads[12] and Railways[13].

As a part of the Preliminary ESIA, the Consultant conducted a Rapid Cumulative Impact Assessment (RCIA), focusing on identified Valued Environmental and Social Components (VESCs) that may be affected by the project and other past, present, and foreseeable development activities that are planned or underway within the project area, including but not limited to other ongoing or planned urban development and transport development in the project area. The study recommended CPA project-level as well as regional planning-level measures for managing negative cumulative impacts and risks and capitalizing on positive benefits associated with the development in the project area.

The Preliminary ESIA assessed labor risks and working conditions. The assessment includes risks from project activities and key labor risks such as hazardous work, child labor and forced labor, migrant or seasonal workers, discrimination against women and vulnerable groups, labor influx, occupational health, and safety (OHS), possible accidents and emergencies, and risks of SEA/SH.

The consultant also prepared an OHS Plan Framework that can be used to inform the bidding documents on OHS requirements as well as assist the winning bidders and contractors in preparing their specific OHS plans. The OHS Plan Framework sets out the minimum specific OHS standards that the contractors will be required to comply with, aligned with ESS2 requirements.

It assessed project impacts on resource use and efficiency, pollution prevention, and how the project could prevent and manage pollution. It assessed impacts on air quality (for example, generation of fugitive dust associated with handling, unloading, and storage of commodities such as grain, sugar, and mineral bulk), noise, and vibration impact on marine and land-based receptors based on limited data. This includes assessing the storage and handling of hazardous

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[10] *EHSG: https://www.ifc.org/wps/wcm/connect/29f5137d-6e17-4660-b1f9-02bf561935e5/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf? MOD=AJPERES&CVID=jOWim3p*
[11] *Ports, Harbors, and Terminals: https://www.ifc.org/wps/wcm/connect/ddfac751-6220-48e1-9f1b-465654445c18/20170201-FINAL_EHS+Guidelines+for+Ports+Harbors+and+Terminals.pdf? MOD=AJPERES&CVID=lD.CzO9*
[12] *Toll Road: https://www.ifc.org/wps/wcm/connect/9c8cfb24-abbd-4ab4-ba63-84f94da02af7/Final%2B-%2BToll%2BRoads.pdf? MOD=AJPERES&CVID=jqeslax&id=1323162564158*
[13] *Railways: https://www.ifc.org/wps/wcm/connect/8a4a0318-9c7a-44f1-80bf-ff30cb3c9087/Final%2B-%2BRailways.pdf? MOD=AJPERES&CVID=jqevJUe&id=1323152551661*

materials (for example, diesel, refrigerants if used for cold storage facilities, IMDG containers, and hazardous cargoes), as well as the generation and safe handling and disposal of hazardous and non-hazardous solid wastes and wastewater (as well as stormwater runoff), and including measures to be implemented for spill prevention, control, and countermeasures. The ESMP provided generic measures to optimize resource use and efficiency, transport of materials, incident and spill response, and management of pollution.

It assessed the potential risks and impacts of the project on the health and safety of the communities that are exposed to the project activities, both at the Bay Terminal site and beyond. It includes a generic assessment of the impacts of the labor influx on the communities' health and safety (including SEA/SH), as well as traffic safety for communities and commuters during construction, onsite and offsite emergency preparedness and response planning during construction and operation, issues with security force deployment (if any), use of hazardous materials and control measures, generation of waste, contagious and noncontagious disease, safety of services, impacts on ecosystem service, etc.

It considered the available information related to land acquisition for the project, including physical and economic displacement and restriction of access to land or resources/livelihoods resulting from implementing the project (especially the determination if there is likely to be economic displacement of fishermen and physical displacement of some of their assets (including their docking grounds)) and related issues.

The area has the potential for many important species and habitats, including the Ganges River dolphin and/or their prey, migratory and wading birds, and sea turtles, as well as 21 critically endangered species and 45 endangered species identified through a preliminary screening using IBAT. The Preliminary ESIA included critical habitat screening and a more in-depth Critical Habitat Assessment with inputs from species specialists. It considered whether the project will affect any natural and critical habitat values, species of ecological and conservation significance, ecosystem services, and any plantation and reforestation areas. The Preliminary ESIA included an impact assessment that considers direct, indirect, and cumulative project impacts on biodiversity values and develops mitigation measures that apply the mitigation hierarchy of avoidance, minimization/reduction, mitigation, and offsets (where needed).

The Preliminary ESIA carried out an additional screening on the presence of ethnic minority communities in the project area. Based on the screening, the project is not expected to affect any ethnic communities during its construction and operation phases. Ethnic communities are living beyond the footprint of the proposed Bay Terminal within Chattogram City.

The Preliminary ESIA assessed risks and impacts on cultural heritage, including the inventory of historical, cultural, and archaeological sites that will be affected, and proposed measures to manage risks and impacts.
The Consultant developed a Stakeholder Engagement Plan (SEP) during the preparation of the Preliminary ESIA, which identified the potential stakeholders (affected people, interested parties, the vulnerable, and the disadvantaged) and identified strategies for continuous and meaningful interactions among the stakeholders by the proponent. The SEP includes the scope of completion of the feedback loop to take the inputs of the stakeholders to design the project and give them continuous feedback on the same. It will guide the consultation and stakeholder engagement processes throughout the project lifecycle, including the process of updating the preliminary ESIA, starting from project preparation to implementation. The Consultant also designed a Grievance Redress Mechanism (GRM) for the project.

MAJOR GAPS IN PRELIMINARY ESIA

A review of the Preliminary ESIA identified some gaps to be addressed during the updating and finalization of the ESIA at the detailed design phase. These are:

Project Description: Feasibility Studies are yet to be completed, so the design and specifications of most of the physical interventions are still not finalized. Thus, the design and specifications of the different interventions furnished in this chapter are based on preliminary conceptual planning and are likely to be changed once FS studies are finalized. Moreover, it has very limited information on the specifications of the Breakwater and Channel Dredging components.

Baseline: The current baseline has been built mostly using either secondary information and/or insufficient primary data. Some of the data are not statistically representative. In particular, detailed surveys /investigations are required on marine hydrological and biological systems of the proposed project area. Baseline information on dredging and sourcing of landfilling materials is also not available. On the other hand, the census and socioeconomic survey have been conducted very recently, and affected properties including structures, businesses, wages, vulnerability, etc. have been identified. However, these data are not yet fully analyzed and presented in the ESIA. The Socioeconomic profile of the fish traders is important for the ESIA, but the preliminary ESIA does not include this information. The gender-specific baseline information lacks an overall understanding of gender needs and gaps that the project will address. The chapter needs to be strengthened with expanded social and environmental data that are needed to conduct a comprehensive ES impact assessment.

Alternative Analysis: It lacks proper analysis of plausible alternatives of different social and environmental elements due to a lack of information due to ongoing feasibility studies, modeling, and limited data collection. The alternative analysis is to be strengthened with relevant information on the advantages and disadvantages of different options from the environmental and social considerations.

Impact Assessment: As this ESIA is still at the preliminary stage, most of the assessments are generic without having specific information on sites, sources, spatial and temporal references, and levels of influence. Some impacts are necessary to be assessed quantitatively, especially, project impacts on the marine environment and climate change need more attention. Besides, there is scope to enrich the quality of this chapter using the modeling outputs that are being done by the Breakwater and dredging consulting firm. Once detailed design and specifications of all the components are available, this chapter needs to be reviewed during detailed ESIA.

ESMP: The preliminary ESIA contains the generic ESIA. Most of the ESMPs suggested further detailing with specific information on those operational and implementation requirements. These must be more specific and be prepared for both the construction and operational phases of the different components. So that, the CPA can integrate the specific ESMPs in the bidding document of different items.

Institutional Arrangement and Budget: The preliminary ESIA didn't include the institutional assessment of the CPA and how the arrangement will be made for the implementation, supervision, and monitoring of different components and related ESMPs between CPA and concessionaires.

3. SCOPE AND METHODOLOGY OF THE CONSULTANCY SERVICES

The Preliminary ESIA will be updated and finalized during the detailed design phase with additional field surveys, stakeholder consultation, additional modeling, interpretation of other study findings, and final design considerations. The updating and finalization of the ESIA will be carried out following the policy and legal requirements of the Government of Bangladesh (GoB), the World Bank's ESF, and any additional requirements of other financing partners.

UPDATING AND FINALIZATION OF THE PRELIMINARY ESIA

The updating of the Preliminary ESIA will include a thorough review of the preliminary ESIA and policy and legal requirements of the GoB, World Bank, and other financing partners. Based on the review, the consultant will prepare a detailed plan for ESIA updating and finalization. It will include the collection of additional baseline data to complete the gaps and deficiencies in the Preliminary ESIA, including shoreline change modeling following good international industry practice (GIIP), dredging and dredge spoil disposal studies following GIIP including testing of sediment/dredge material quality, the decision on onshore/offshore disposal based on dredge material quality testing, and dispersion plume/turbidity increase modeling; and modeling of climate change resilience including impacts related to sea level rise, increase in frequency and severity of extreme weather events (storms, storm surges, rains, floods, temperatures, etc.), bathymetric study of the project area etc.

It will include additional investigation for alternative options of the different components and activities with relevant information on environmental and social considerations. The analysis of potential impacts presented here is mostly qualitative, but it is necessary to quantify the impacts both in the Future-without-project (FWOP) and Future-with-project (FWIP) scenario. The RCIA is to be further strengthened on further field-level data collection and consultations with different agencies. It will develop a robust development and monitoring plan for the areas.

It will also investigate the capacity needs and building requirements of CPA in terms of environment, social, and health and safety staffing, based on the institutional capacity assessment carried out as a part of the ESIA. The updating and finalization process will require an understanding of the involvement of private concessionaire and their role in E&S risk management, recommendations on a well-justified ES organogram, detailed for implementation of environmental and social mitigation measures, supervision, monitoring, reporting, quality assurance, and corrective actions. In addition, the detailed cost estimates will be required for each element. The findings of the assessment will be integrated into the revised ESIA/ESMP.

The updating of the Preliminary ESIA will reassess energy, water, and raw material use and efficiency. It will also calculate and estimate the greenhouse gas (GHG) emissions from the construction and operation of the project following internationally accepted methodologies for estimating GHG emissions.

The process will include an assessment of impacts and risks in ancillary facilities such as borrow pits, quarry sites, spoil disposal areas, workers' camps, etc. Measures in the ESMP and in relevant plans (e.g., Traffic Management Plan) to be developed by the Contractors will be updated to have a site-specific measure. The Consultant will prepare a comprehensive gender and SEA/SH action plan and identify the specific measures the CPA will undertake to manage the risks of SEA/SH that may occur during the project's implementation.

A security assessment will be conducted to assess the risks posed by the security arrangements[14] to those within or outside project sites including the compliance with ESS4 requirements. Based on the security assessment, a security management plan will be prepared as part of ESMP.

A Resettlement Action Plan (RAP) will be prepared for the project. The RAP will be based on primary data obtained through a census survey of the PAPs and consultations with the PAPs and relevant stakeholders, along with other related or relevant secondary data. It will ascertain the amount of land acquired, determine the valuation of the land and other assets under acquisition, the number of PAPs, including the socio-economic and ethnic profiles, loss of properties, income, livelihood, and businesses, as well as the amount of compensation for land acquisition and income restoration. Gender will be mainstreamed in the planning process of the involuntary resettlement activities, including consultation and livelihood restorations.

[14] *The International Ship and Port Facility Security (ISPS) Code applies to the Chattogram Port for its security management. Direct or contracted security personnel will be retained to provide security to safeguard its personnel and property, or government security personnel will be deployed to provide security services.*

It will re-assess the land acquisition for the project, including physical and economic displacement and restriction of access to land or resources/livelihoods resulting from implementing the project (especially the determination if there is likely to be economic displacement of fishermen and physical displacement of some of their assets (including their docking grounds)) and related issues. It will provide information on the number and different types of PAPs and propose measures to manage impacts following the mitigation hierarchy of avoidance, minimization and reduction, mitigation, and compensation/offsetting. In addition, a due diligence review of the land acquisition process will identify the presence of legacy issues, and negative impacts on livelihoods, and the need of a corrective action plan to be included in the RAP.

The process will fill in data gaps for terrestrial, freshwater, coastal, and offshore marine features, and ecosystem services (e.g., fisheries) of the project area and surrounding regions that could receive direct and indirect impacts (e.g., downstream bird and marine animal migration routes, Ganges River dolphin habitat or prey, etc.). In addition, it will include the preparation of Terms of Reference (ToR) for long-term monitoring of key species in the project impact areas.

If project activities are unavoidable in areas of natural and critical habitats and all conditions as defined under ESS6 are met[15], the project's mitigation strategy to ensure no net loss of natural habitats and achieve net gain on critical habitats will be described in a stand-alone Biodiversity Management Plan (BMP) or Biodiversity Action Plan (BAP), which will include a long-term biodiversity monitoring plan to demonstrate no net loss or net gain and coordinated actions to address impacts on ecosystem services.

A chance-find procedure will be developed for any cultural heritage discovered during construction and implementation. It will be incorporated into the ESMP as part of the updating of the Preliminary ESIA. A chance-find clause will also be incorporated in work contracts requiring contractors to stop construction. Further consultation on tangible and intangible cultural heritage is required.

The consultant will be required to further update the SEP, carry out extensive consultations with the different stakeholders, and analyze their concerns and recommendations to be considered in the project's final design.

SCOPES

The Consultant will be consistent with the requirements of the GoB, the World Bank, and other financing partners. It will be based on the gaps and additional activities already identified in the above section and further assessment of the gaps. The detailed activities to be carried out by the Consultant are described below:

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[15] *(a) No other viable alternatives within the region exist for development of the project in habitats of lesser biodiversity value; (b) All due process required under international obligations or national law that is a prerequisite to a country granting approval for project activities in or adjacent to a critical habitat has been complied with; (c) The potential adverse impacts, or likelihood of such, on the habitat will not lead to measurable net reduction or negative change in those biodiversity values for which the critical habitat was designated; (d) The project is not anticipated to lead to a net reduction in the population13 of any Critically Endangered, Endangered, or restricted-range species, over a reasonable time period;14 (e) The project will not involve significant conversion or significant degradation of critical habitats. In circumstances where the project involves new or renewed forestry or agricultural plantations, it will not convert or degrade any critical habitat; (f) the project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated; and (g) a robust and appropriately designed, long-term biodiversity monitoring and evaluation program aimed at assessing the status of the critical habitat is integrated into the Borrower's management program.*

(i) Evaluating the adequacy of baseline data and the completion of gaps and deficiencies in the Preliminary ESIA;
   a. Impact of seasonal variations of different baseline conditions
   b. Ecological features of the project impact areas including data on fish abundance, the state of benthic fauna and invasive alien species, etc. to support assessment of important impacts on the local marine environment
   c. Water resources need to distinguish between the use of water as a medium (for navigation and port operation), to sustain aquatic life (of importance to fisherman and biodiversity), and as a resource for direct use in land-based activities (for example, for construction or cleaning, or irrigation)
   d. Drainage, waterlogging and tidal flooding of the backyard area including runoff and tidal water drainage capacity, etc.
   e. Social baseline, especially those that address land acquisition, livelihood impact, cultural heritage, gender, etc.
   f. Water and electrical requirements and sources during construction
   g. Source of construction materials (borrow area) and list of construction equipment
   h. Ballast water discharge management
   i. Description of major construction activities (capital dredging and backfilling, reclamation, and construction of breakwater and port terminal facilities)
   j. Description of maintenance dredging during the operation of Bay Terminal
   k. Bathymetry and oceanography survey
   l. The optimal option for the breakwater structure
   m. Management of breakwater

(ii) Updating the assessment of impacts, especially on sensitive receptors and more quantification of the impacts for coming up with site-specific measures;
   a. Shoreland changes due to dredging and breakwater construction as it may impact the littoral drift due to alteration of wave refraction, diffraction, and reflection;
   b. Disruption of area drainage resulting in inland flooding;
   c. Biodiversity loss due to the incremental volume of ballast water;
   d. Assess the percentage of dredge materials from the capital dredging sites (navigation channel) to fill up the terminal base, and the rest would come from somewhere else further upstream. So, in addition to the dredge material impact study and management plan, the ESIA requires an assessment of the impact of dredging on the surroundings of the other potential dredging sites;
   e. Climate change includes the risk of (i) overtopping of breakwaters due to storm surges; (ii) stability of structures (quay cranes, etc.) and increased operational constraints due to changes in cyclones, storms, and wind patterns, severity, and frequency; and (iii) inland and coastal floods;
   f. Evaluation of the occupational health and safety, and community risks and impacts.

(iii) Comprehensive site-specific impact assessment of territorial and marine ecosystems. If necessary and based on the assessment, the updating of the Preliminary ESIA should develop a stand-alone biodiversity management plan (BMP) and/or biodiversity action plan (BAP) to ensure no net loss on natural habitats and the achievement of net gain on critical habitats, as applicable;

(iv) Updating of the implementation arrangement to include the different contractors of the components to be financed by different financing institutions, including the reporting requirements to the CPA for the monitoring of the activities.

(v) Apply mitigation hierarchy principles to characterize the types of mitigation. Prepare separate ESMP for each component for the pre-construction, construction, and operation phases. Estimate the cost for ESMPs.

(vi) Extensive consultations with the stakeholders and analyze their concerns to be incorporated into the project design and operations including update of SEP and GRM.

(vii) Prepare a plan for declaring a no-go zone around the Bay Terminal may be necessary for the security of the project which provides an opportunity for the area to be protected in a manner that is beneficial for shorebirds.
(viii) Develop a plan for monitoring Ganges Dolphin, Irrawaddy Dolphin, Migratory birds, and Green Turtle.
(ix) Prepare/update the following plans:
a. Occupational and Community Health and Safety Plans (including the management of labor influx)
b. Labor Management Procedures (LMP)
c. Traffic Management Plan
d. Waste Management Plan
e. Cultural Heritage Management Plan and Chance Finding Procedure
f. Borrower E&S Capacity Building Plan
g. Dredging Management Plan, including collection, analysis, treatment, and disposal of dredge material as well as pre-, during-, and post-ecological surveys
h. Breakwater Materials Management Plan
i. Ballast water management plan
j. Security Risk Assessment and Management Plan
k. Marine spatial plan[16]
l. Stakeholder Engagement Plan (SEP) following consultation
m. Code of Conduct
n. Biodiversity Management Plan and/or Biodiversity Action Plan (assuming offsite measure, e.g., offset will be required to meet No Net Loss/Net Gain)

4. EXPERTISE REQUIRED AND QUALIFICATIONS

Team Leader and Environmental Specialist (International/National) with extensive international experience, including on large marine and port/harbor infrastructure development projects. Will take charge of coordinating the ESIA, integrating the inputs of the design engineers and specialists, putting together the ESIA, and managing the consultation processes. S/he should have background in engineering and at least 15 years of experience in leading and conducting ESIA development of marine and similar large projects and be familiar with the WBG ESF. A Master's degree in Environmental Science and Engineering or similar field is required.

Social Development Specialist with at least 10 years of experience in conducting ESIA and preparing RAP, including management, implementation, and administration of the resettlement plan, and be familiar with the WBG ESF. S/he will serve as co-Team Leader and will be in charge of socio-economic baseline, including cultural heritage, social assessment, and mitigation measures in the ESIA. S/he will also conduct screening of the project sites for ethnic minorities, and if ethnic communities are confirmed to be present in the project areas, ensure that the ESIA includes social impact assessment in compliance with ESS7. S/he will also lead the preparation of the project's RAP and livelihood restoration plan with relevant input from other team members. A Master's degree in Social Science or a related field is required.

Wildlife Biologist/Ecologist in charge of coordinating the collection of baseline data, identifying and assessing critical habitats, engaging species specialists, assessing impacts, and developing management measures to mitigate impacts on biodiversity and ecosystem services.

[16] for the entire DIA to introduce some locally managed areas by engaging local fishermen and other users, and to delineate vessel movement routes so that the project activities both during and after construction would have less impact on the local biodiversity and interest of other users (tourism, fishing, etc.).

S/he will apply the mitigation hierarchy (avoidance, minimization, mitigation, or compensation/offset) to develop a BMP and/or BAP to achieve no net loss and/or net gain as required for the port or harbor development and construction of a large breakwater. S/he should have at least 10 years of experience in conducting biodiversity impact assessments of marine and port/harbor projects and be familiar with the application of ESS6 and the mitigation hierarchy. The Biologist / Biodiversity Specialist will be supported by a Marine Biologist / Ecologist and other field team members as required. At least a Master's degree in Biology or a related field is required, while expertise in the ecology of Ganges River dolphins and sea turtles and familiarity with appropriate species specialists will be beneficial.
Marine Fisheries Specialist/Marine Biologist will be in charge of collecting and analyzing marine survey data and information through both primary and secondary sources. S/he will be responsible for assessing impacts and developing management measures to mitigate impacts on marine fishes and other animals and ecosystem services. S/he will apply the mitigation hierarchy (avoidance, minimization, mitigation, or compensation/offset) to develop a BMP and/or BAP to achieve no net loss and/or net gain as required for the port or harbor development and construction of a large breakwater. S/he will use the data and information derived from the modeling exercises by the feasibility study teams and project the potential impacts on the marine fishes and other species specific to their biological and habitat requirements. At least a Master's degree in Marine Biology or Oceanography or a related field is required, with at least 10 years of working experience in marine biodiversity assessment. Working experience with a Feasibility Study/ESIA on marine-related infrastructure development projects will be considered as an advantage.

Labor Law Expert will be in charge of conducting a detailed assessment of the application of ESS2 to the project and developing the LMP with input from the Health & Safety Specialist on OHS requirements. The Expert should have at least 10 years of working experience and a very good knowledge of the labor laws of Bangladesh, international labor laws, and International Labor Organizations' (ILO) requirements. A Master's degree in Law or a related field is required.

Occupational Health & Safety (OHS) Specialist will do the assessment and develop measures and plans to meet the requirements of ESS2 (OHS) and ESS4 (community health & safety). S/he will work closely with the Labor Laws Expert for the development of the LMP. S/he should have at least 10 years of practical experience in OHS and the development of an OHS plan to address or manage occupational and community health and safety. S/he will lead the preparation of the Framework OHS Plan (reflecting the specific standards to be followed by contractors) and the Community Health and Safety Plan (including the management of labor influx). A Master's degree in OHS or a related field is required.

Gender Expert will be responsible for analyzing and integrating gender-related issues in the ESIA and preparing the Gender and SEA/SH Action Plan for the project. The Gender Action Plan should focus on women's economic empowerment opportunities in the project (given the context in Bangladesh and the project area). S/he will also work with the Labor Expert and OHS Expert on preparing the LMP. At least 8 years of working experience in the area is required. A Master's degree in Social Science or a related field is required.

Hydrologist/Hydrological Modeling Specialist will undertake shoreline change modeling, dredging, and dredge spoil disposal studies, including testing the dredge material quality to inform decision-making about onshore and offshore disposal options and dispersion plume and turbidity modeling. S/he will prepare climate change resilience modeling, including that related to sea level rise, the increase in frequency and severity of extreme weather events (storms, storm surges, rains, floods, temperature changes, etc.), to assess project impacts on the coastal environment, including water quality, and develop mitigation measures in the design of the project to address impacts on the shoreline and aquatic/fisheries environment, as well as inform the siting and design of the project to mitigate impacts of climate change on the project's infrastructure. S/he should have at least 12 years of experience in hydrological modeling and in preparing ESIAs. S/he will work closely with the Biologist/Biodiversity Specialist. A Master's degree in Hydrology or a related field is required.

Stakeholder Engagement Specialist will develop the SEP (including GRM), including the identification of the stakeholders. S/he should be familiar with the local conditions and culture in the project area and have experience in community engagement and consultation. S/he will also lead the stakeholder engagement issues and prepare the citizen engagement plan embedded in the project design. A Master's degree in Social Science or a related field is required.

Cumulative Impact Assessment Specialist will develop the CIA in conjunction with the ESIA. Should be familiar with the IFC CIA process and have experience conducting cumulative impact assessments for large infrastructure projects. Experience in large marine and port/harbor infrastructure development projects is desirable. A Master's Degree in Environmental Science or Impact Assessment is required.

5. TIMETABLE AND DELIVERABLES

The total duration of the consulting services is 12 months. The Consultant will deliver all reports in English and the executive summary in Bangla according to the following timeline:

Report	Timetable (from contract signing)
First draft of the ESIA and ESMP Plus all E&S Instruments	4 months
Second draft of the ESIA and ESMP Plus all E&S Instruments incorporating World Bank and CPA's comments	6 months
Draft final of the ESIA and ESMP Plus all E&S Instruments incorporating World Bank and CPA's comments	10 months
Final ESIA and ESMP plus all E&S Instruments incorporating World Bank and CPA's comments and Bangla Version of Instruments or their executive summaries	12 months

Note: The final timeline may have to be adjusted based on the project design schedule since the preparation of the E&S instruments will hinge on the flow of information related to the port design, dredging and reclamation methodology, design of the breakwater, associated infrastructure, etc.

6. REPORTING REQUIREMENTS

The Consultants will report directly to the Project Implementing Unit (PIU) of CPA. The Consultants will be required to work closely with other project Consultants including procurement Consultants, design engineers, and other experts associated with the project, to ensure that the project designs and bidding documents take into account the E&S measures and outputs.

7. REFERENCES

The Environmental Conservation Rules'2023 of the GoB
The World Bank Environmental and Social Framework (ESF)
The World Bank's Environmental and Social Standards (ESS)
World Bank Group General Environmental Health and Safety Guidelines (EHSG)
Bank Directive on Addressing Risks on Disadvantaged or Vulnerable Individuals/Groups
Good Practice Note on Labor Influx
IFC Good Practice Handbook on Cumulative Impact Assessment and Management

To assist with the updating of the Preliminary ESIA, CPA will provide relevant background reports and studies, Preliminary ESIA report, design reports, etc., and assist the Consultant with access to relevant government ministries and departments.