Bangladesh Economic Zones Authority

Environmental and Social Impact Assessment
Kushtia Economic Zone

Final

Infrastructure Investment Facilitation Company

September 2023

Environmental and Social Impact Assessment

Kushtia Economic Zone

Observations and Comments

	Items	Comments	Response
(1)	2.2 National Legislation	Please include the National Air Pollution Control Rules 2022, Waterbody Protection Act, Deltaic Plan 2100, Ecological Critical Area Rules, Eighth Five-year Plan 2021-25, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides, Solid Waste Management Rule 2021.	Has been included in Section 3.3 and 3.4. National Air Pollution Control Rules 2022: SL 36 Waterbody Protection Act: There is no such act Deltaic Plan 2100: SL 38 Ecological Critical Area Rules, 2016: SL 37 Eighth Five-year Plan 2021-25: SL 39 Solid Waste Management Rule 2021: SL 32
(2)	2.8 Procedure for Obtaining Environmental Clearance	Also include the environmental clearance renewal steps. Use a Flow Chart for better understanding of the Environmental Clearance process	Has been included in under section 3.9: Figure 3.1
(3)	3.1 Geographic Location of the Project Site	Correction the table/figure number.	Updated accordingly Figure 4.32 under Section 4.14
(4)	Table 3.1: Annual Distribution of maximum temperature (°C) at Kushtia EZ	Please highlight the maximum and minimum Teamperature in the table	Updated accordingly under section 6.1.1 Table 6-1
(5)	Table 3.2: Average minimum temperature (°C) in Ishwardi Station near Bheramara	Please highlight the maximum and minimum Temperature in the table	Updated accordingly under section 6.1.1 Table 6-2
(6)	Table 3.3: Annual Average Maximum and Minimum Temperature of Kushtia EZ	Not in the EZ it should be at Ishwardi Station or project area	Covered in Table 6-1 and Table 6-2
(7)	3.2.3 Humidity	Please cross check the figure number in the write up	Updated under Section 6.1.2

	Items	Comments	Response
			Table 6-3
(8)	3.2.3 Humidity	The monthly variation of humidity patterns from the Kushtia station has been given. Relative Humidity data was also collected from the BMD station at Ishwardi station and analyzed. Please clerafiy the exact station name in the table that is used.	Updated under Section 6.1.2 Table 6-3
(9)	Table 3.4: Monthly relative humidity variation (%) of Kushtia	Highlight the highest and lowest humidity in the table	Updated under Section 6.1.2 Table 6-3
(10)	3.2.4 Rainfall	From the available data, the analysis at Ishwardi station was done for the period from 2011 to 2021. Please again check the data period.	Checked and updated under Section 6.1.3 Table 6-4
(11)	3.2.4 Rainfall	From the observation of last ten years data highest annual rainfall data is 1799 mm and lowest annual rainfall data is 1062 mm. But in page no 28 mentioned that varies from 1500 mm – 1600 mm. Please clarify it.	Updated under Section 6.1.3
(12)	Table 3.5: Average monthly Rainfall over the last 10 years at Kushtia EZ	Please highlight the maximum and minimum rainfall in the area	Highlighted under Section 6.1.3 Table 6-4
(13)	3.2.5 Wind Speed and Wind Rose Analysis	From the observation of last 10 years data of wind speed, wind direction of this area, a wind rose diagram was created by WARPLOT software. What is the time period, is it from 2011-2020? please clear the time period	Updated accordingly under Section 6.1.4
(14)	3.2.6 Sunshine Hour	In the write up you mentioned the period from 2011 to 2021 but in the table, it is 2010-2020. Also mentioned 10 years data but it is 11 years from 2010 to2020.	Updated under Section 6.1.5
(15)	3.3.1 Air Quality	Please correct the table/figure number in the write up	Corrected Section 6.2.1
(16)	Table 3.8: Environment (Protection) Seventh Amendment Rules, 2009, National AAQS	Please use the Air Pollution Control Rules 2022 for national standard	This rule has been used for all the tables of air quality monitoring. under Section 6.2.1; Check Table 6-8
(17)	3.3.1 Air Quality	Mentioned here fig no 1.3 for location map but not found in the report. Please correction it.	Corrected Section 6.2.1
(18)	Table 3.9: Baseline Ambient Air quality monitoring data -Sample 1	Use one table by showing the result of three locations. Then it will be easy to comparison with one sample to another sample. Also use the air pollution control rules 2022 od BD government that is the latest one.	Incorporated. under Section 6.2.1; Table 6-9
(19)	3.3.2 Noise Quality Assessment Report	Please add the day time and night time count like for day time 6am-9pm and night time 9pm to 6am. Please highlight the result if anywhere exceed the BD standard. Also, it would be better if you conduct the noise monitoring as per DoE guidelines by following 5 categories (Silent, Residential,	Added Assessment results are presented under Section 6.2.2

	Items	Comments	Response
		mixed, commercial and Industrial zone)	
(20)	3.3.3 Water Quality Assessment Report	Correct the table no in the write up of page 50.	Corrected accordingly under section 6.2.3
(21)	Table 3.19: Baseline groundwater quality monitoring 01	Please use one table by showing three samples result and highlight if any result crosses the DoE standard. Also add WHO/IFC standards in separate column. Add the depth of ground water collection sources	Updated for all the table of groundwater quality monitoring under Section 6.2.3. Table 6-16
(22)	Table 3.26: Baseline soil quality monitoring 01	Use one table by showing three different samples result	Updated under Section 6.2.4 Table 6-19
(23)	3.3.7 Soil Characteristics	Please correct the figure and table number in the write up. Please follow the BNBC 2020 instead of BNBC 2010	Updated. BNBC 2020_under Section 3.3
(24)	Figure 3.38: Earthquake Zones of Bangladesh showing the project area	Add the source of the information and Map	Find in the footnote of Figure 6.47
(25)	3.4.2.2 Ganges River	Recheck the fugure/table no in the write up	Checked and updated under 6.3.2
(26)	3.4.2.3 Ganges River at Hardinge Bridge Station (ID-90)	Prepare a table for water level by showing the time period	Added under Section 6.3.2 Tables are shown with the graph of Figure 6.51
(27)	3.4.2.4 Ganges River at Talbaria Station (ID-91)	Prepare a table for water level by showing the time period	Added under Section 6.3.2 Tables are shown with the graph of Figure 6.52
(28)	Figure 3.45: Monthly Max and Avg Discharge of the Goral Railway Bridge Station	Use a table by showing the maximum, minimum and average discharge	Added under section 6.3.2 Tables are shown with the graph of Figure 6.55
(29)	Figure 3.45: Monthly Max and Avg Discharge of the Goral Railway Bridge Station	Please address the source of data	Addressed. Figure 6.55, BWDB
(30)	3.4.3.4 Tropical Cyclones	Please Historical Analysis of Flood, Cyclone, Tidal Surges for 100 yrs as per ToR	Historical analysis has been shown for 62 years. under Section 6.3.3 Table 6-30
(31)	3.4.4 Ground Water System in the Vicinity of the Project Site	Recheck the figure/table no	Checked and updated accordingly under Section 6.3.4
(32)	3.4.5 Flow Regime, Direction, Depth of each existing Wells (including water level)	Beside the figure add a table by by showing depth of the ground water in different station.	Updated under section 6.3.4 Figure 6.62 Figure 6.63

	Items	Comments	Response
(33)	Biological Environment. Page no 98	No information found. Please Recheck	The sub sections under this title are all of the information regarding biological environment.
(34)	3.4.8 Agricultural Resources	Recheck the table or figure number	Updated. Section 6.3.9; Table 6-44
(35)	3.4.11 Environmental Critical Area	Please add Halda river in the list of Figure 3.59. Also add information and map on Protected areas of Bangladesh by showing the distance from the project area	Has been added under section 6.3.11 and updated accordingly. Figure 6.78
(36)	3.4.22 Historic, Cultural, Archeological and Ceremonial Resources	Prepare a map by showing historical, archaeological site in and around the project area	Added in Section 4.1 Figure 4.1
(37)	3.5 Socio-Economic Status	Please add more information on Infrastructure and Industry, communication system, existing utilities etc.	Given in Chapter 4 .
(38)	4 Next Course of Action	Environmental Modelling (Air, Noise and Vibration) should be included	Result of modeling has been discussed in Chapter 8. Detail modeling report has been added in Annexure 6,7,8
(39)	Others	a) Sensitive Receptors in the project site and influence area (communities, schools, water bodies, ecosystems etc)	Sensitive receptors and impact on them have been discussed in Chapter 7
(40)		b) Gap analysis with Bangladesh and International Standard	-
(41)		c) Cross Check the all-GPS locations of Monitoring	All-GPS locations of monitoring has been cross checked Please find under sections 6.2.1, 6.2.2, 6.2.3
(42)		d) Recheck the Source of all Maps and Tables and address in the report	Source of all maps and Tables has been addressed.
(43)		e) Green House Gas status	Added under section **Error! Reference source not found.**. Please check Table 5-3 The classification is based on the GHGs status.
(44)		f) Existing or Proposed Features Covering all Permanent and Intermittent Streams, Rivers, Wetlands, Lakes and Water Reservoirs within the Area and Area of Influence (Name and Location)	Surface water system in the project and study area has been shown under section 6.3.2
(45)		h) Historical Analysis of Flood, Cyclone, Tidal Surges (100 yrs) -Only analysis on very few numbers of cyclones in the report. Please incorporate the list of historical flood and cyclone	Recent Cyclones has been added in the list under Section 6.3.2 Table 6-30

	Items	Comments	Response
(46)		i) Location and Characteristics of all Existing Wells in the area of influence (on Topographic Map)	Locations has been shown in the map under Section 6.3.4 and other characteristics and depth have been mentioned in the write up of the same section.
(47)		j) Seasonal Variation of Water Table Level	Has been discussed under Section 6.3.4
(48)		k) Vulnerability to Contamination (Construction/Operation Phase)	Has been discussed in Chapter 7.
(49)		l) Inventory of existing noise sources	Has been discussed in Section 6.2.2 Find in the last two lines of Assessment Report
(50)		m) No traffice survey found in the report	Traffic survey has been added under section 6.2.5
(51)		n) Community Recommendation	Please find in Chapter 9
(52)		o) Vibration monitoring should be included in the baseline	-
(53)		p) for climate data you are using 2010-2021 that is 11 years. But you mentioned it is 10 years. Please correct it in the whole meteorology part	Updated accordingly Find in Section 6.1
(54)		q) Recheck the figure and table number in the report.	Checked and updated
(55)		r) Add all lab monitoring report in Annex	Has been added in annexure
(56)		s) Incorporate the list of all references	Has been added under Section 2.9

Response to Comments on Final Report

	Comments	Response
1.	Analysis of alternatives such as onsite/off-site infrastructure, proposed utilities, EZ locations/sites, with/without project scenarios should be analyzed and tabulated highlighting the economic, technological, environmental and social aspects for the proposed ES development in that area should be discussed with the alternative EZ site layout maps in chapter 4.	Has been included under chapter 4, section 4.3.1, Table 4-2.
2.	In line with table 5.1 and figure 5.2, detail land use calculation with percentages of the proposed sub-project components should be enclosed in the main report apart from figure;	Has been included under section 5.1, immediately after figure 5.2.
3.	Guidelines on environmental and social conditions in the BOQ/contract documents in section 10.8 should be given;	Has been included under Chapter 10, section 10.8.
4.	6.3 Natural Environment under section 6 should be split into sub-topics in page viii table of contents;	Has been corrected in TOC

5.	i. The detail approach methodology for stakeholder engagement ii. Stakeholder Mapping details; iii. list out key concerns of FGD, KII and institutional consultations (along with their contact details) iv. Meeting minutes with decisions of the consultations (FGD, KII and Institutional) v. The institutional consultations particularly with local UP chairman, DC office, DoE, DoF, BWDB, DPHE, Department of Livestock and fisheries should be particularly addressed in chapter 09. vi. FGD list should contain date and location name	i. Has been included under chapter 9, section 9.1 ii. Has been included under chapter 9, section 9.2 iii. Please find in table 9-2 for FGD, and table 9-3 for KII. Contact details has been added with the attendance sheets in appendix. iv. Meeting minutes has been included in Appendix 17. v. Has been added in table 9-3 and all the pictures has been added in Appendix 18. vi. Please find in table 9-2.

Contents

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Abbreviations and Acronyms

AAQ	Ambient Air Quality
As	Arsenic
APHA	American Public Health Association
AEZ	Agro-ecological Zone
BBS	Bangladesh Bureau of Statistics
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BNBC	Bangladesh National Building Code
BEPZA	Bangladesh Export Processing Zone Authority
BEZ	Bio-ecological Zones
BEZA	Bangladesh Economic Zone Authority
BMD	Bangladesh Meteorological Department
BOD	Biological Oxygen Demand
BWDB	Bangladesh Water Development Board
CO	Carbon Monoxide
CO2	Carbon Di-oxide
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CSR	Corporate Social Responsibility
CSTP	Combined Sewage Treatment Plant
DC	Deputy Commissioner
DG	Directorate General
DoE	Department of Environment
DoF	Department of Forest
DoF	Department of Fisheries
DPHE	Department of Public Health and Engineering
ECA	Environmental Conservation Act
ECA	Ecologically Critical Area
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
EHS	Environmental Health and Safety
EMoP	Environmental Monitoring Plan
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMF	Environment Management Framework
EPZ	Export Processing Zones
ERP	Emergency Response Plan
ERD	Economic Relations Division
ERT	Emergency Response Team
ESIA	Environmental and Social Impact Assessment
ESSs	Environment and Social Standards
ESMP	Environmental and Social Management Plan
ETP	Effluent Treatment Plant
EZ	Economic Zone
FDI	Foreign Direct Investment
FDS	Fine Dust Sampler
Fe	Iron
FGD	Focused Group Discussion
FS	Feasibility Study
FY	Financial Year
GDP	Gross Domestic Product

GIS	Geographic Information System
GoB	Government of Bangladesh
GPS	Global Positioning System
GTCL	Gas Transmission Company Limited
GWT	Ground Water Table
HHs	Households
HIES	Households Income and Expenditure Survey
HYV	High-Yielding Varieties
ICTPs	International Conventions; Treaties and Protocols
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
IFC	International Finance Corporation
IIFC	Infrastructure Investment Facilitation Company
ILO	International Labour Organization
IPF	Investment Project Financing
IUCN	International Union for Conservation of Nature
KEZ	Kushtia Economic Zone
KV	Kilo Volt
MoEF	Ministry of Environment and Forest
MoEFCC	Ministry of Environment, Forest and Climate Change
MOHFW	Ministry of Health and Family Welfare
mph	Miles per hour
MSDS	Material Safety Data Sheets
MSL	Mean Sea Level
MT	Metric Ton
NBSAP	National Biodiversity Strategy and Action Plan
nos	Numbers
NOx	Oxides of Nitrogen
NWRC	National Water Resources Council
NWRD	National Water Reuse Database
OHS	Occupational Health and Safety
O_3	Ozone
PBS	Palli Bidyut Samity
pH	Potential of Hydrogen
PM	Particulate Matter
PMO	Prime Minister's Office
PPP	Public-Private Partnership
PGCB	Power Grid Company of Bangladesh
PWD	Public Works Department
RCC	Reinforced Cement Concrete
RDS	Respirable Dust Sampler
SCC	Site Clearance Certificate
SPM	Suspended Particulate Matter
STP	Sewerage Treatment Plant
SQ	Soil Quality
SW	Surface Water
TDS	Total Dissolved Solids
ToR	Terms of Reference
TSS	Total Suspended Solids
UNDP	United Nations Development Programme
UNO	Upazila Nirbahi Officer

USEPA	United State Environmental Protection Agency
WHO	World Health Organization
WWTP	Waste Water Treatment Plant
Zn	Zinc

1 Executive Summary

BEZA planned to establish an Economic Zone over '420 acres of land at Bheramara Upazila of Kushtia District. The construction of the zone includes three major components: i) development of '420 acre land for the KEZ, ii) construction of on-site infrastructure for utilities including roads, power lines, water supply, effluent treatment plant, sludge treatment plant, waste management system, administrative buildings, etc. and iii) off-site connectivity and infrastructures. According to study findings, the project would have low impacts on socio-economy due to less acquisition of lands and other factors. Therefore, the site has been selected for the development of the EZ.

The project and related activities, requires approval from the Department of Environment according to the Environment Conservation Rules (ECR) 2023. The ECR categorizes different industries/projects/units into three broad types: Green, Orange, and Red, of which the proposed KEZ falls into Red category. In principle, the Red category project requires 'Site Clearance Certificate' (SCC) through an approval of Initial Environmental Examination (IEE), followed by Environmental Impact Assessment (EIA) according to approved ToR for getting Environmental Clearance Certificate (ECC). However, BEZA received an exemption from IEE, hence SCC, upon submission of an application to the DG, DoE considering importance of the project to boost up economy of the country to fulfill its targeted objectives to become a middle-income country by 2021 and a developed country by 2041. Thus, EIA and ECC is required only for carrying out the project, for which DoE already approved a ToR, following which this ESIA has been prepared.

This EIA study follows the participatory approach and a standardized methodology from beginning to the end of the study trajectory. Both primary and secondary stakeholders were consulted at different layers through different consultation meetings. The study steps included: baseline assessment, scoping, bounding, major field investigation, impact prediction, mitigation measures, environmental management and monitoring plan.

In describing the existing condition, three environmental components: physical, biological and socio-economic environment were assessed. The physical environment includes: meteorology, topography, ambient noise, ambient air quality, surface and ground water. The biological environment includes: ecology, fishery, agriculture and land resources. The socioeconomic environment includes conditions of social/economic and cultural parameters in the study area.

With respect to physical environment, it was found that the highest rainfall occurred during April to October while November to March was the drier part of the year with very less rainfall. On the other hand, the highest maximum temperature was recorded as 42° C in May of 2014 and the lowest minimum temperature was recorded as 3.9° C in January of 2013. The highest values of humidity were recorded as 88 whereas the minimum value was found 60. The most humid months were from June to October.

The general elevation profile of Kushtia Sadar indicates that it slides down from north to south and ends at Kushtia-Rajbari road. Bheramara Paurashabha is 14.19 m above the mean sea level (MSL). The highest point of Bheramara upazila is 14.67 m, while the lowest is 2.90 m. The average elevation of the upazila region is 8.90 m.

Based on the spot elevations, the site level varies from 16.31 to 12.91 m MSL (average 14.61 m). The 100-year highest flood level based on the frequency analysis is 15.14 m MSL in 1998. With a 1 m freeboard, the proposed formation level for the site will be 15.14+1=16.14 MSL. Therefore, this area is less vulnerable to riverine flood. At the time of survey, the noise level inside the project area was found very calm and low whereas, at several points surrounding the project area, medium to heavy noise was observed.

The existing air quality of the proposed KEZ area as well as the surroundings were observed to be good. The surface and ground water quality of the proposed area were found within standard level. The soil belongs to moderate nutrient load with clay loam which is evident from the analytical results of soil samples. Within the project area the predominant anthropogenic interventions were observed as farming (vegetation and tree plantation) throughout the year and for fishing in the river for a certain period of the year.

The Ganges River which is a very dynamic meandering river and is the main surface water source in this area. The depth of groundwater level from the ground surface in dry season goes downward, and depth is highest in April. On the other hand, the water table rises in monsoon, and the lowest depth of groundwater level from the ground surface is observed in September due to recharge by rainwater, and peripheral river water.

Utility Requirement

		Power	Water	Gas
		MW	liter/day	m3/day
1	Industries	‘26.20	‘15,865,223	‘108,580
2	Other than Industries	‘6.59	‘1,167	‘1,164
		‘32.79	**‘15,866,390**	**‘109,744**

Power Supply: Power demand is planned to be met up from the following sources:

(1) 132 /33/11 KV grid Sub-Station (2x25/41MVA capacity): Grid substation along with associated Transmission Line to be constructed by PGCB

(2) 33/11KV, 2x20/28MVA Indoor SS: Dedicated 33 KV line from Bheramara 132/33 KV Grid Sub Station will be drawn to proposed 33/11 KV sub-station at BEZA site for availability of power at 11 KV.

(3) 11KV line: There exists 11 KV line in the nearby BEZA site from Bherama-1 33/11 KV sub-station at Baro Mile area, which will be drawn to BEZA site and will to be connected to 11/0.4 KV substation at project site for receiving power.

The EZ will leverage on use of solar panels mounted on top of street lamp posts for reducing impact on environment.

Gas Supply: Sundarban Gas Company Ltd. has a plan to extend gas lines to Kushtia EZ from Bottoil TBS off-take point. The point is 36 km away from the site. However, as gas pipeline has already been laid along the line, it is estimated that around 5 km more pipeline is required to connect the site to the nearest gas substation.

Water Supply: Multiple sources of water need to be utilized for the zone as and when appropriate. For Kushtia EZ the sources of water are given below:

(1) Surface water of Padma River
(2) Rain water run-off
(3) Deep tube well (*i.e.* ground water)

Surface water is recommended as the source of water supply to the zone during the seasons when such water is available. The Padma is a potential source, a possible intake point being around 1 km away from the site. The water level in the river is subject to seasonal variations and will not be available with sufficient quantity during dry season which falls to as low as 35-50 million m3/day.

The project is scheduled to be implemented in 36 months in a single phase.

Natural disasters are not very frequent in the study area. Analysis of Satellite images approves that there are no significant Bankline changes was observed near the proposed economic zone. But in the upstream of the economic zone there is a possibility of creating "Ox-bow Lake" as the loop joints have chances to come closer, but eventually the possibility will take more than 50 years to take. The dynamics of bank line shifting and generation of island char at the upstream due to erosion and deposition prove the reach unstable with respect to morphological aspect. But the existence of stable bank lines beside the project area could indicate the presence of less erodible materials.

The terrestrial and aquatic flora and fauna found in the project as well as study area has been identified and their status has also been mentioned in the EIA report. The amount of capture fishery in the area was found about 1253.36 ton/hctare/yr and culture fishery was found 457.5 ton/hectare/yr. During the monsoon period, some riverine fishes migrate to the floodplain area for breeding, grazing and nursing purpose. But in winter season, the floodplain area dries up (observed during field visit) and farmers cultivate crops in that low land area. Almost every household has a small poultry or dairy farm in the project area.

The proposed Kushtia EZ has fallen under three Bio-ecological Zones namely; Ganges Floodplain, Major River and Teesta Floodplain. The proposed Kushtia EZ falls under two Agro-Ecological zones namely active Brahmaputra-Jamuna floodplain and Active Ganges Floodplain.

Apprehending the project driven impacts on environmental and social parameters, a number of key issues were identified to assess the potential impacts and their magnitudes. The key issues are: i) air quality, ii) noise quality, iii) groundwater, iv) surface water, v) drainage and water logging, vi) flooding, vii) land type, viii) landscape, ix) land use, x) crop production, xi) fish habitat, xii) fish production, xiii) fish species diversity, xv) wildlife habitat, xvi) species composition, xvii) dispossession, xviii) livelihoods loss, xix) social conflict, and xx) employment generation, xxi) off-site development, and xxii) urbanization and economic development.

With respect to environmental impacts, ambient air quality will be deteriorated due to dust generated from vehicular movements and gaseous emissions of the construction vehicles and equipment, and alongside, noise will be generated. Due to the land development and the construction of on-site structures, the natural drainage pattern may get temporarily blocked at certain places by the land soil and construction debris which can occur water logging problems in case of heavy rainfall. In addition, during the wet periods' floodwater may not pass through the natural ways and hence can cause water logging at the northeast corner of the project area as floodwater flows over the project area through this corner.

Groundwater is another important issue for the project. The withdrawal of groundwater, might cause depletion of groundwater table, resulting water crisis for the local community and for the project itself. The project area is the combination of terrestrial and aquatic ecosystem, which includes large trees and roadside vegetation as well as lowland. Due to land development work, all habitats with associated vegetation will permanently be damaged. In addition, wildlife habitat in the project-influenced area will also be deteriorated due to sand mining.

The EIA study proposed a number of environmental and social management measures to be strictly considered during pre-construction, construction and operation phases of the project. By assessing potential disaster, hazard and risk, and climate change issue, the study suggested some mechanism to be followed for the project. The hazard assessment has been carried out to identify the potential hazard associated with or inherent in the design process and to identify possible measures to avoid the hazard along with the safety plan for minimizing the risk. Incorporation of these measures and safety plans in design, planning and operational procedure of the proposed KEZ would eliminate the potential hazards.

The proposed project appears as one of the key cornerstones of the country's development activities. Similar to other development project, this project will bring negative consequences for the local environment, landowners and dependent communities; but would be mitigated with proper measures, management plan and monitoring. Thus, ground water, surface water networks, waterbody, aquatic and wildlife, land losers and dependent population should be given special focus following the measures suggested in this report. Alongside, the project will also bring immense positive impacts for local-regional and national economy and socio-economic benefits for the communities. Hence, measures suggested in this report for enhancing of these positive impacts should be given special focus.

2 Introduction

BEZA planned to establish an EZ at Bheramara Upazila of Kushtia District, for which a Feasibility Study has carried out by the Infrastructure Investment Facilitation Company (IIFC), an advisory body of the Government of Bangladesh under the Economic Relations Division (ERD) of the Ministry of Finance, GoB. Since the government intends to establish EZ countrywide, Kushtia has been selected as a potential area.

Kushtia EZ falls under "Red" category, according to the Environmental Conservation Act (ECA), 1995 and Environmental Conservation Rules (ECR), 2023 including related amendments. The proposed site requires simultaneously both Site Clearance Certificate (SCC) and Environmental Clearance Certificate (ECC) upon approval of the Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) study reports by the Department of Environment (DoE). Considering the importance of establishing EZ aiming to fulfill the long vision of GoB, BEZA requested DoE to get necessary exemption from carrying out IEE for obtaining the SCC.

In a request letter, BEZA desired to conduct an Environmental Impact Assessment (EIA) study based on a Terms of Reference (ToR) (through attaching with that letter) to obtain ECC from the DoE. Taking the noted issues in consideration, DoE provided exemption order (vide the Memo no. 22.02.0000.018.72.041.22.60; dated 28 April, 2022) from conducting IEE and approved the ToR for conducting a comprehensive EIA of Kushtia EZ.

The copy of DoE's approved ToR has attached in at Appendix-II. In order to conduct the EIA, BEZA assigned IIFC, an advisory body of the Government of Bangladesh under the Economic Relations Division (ERD) of the Ministry of Finance, Government of Bangladesh (GoB) for conducting the study.

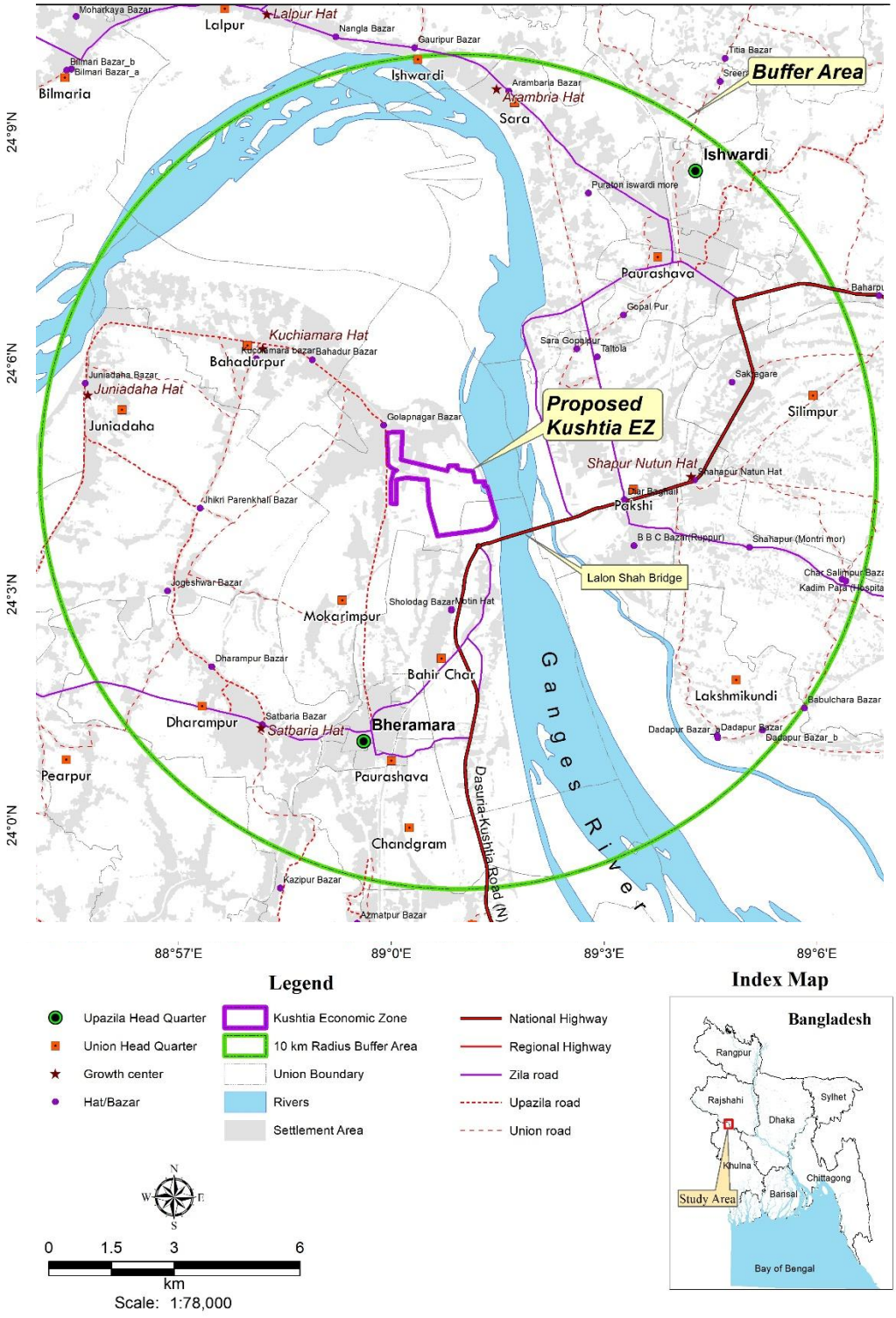

Figure 2.1: Base Map of Proposed Kushtia EZ[1]

[1] Source: Shahidul Consultant Limited

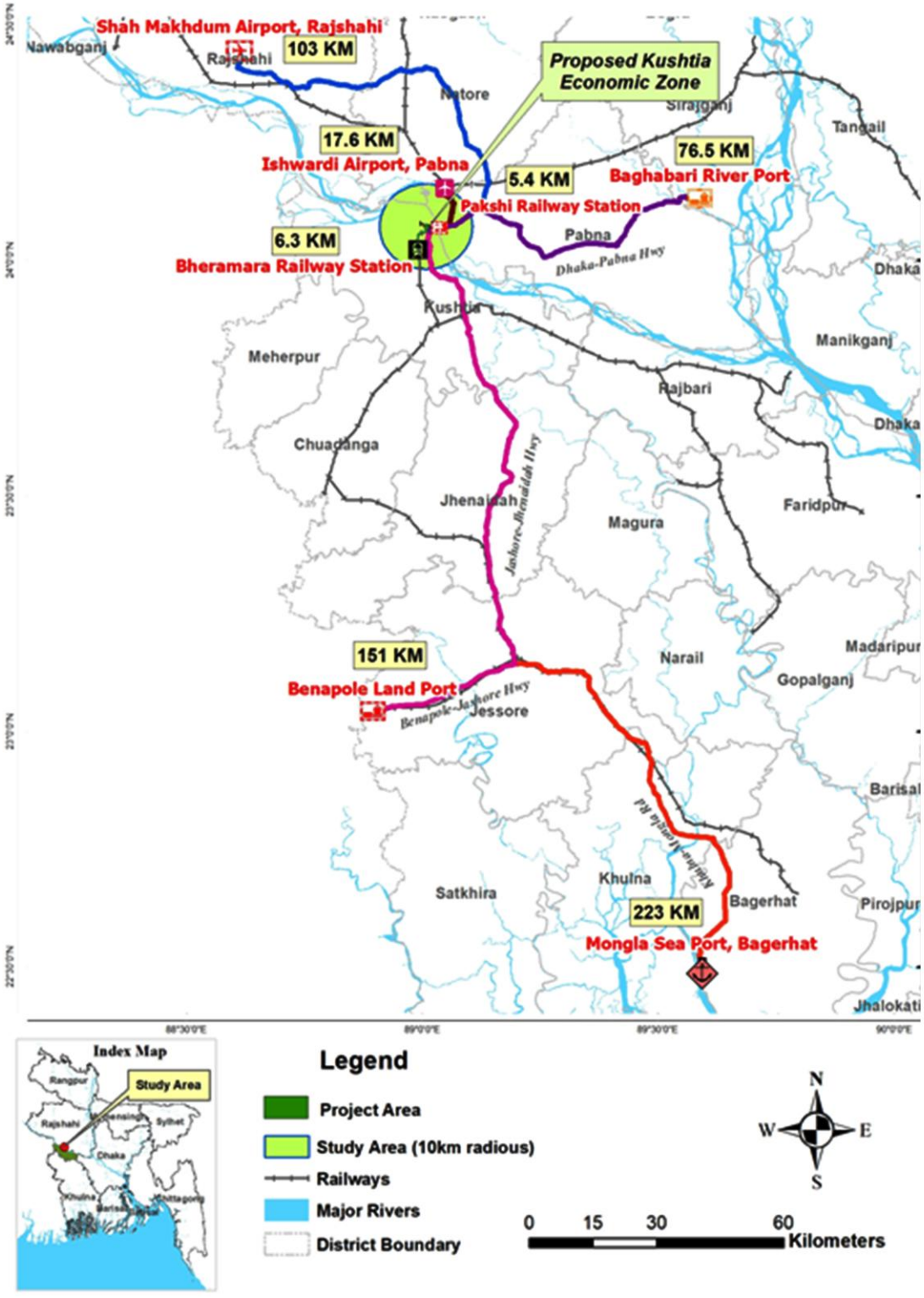

Figure 2.2: Communication Network/Connectivity map with distance from the site

2.1 Rationale for the Proposed Project

Manufacturing sector of industry in Bangladesh shows predominance in export led garments and textile industries, which makes the country as world's second largest garment manufacturer. However, relatively low emphasis has given to other items and export

competitiveness of those items not explored fully. Therefore, the country during the period of 1980s required to boost up exports of other indigenous products, which has improperly enhanced due to absence of industrial infrastructure, capacity building, and policy initiatives. Owing to that, GoB has provided tailored infrastructure services and business environment conditions through establishing EPZs in the 1980s. The EPZs were used as the 'strategic instrument' for attracting FDI and dealing with the shortcomings of the overall investment climate, business registration, licensing, etc. which, in fact, were restricting smooth investments in the country. Further, to overcome the limitations of EPZ model, new EZ regime has been adopted by the GoB, so as, more spill-over can be harnessed by local firms from FDI, additional investments can be encouraged within the value chains and more local produce can be procured.

The EZ development, a zoned industrialization, is required in Bangladesh to maximize the growth benefits of accumulation and ease the increasing urban congestion. More importantly, the EZ will enable new sources of growth, where investor will show their interest. In this context, establishment of economic zone has proposed in Kushtia (Bheramara).

2.2 Scope of the Study

The following activities have envisaged that shall be carried out by the entrusted Consultant for the ESIA Study:

(1) Review Feasibility Study and other related document(s) to get overview of the proposed EZ including project plans, designs, interventions, layout etc.;
(2) Analysis of alternative sites and technology;
(3) Legislative analysis;
(4) Description of the Environmental and Socio-Economic Baseline Condition of the resources considered under physical, biological and social environment;
(5) Identifying the Important Environmental and Social Components (IESCs) which would be impacted by proposed EZs;
(6) Assessing the impacts of the proposed economic zone on the IESCs;
(7) Assessment of potential hazard and risk;
(8) Conducting public consultation meeting before impact assessment and disclosure meeting after impact assessment;
(9) Preparation of detail Environmental Management Plan (EMP);
(10) Preparation of hazard and risk management plan;
(11) Preparation of Environmental Monitoring Plan;
(12) Addressing all site specific technical, land use, infrastructural and utility based environmental due diligence issues along with tentative solutions which may go beyond the scope of the feasibility studies (in some cases) as per DoE, World Bank and BEZA requirements;
(13) Preparation of EIA Report by maintaining the approved ToR, which shall form the basis of obtaining environmental clearance from the DoE.

2.3 Methodology of ESIA Study

The Environmental and Social Impact Assessment (ESIA) study for the proposed Kushtia EZ (KEZ) has been carried out following the scope of work defined in terms of Reference (ToR) and relevant guidelines of the Department of Environment (DOE). The approach to carrying out the ESIA study was organized based on the field investigations and reconnaissance surveys in the project area, collection, collation, and analysis of secondary data, and

discussions with key stakeholders on the potential impacts of the project. Information on various environmental components was collected through survey-oriented screening, collection of data using a questionnaire, monitoring of air, water, and soil quality, and collection of secondary data.

2.4.1 Socio-Economic Screening

Screening is that part of the ESIA process which helps with the categorization of the project, and from this, a decision is made on whether or not a full ESIA is to be carried out.

The ESIA team reviewed available information on similar projects, Environmental Conservation Act (ECA), 1995 and Environmental Conservation Rules (ECR), 2023, which is followed by DoE as a guideline of EIA preparation. According to ECR'23, the proposed project has been categorized as red (Item 36: Industrial Zone), and all the Red category projects need to conduct a detailed ESIA.

2.4.2 Scoping

Scoping is the process of determining which are the most critical issues to study and will involve community participation to some degree. The ESIA team had a brief introduction meeting with the Bangladesh Economic Zone Authority (BEZA) team in Dhaka before the site reconnaissance visit. Consultants undertook a 5 days site visit to understand the site setting, environmental and social condition of the project area and to identify the relevant stakeholders as well as analyze the local requirements, which would be important for primary and secondary data collection and designing of the project.

2.4.3 Data Collection and Literature Review

Data Collection

Data collection is the process of gathering and measuring information on targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes. Data collection is the most important part of ESIA. The goal for all data collection is to capture quality evidence that allows analysis to lead to the formulation of convincing and credible answers to the questions that has been posed.

Secondary Data Collection

Secondary data of the project area collected for different environmental/social settings of the project area from different authentic secondary sources like published works of literature from various government agencies or institutions. The organizations are Bangladesh Bureau of Statistics (BBS), Soil Resources Development Institute (SRDI), Bangladesh Water Development Board (BWDB), Department of Fisheries (DoF), Department of Public Health and Engineering (DPHE), Bangladesh Meteorological Department (BMD), Department of Environment (DoE). Moreover, Households Income and Expenditure Survey (HIES), 2016 prepared by Bangladesh Bureau of Statistics (BBS), Local Health Bulletin-2016, Ministry of Health and Family Welfare (MOHFW), Bangladesh National Portal, etc. The secondary data collected to cover the information on physiography, geology, soil, water body, drainage pattern, meteorology, forest and vegetation, flora and fauna, protected areas, other ecologically sensitive areas, land use pattern, demography, socio-economic aspects within the study area. The data reviewed and verified for establishing existing environmental and ecological status within the project area.

Primary Data Collection

The baseline has covered a detailed description of the existing physical environment, water resources, land resources, agriculture, fisheries, eco-systems condition, and socio-economic environment of the project area and surrounding area of the proposed project. The primary study approach has designed using both quantitative and qualitative tools. The quantitative study consists of different types of surveys and environmental quality tests. All quantitative data has recorded properly and analyzed using appropriate analyzing software and method. On the other hand, Qualitative study consists of public consultation, Focus Group Discussions (FGDs), Key Informant Interviews (KIIs). Here also qualitative data were systematically recorded, analyzed, and merged with the quantitative findings where appropriate.

Literature Review

The consultants reviewed all the available documents on environment, economy, agriculture, livelihood, socio- cultural norms and practice of the concern area. Moreover, the consultants have reviewed the government and international policies and legislations, best practices of EZ and all other relevant documents of ESIA. All the reviewed documents can be categories as follows.

Review of Environmental Documents

The consultants collected and reviewed all the relevant documents from local and national level environment issues to prepare the EIA. Specially, baseline documents on water resource, noise level, ambient air quality, land resources, geology, topography and soils, climate and meteorological, temperature, rainfall and wind force, agricultural resources, fishery resources, livestock and poultry resources and ecological resources form the local level. Moreover, the consultants have also reviewed the government and international guideline regarding the environment conservation and awareness.

Review of Socio-economic Documents

The consultants collected and reviewed socio-cultural and economic documents related Kushtia EZ to do the SIA. Specially, the consultants reviewed the documents on demography, livelihood, health, education, gender, religion, ethnicity and food habit of the Kushtia EZ area. As well as, they also reviewed the relevant government and international guideline of social framework.

Current Relevant Policies and Legislations

The Consultants reviewed the current relevant policies and legislations in practice related to Economic Zones. These include, inter alia, environment related laws and policies, ESIA procedures/practices and land acquisition procedure of the Government of Bangladesh (GoB) related to the facilities' development and their applicability and implications for the proposed project. The Consultants also reviewed the relevant international environmental and social safeguard policies, Environmental Health and Safety (EHS) Guideline, guidelines related to inclusion, participation, transparency and social accountability.

2.4 Impact Assessment

The ESIA process identifies the potential environmental impacts that may result from the implementation of the Project. Both positive and negative potential impacts for the Project

were identified through the application of standardized international best practice methods of environmental impact assessment.

The principal method for assessing the potential impacts of the Project on the biophysical and social environments utilized for this ESIA was the matrix method. Details on the risk assessment process and how it was utilized to identify impacts, the likelihood, and consequence of the actions and implement appropriate mitigation measures to reduce any potential impacts to an acceptable level are detailed in the ESIA study.

The impact Assessment was followed by an evaluation of the information to delineate the possible environmental issues relating to the project. During the process, the following steps were followed:

(1) Critical analysis of the project document;
(2) Understanding the process involved in the project;
(3) Identification of potential impacts and evaluation of their consequences;
(4) The possible mitigation / enhancing measures for negative and beneficial impacts have been suggested to develop an Environmental Management Plan (EMP).

Geographical Information Systems (GIS) was used as a specialized analysis and presentation tool. Before commencing field investigations, spatial analysis of satellite imagery and present administrative areas and other boundaries/constraints were considered for the environmental assessments, such as the connectivity, vegetation, water bodies, infrastructures, etc., were identified.

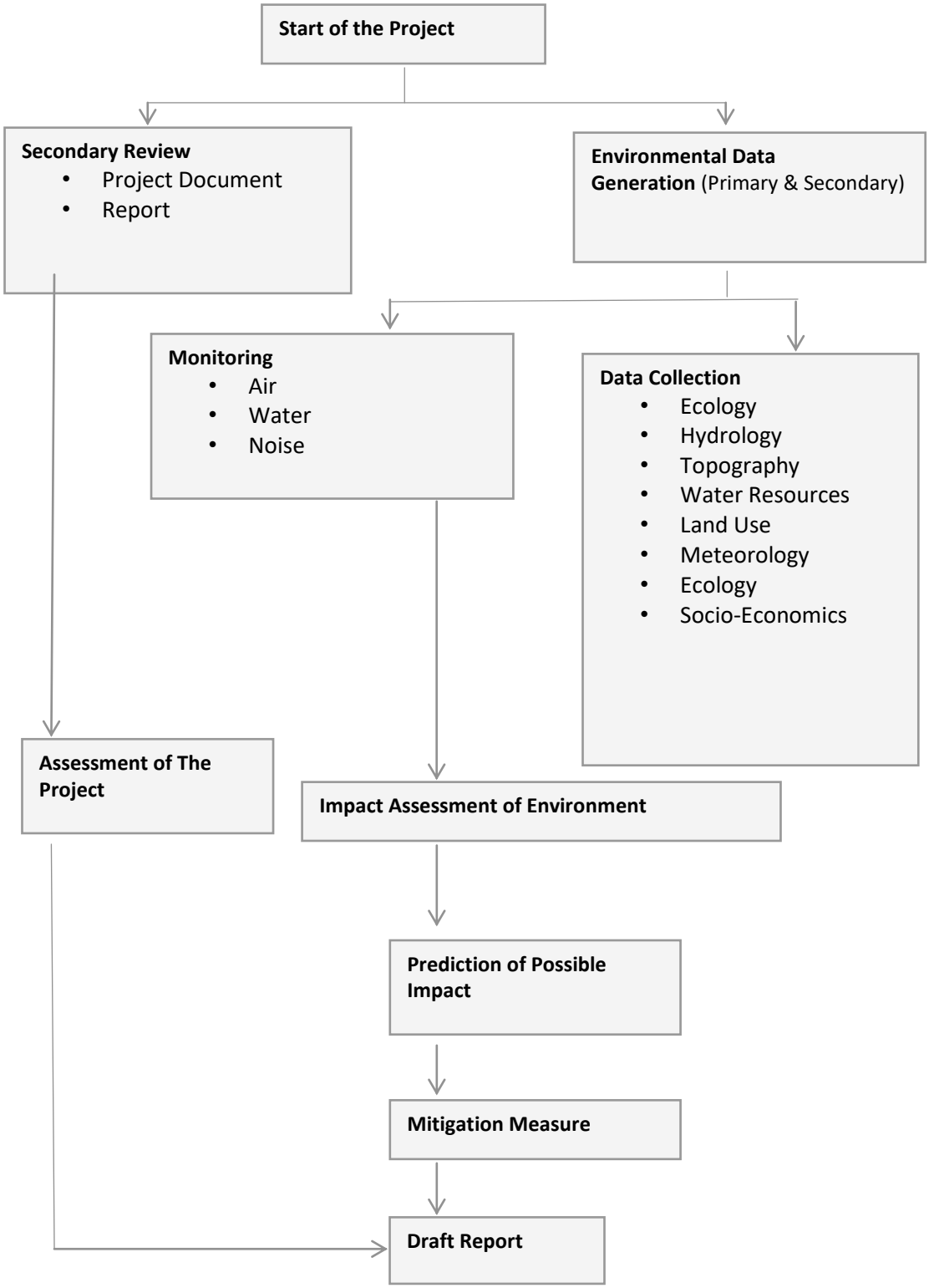

Figure 2.3: Process of Environmental and Social Impact Assessment

2.5 Limitation of the Study

This Environmental and Social Impact Assessment (ESIA) report on Kushtia EZ is enriched by the inclusion of environmental reconnaissance of the project area, identification of potential impacts and corresponding mitigating measures, identification of significant environmental issues, and recommendations for further studies in order to address these issues. It provides

a brief description of the project activities to be carried out and identifies major environmental impacts resulting from these activities during the operation phase. Eventually, the ESIA suggests specific measures to mitigate adverse environmental impacts and to enhance beneficial impacts. Important environmental issues that need further studies have identified.
Services performed by the consultant have conducted in a manner consistent with that level of care and skill generally exercised by members of the consulting profession. The report may not exhaustively cover an investigation of all possible circumstances that may exist. However, an effort has made to discover all meaningful areas under the stipulated time available.

In evaluating the subject site, the consultant relies in good faith on information provided by the client's management or employees. The Consultant assumes that the information provided is factual, accurate and accepts no responsibility for any deficiency, misstatement, or inaccuracies contained in this report as a result, of omission or misrepresentation of any person interviewed or contacted. It should be recognized that the information given in the report is time-specific, and with the passage of time, the relevancy of data and analysis may suffer. Specific circumstances and conditions of the site can change due to which conclusions and opinions may change too.

2.6 Consistency with DoE Guideline

This guideline has been prepared by DoE on the basis of the work done by various types of industry projects as well as on the requirements of the Environment Conservation Rules (1997). Owing to this, this guideline specifically covers industry projects and shows how the EIA for industry projects in Bangladesh should be implemented. The brief composition is:

(1) Introduction to EIA in Bangladesh

(2) Criteria for locating industrial plants

(3) Steps involved in conducting IEE

(4) Steps involved in conducting EIA

(5) Review of an EIA report

All requisite clearance from the DoE shall be obtained prior to commencement of civil work. BEZA will proceed with the application in consistency with DoE guideline for clearance in due course.

2.7 ESIA Team Composition

Following Key Professionals were engaged in carrying out the EIA Study:

- Dr. Md. Eftekharul Alam, Environmental Specialist
- Md. Shafiqur Rahman, Environmental Specialist
- Dr. Md. Kamrul Hasan, Ecologist
- Dr. Mohammad Maniruzzaman, Social Specialist
- Md. Yahya Mian, Agriculture Specialist
- Mohammed Jamal Uddin, GIS, RS and Modeling Expert

The Non-Key Professionals engaged in the EIA Study were:

- Santanu Dey, Disaster Management Specialist
- Satchidananda Biswas, Fisheries Expert
- Mohammod Mizanur Rahman, Hydrologist
- Md. Shofiul Islam, Field Researcher (Environment)
- Sultana Afrose, Field Researcher (Social)

2.8 Structure of the Report

This EIA report has been prepared strictly following the report structure desired by DoE as per ToR. The EIA report contains project features, baseline environmental conditions, assessment of environmental impacts, and formulation of mitigation measures along with environmental management and monitoring plan.

The report includes the following chapters:

Chapter 1: Executive Summary

Chapter 2: Introduction contains background, project brief, rationale of the project, scope of work, Methodology, Limitations, EIA study team and structure of the report.

Chapter 3: Policy, Legal and Administrative Framework describes the relevant policy and legal frameworks for the EIA process.

Chapter 4: Project Description contains description of technical details of the proposed EZ and associated on-site and off-site interventions along with project plan, activities and schedule.

Chapter 5: Site Details describes all details of the site and the reason for choosing the site.

Chapter 6: Environmental and Social Baseline describes the environmental and socio-economic baseline condition with detail on physical, biological and socio-cultural environment of the project and influenced area.

Chapter 7: Environmental and Social Impacts presents the impacts assessed in this study with respect to identified key environmental and social issues.

Chapter 8: Cumulative Impact Assessment describes the altogether impact of air, noise modeling and pollution load status.

Chapter 9: Public Consultations includes summary of the consultation with interested parties and the general people including stakeholders with the note to consider their views in the planning and execution of the project.

Chapter 10: Environmental Mitigation, Management and Monitoring Plan describes the environmental and social management plan (ESMP) for minimizing the effect of the negative impacts and enhancement measures for increasing the benefits of the positive impacts at pre, during and post construction phases.

Chapter 11: "Conclusions and Recommendations" is the concluding chapter of the ESIA Report with conclusion and recommendations of the ESIA study.

2.9 References

A list of secondary data used for carrying out ESIA study and preparation of ESIA report is given at the following table.

Table 2-1: General References used for the ESIA Report

	Reference
Information collected from Government and INGO Departments	
1.	Bangladesh Economic Zone Authority
2.	Department of Public Health and Engineering
3.	Department of Environment
4.	Bangladesh Meteorological Department
5.	Bangladesh Forest Research Institute
6.	Bangladesh Agricultural Development Corporation (BADC)
7.	Bangladesh Meteorological Department (BMD)
8.	Bangladesh Bureau of Statistics
9.	Geological Survey of Bangladesh
10.	Bangladesh Water Development Board
11.	Department of Disaster Management
12.	Upazila office
13.	Food and Agriculture Development Program
Referred Journals and Books	
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13.	Ferdous S., Lodi M.K., Ecosystem Goods and Services (EG&S) in Bangladesh (2020), Nature Study Society of Bangladesh. Available link-

	Reference
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15.	Hultman, C.W. (1967), Exports and economic growth: a survey. Land Economics, Vol. 43, pp. 148-157.
16.	Khatun M. A., Rashid M. B., and Hygen H. O., Climate of Bangladesh (2016), MET report, Bangladesh Meteorological Department (BMD), ISSN no. 2387-4201
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19.	Rimex International (2021). Available link- http://www.projectsprofile.com/news/news_profile_eight.html [Accessed:28.06.2021]
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2.	Google maps
3.	Google earth imageries
4.	World Health Organization
5.	CDC (USA)
Others	
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2.	WB General EHS Guidelines
3.	WB Operational Policies
4.	CDC COVID-19 Guidelines
5.	WHO COVID-19 Guidelines
6.	World Bank

3 Legislative, Regulation and Policy Consideration

3.1 Introduction

In this chapter, all relevant policies and legislations pertaining to the GoB, particularly, the Environment Conservation Act (ECA) 1995 (with subsequent amendments) and the Environment Conservation Rules (ECR) 2023, were assessed. The Project Proponent, Bangladesh Economic Zone Authority (BEZA), will ensure adherence to all applicable regulations and standards for environmentally acceptable operation of this Project.

The Economic Zone project includes land development activities for industrial purposes in Kushtia (Bheramara). The Environment Conservation Rules (ECR) 1997, amended in December, 2017 is the main legal instrument, which obliges industries/projects/units to get either site and/or environmental clearances from the competent authority. The Environmental Conservation Act (ECA) 1995 (subsequent amendment 2002), clearly states in serial no. 12 that an Environmental Clearance Certificate (ECC), that follows the ECR 2023 must be approved by the Director General (DG) of the Department of Environment (DoE) prior to establishing/ undertaking any industrial unit/ project. The ECR categorizes different industries/projects/units into three broad types: Green, Orange, and Red. According to the industrial unit classification, mentioned in the ECR 2023, this proposed project is under the 'Red' category: serial 36-industrial estate. The Red category project primarily requires 'Site Clearance Certificate' (SCC) through approval of Initial Environmental Examination (IEE), followed by Environmental Impact Assessment (EIA) according to approved ToR for getting Environmental Clearance Certificate (ECC). However, BEZA received an exemption from IEE, hence SCC, upon submission of an application to the DG, DoE. Thus, EIA and ECC is required only for carrying out the project, for which DoE had already approved a ToR, following which this EIA has been prepared. In the following sections, summary of relevant legislations and policies are presented.

3.2 Institutional Framework

Roles and responsibilities of various Ministries and Departments involved in the enforcement of environmental requirements are described below:

Ministry of Environment, Forest and Climate Change

The Ministry of Environment, Forest and Climate Change (MoEFCC) is the key Government institution in Bangladesh for all matters relating to national environmental policy and regulatory issues. Realizing the ever-increasing importance of environmental issues, the MoEFCC replaced the Ministry of Agriculture and Forest in 1989 and is at present a permanent member of the Executive Committee of the National Economic Council. This is the major decision-making body for economic policy issues and responsible for approving all public investment projects. The MoEFCC oversees the activities of the following technical and implementing agencies.

Department of Environment

In order to expand the scope of environmental management and to strengthen the power for achieving it, the Government adopted the Environmental Pollution Control Ordinance in

1977. The ordinance provided the opportunity for the establishment of an Environmental Pollution Control Board, which was assigned with the responsibility of formulating policies and proposing measures for their implementation. In 1982, the Board was renamed as the Department of Environmental Pollution Control (DEPC). Six divisional offices were established in Dhaka, Chattogram, Khulna, Barishal, Sylhet and Rajshahi.

A special presidential order again renamed the DEPC as the Department of Environment (DoE) and placed it under the newly formed MoEFCC in 1989.

The DoE is a Department of the MoEFCC and is headed by a Director General (DG). The power of the DG, as given under the Act, may be outlined as follows:

(1) The DG has the power to close down activities considered harmful to human life or the environment. The operator has the right to appeal and procedures are in place for this. However, if the incident is considered an emergency, there is no opportunity for any appeal.

(2) The DG has the power to declare an area affected by pollution as an ecologically critical area. The DoE governs the type of work or process, which can take place in such an area.

(3) Before undertaking any new development project, the project proponent must take Environmental Clearance Certificate (ECC) from the DoE. The procedures to take such clearance are in place.

(4) Failure to comply with any part of the Environment Conservation Act (ECA), 1995 with subsequent amendments may result in punishment by imprisonment or a fine of or both.

Forest Department

This department under the MoEFCC is responsible for the protection and management of all reserve forests in the country. Department personnel extend down to the union level in areas where there are reserve forests. The department has recently started some agro forestry programs and its officers are also responsible for the protection of wildlife in the forests.

3.3 Key Environmental Laws and Regulatory Requirements

Key environmental laws and regulatory requirements toward protection and conservation of environment and various environmental resources and toward protection of social environment from adverse impact of projects and activities associated with them have been enunciated by the GOB requirements are summarized below.

National Acts and Rules related with the ESIA study include the following:

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(1)	Environment Conservation Act, 1995 and its amendment in 2000, 2002 and 2010	• Declaration of Ecologically Critical Areas (ECAs); • Obtaining Environmental Clearance Certificate (ECC); • Regulation for vehicles emitting smoke harmful for the environment; • Regulation of development activities from an environmental perspective; • Promulgation of standards for quality of air, water, noise and soils for different areas and different purposes; • Promulgation of acceptable limits for discharging and emitting waste; • Formulation of environmental guidelines relating to control and mitigation of environmental pollution, conservation and improvement of the environment.	According to the Act "no industrial unit or project shall be established or undertaken without obtaining an ECC from the DG" of DoE. Therefore, the provisions of the act apply to all of the project intervention phases during the project life cycle.
(2)	Environment Court Act, 2010	• Establishment of one or more environment courts in each district and one or more special magistrate courts in each district; • Also provides the jurisdictions of environment court, the penalty for violating courts order, trial procedure in special magistrate court, power of entry and search, procedure for investigation, procedure and power of environment court, authority of environment court to inspect, appeal procedure and formation of the environment appeal court.	The court has jurisdiction, under the act's provisions, over trial for an offense or compensation under environmental law, imposing penalties for violation, etc.
(3)	Wildlife (Conservation and Security) Act, 2012	• Prohibition related to capturing, killing, shooting, or trapping wildlife. No person shall hunt any wild animal without a license; • Determination of threatened flora and fauna in four (4) schedules; • Prohibitions, entry and declaration procedure of protected areas (sanctuary, national park, community conservation area, safari park, eco-park, botanical garden, wild animal breeding center, landscape zone or corridor, buffer zone, core zone, special biodiversity conservation area, national heritage, memorial tree, sacred tree, and kunjaban, etc.); • No person, institution, or company shall establish or operate any industrial factory or brick-field within 2 (two) kilometers from the boundary of a sanctuary.	No project activities are going to undertake within the buffer zone of the eco-sensitive zone notified in this act.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(4)	The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry)	• Declare any forests land or wasteland as protected forests • May stop public or private way or watercourse in the interest of preservation of the forest; • Declare a reserved forest area as Village Forests • Declare an area as social forests or launch a social forestry programme in Govt. land or private land with permission.	No forestland will be required to be diverted;
(5)	The Explosive Act, 1884	To prevent any accident due to explosive storage, use or transportation due to careless handling/management	It is applicable depending on the quantity of fuel storage. Fuel will be stored and used at site for running various construction machinery and equipment
(6)	Water Supply and Sewerage Authority Act, 1996	Management and Control of water supply and sanitation in urban areas	Required for all development projects. Regulatory authority is Ministry of Local Government, Rural Development and Cooperatives
(7)	The Embankment and Drainage Act 1952	An Act to consolidate the laws relating to embankment and drainage and to make better provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion and other damage by water.	Required for the construction of drainage facility at the Construction Yard and the Depot Area. Regulatory authority is Ministry of Water Resources and Flood Control Department (FCD).
(8)	Antiquities Act 1968	Governs preservation of the national cultural heritage, protects and controls ancient monuments, regulates antiquities as well as the maintenance, conservation and restoration of protected sites and monuments, controls planning, exploration and excavation of archaeological sites	No structure of national cultural heritage will be affected due to project development. Regulatory authority is Ministry of cultural Affairs.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(9)	Bangladesh National Building Code (BNBC), 2020	BNBC was first drafted in 1993 but not formally reviewed and updated. In 2006 the Building Construction Act was amended to include a new section 18 A, empowering the government to promulgate the building code as a legally binding document. The new edition of Bangladesh's building code is the Bangladesh National Building Code 2020 (BNBC 2020). • The provisions of this Code shall extend to the design, construction, usage or occupation, modification, movement, demolition and repair of any building or structure and any equipment installed or related therein or attached therein, except as otherwise provided for in other laws and regulations governing and regulating buildings. • If, in any event, various parts of this Code have different specifications for materials, design or construction methods, or other conditions, then the most restrictive specification shall be governed. • The special provision shall be applicable in the event of any discrepancy between a general requirement and a particular requirement.	Cover the requirement for the structural design
(10)	The Building Construction Act 1952 (with amendments)	An Act to provide for the prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh.	The project involves development of infrastructure. Regulatory authority is Ministry of Public Works.
(11)	The Vehicle Act, 1927	To regulate vehicular exhaust emissions	Heavy vehicle movement is involved during construction and operation phase. Regular maintenance and up keeping of the vehicles should be carried out. Regulatory authority is BRTA.
(12)	Acquisition and Requisition of Immovable Property Act, 2017	Current GOB Act and Guidelines, relating to acquisition and requisition of land; • According to the law, the affected person will get an additional 200% of assessed value for land and an additional 100% for structures, trees, crops, and other assets; • This law deals with social and economic impacts as a consequence of land acquisition;	Land acquisition will be carried out at Depot Area. Regulatory authority is Deputy Commissioner.
(13)	Bangladesh Labor Act, 2006 (Amended 2013, 2018)	Provides health, safety, and wellbeing of workforce during project life cycle. In addition, it also stipulated that children under 18 years are not allowed to be employed during project life cycle and therefore, this law requires to be complied.	Skilled, semiskilled and temporary workers are likely to be involved in the project

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(14)	Right to Information Act, 2009	The Act makes provisions for ensuring free flow of information and people's right to information. The freedom of thought, conscience and speech is recognized in the Constitution as a fundamental right and the right to information is an alienable part of it. Since all powers of the Republic belong to the people, it is necessary to ensure right to information for their empowerment. The right to information shall ensure that transparency and accountability in all public, autonomous and statutory organizations and in private organizations run on government or foreign funding shall increase, corruption shall decrease and good governance shall be established. It is expedient and necessary to make provisions for ensuring transparency and accountability.	Applicable for the stakeholder consultation phase
(15)	Bangladesh Biodiversity Act, 2017	The Act is 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.	To protect environment and sustainable development.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(16)	Bangladesh Water Act, 2013	The key features of the Act are: • A National Water Resources Council (NWRC) to be established for implementing the provisions of the Act • A National Water Policy shall be adopted by the Council addressing the following issues: • Purpose and sectors of water use • Affordability of water users • Actual cost of water abstraction and distribution • Financial ability and backwardness of water users of any group there of • Water demand and supply • Any other issues considered relevant by the government • An Executive Committee of the Council shall be established or ensuring efficient performance of the Council. • The GoB can declare certain areas as Water Stress Areas for the protection of water sources or aquifers. • Water zone demarcation (industrial, agricultural, brackish water aquaculture and hatchery water zones) through gazette notification and issuance of protection order for efficient water management in such zones. • Declaration of flood control zone and its management. • Restriction on abstraction of total water from any water source.	Kushtia EZ shall ensure compliance with legal requirements under this Act, if applicable.
(17)	The Bangladesh Economic Zones Act, 2010 (amendment in 2015)	An Act to make provisions for the establishment of economic zones in all potential areas including backward and underdeveloped regions and development, operation, management and control thereof including the matters ancillary thereto with a view to encouraging rapid economic development through increase and diversification of industry, employment, production and export.	Kushtia EZ must follow this Act while implementing the project.
(18)	Communicable Diseases (Prevention, Control, and Eradication) Act, 2018	The Act is designed to raise awareness of, prevent, control, and eradicate infectious or communicable diseases to address public health emergencies and reduce health risks.	Applicable to manage the occupational /Community Health Safety at EZ.
(19)	Fatal Accidents Act, 1855	An Act to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong.	Applicable to the employees of the Kushtia EZ.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(20)	National Human Rights Commission Act, 2009	The National Human Rights Commission Act, 2009 in consonance with Bangladesh's commitment to international human rights law, the Commission serves as a mechanism for the enrichment of the realization of human rights. Its journey is aimed at creating a culture of human rights through public enlightenment on diverse human rights issues so that the people of the country can contribute to larger peace and security keeping in pace with the 'progressive aspirations of human kind.'	Applicable to protect the rights of the PAPs and the inhabitants of the Kushtia EZ area.
(21)	Bangladesh Water Development Board Act, 2000	An Act with a view to ensure development and management of water resources by rescinding provisions of the Bangladesh Water and Power Development Boards Order of 1972 under the Bangladesh Water and Power Development Boar Order, 1972	Applicable to water resources of the EZ area.
(22)	National River Protection Commission Act, 2013	An Act to establish a Commission for preventing illegal occupation of rivers, pollution of water and environment, pollution of rivers caused by industrial factories, illegal constructions and various irregularities and ensuring multidimensional use of rivers for socio-economic development including restoration of the normal flow of rivers, proper maintenance thereof and making them navigable.	Applicable to the adjacent rivers of the EZ.
(23)	The Children Act, 2013	The Children Act 2013 repeals the 1974 Children Act with the aim of bringing the country in line with provisions of international instruments such as the UNCRC, as well as decisions of the Bangladesh Supreme Court.	Applicable to the children at EZ and in the project area.
(24)	Road Transport Act, 2018	The Road Transport Act, 2018 was promulgated to address both the horrendous situation with road accidents and to quell the public unrest over the same. The specific issues of the act are driving license, conductor license, motor vehicle registration, transport committee, route permit, vehicle control, vehicle production and maintenance, traffic, ozone and environment control, compensation, treatment and insurance for accidents, driving training school, vehicle repair factory, dumping yard, crime, law and justice etc.	Applicable to road transport management of EZ.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(25)	Investment Board Act, 1989	Board of Investment, established under this act, is the principle private investment promotion and facilitation agency of Bangladesh, which is responsible for implementation of provisions of above said policy. Under the provision of this Act as per schedule 11, all industries established in non-governmental sectors licensed by the board shall be registered in the prescribed manner. As per Schedule 15 of this Act, any industrial undertaking licensed transgresses any provision of this Act or of any rule made there under or breaks any condition relating to the license, the board may, in such manner as may be prescribed, cancel the license of the industrial undertaking.	Kushtia EZ shall ensure that the proposed project is registered as prescribed by the Act.
(26)	Bangladesh EZ Labour Law Ordinance, 2019	This law although follows Bangladesh Labour Act, 2006, it exclusively focuses on industrial sectors and economic zone related employments. It provides instructions for the directives on labour appointment, wages, working hours, termination, occupational health and safety issues etc. The salient features are as follows: • Providing appoint letter and id card is mandatory • Maximum working hours is restricted to 48 hours, additional payment is required in the case of extra hour work • Any labour will get one day weekly leave with pay • Female labour will get eight weeks of maternity leave • Prior notice is required for termination, retrenchment and discharge • Inappropriate/indecent behaviour and harassment to female worker will be strongly handles • It is prohibited to appoint under-aged and forceful labours • The employers are entitled to ensure the safety of workers and also maintain a safe and healthy working environment within the workplace • It is mandatory to facilitate every zone with health cares • In case of industries containing more than twenty-five (25) permanent workers, it is obligatory for employers to maintain group insurance for the workers	This Law give strong emphasis on labour rights, irrespective to gender and their orientation. It includes a separate chapter on occupational health and safety. BEZA is obliged to follow all of these rules during land development and period and to monitor so that established industries follow this law during the operation period. The law, however, does not contain any close concerning to the community health and safety. During construction and operation community health and safety issue will be more crucial. Therefore, such an addition will be required.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(27)	The Penal Code, 1860	Chapter XIV of the Penal Code provides offences affective public health, safety, convenience, decency and morals; Section 277: Falling Water or Public Spring or Reservoir; Section 278: Making Atmosphere Noxious to Health; • Section 284: Negligent Conduct with Respect to Poisonous Substance; Section 285: Negligent Conduct with Respect to Fire or Combustible Matter; • Section 286: Negligent Conduct with Respect to Explosive Substance. • Section 277: whoever voluntarily corrupts or fouls the water of any public spring or reservoir, to render it less fit for the purpose for which it is ordinarily used will be punished under the law. • Section 278: whoever voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighborhood or passing along a public way will get punishment.	It is required to take all the measures proposed and suggested by DoE, Bangladesh during both construction and operation phase to minimize the environmental pollution.
(28)	Environment Conservation Rules, 2023	• NEQS for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise, and vehicular exhaust; • Categorization of industries, development projects and other activities based on actual (for existing industries/development projects/ activities) and anticipated (for proposed industries/development projects/activities) pollution load; • Procedure for obtaining ECC; • Requirements for undertaking IEE and EIA's as well as formulating EMP according to categories of industries/ development projects/activities; and • Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.	The subject project falls under the "Red" category and requires clearance before the commencement of any project activities. Besides, it is stipulated that environmental quality standards and other relevant requirements shall be complied during the project life cycle.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(29)	Bangladesh Water Rules, 2018	Provision of No Objection Certificate for the establishment of projects related to flood control and management project; surface water extraction, supply and use related project and part of the project; irrigation project using surface water; construction of hydraulic structures; water conservation project; flood affected plain land and wetland development project; groundwater for industrial use; riverbank protection and river control; river excavation and dredging project; canal excavation and re-excavation project; fisheries development in surface water project; groundwater extraction, supply, and use related project and part of the project; and others project: • According to the Clause-16 of the rules, a NOC should be taken from DG of WARPO, District Committee/DC, Upazila Committee/UNO, and Union Committee/Chairman based on the total investment of the specific project.	Applicable- As the subject project will required surface/ground water extraction during construction period. Therefore, a NOC will be required prior to use surface/ground water.
(30)	Noise Pollution (Control) Rules 2006	• Prevention of Noise pollution • Standards for noise levels	Noise will be generated due to the construction activity
(31)	Hazardous waste (e-waste) management rules 2021	On June 10, 2021, Bangladesh's Department of Environment (DoE) published the Hazardous Waste (e-waste) Management Rules, 2021 under the Bangladesh Environmental Protection Act, 1995. The E-waste rule covers the products listed in the Schedule (home appliances, monitoring and control equipment, medical equipment, automatic machines, IT and communication equipment), and establishes obligations for manufacturers, assemblers, collectors, sellers, and consumers of the products. The rule also sets provisions to limit the use of the 10 substances covered by the EU RoHS Directive.	Applicable to hazardous waste management of Kushtia EZ.
(32)	Solid Waste Management Rules 2021	The Solid Waste Management Rules 2021 were published in Bangladesh on December 23, 2021, under the Bangladesh Environmental Protection Act, 1995. The Regulations define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to Extended Producer Responsibility (EPR) on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery.	Applicable to solid waste management of Kushtia EZ.

	Name	Summary of Applicable Legislation	Applicable Permit and Requirement
(33)	Bangladesh Economic Zones (Construction of Building) Rules, 2017	The rules have been formed under section 38 of the Bangladesh Economic Zones Act, 2010. The rules describe in detail the design and construction issues of an economic zone *i.e.* economic design requirements, individual building design requirements, permits, qualification and responsibilities of the technical personnel, inspection, unsafe building etc.	Kushtia EZ must comply the requirements and follow the standard mentioned in this Rules.
(34)	Bangladesh Labour Rules, 2015	Provides health, safety, and wellbeing of workforce during project life cycle. In addition, it also stipulated that child under 18 years are not allowed to be employed during project life cycle and therefore, this law requires to be complied.	Skilled, semiskilled and temporary workers are likely to be involved in the project
(35)	Rules for Corrosive Material (Control) responsible for Ozone Layer Depletion, 2004	The rules have been formed to control or management the harmful materials for environment all over Bangladesh to produce, import, export, marketing, sell, display to sell, storage, distribution or commercial use of corrosive material responsible for ozone layer depletion.	Applicable to control corrosive material responsible for ozone layer depletion at the EZ.
(36)	Air Pollution (Control) Rules 2022	The Rule has been formulated with the objective of preventing, controlling and reducing air pollution in order to protect the environment and public health.	Applicable to air pollution control of EZ.
(37)	Ecological Critical Area Rules, 2016	The Government framed the Ecologically Critical Areas (ECA) Rules, 2016 for the proper management and development of the ECA s in Bangladesh.	EZ must comply the requirements and follow the standard mentioned in this Rules.
(38)	Deltaic Plan 2100	The Bangladesh Delta Plan (BDP) 2100 is a broad-based long-term vision about the likely changes and necessary intervention to make the Bangladesh Delta a safe by the end of the 21st Century.	EZ will act accordingly.
(39)	Eighth Five-year Plan 2021-25	8FYP titled “Promoting Prosperity and Fostering Inclusiveness” focuses on a pro-poor growth strategy. This strategy includes seven themes. These are labour-intensive, export-oriented manufacturing-led growth, agricultural diversification, dynamism in cottage, small and medium enterprises, modern services sector, ICT based entrepreneurship, and overseas employment.	EZ will help in achieving the seven themes of 8FYP.

3.4 International Legislation Ratified by Bangladesh

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

Table 3-1: International Conventions, Treaties and Protocols Ratified by Bangladesh

	Conventions	Years	Ratified/Accessed (AC)/ Accepted (AT)/ Adaptation (AD)	Relevance	Responsible Agency
(1)	International Convention for Protection of Birds, Paris	1950	Signed	Protection of the birds in their wild state	DoE/DoF
(2)	International Plant Protection Convention (Rome,) and Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	1951 1999	01 September, 1978 04 December, 1974 (AC) (Entry into Force)	Ensuring that the Project work or construction materials do not introduce plant pests	DoE
(3)	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, Brussels	1969		Civil liability on oil pollution damage from ships	DoE/MoS
(4)	Convention on Wetlands of International Importance ("Ramsar Convention":1971)	1971	20 April, 1992 (ratified)	Protection of significant wetland and prevention of draining or filling during construction	DoE/DoF
(5)	Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972)	1972	03 August, 1983 (AT) 03 November, 1983 (ratified)	Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc.	DoA
(6)	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters (as amended), London-Mexico City-Washington	1972	Signed	Effective control and prevention of all sources of pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.	
(7)	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington	1973		Ban and restrictions on international trade in endangered species of wild fauna and flora	DoE/DoF
(8)	Convention Concerning the Protection of Workers Against	1974	Signed	To protect workers against hazards arising	MoHFW

	Conventions	Years	Ratified/Accessed (AC)/ Accepted (AT)/ Adaptation (AD)	Relevance	Responsible Agency
	Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration, Geneva			from occupational exposure to carcinogenic substances and agents	
(9)	Convention on the Conservation of Migratory Species of Wild Animals, Bonn	1977	Signed	Conservation of migratory species of wild animals	DoE/DoF
(10)	Convention Concerning the Prevention and Control of Occupational Hazards caused by Carcinogenic Substances and Agents, Geneva	1979		Protect workers against occupational hazards in the working environment	MoHFW
(11)	Convention Concerning Occupational Safety and Health and the Working Environment, Geneva	1981	Signed	Ensuring occupational health and safety of workers in all branches of economic activity	MoHFW
(12)	Vienna Convention for the Protection of the Ozone Layer, Vienna	1985	2 August, 1990 (AC) 31 October, 1990 (entry into force)	Preventing human activities that may have adverse effects on ozone layer	DoE/MoEFCC
(13)	Convention Concerning Occupational Health Services, Geneva	1985		To promote a safe and healthy working environment	MoHFW
(14)	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal	1987	31 October, 1990 (entry into force)	Reduction of the abundance of the substances that deplete the ozone layer in the atmosphere, and thereby protect the earth's fragile ozone Layer	DoE/MoEFCC
(15)	Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal, Basel	1989		Safe methods for transport of dangerous goods by road, railway and inland vessels	MoC
(16)	Convention Concerning Safety in the Use of Chemicals at Work, Geneva	1990	Signed	Regulating the management of chemicals in the workplaces, in order to protect workers from the harmful effects of these substances	MoHFW
(17)	International Convention on Oil Pollution Preparedness, Response, and Cooperation, London	1990		Legal framework and preparedness for control of oil pollution	DoE/MoS
(18)	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London	1990		Control of global emissions that deplete ozone layer	DoE/ MoEFCC
(19)	Convention on Biological Diversity (Rio de Janeiro, 1992)	1992	5 June 1992	Protection of biodiversity during construction and operation	DoE/ MoEFCC

	Conventions	Years	Ratified/Accessed (AC)/ Accepted (AT)/ Adaptation (AD)	Relevance	Responsible Agency
(20)	United Nations Framework Convention on Climate Change (New York, 1992)	1992	15 April 1994	Reduction of emission of greenhouse gases	DoE/ MoEFCC
(21)	Agenda 21, UNCED, Rio de Janeiro	1992	Signed	Ensuring sustainable development	
(22)	Preparedness, Response and Cooperation (London, 1990.) 30 September, 90 United Nations Framework Convention on Climate Change, New York	1992	15 April 1994	Achieving stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system	
(23)	Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992	1992	27 November 2000 (AT) 26 February 2001 (Entry into force)	Extending the coverage of Montreal Protocol to new substances	
(24)	International Convention to Combat Desertification, Paris	1994	26 January 1996 (Ratification) 26 December 1996 (entry into force)	Combating desertification and mitigating the effects of drought.	
(25)	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London		18 March 1994 (AC) 16 June 1994 (entry into force)	To strengthen the control procedure and extend the coverage of Montreal Protocol to new substances	
(26)	Kyoto protocol to the United Nations Framework Convention on Climate Change	1997	21 August 2001 (AC) 11 December 1997 (AD)	Reduction of emission of greenhouse gases	DoE/ MoEFCC
(27)	Cartagena Protocol on Biosafety to the Convention on Biological Diversity, Montreal	2000		Biological safety in transport and use of genetically modified organisms	DoE/ MoEFCC
(28)	Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal	2001	27July 2001 (Accepted) 26 October 2001 (Entry into force)	Controls in the trade of ozone depleting substances and the use of licensing procedures to control the import and export of new, recycled and reclaimed ozone depleting substances	
(29)	Convention on Persistent Organic Pollutants, Stockholm	2001	In process	Restrict use of different chemicals containing POPs.	
(30)	Nagoya Protocol on Access to Genetic Resources and the	2010		Access to Genetic Resources and the Fair	MoEFCC

	Conventions	Years	Ratified/Accessed (AC)/ Accepted (AT)/ Adaptation (AD)	Relevance	Responsible Agency
	Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity			and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity	
(31)	Paris Climate Agreement	2015		Climate Change	MoEFCC
(32)	The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides	1998	---	The convention promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labeling, include directions on safe handling, and inform purchasers of any known restrictions or bans.	---

3.5 World Bank Guidelines

Since October 2018, all World Bank Funded Investment Project Financing (IPF) are required to follow the Environmental and Social Framework (ESF) consisting of ten (10) Environment and Social Standards (ESSs). The ESF sets out its commitment to sustainable development, through Bank Policy and a set of Environmental and Social Standards (Table 3-2) that are designed to support projects.

Table 3-2: World Banks Environmental and Social Standards

	World Bank ESF Policy, Standards, Directive	Objectives
(1)	World Bank Environment and Social Policy for Investment Project Financing	It sets out the mandatory requirements of the Bank in relation to the projects it supports through Investment Project Financing.
(2)	ESS-1 Assessment and Management of Environmental and Social Risks and Impacts	Identify, assess, evaluate, and manage the environment and social risks and impacts in a manner consistent with the ESF. Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities.
(3)		
(4)	ESS-2 Labor-and-Working-Conditions	Promote safety and health at work. Promote fair treatment, non-discrimination, and equal opportunity for project workers. Protect project workers, with particular emphasis on vulnerable workers. Prevent the use of all forms of forced labor and child labor. Support the

	World Bank ESF Policy, Standards, Directive	Objectives
		principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. Provide project workers with accessible means to raise workplace concerns.
(5)	ESS-3 Resource-Efficiency-and-Pollution-Prevention-and-Management	Promote the sustainable use of resources, including energy, water, and raw materials. Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. Avoid or minimize project-related emissions of short and long-lived climate pollutants. Avoid or minimize the generation of hazardous and non-hazardous waste. Minimize and manage the risks and impacts associated with pesticide use. Requires technically and financially feasible measures to improve efficient consumption of energy, water, and raw materials and introduces specific requirements for water efficiency where a project has high water demand.
(6)	ESS-4 Community-Health-and-Safety	Anticipate or avoid adverse impacts on the health and safety of project-affected communities during project life-cycle from routine and non-routine circumstances. Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. Have in place effective measures to address emergency events. Ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.
(7)	ESS-5 Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement	Avoid or minimize involuntary resettlement by exploring project design alternatives. Avoid forced eviction. Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use by providing compensation at replacement cost and assisting displaced persons in their efforts to improve, or at least restore, livelihoods and living standards to pre-displacement levels or to levels prevailing prior to the beginning of the project implementation, whichever is higher. Improve living conditions of poor or vulnerable persons who are physically displaced through the provision of adequate housing, access to services and facilities, and security of tenure. Conceive and execute resettlement activities as sustainable development programs.
(8)	ESS-6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	Protect and conserve biodiversity and habitats. Apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. To promote the sustainable management of living natural resources.
(9)	ESF-7	Ensure that the development process fosters full respect for affected parties' human rights,

	World Bank ESF Policy, Standards, Directive	Objectives
	Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	dignity, aspirations, identity, culture, and natural resource-based livelihoods. Promote sustainable development benefits and opportunities in a manner that is accessible, culturally appropriate, and inclusive. Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. Obtain the Free, Prior, and Informed Consent (FPIC) of affected parties in three circumstances. Recognize, respect and preserve the culture, knowledge, and practices of Indigenous Peoples, and to provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.
(10)	ESS-8 Cultural-Heritage	Protect cultural heritage from the adverse impacts of project activities and support its preservation—Address cultural heritage as an integral aspect of sustainable development. Promote meaningful consultation with stakeholders regarding cultural heritage. Promote the equitable sharing of benefits from the use of cultural heritage.
(11)	ESS-9 Financial-Intermediaries	Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the subprojects it finances. Promote good environmental and social management practices in the subprojects the FI finance. Promote good environmental and sound human resources management within the FI.
(12)	ESS-10 Stakeholder-Engagement-and-Information-Disclosure	Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship with them. Assess stakeholder interest and support for the project and enable stakeholders' views to be taken into account in project design. Promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life-cycle. Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner.
(13)	Environmental and Social Directive for Investment Project Financing	This Directive applies to the Bank and sets out the mandatory requirements for the implementation of the Environmental and Social Policy for Investment Project Financing (IPF).

3.6 National Policies and Plans

National Policies, plans and strategies of Bangladesh relevant the ESIA study are as follows:

	Name	Summary of applicable policies/Plans	Applicable Permit and Requirement
(1)	National Environment Policy, 2018	The National Environment Policy envisaged environment conservation, pollution control, biodiversity conservation, and mitigation of the adverse effect of climate change to ensure sustainable development.	Kushtia EZ must follow the policy and comply with provisions while implementing the project.
(2)	The National Forest Policy, 1994	Conserve the existing forest areas and to increase forest cover of country and increase the reserve forest.	No diversion of forest land is involved
(3)	The National Water Policy, 1999	To ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management.	Applicable, if Ground water is required to be withdrawn for fulfilling water requirement at construction phase Conjunctive use of water should be explored
(4)	National Land use Policy, 2001	(1) Deals with several land uses including agriculture (crop production, fishery, and livestock), housing, forestry, industrialization, railways and roads, tea and rubber; (2) Identifies land use constraints in all these sectors;	land use change from seasonal cultivable land and residential area to urban Area
(5)	The National Energy Policy, 1995	Protecting the environment by requiring an EIA for any new energy development project, introduction of economically viable and environment friendly technology.	Energy efficient materials and techniques should be explored
(6)	National Industrial policy, 2010	(1) The policy aims to ensure the industrialization process is compliant with internationally agreed environment, health, and safety and labor standards. (2) The government will ensure assistance for creating alternative employment, keeping the socio-economic backdrop in mind, for any privatization proposal.	Kushtia EZ shall ensure that the proposed project authority follows the policy.
(7)	National Agriculture Policy, 2013	National Agriculture Policy is to ensure food and nutrition security for all, improve rural livelihoods through increased crop production with higher productivity and create employment opportunities through diversification of agricultural activities.	Kushtia EZ shall ensure that the proposed project authority follows the policy.
(8)	National Fisheries Policy, 1998	(1) Preservation, management, and exploitation of fisheries resources in inland open water; (2) Fish cultivation and management in inland closed water; (3) Prawn and fish cultivation in coastal areas; (4) Preservation, management, and exploitation of sea fishery;	No areas of fish production are likely to be impacted by the project Kushtia EZ shall ensure that the proposed project authority follows

	Name	Summary of applicable policies/Plans	Applicable Permit and Requirement
			the policy.
(9)	National Livestock Development Policy, 2007	The National Livestock Development Policy intends to provide the enabling environment, opening up opportunities, and reducing risks and vulnerability for harnessing the full potential of livestock sub-sector to accelerate economic growth for reduction of rural poverty.	Kushtia EZ shall ensure that the proposed project authority follows the policy.
(10)	National Poultry Development Policy 2008	National Poultry Development Policy was formulated to encourage poultry industry and to control quality of inputs for sustainable poultry development.	Kushtia EZ shall ensure that the proposed project authority follows the policy.
(11)	National Disaster Management Policy, 2015	This policy is formulated with a vision to enhance the country's capacity in manifold ways addressing all necessary hazards and establishing risk reduction culture.	Kushtia EZ shall ensure that the proposed project authority follows the policy.
(12)	Bangladesh Coastal Zone Policy, 2005	The Coastal Zone Policy intends provide a general guidance to all agencies and institutions concerned for the management and development of the coastal zone in a manner that provides a secure and conducive environment for coastal communities to pursue their life and livelihoods. Amongst several objectives it identifies the following: the creation of sustainable livelihoods; intensifying the overage of safe drinking water facilities; reducing vulnerabilities, (including to climate change) and closing the gender gap.	Kushtia EZ shall ensure that the proposed project authority follows the policy.
(13)	National Environment Management Action Plan 1995	Conservation of natural habitats, bio-diversity, energy, sustainable development and improvement of life of people	
(14)	The National Water Management Plan, 2001	Addresses options for water quality, considerations behind measures to clean up waste water pollution, where effluent discharge monitoring and zoning regulations for new projects are emphasized;	This is an infrastructure development project and is likely generate waste water from batching plant Installation of effluent treatment facility within the premises.
(15)	National Biodiversity Strategy and Action Plan, 2005 (NBSAP)	The NBSAP provides a framework for conservation, sustainable use and sharing the benefits of biodiversity of the country. A major focus of the plan is to ensure cross-sectoral linkages, reflecting the fact that in Bangladesh, more so than most other countries, biodiversity conservation is closely inter-woven with social and economic development. Thus, the NBSAP also provides a framework for securing the necessary environmental settings to reduce poverty, ensure sustainable development and implementation of Poverty Reduction Strategy Paper (PRSP).	

	Name	Summary of applicable policies/Plans	Applicable Permit and Requirement
(16)	Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009	The GoB prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 and revised in 2009. This is a comprehensive strategy to address climate change challenges in Bangladesh. Bangladesh Climate Change Strategy and Action Plan built on and expanded the NAPA.	Relevant as the country is vulnerable to climate change effect.
(17)	National Conservation Strategy	Sustainable development for project activity	Usage of energy efficient material, green building techniques, reduction of carbon foot prints etc.
(18)	National 3R Strategy for Waste Management, 2010	Waste minimization can be achieved in an efficient way by focusing primarily on the first of the 3Rs, "reduce," followed by "reuse" and then "recycle." The waste hierarchy refers to the "3Rs" *i.e.* reduce, reuse and recycle, which classify waste management strategies according to their desirability.	Kushtia EZ will apply 3R strategy for waste management.
(19)	Air pollution reduction strategy 2012	This strategy describes the status of each the six criteria air pollutants, pollutants that are generally controlled by air quality standards in many countries and the current ambient air quality standard in Bangladesh.	Applicable to control air pollution.
(20)	Bangladesh Standards and Guidelines for Sludge Management, 2015	The guideline provides extensive information on all aspects of sludge management. It is addressed to anyone operating water or wastewater treatment plants or central effluent treatment plants producing sludge, regardless of the origin of the wastewater involved in the classification, management and use or disposal of sludge.	Applicable for sludge management of the project site.
(21)	EIA Guidelines for Industries, 2021	The EIA Guidelines is a handbook defining procedures for preparing EIAs and for reviewing them, prepared for the benefit of the development partners, EIA consultants, reviewers, and academicians.	The Guidelines provide a step-by-step methodology for the completion of EIA.

3.7 Environment Management Framework

The EMF provides general policies, guidelines, codes of practice and procedures to be integrated into the implementation of the project. It defines the steps, processes, and procedures for screening, alternative analysis, assessment, monitoring and management. In addition, the EMF will analyze environmental policies and legal regime of Bangladesh and international safeguard policies as well as institutional and capacity assessment for environmental management. The EMF is intended to be use as a practical tool during program formulation, design, implementation, and monitoring the physical intervention of the project. The EMF will provide guidance on pre-investment works/studies (such as environmental screening, environmental assessment, environmental management plans, etc.), provide set of steps, process, procedure, and mechanism for ensuring adequate level of environmental consideration and integration in each investment in the project-cycle; and describes the principles, objectives and approach to be followed to avoid or minimize or mitigate impacts.

3.8 Project Categorization

The MoEFCC enacted the Bangladesh Environmental Conservation Act (BECA 1995) and the Bangladesh Environmental Conservation Rules (BECR, 2023). The Environmental Conservation Rules (ECR), 2023, the main subsidiary legislation of the BECA, provides specific rules and procedures for various categories of projects to their approval before construction and operation. In the ECR'23 various industries/projects in the country are classified into the following categories depending on their environmental impacts.

(1) Green
(2) Yellow
(3) Orange
(4) Red

The Categorization list mentioned in ECR'23 is performed based on the activity. According to Schedule-1 of the ECR'23 "Economic zone" development falls under the "Red" category (Item-36). To get the Environmental Clearance Certificate (ECC) from DoE, conduct a detailed Environmental, and Social Impact Assessment (ESIA) is a mandatory requirement.

3.9 Procedure for Obtaining Environmental Clearance

An Environmental Impact Assessment (EIA) report along with necessary documents has required to be submitted to the DoE for getting Environmental Clearance Certificate (ECC). DoE will approve the ECC upon its satisfaction. For this project, the steps of getting ECC are given below:

(1) Apply to DoE for waiving of Site Clearance Certificate (SCC) through Initial Environmental Examination (IEE);
(2) Exemption of IEE and approval of Terms of References (ToR) for Environmental Impact Assessment (EIA);
(3) Apply to DoE with the EIA report appending necessary documents for getting ECC upon the payment of charge;
(4) Presentation of EIA report to DoE, and upon satisfaction receives ECC.

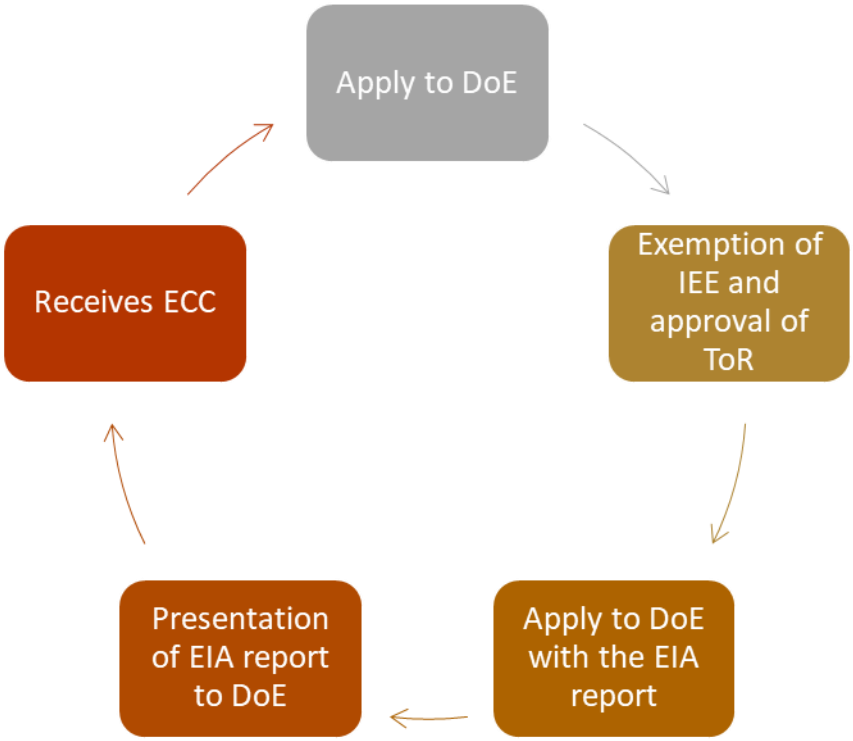


Figure 3.1: Procedure for obtaining Environmental Clearance

3.10 Permits and Consents

	Permits and Consents required	Authority	Responsibility
Preconstruction			
	ECC	DoE	BEZA
Construction			
	Consent to establish and Consent to operate construction camp sites, crusher units, hot mix plants, concrete batch mix plants, WMM plants, work force camps etc.	DoE	Contractor
	Permissions for sourcing of water for construction activities (Surface and Ground Water)	BWDB	Contractor
	Permission to Establish Construction camps	DC, Union Parishad	Contractor
	Extraction of Groundwater	BWDB	Contractor
	Labor License	District Labor commissioner	Contractor

4 Project Description

4.1 Introduction

The proposed Kushtia EZ is located at following 4 Mouzas; Mokarimpur, Charmokarimpur, Arazisara, and Char Ruppur of Mokarimpur Union, Bheramara Upazila in Kushtia District. Geographically, the area is situated in the south-western part of Bangladesh between 24°04'09.35'' north latitudes and 89°00'59.51'' east longitudes. The total area of the proposed site is '420 acres. The Hardinge Rail Bridge and Lalonshah Road Bridge is situated within 1 km of the site. The project area mainly situated on the bank of Padma River.

Table 4-1: Salient features of the proposed Kushtia EZ

Particulars	Details
Division	Khulna
District	Kushtia
Upazila	Bheramara
Mouza	Mokarimpur, Charmokarimpur, Arazisara, and Char Ruppur
Co-ordinates	24°04'09.35'' north latitudes and 89°00'59.51'' east longitudes
Area	'420 acres
Surroundings locations	Bounded by Rajshahi, Natore and Pabna district on the North, Jhinaidaha, Chuadanga and Meherpur district on the South, Rajbari district on the East and India on the West.
Climate	Tropical climatic zone
Current land use	Fallow land, Agricultural Land
Average land elevation	Reduced Levels (RLs) inside the project vary from 14 to 16 m PWD.
Distance from Dhaka	184 km via Dhaka Pabna Highway
Nearest airport	30 km from Ishwardi airport
Nearest railway line	Bheramara railway station (7km)
Distance from nearest highway	Kushtia-Jhenaidah Highway (1km)
Probable water sources	Groundwater and Surface water (Padma River)
Flooding	The Highest Flood Level is 15.19 m in 1998
Forests / National Parks	No forest/national parks within 10km
ECA	No Environmentally Critical area within 10km

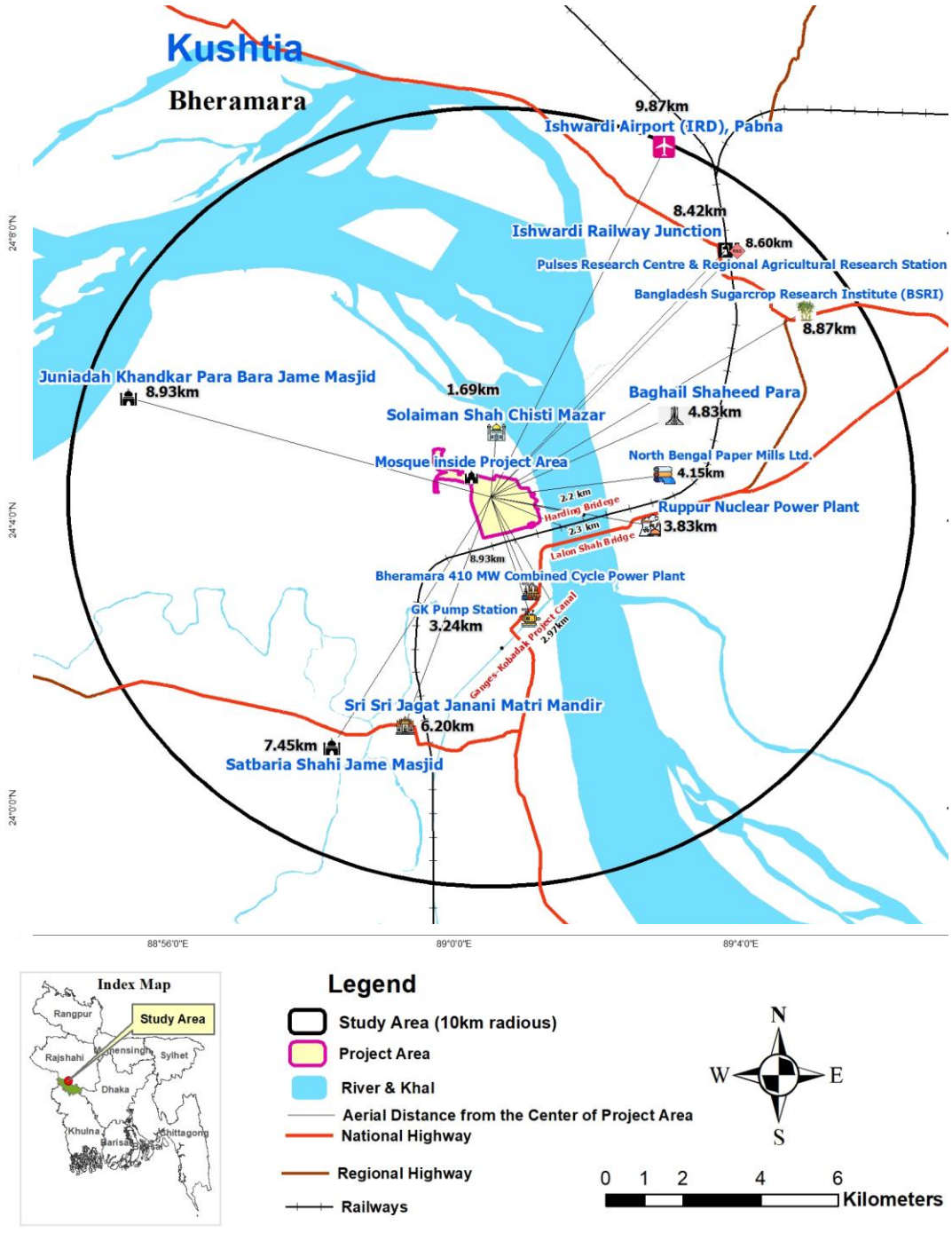


Figure 4.1: Historical and Cultural features with distance

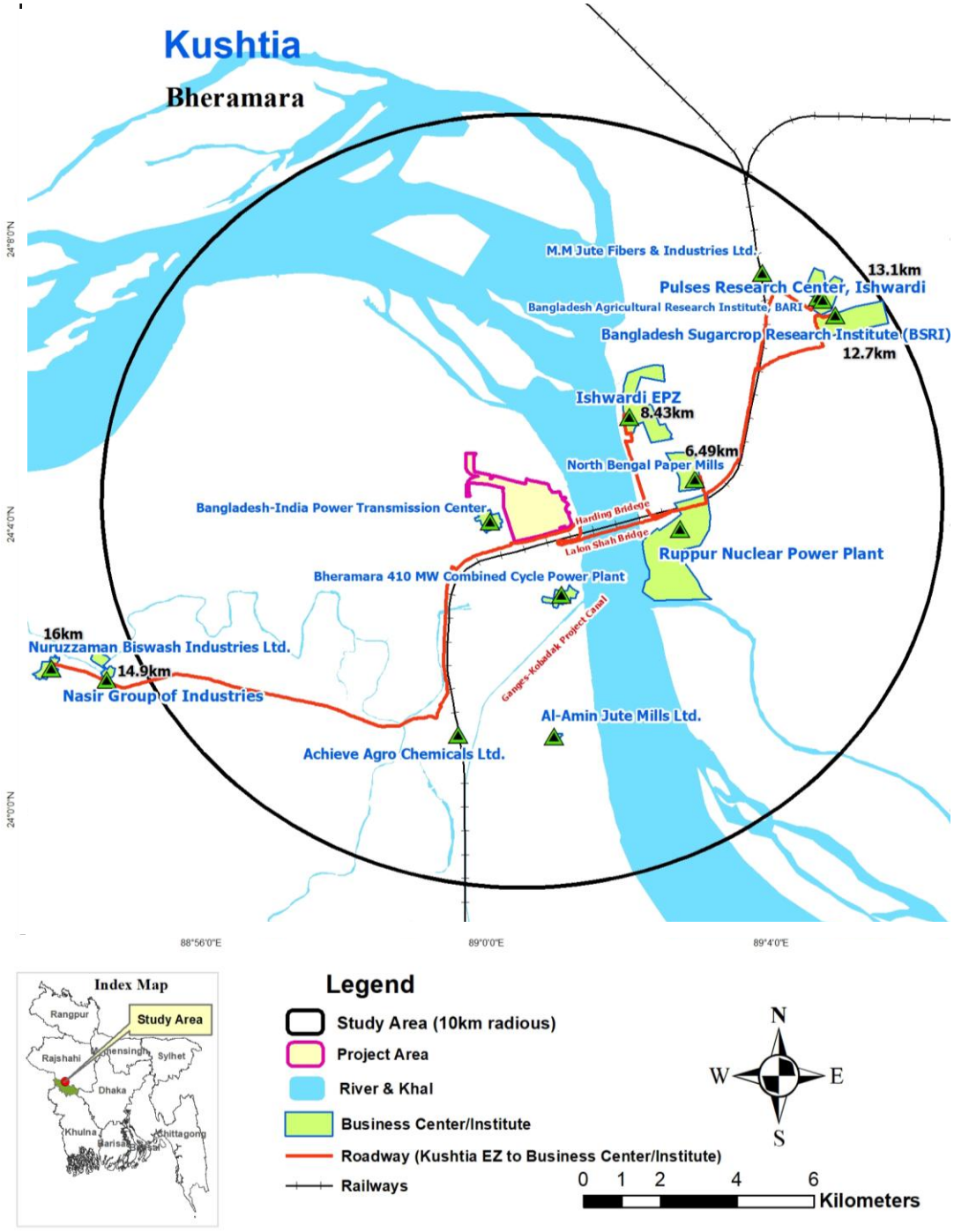


Figure 4.2: Map showing business centers in the study area

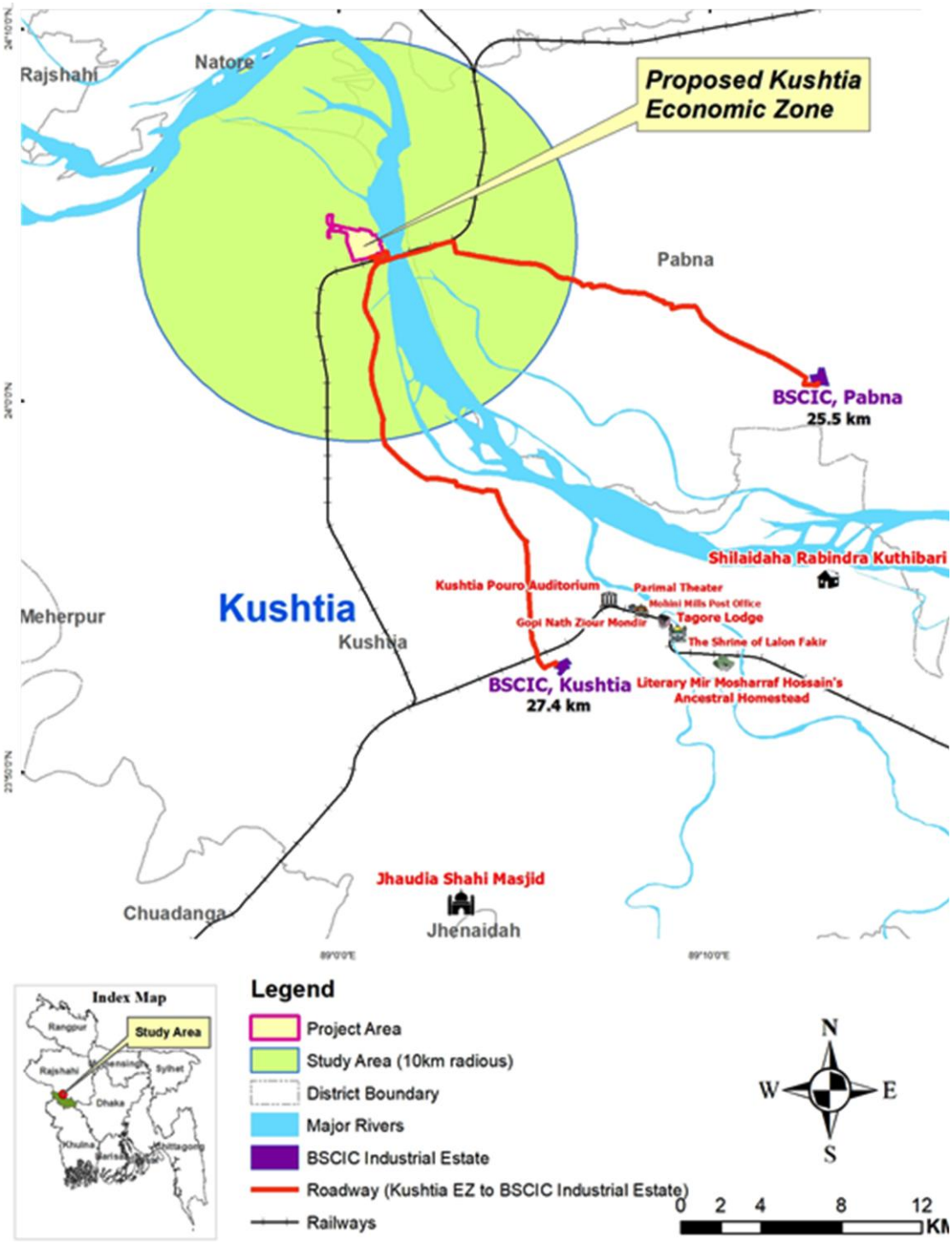


Figure 4.3: Map showing the nearest BSCIC with distance

4.2 Project Objectives

With the aim of encouraging rapid economic development by increasing and diversifying industry, employment, production and exports, BEZA plans to establish 100 economic zones and Kushtia EZ is one of them. One of the main objectives of this EZ establishment is to upgrade the economic condition of the district by enabling the environment of industrialization and economic diversification. It will encourage local entrepreneurs as well as attract investors from outside including foreign investment. It will enable opportunities for

creating new employment. The project would also encourage other induced development especially infrastructural development, economic development, etc.

4.3 Project Option

Alternative approaches include alternative configuration on the site, designing, constructing, operating the project firstly to avoid and prevent, or secondly to reduce or minimize adverse or improve beneficial environmental or socio-economic impacts. The alternatives to the project include a "No Action" alternative, indicating what would happen in the absence of the proposed project as well as consideration of best practices that may not otherwise have been incorporated in the proposed project. Other alternatives were developed to address significant issues with the study.

The proposed land for Kushtia EZ was mostly owned by Bangladesh Railway. Bangladesh Railway has transferred the ownership of the proposed land in favor of BEZA with token value consideration. Thus, BEZA does not have to pay huge amount of money for land acquisition. Settlement on the land is minimal, and BEZA will not have to compensate for the land. Consequently, the resettlement action plan will require a smaller amount of funding, making its implementation easier. Regarding off-site infrastructure, the site is linked to the national highway (N704) via a village road that starts at the highway, passes through the site, and connects to the Union road known as the 'Bheramara- Kuchiamora road.' The existing road and the nearest railway line offer the most favorable options for off-site connectivity.

From perspective of environment, significant indicators or factors have been studied, *i.e.* meteorology, air, water, noise, soil, loss of agricultural and ecological assets, and hydro-meteorological parameters. The proposed economic zone would create huge employment opportunity, improve the living standard of local people and increase the asset value etc. Given the above scenarios, it can be concluded that the selected land is the most feasible option available.

The purpose of this chapter is to systematically compare feasible alternatives to the proposed interventions related technology, design, and operation – including the “without project’ situation in terms of their potential technical, economic, environmental and social impacts. This section is a requirement of the Department of Environment (DoE) and is critical in consideration of the ideal development with minimal environmental disturbance. The proposed project interventions have been compared in terms of overall technical, economic, environmental and social aspects.

4.3.1 Comparison of “Without Project” and “With project” Scenarios

Without Project Alternative in this report was based on the situation before starting of the development work of the zones. With project scenario is considered as the phase when the operation of the industries starts. In the following section a comparison between the without project and with project scenarios is shown in Table 4-2.

Table 4-2: Comparison between with project and without project alternatives

Aspect		Condition Without the Project	Condition With the Project
Technical Aspect	Development planning of	• Random development might be implemented	• Economic Zone would be developed efficiently in accordance with the

Aspect		Condition Without the Project	Condition With the Project
	the area	without any plan for overall area development. Then, the future development plan might be restricted after disorderly development	planned area development plan.
	Distribution of industries	• The distribution of industries would have been sporadically and haphazardly.	• A well-studied and ecofriendly Master Plan has been prepared for Kushtia EZ. In the Master Plan of Kushtia EZ, clustering of industries (Light/ Medium and Heavy), and zoning of other associated facilities such has Residential, Educational, Health, Administrative/ Institutional, Open Space, etc. have incorporated.
	Source of water	• In without project scenario, the sources of water for domestic use, irrigation and fish farming were based on surface water, rain water and ground water from shallow aquifer in small quantity.	• In after project scenario, surface water (Padma River), rain water and ground water from confined deep aquifer will be used. • Kushtia EZ is situated adjacent to Padma River. • The main source of groundwater is coming from the floodplains of Ganges delta and going to the Bay through Padma River and it's tributaries at a depth of about 70 meters (roughly) or more almost in unused condition. That's why Kushtia EZ is/will be suitable to use ground water.

Aspect		Condition Without the Project	Condition With the Project
Economic Aspect	Energy use	• Overall energy use in terms of electricity was low. There was no possibility of having gas connections in this area.	• The estimated power demand for Kushtia EZ is 32.82 MW, will be supplied from existing available power infrastructure • The estimated gas demand is 109752 m^3/day and Sundarban Gas Company Ltd. has suggested gas line to Kushtia EZ from Bheramra CGS of GTCL located alongside N704: Rajshahi Kushtia highway
	Green industrialization	• The concept of green industrialization would not have been considered in case of unplanned and haphazard industrial development.	• Resource efficient green industries will be possible to establish following international norms and guidelines.

Aspect		Condition Without the Project	Condition With the Project
	Employment	• Job increase from the current situation opportunity would not	• Job opportunities would increase for local community during construction and operation phase of the Kushtia EZ. • Moreover, there would be a huge employment opportunity associated with development and operation of the industries. The expected employment in KUSHTIA EZ area will be 30,000 (Source: KUSHTIA EZ Master Plan, 2023)
	Profession	• No need to change the occupation of the local people	• Local people will have an opportunity to increase their skill by changing their profession based on the demands of the industries
	Infrastructural Development	• Infrastructural development of the entire area would be limited.	• There would be a planned and systematic development of railways; access roads; waterway communication; educational facilities; health facilities; and different utility services such as water supply, gas supply, telecommunication, power supply

Aspect		Condition Without the Project	Condition With the Project
Environmental and Social Aspects	Annual revenue	• Annual revenue from farming and aquaculture is limited.	• Increased annual revenue from all types of infrastructures, utility services, wages/ salaries of staffs and workers.
	National economy	• Contribution to the national economic development of this entire area would be limited.	• Because of high industrial development by local and foreign investors and thousand job holders will contribute on national economic growth.
	Environment	• Impact on natural environment due to existing farming and aquaculture will not be significant	• Impact on natural environment and pollution caused by the construction work and operation of Economic Zone would occur.
	Social	• Impact on social environment that might be caused by the development of Economic Zone will not occur.	• Impact on social environment (road accident, social conflict, Community health and safety) caused by the construction work and operation of Economic Zone might occur.
	Environmental and Social Consideration	• Issues of environmental and social consideration might be more complicated and segmented in case random developments are conducted.	• Planned area development would effectively and comprehensively address environmental and social consideration issues.

Aspect	Condition Without the Project	Condition With the Project
Living environment	• Living environment of the adjoining area of proposed KUSHTIA EZ will improve slowly.	• Living environment for local residents would be improved due to the development of the surrounding infrastructure.
Resettlement	• Resettlement would not occur.	• Resettlement will be done followed by the ARIPA-2017 and ESS-5.
Source of labour	• The main source of labour is local residents.	• In with project condition, major sources of labour will be from migrant workers coming from across the country. Even some of the skilled persons might come from abroad.

Considering the overall technical, economic, environmental and social aspects as mentioned above, it is revealed that the selection of Kushtia EZ sites is more appropriate.

4.4 Geographic Location of the Project Site

The proposed Kushtia EZ is located int the following mouzas; Mokarimpur, Charmokarimpur, Arazisara, and Char Ruppur of Mokarimpur Union, Bheramara Upazila in Kushtia District. Geographically, the area is situated in the south-western part of Bangladesh between 24°00.220' north latitudes and 88°59.868' east longitudes. The total area of the proposed site is '420 acres. The Hardinge Rail Bridge and Lalonshah Road Bridge is situated within 1 km of the site. The project area mainly situated in the bank of Ganges River. Figure 4.4 shows the location of the Kushtia EZ.

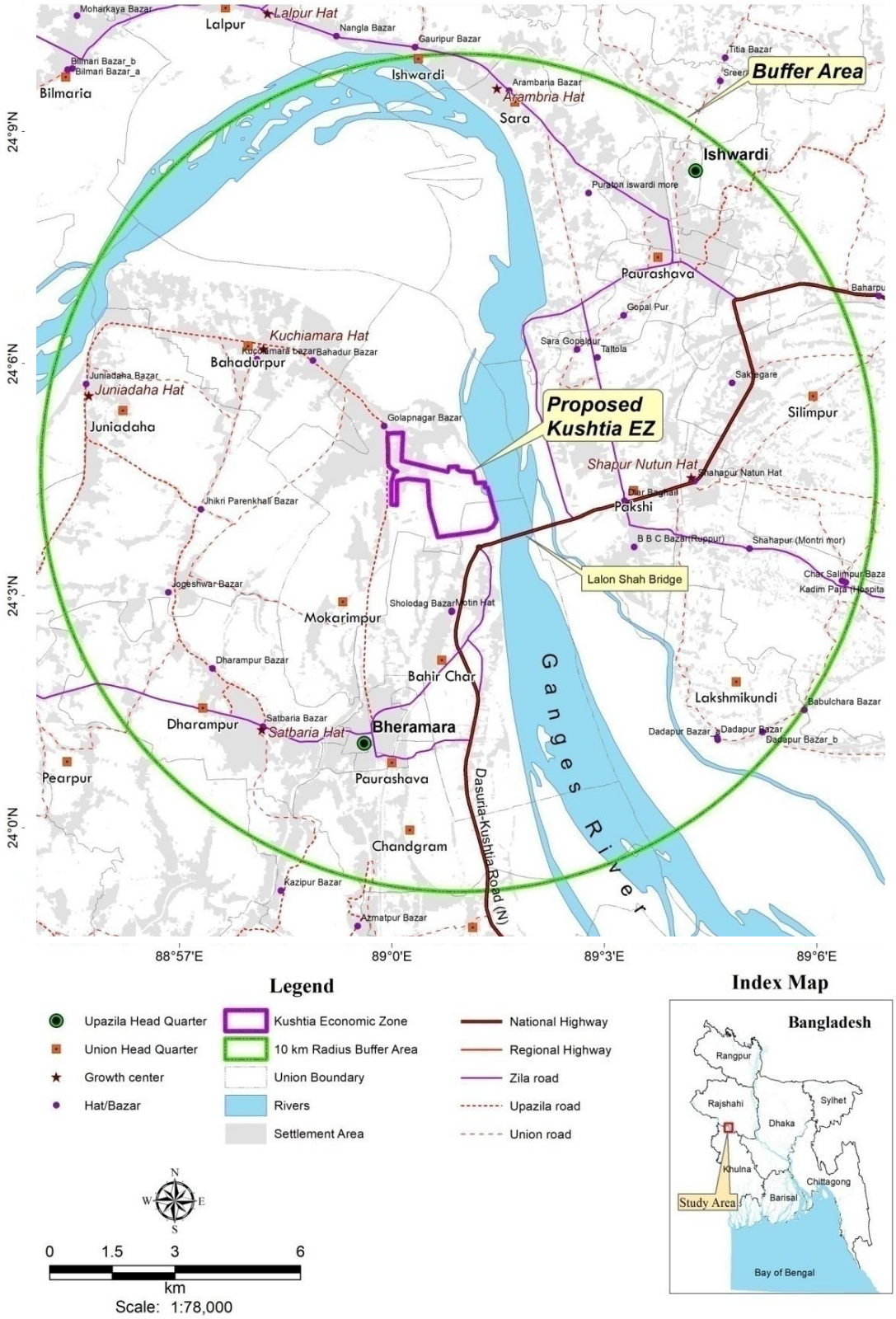


Figure 4.4: Study Area of Kushtia EZ

4.5 Area Demarcation

The site is proposed on '420 acres of land out of 1,654.27 acres under Arazishara, Char Ruppur, Char Mokarimpur and Mokarimpur mouzas. It is located adjacent to the Bheramara-Kuchiamara road, which is near Bheramara–Bahadurpur highway. The following table provides the land particulars of the proposed site.

Table 4-3: Land Particulars of Kushtia EZ

Upazila	Union	Mouza	JL No.	Area (acre)	Proposed Site (acre)		
					As per government documentation	Proposed to be added	Total Land
Bhera-mara	Mokarimpur and Bahirchar	Arazishara	11	113.8	5.01		5.01
		Char Ruppur	12	408.57	19.02		19.02
		Char Mokarimpur	3	761.48	287.97		287.97
			Proposed to be acquired (private land)			37.93	37.93
		Mokarimpur	14	370.42	70.07		70.07
Total				**1,654.27**	**382.07**		**420**

The land parcels under the column "As per government documentation" originally owned by Bangladesh Railway are currently under custody of BEZA through a government to government transfer mechanism.

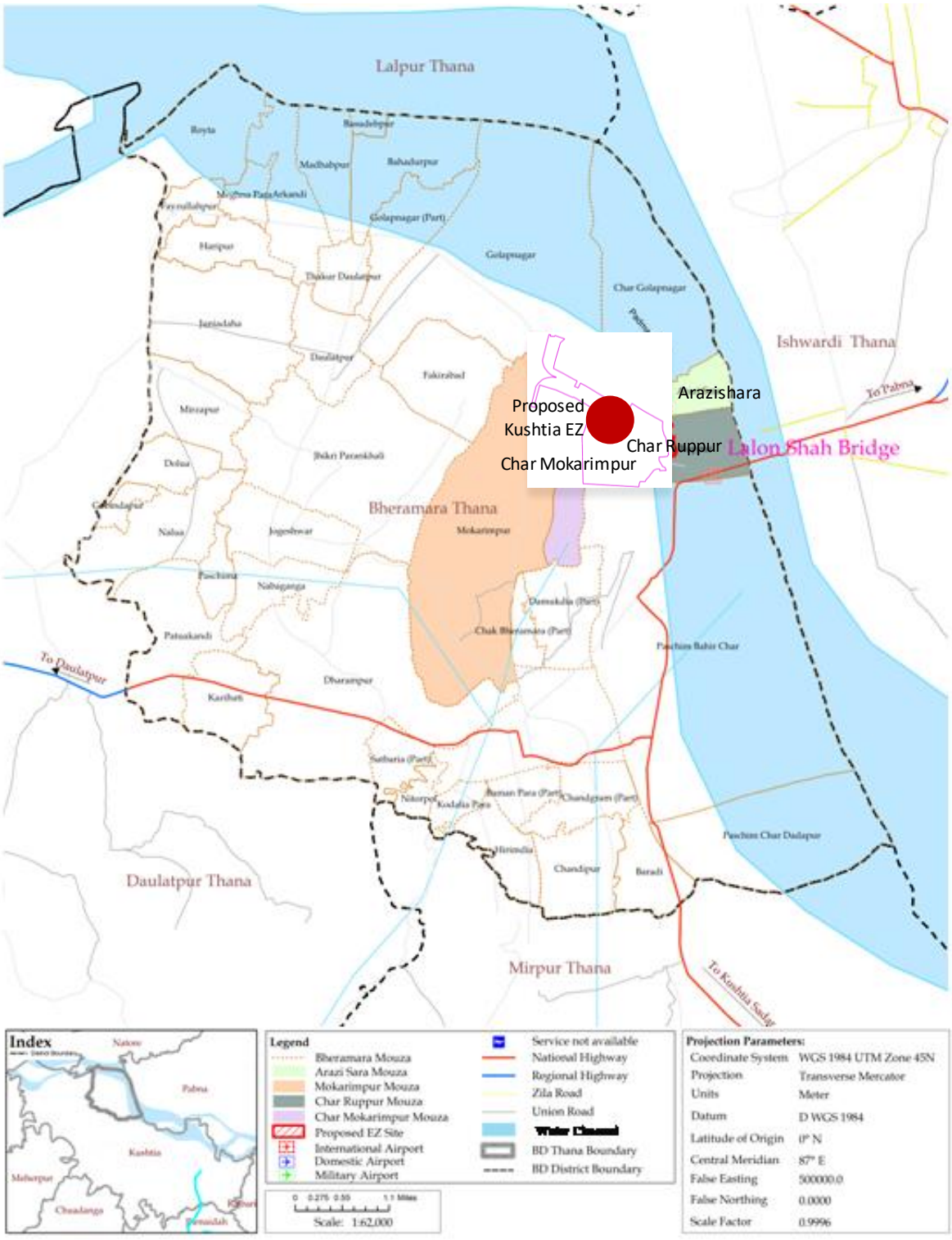


Figure 4.5: Proposed Kushtia EZ Site

4.6 Details regarding R & R involved in the project

The Government of Bangladesh has the right to acquire land for "public purposes" under Article 42 of the constitution. On the basis of this provision, the legal and policy framework for land acquisition and involuntary resettlement for the interest of the present Project will be synchronized based on the national Act: (i) the *Acquisition and Requisition of Immovable*

Property Act 2017 (Act 2017), and (ii) Resettlement and Social Management Framework (RSMF) under Private Sector Development Support Project (PSDSP) of BEZA.

Thus, the Project requires physical dislocation of those households and mitigates other adverse impacts. And, the affected persons will lose their access to resources for losing possession of resources. Some of those affected persons may require shifting to alternative forms of livelihood. Such involuntary loss of access to resources deserves involuntary resettlement. "Resettlement and/or rehabilitation" is a process by which the affected persons are compensated and those adversely affected are assisted along with compensation in their efforts to improve, or at least to restore, their incomes and living standards.

4.7 Project activities

Area of the site considered for development is '420 acres. At present only on-site developments will be carried out by KEZ. KEZ will develop the on-site facilities for the EZ site so as to provide ready to develop land and attract developers for development of the EZ. It will be developed by developer in later stages. On-site facilities to be carried out by KEZ are listed below:

Table 4-4: Details of On-site Facilities

Pre-ConstructionPhase
Necessary Paper work, permission
Construction Phase
• Boundary development • Development of land • Site preparation, labor shed construction, • Utility infrastructures • Mobilization of construction equipment and materials • Development of on-site road network • Establishment of administrative units
OperationPhase
Establishment of industries

Trees are to be fell for the development. The following table provides the details of the same.

4.8 Details of the trees to be fell for the project

Item	Quantity (nos.)	Rate in BDT/nos.	CUL including 100% premium (BDT/dcl)	Estimated cost (BDT)
Fruit Trees				
Large	891	5,200	10,400	9,266,400
Medium	792	3,000	6,000	4,752,000
Small	1,188	1,200	2,400	2,851,200
Timber Trees				
Large	693	10,200	20,400	14,137,200
Medium	1,089	5800	11,600	12,632,400
Small	1,386	2500	5,000	6,930,000

Item	Quantity (nos.)	Rate in BDT/nos.	CUL including 100% premium (BDT/dcl)	Estimated cost (BDT)
Banana	1,387	250	500	693,500
Bamboo	1,268	250	500	634,000
Total				51,896,700

4.9 Off-site Infrastructure

In order to develop an economic zone, a multimodal transportation platform comprised of roads, waterways, and rail connections must be considered. The regional and local road networks surrounding the project are critical because they will transport and transfer vehicles on and off the zone. Transportation and land use planning must be integrated to achieve the overall goal of increasing accessibility throughout the economic zone. The capacities of the adjacent local access roads need to improve for better communication, and the number of existing links into the project need to increase. As a result, the road system will need to be upgraded and improved for functional characteristics of the project, as well as the passenger and freight movement patterns. The major communication networks near to the project are:

- Bheramara–Bahadurpur highway runs near the proposed site
- Bheramara-Kuchiamara road is adjacent
- Kushtia- Jhenaidah highway (N704)
- Lalonshah bridge
- South and east side connected by union/local roads
- A rail line from Bheramara railway station runs adjacent the site. The railway station situated around 7 km.
- The Hardinge bridge (on railway) and Lalonshah bridge lie within one km from the site.
- Pakshi rail station connected with the proposed project site by Lalonshah bridge and Kushtia- Jhenaidah highway (N704).

4.10 Proposed Off-site Physical Connectivities

4.11.1 Road Network

Better communication depends on the interconnectivity of the local, regional, and national highways. The site is within one km of Kushtia-Jhenaidah Highway (N704) which connects northern part of Bangladesh to West and South-Western Part of Bangladesh. The site is accessible from Jashore via N704. The distance by road is around 155 km and takes approximately 3-3.5 hr. The site is also accessible with Dhaka by Lalon Shah and Jamuna bridges. The distance between Dhaka and Bheramara is about 230 km (takes about 5-6 hr at present).

At present the capacity of the local access roads adjacent to project area are limited and the widths are inadequate to cater to the new volume of traffic. Therefore, in future heavy traffic generated by the EZ may hamper normal traffic movement. Hence, the network needs to be upgraded and improved.

- An overpass is required to enter and exit the EZ, in addition to at-grade approach road.
- Bheramara-Kuchiamara road needs to be improved for future traffic volume.
- Because the current road network (local/union level) is not sufficient to meet future transportation demand, such roads must be widened and improved.

- A U-turn is proposed, 500 meters away from the Lalon Shah bridge square on the Kushtia-Jhenaidah Highway (N704) to enter the project area.

Although the site is adjacent to the rail line, Bheramara railway station is the nearest. To link the site with railway, a separate study needs to be carried out through creating parallel rail lines to cater for the EZ.

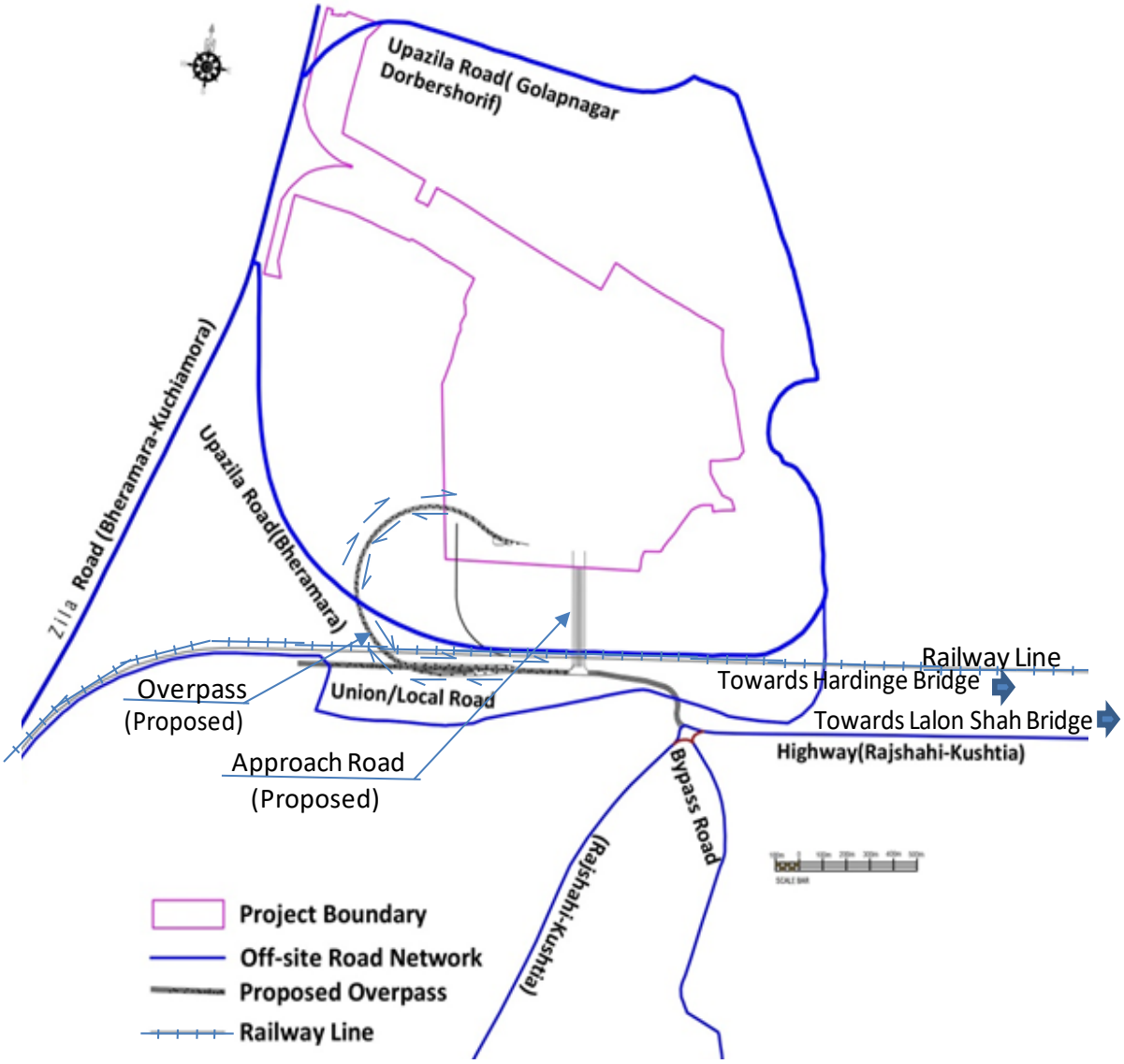


Figure 4.6: Off-site Infrastructure (Transport Network)

4.11.2 Railway

The project area can be connected with rail line. A Bheramara railway station is around 7 km from the proposed project site. The railway line runs (10 km) through Bheramara upazila. The Hardinge Bridge (on railway) and Lalonshah Bridge lie within 1 km from the site. Cargo facility is available at Bheramara rail station and goods are transported to Khulna and Rajshahi divisions from this region. Pakshi rail station connected with Bheramara railway station by Lalonshah Bridge and Kushtia- Jhenaidah Highway (N704). Both the stations are well connected to other parts of Bangladesh. In order to promote multimodal connectivity, a single rail line connecting with Bheramara station is proposed for this project. The container/goods can easily load and unload on this proposal, so it reduces the pressure on roads.

4.11.3 Airway

It is located at a distance of around 30 km from Ishwardi Airport and 80 km from Rajshahi airport. Approximate travel time is 45 min and 2-2.5 hr respectively by road. Proposed project site is located at a distance of around 30 km from Ishwardi Airport and 80 km from Rajshahi airport. Approximate travel time is 45 min and 2-2.5 hr respectively by road.

4.11.4 Water Way Network

The site is located at the bank of Padma River. The Padma is a major river of Bangladesh. It is the main distributary of the Ganges, flowing generally 356 km to its confluence with the Meghna River near the Bay of Bengal. Distance of the site form the river is within hundred meters. However, presently no water way passenger service operates nearby the site. However, barges plies regularly through the river for carrying sand nearby the site.

4.11.5 Off-site Power Infrastructure

Bheramara Upazila is under Kushtia Palli Bidyut Samity (PBS) and power is fed from Bheramara 33/11 KV Substation, capacity 20 MVA at a location in Baro Mile where its grid connectivity from Bheramara 132/33 KV grid (capacity 2x25/41 MVA).

The proposed BEZA site is 10 km from Bheramara 33/11 KV substation and 6-7 km from Bheramara Grid Substation. As per infrastructure and facilities to be arranged and based on industrial load assessment, where power demand for the proposed Kushtia EZ will be about ‘32.79 MW. During construction period, power requirement for running construction equipment and machinery items in EZ areas is estimated to be approximately 1-2 MW power.

The private unit investors however, may have and will undertake a separate industrial assessment for their own industries. But the power load master planning in BEZA site has to be linked with the entire power load management. To cater the forthcoming power requirement, 132/33 KV grid substation and a dedicated 33/11 KV substation at Kushtia EZ site area have been taken into consideration.

Existing Facilities

Presently, there exist an 11 KV line to Bheramara upazila from Bheramara 33/11 KV sub-station (capacity 10 MVA) at a location in Baro Mile, which is about 10 km from proposed EZ

site and have its grid connectivity from Bheramara 132/33 KV grid substation (capacity 2x25/41 MVA).

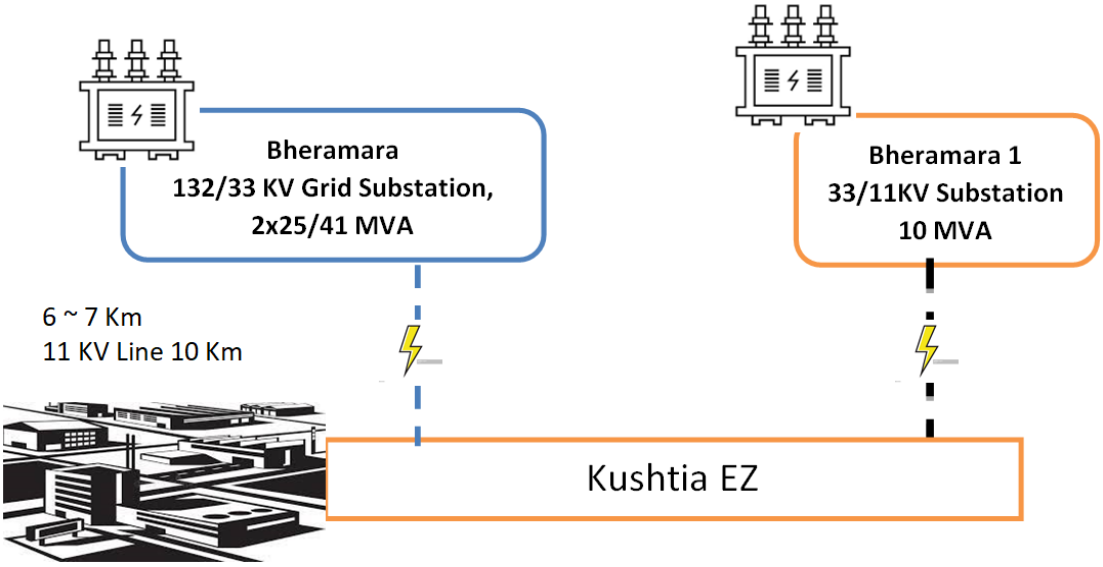


Figure 4.7: Existing Power Infrastructure

As shown above, there exists an 11 KV line nearby BEZA site, which may be connected to 11/0.4 KV substation of the EZ for receiving Power.

New Off-site Power Facilities being proposed

For running equipment and machinery during construction of the EZ, approx. 1~ 2 MW power is estimated to be required. The power demand during operation will be around '32.79 MW, which is planned to be fed from the following off-site power facilities being proposed to be added:

(1) 132 KV grid line up to BEZA site: It is to be newly installed for carrying power from 132/33 KV Grid Substation at 132 KV ate Bheramara to connect 132 KV line at EZ site.

(2) 11 KV line: There exists 11 KV line nearby the BEZA site from Bheramara 1 33/11 KV sub-station at Baro Mile area, which will be drawn to BEZA site and will be connected to 11/0.4 KV substation at project site for receiving power. HT Power in 11 KV as well as LT power in 0.4 KV will thus be made available for construction activities and will be additionally be available during operation.

Availability of Power in 11 KV, 33 KV, 132 KV : BEZA will be capable of making power available in (a) 132 KV (30 MW ~ 140 MW), (b) 33 KV (5 KW ~ 30 MW) and (c) 11KV (50 KW ~ 5 MW) according to the respective power demand of the industries concerned. For connectivity with (a), (b) and (c), proposed 132 /33 KV substations (2x25/41 MVA capacity) will be used with the provision for providing 33 KV line from spare bay of 132 KV line. For (c) either exiting 11 KV line or with the proposed 33/11 KV, 2x20/28 MVA indoor SS will be sourced.

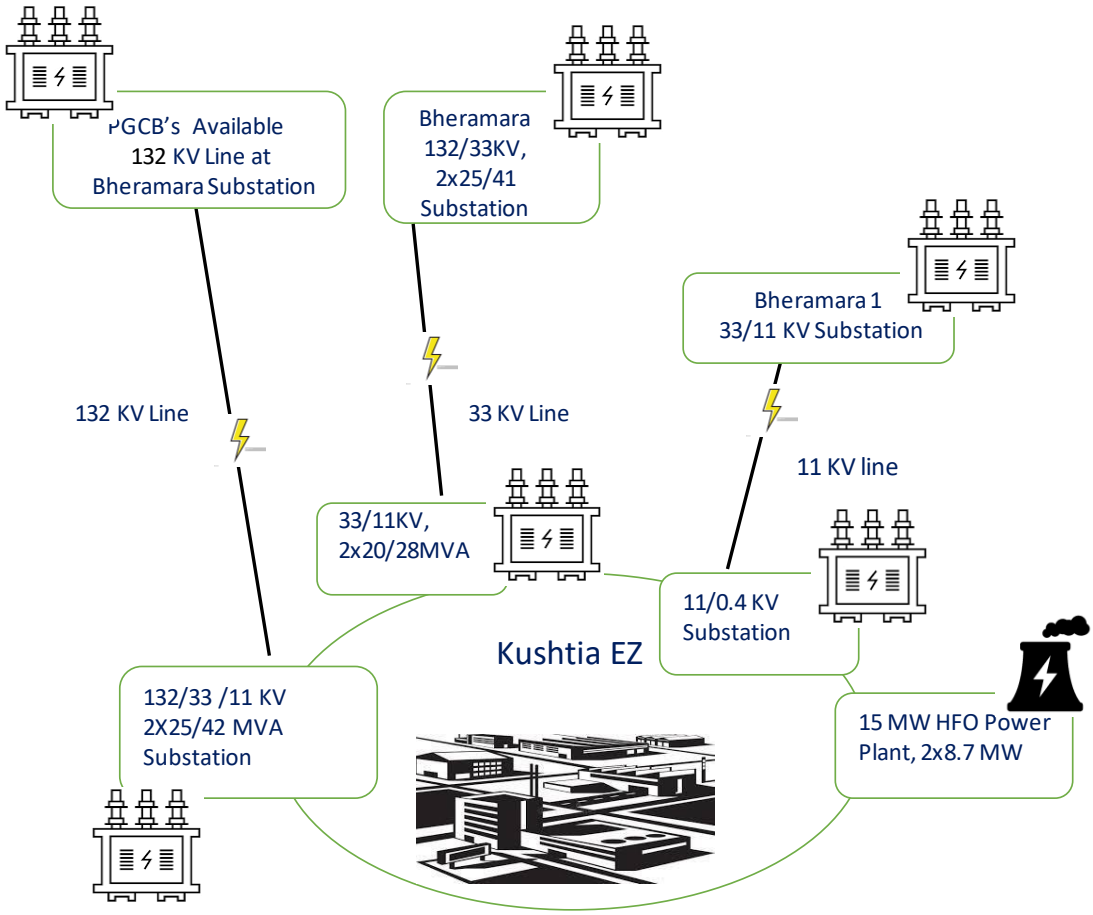


Figure 4.8: Proposed Power Connectivity Route to the Site

Table 4-5: Off-site Power Infrastructure Proposed to be Added

Power Infrastructure		Nature of the Facility	Status	Connectivity	Line	Capacity		Comments
					KV	MVA	MW	
(1)	132 KV grid line up to the zone site	PGCB 132 KV Gridline	Recommended and to be newly installed/ constructed by PGCB	From 132/33 KV Grid Substation, Bheramara to connect 132 KV line at EZ site	132			
(3)	11 KV power line	11KV line		From 33/11KV Bheramara 1 Substation to the area near the site of BEZA	11			11 KV line upto BEZA site for receiving power to 11/0.4 KV distribution transformer

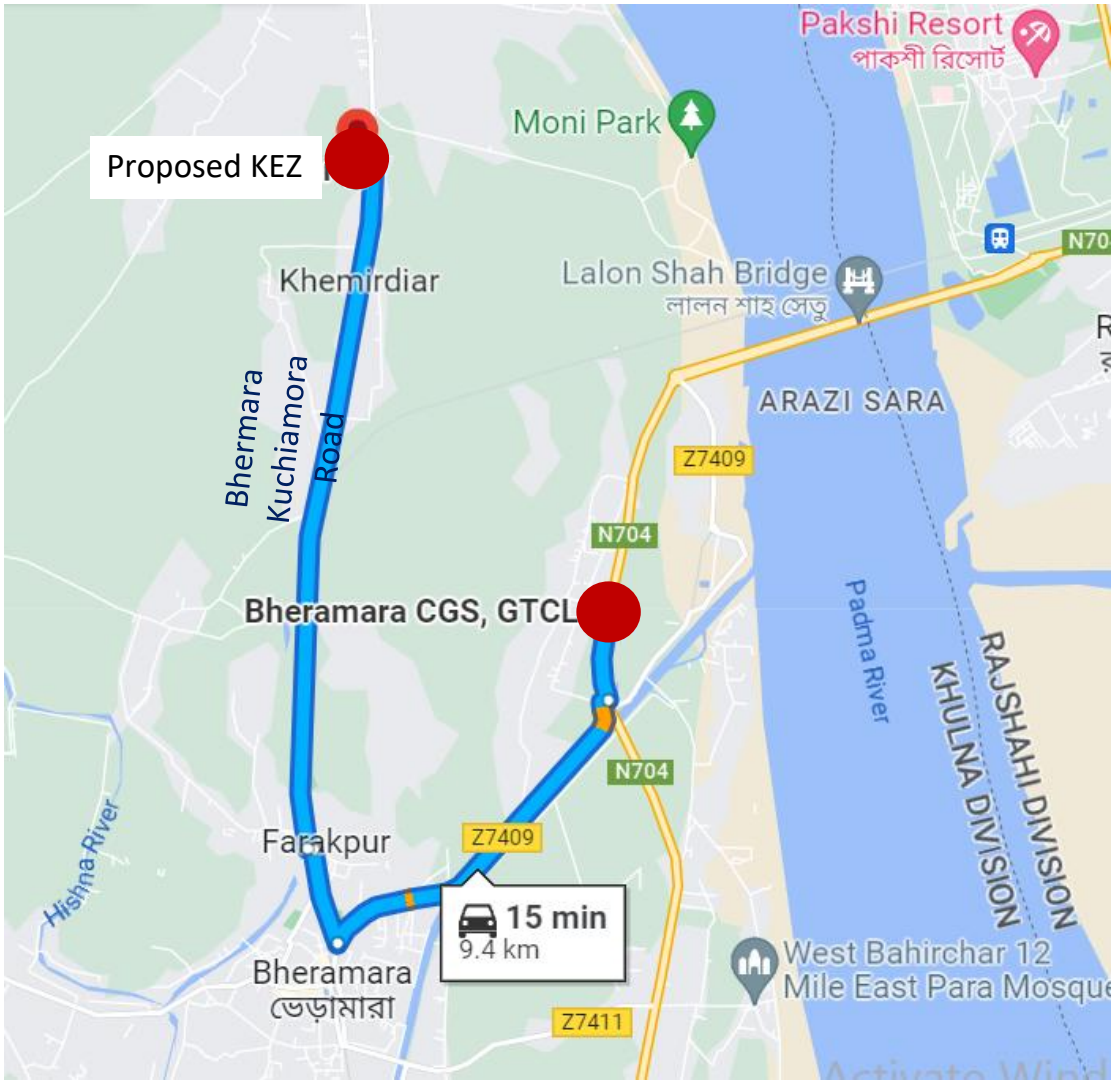
4.11.6 Telecommunication

Kushtia already established its optical fiber communication and telephone exchange nearest to Mokarimpur. Distance between the hub and the proposed area is '5.00 km. BTCL has verbally confirmed that there is enough bandwidth for the proposed project site. For establishing a control room of BTCL, an area of 200 sft is needed.

4.11.7 Gas Supply to EZ

Sundarban Gas Company Ltd. has suggested gas line to KEZ from Bheramara CGS of GTCL located alongside N704 (Rajshahi Kushtia highway).[2] Bheramara 410 MW combined cycle power plant, a nearby power generation facility, also draws gas from the CGS.[3] It is estimated that around '9.40 km pipeline is to be laid through Bheramara Kuchiamara road to connect the site to the CGS.

The following figure illustrates an indicative route of the gas pipeline for supply of gas to the site.



[2] Jhenaidah-Kushtia-Dashoriya highway in alternative name
[3] The CGS draws gas from Battail 23 km away.

4.11.8 Water Intake to EZ

Around '15,866,390 liters of water per day is estimated to be required. Multiple sources of water need to be utilized for the zone as and when appropriate for taking care of environment and at the same time fulfilling the demand for the zone. The sources of water are given below:

(1) surface water of Padma river
(2) rain water run-off
(3) deep tube well

Surface Water: Surface water is recommended as one of the sources of water supply to the zone, due to its least impact on the environment. The Padma is a potential source of surface water (Figure 4.10).

The water level at the river is subject to seasonal variations and will not be available with sufficient quantity even during season as per BWDB water discharge data. It indicates a large oversupply during monsoon and an undersupply during dry months (Jan to May). In any case, it is recommended to keep the surface water source option open to reduce pressure on ground water, even if it is not sufficiently available during dry season, but abundant during seasons when rain water from upstream is naturally available in the Padma during June to October period, as shown in the following figure:

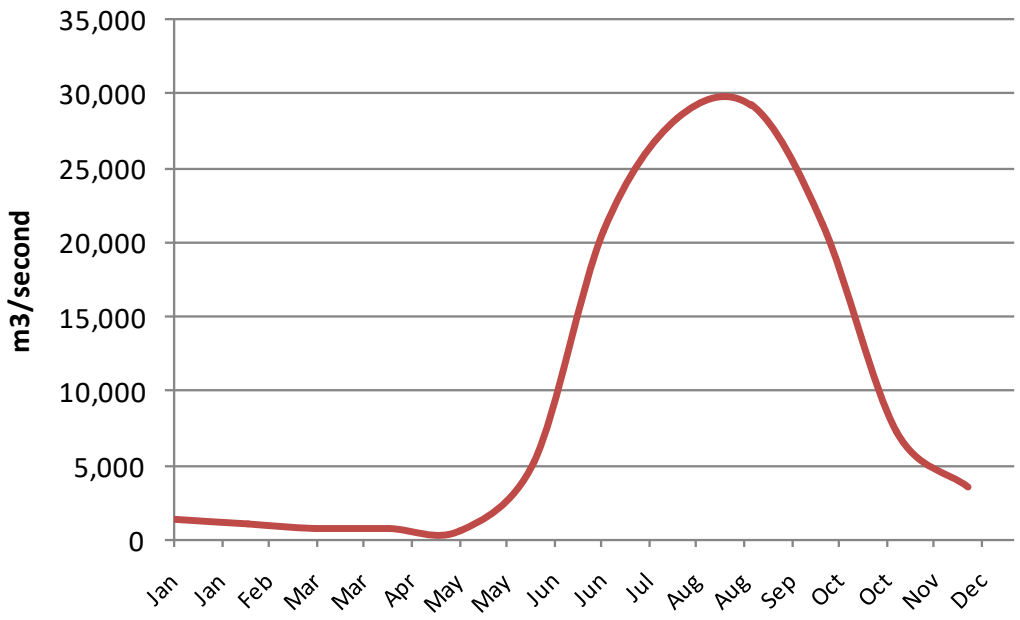


Figure 4.9: Time vs Water Discharge (for SW 90 Hardinge Station)[4]

The water shall be drawn by pipeline from the Padma intake point. It is around 4 to 5 m deep underneath and at a distance of 750 m from the bank near Hardinge Bridge. The distance of the site from potential intake point at Padma is around '1,850 m including under water pipeline.

[4] In 2021

Length of the Pipeline	=	From boundary of the EZ upto bank line	+	Alongside bank line	+	From the bank line upto the intake point at the Padma (under water)
	=	‘200 m	+	‘900 m	+	‘750 m
	=	‘1,850 m				

The length and width of land required for laying water intake pipeline at the entry point upto the bank of the river is estimated to be ‘200 m x ‘21.75 m, which translates to around ‘2.19 acre over char land of Arazi Sara mouza.

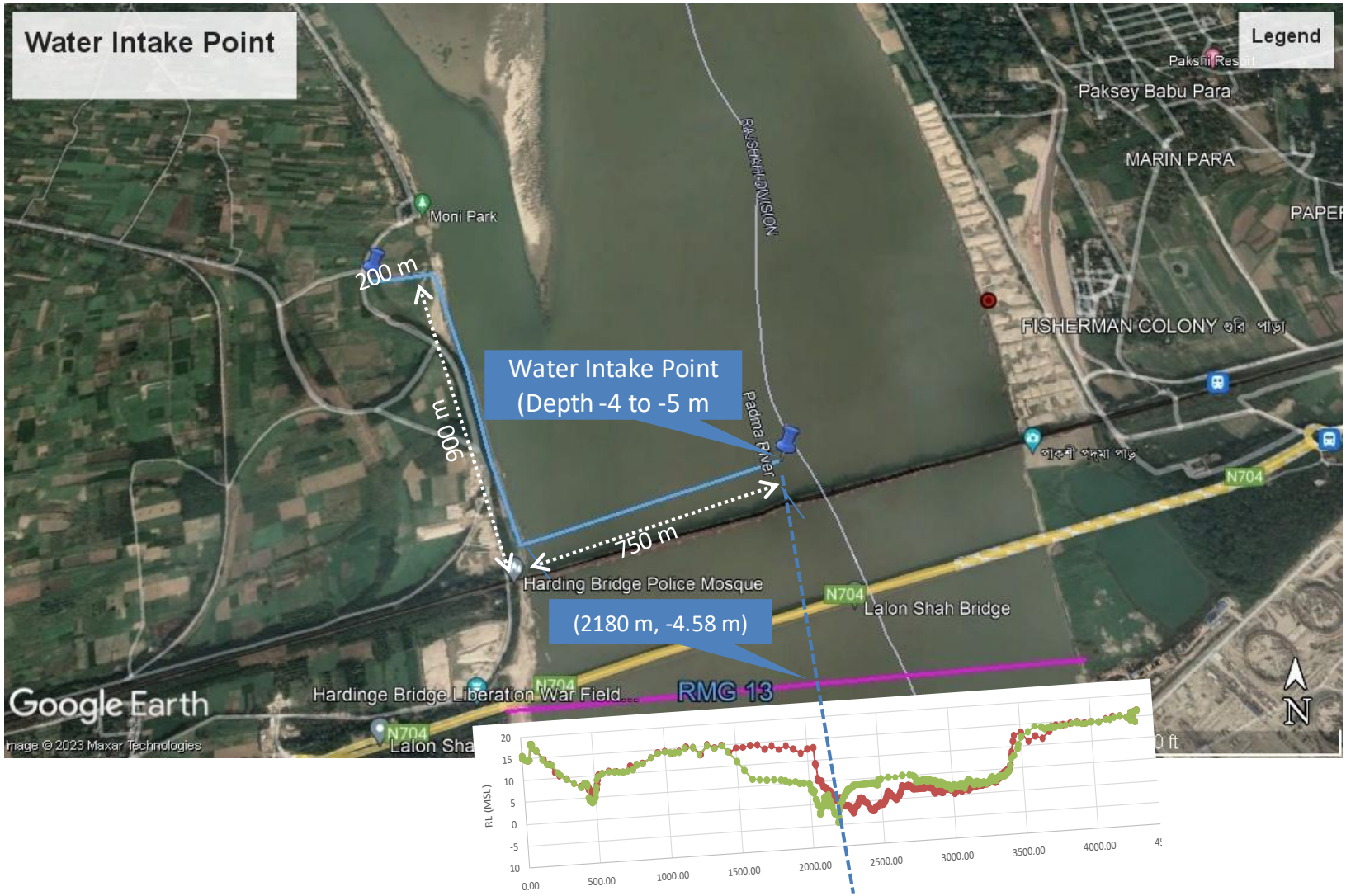


Figure 4.10: Water Intake at the EZ

4.11.9 Drainage and Flood

Flood levels on and around a site are mostly linked with the water levels at the nearest river *i.e.* the Padma and nature of water reservoir capacity in the catchment area. The following figure shows the location of the BWDB gauge SW 90.

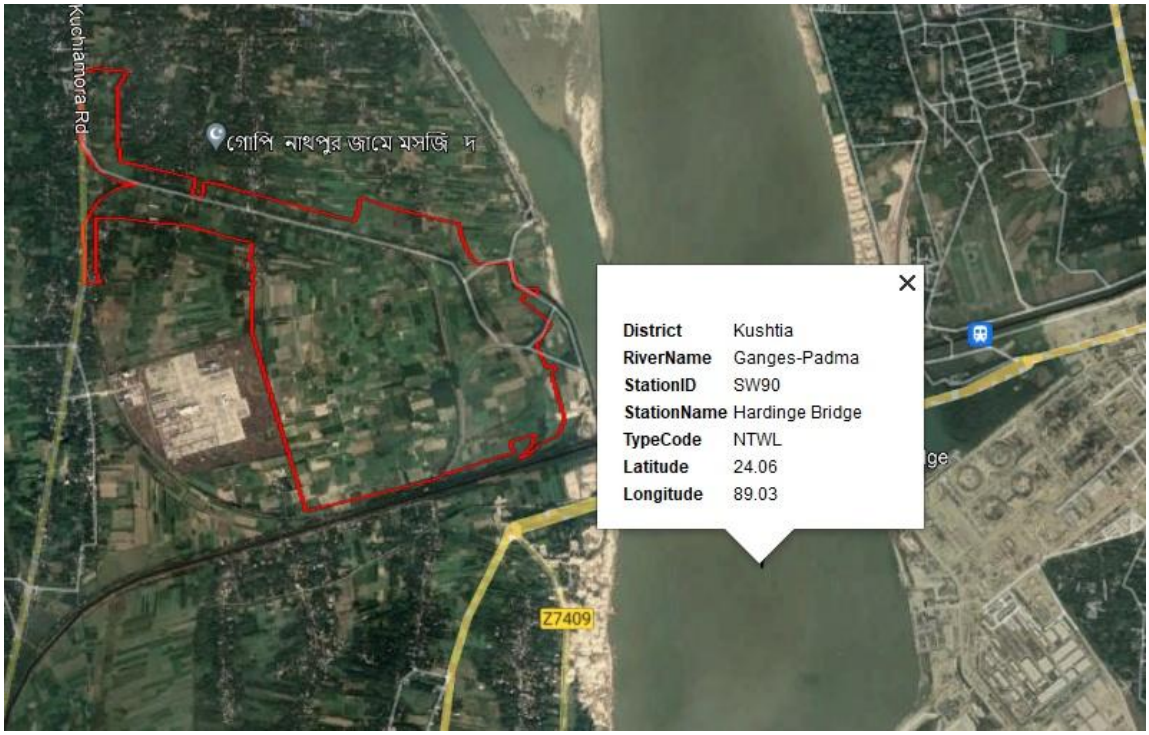


Figure 4.11: Site Location with Respect to Gauge

Daily water level data were obtained from 1988 to 2020. The following graph shows the time vs water level data. There are some missing data from 1994-1996. Based on the data it can be seen the highest flood level for this location occurred in 1988 and 1998. The flood level in 1998 was approximately 15 m PWD. The following table provides the details of water level measuring station with the highest water level in the Padma.

Table 4-6: Highest Water Level[5]

Station ID	Station Name	Year	Highest Water Level (m)
SW90	Hardinge Bridge	1998	15 m PWD equivalent 14.54 m MSL

This highest water level has been assumed as a benchmark as the filling height for land development for the zone as discussed in Section 4.12.1.

4.11.10 Drainage from the Site

The drainage will be required mainly for discharging rain/storm water and the discharge from the effluent treatment plant. It is recommended to connect the discharge after treatment from the drain to the Padma River.

The discharge point will be connected to the river through a canal to be located in the Char Ruppur mouza, which is estimated to be '339 m long between the discharge point at the

[5] Bangladesh Water Development Board, Processing and Flood Forecasting Circle, Green Road, Dhaka

boundary of the site and the river and ‘22 m wide (*i.e.* occupying around ‘1.84 acres of land). The surface water discharge is also connected to the river as well. The following figure indicates the discharge canal.

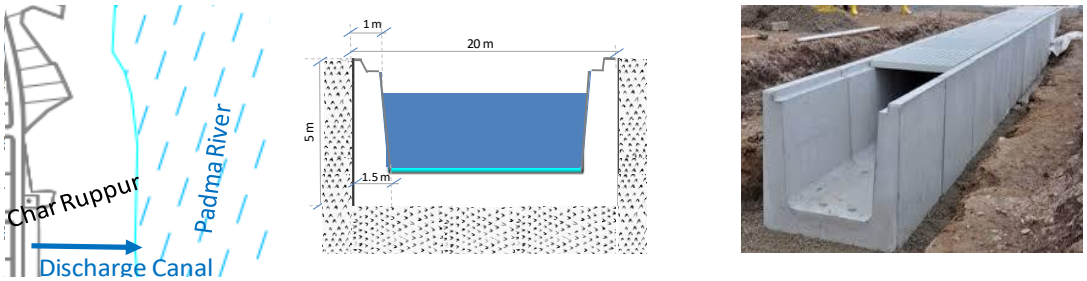


Figure 4.12: Plan and Cross-section of Off-site Drainage Discharge Canal

4.11 On-Site Infrastructure

Transportation system integration is critical to achieving the overall goal of increasing accessibility throughout the zone. Integrate various modes of transportation - road, rail, and waterway - so that each can be used to its full potential and people can move easily throughout the zone. External linkage development is important for improved communication, in addition to improving the internal circulation network.

4.12.1 Land Filling and Sand Supply

Based on the spot elevations, the site level varies from ‘16.31 m to ‘12.91 m MSL (average ‘14.61 m). The following figure shows the spot elevations in MSL for the site.

Figure 4.13: Spot Elevation on Topographic Survey

This level has to be tested against the highest water level in the Padma. The 100 years highest flood level based on the frequency analysis is ‘15.14 m MSL in 1998. With a 1 m freeboard, the proposed formation level for the site will be‘15.14+‘1.0=‘16.14 MSL.

Based on this information the average fill on the site could be ‘16.14 - ‘14.61 = ‘1.53 m.

This translates to a requirement of around ‘31.2 lakh cum of sand with the assumption that 20% more material is needed to allow for compaction.

4.12.2 Sand Supply Source for Land Filling

The sand for land filling has to be sourced from underneath inland water. The nearest similar sand hub lies at the bottom of the Padma on the opposite side near Soleman Babar Astana, which is around ‘3.50 km from the proposed zone. The sand may be transported to the zone through dredging from the bottom of the river near Soleman Babar Astana and carried through sand slur carrying pipes. The following figure illustrates the route and cross section of dredging pipe:

Figure 4.14: Route for Pipeline Carrying Sand and Cross Section

4.12.3 Road

Within the project area, a road hierarchy has been designed with the goal of: segregating processing and non-processing areas to improve safety within the zone, road network design in a grid pattern to reduce congestion and constructing secondary and access roads to improve accessibility to projects and plots. All road networks will be designed considering services and utilities in mind. The following types of roads are proposed for this project area.

Table 4-7: On-site Road Categories

Road Categories	Width (ft)	Length (m)
Avenue Road	150'	‘1,354 m
Collector Road	100'	‘1,462 m
Secondary Road	80'	‘6,133 m
Tertiary Road	60'	‘673 m

The following figures show the road network with cross sections.

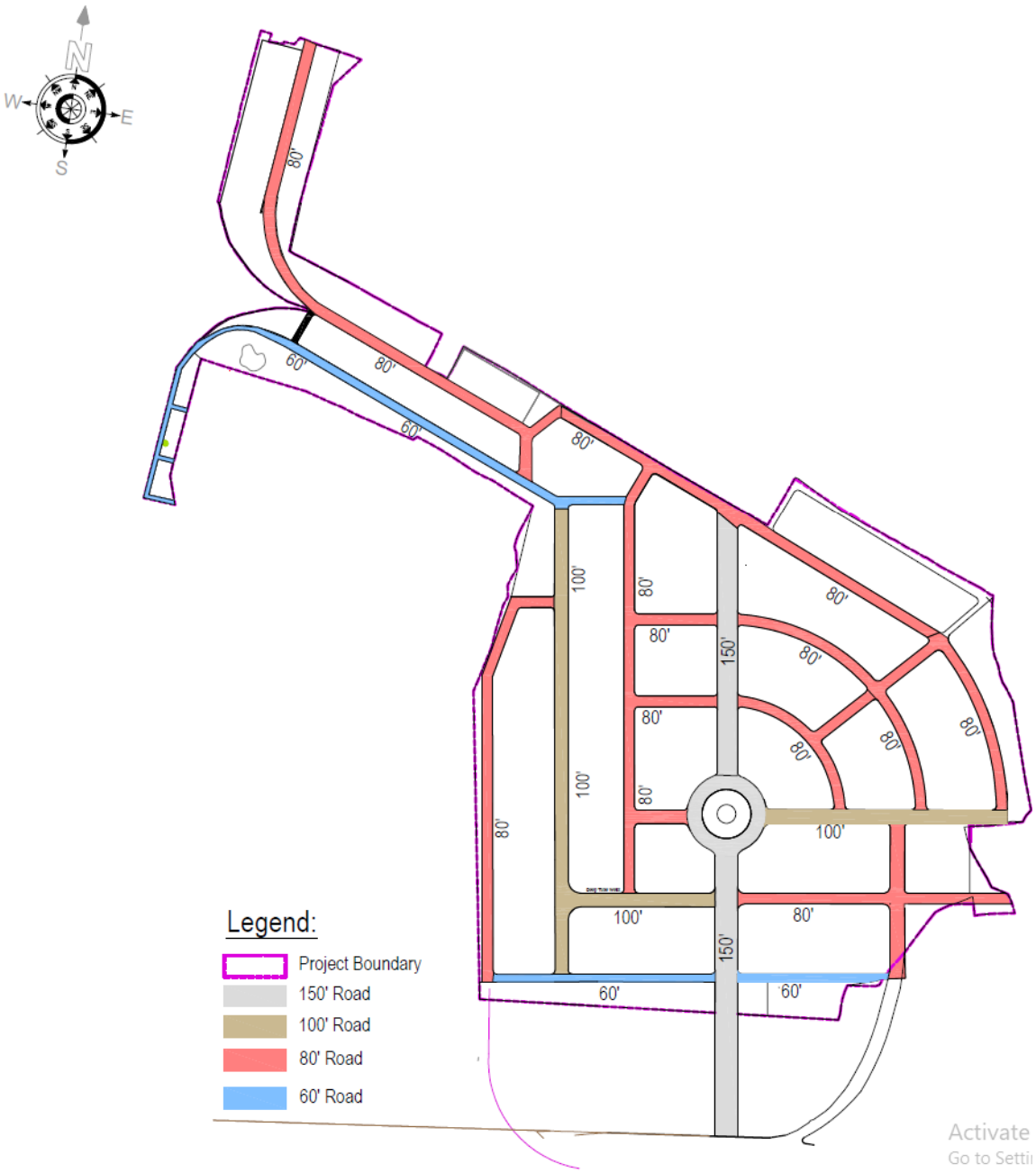
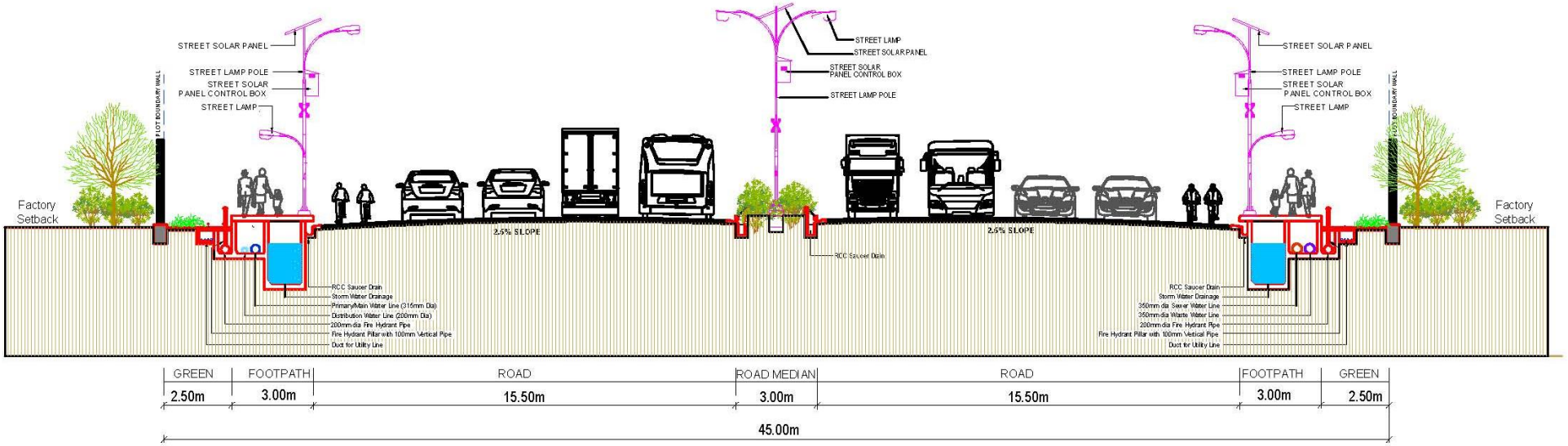
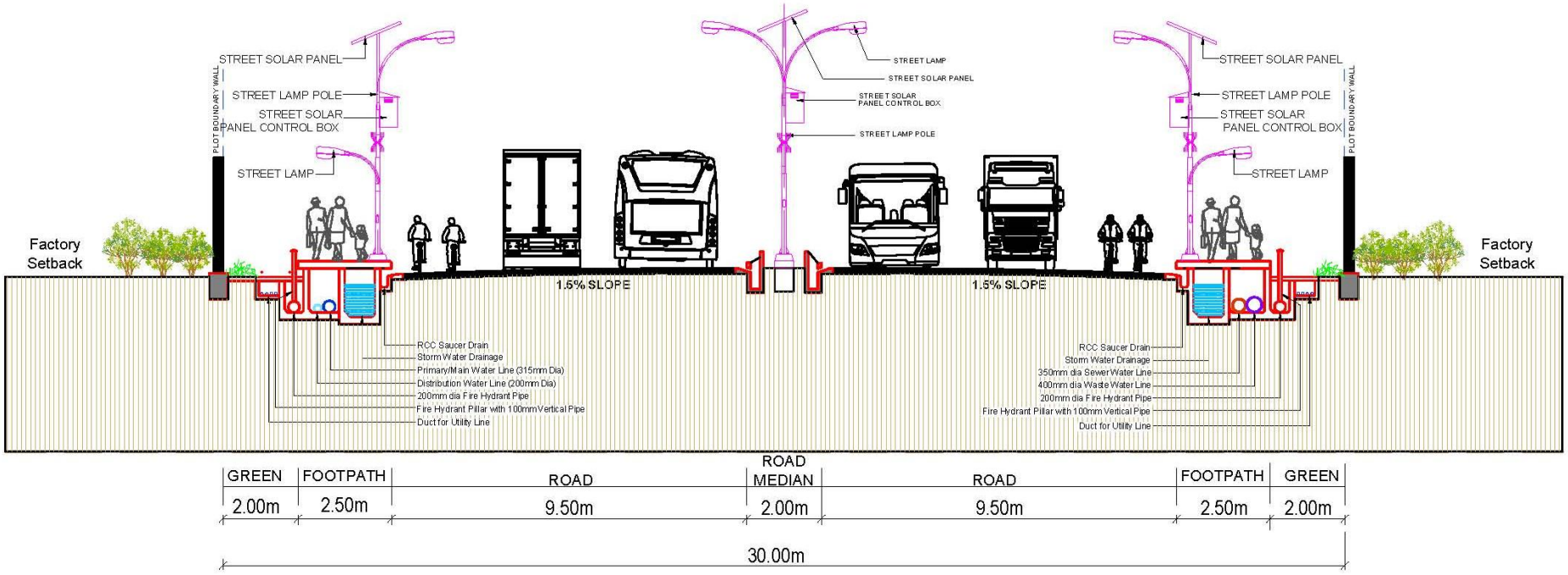


Figure 4.15: Road Network inside the Proposed EZ

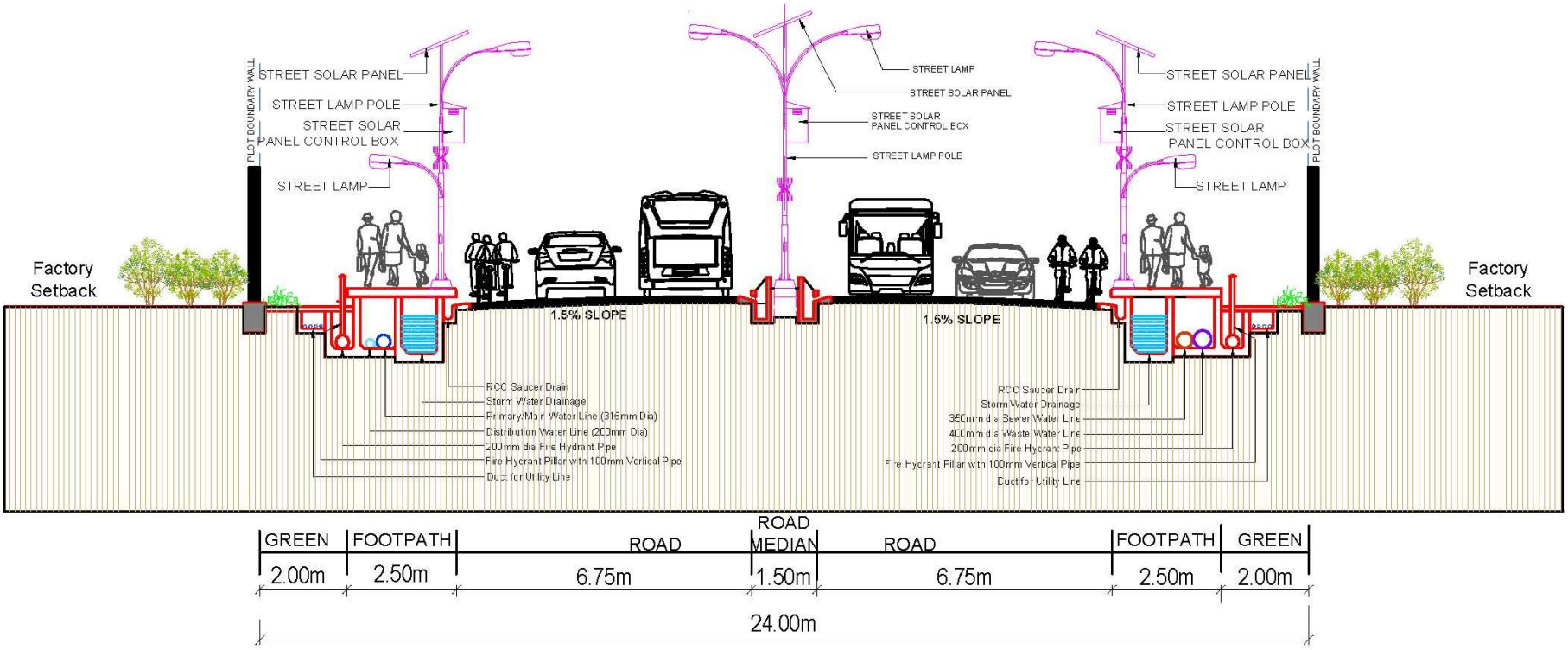
Figure 4.16: Road Cross Sections



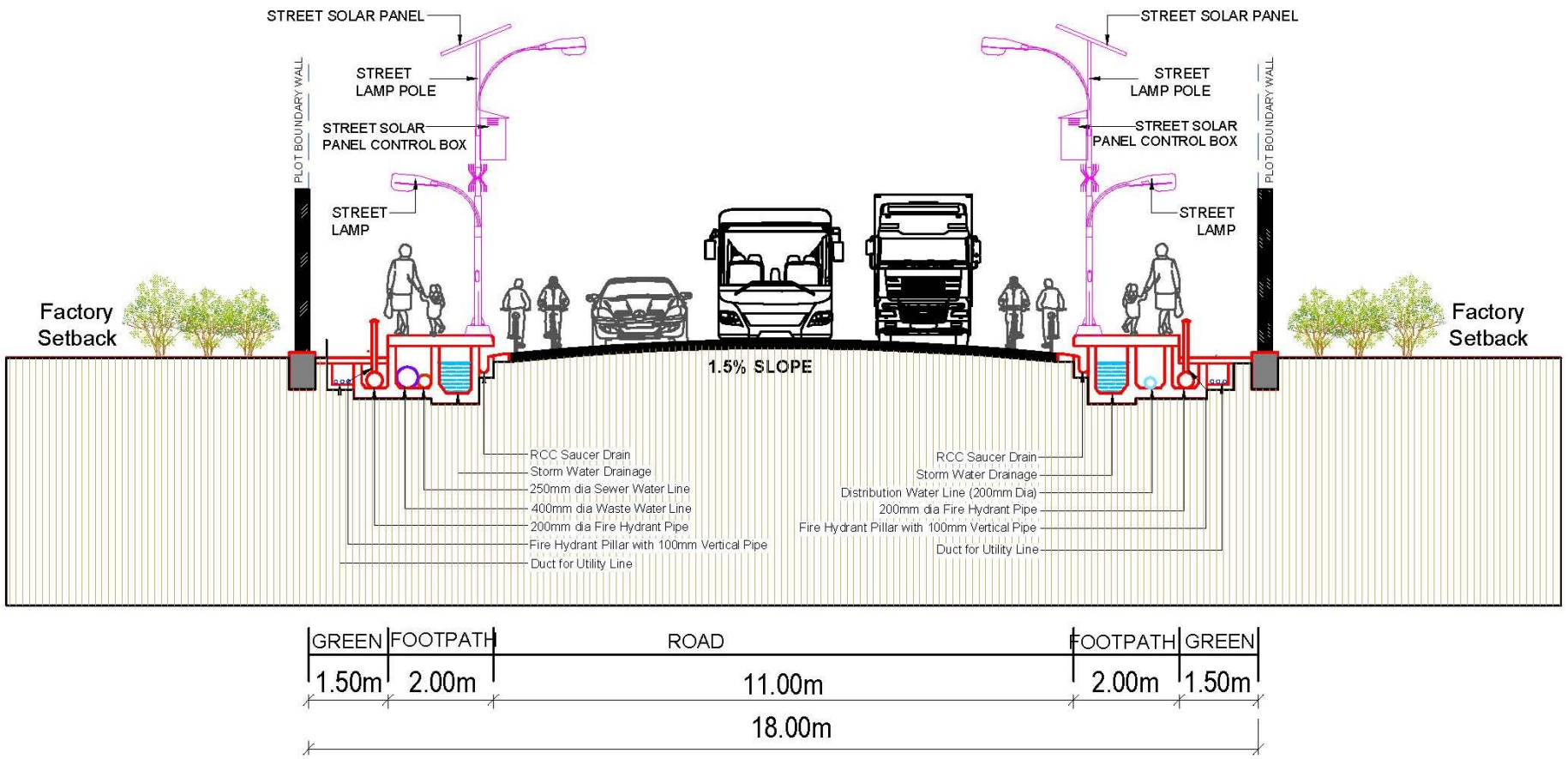
[45 meter or 150 ft]



[30 meter or 100 ft]



[24 meter or 80 ft]



[18 meter or 60 ft]

4.12.4 On-site Power Supply and Distribution Infrastructure

The EZ will be fed from a substation or a HFO based on-site power plant. The power will be distributed through a distribution network throughout the zone. The following on-site power supply and distribution facilities are being proposed to be added:

(1) 33/11KV, 2x20/28 MVA Indoor SS: A dedicated 33 KV line from Bheramara 132/33 KV Grid Substation will be drawn to proposed 33/11 KV substation at BEZA site for availability of power at 11 KV, and which will be used during Construction phase and will be additionally be available during operation phase. To construct this substation about one acre land will be required in BEZA site and a dedicated 33 KV transmission line from grid substation to BEZA site will be installed.

(2) 132/33 KV grid Substation (2x25/41 MVA capacity): Grid substation along with associated transmission line to be constructed by PGCB. As per PBCB's objective to ensure adequate power supply for all the proposed economic zones, proposed Kushtia132 /33 KV substation will facilitate 33 KV lines to the site. Such grid substation with 2x25/40 MVA capacity with provision of a few 33 KV bay breakers will be proposed to PGCB by BEZA.

(3) 11/0.4 KV, 2X100 KVA Substation: The facility is being proposed to be constructed and installed to connect with 11 KV line to cater for 0.4 KV power in BEZA site

(4) 15 MW HFO based Power Plant: for partially mitigating power in blackout condition or shut down in the power grid line during operation of the EZ. This can be installed as an additional / emergency power source of the 2x8.7 MW power plant, designated earlier for running construction activities, for up to 15 MW. It will also be operated on emergency during operation phase.

(5) 11 KV distribution line: It is being proposed to be newly installed within the EZ to be linked with (1) for distributing 11 KV power to the EZ industries.

The technical specifications of the on-site power facilities recommended to be added are provided in the following table:

Table 4-8: On-site Power Facilities to be added

Power Infrastructure	Nature of the Facility	Status	Connectivity	Line Voltage	Capacity	Comments
(1) 33/11KV indoor Substation	33/11KV indoor Substation	Recommended to be newly installed/constructed at Kushtia BEZA site	To be backward linked with 132/33 KV Grid Substation, Bheramara	33KV	2x20/28 MVA	Dedicated substation necessary to start construction of the site and during operation
(2) 132/33KV grid Substation at BEZA site	Grid Substation	Recommended to be newly installed/constructed by PGCB at Kushtia BEZA site	To connect with 132 KV grid line	132/33KV	2x25/41 MVA	
(3) 11/0.4 KV, 2X100 KVA Substation on-site	Substation	To be constructed and installed	To connect with 11 KV line	11/0.4KV	2X100 KVA	To cater for 0.4 KV power in BEZA site
(4) 15 MW HFO based Power Plant	Power Plant	To be constructed and installed				Recommended to be installed/ constructed for additional /emergency power source
(5) 11 KV distribution line within the EZ		To be newly constructed and installed	To be linked with (1)	11KV		Necessary for feeding operation of the EZ

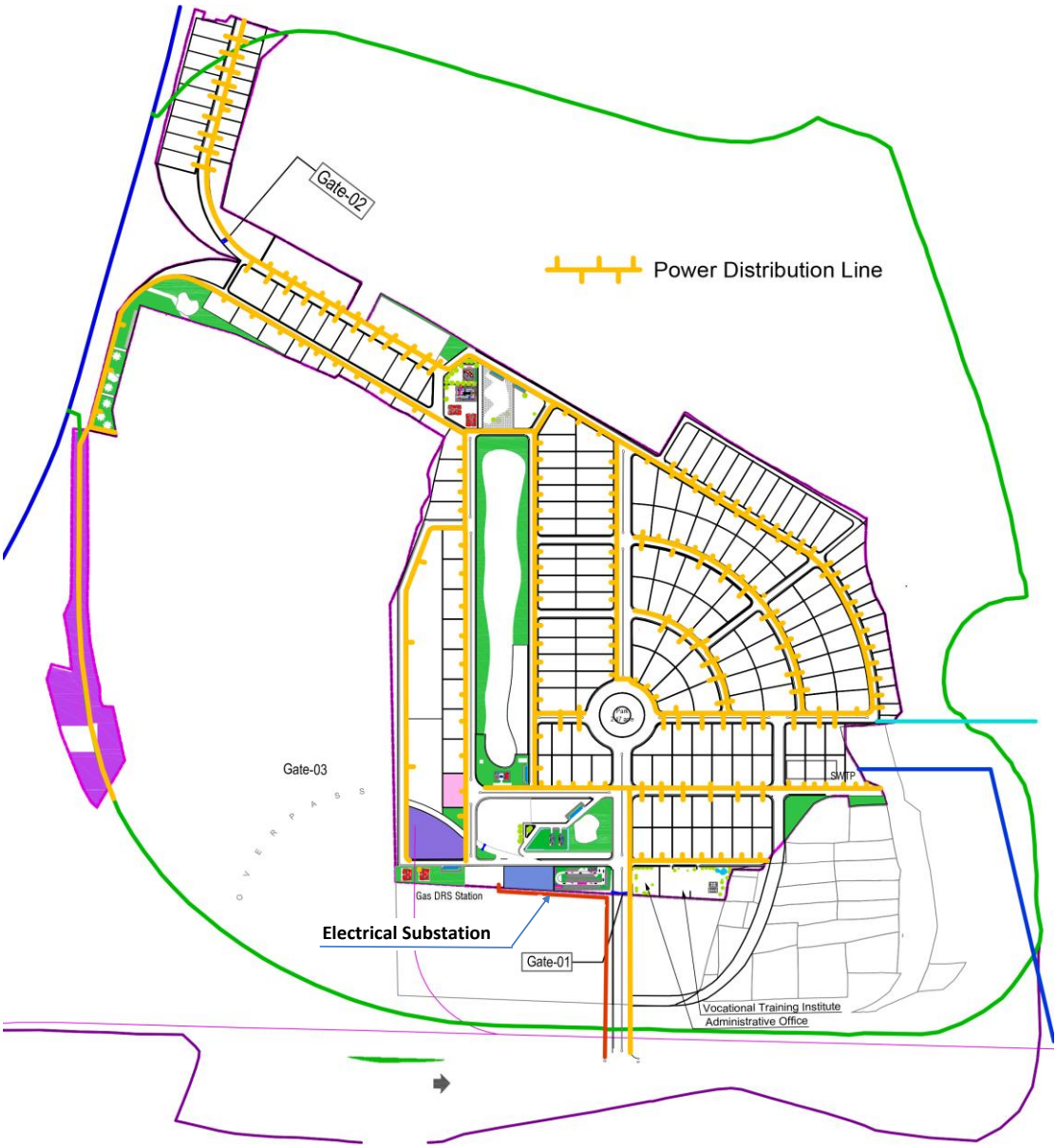


Figure 4.17: Proposed 11 KV OH Internal Power Distribution Network

4.12.5 Water Supply and Distribution to EZ

Around '15,866,390 liter/day will be required in the EZ. The following figure shows the internal water supply network in the proposed EZ with water intake location:

Figure 4.18: Internal Water Supply Network

The following table provides the lengths of water supply pipeline by diameters:

Table 4-9: Diameter-wise water supply network length (onsite)

Diameter (mm)	Length (km)
200	13.273
315	3.703
Total	16.976

Rain Water Harvesting: Rain water harvesting can be a potential source of water. The water that falls on roof and the ground will be collected into the water reservoir through a system of pipes. The water from the water reservoir will be pumped directly to the industries, as rain water does not need any treatment. In any case, rainwater harvesting can contribute very little compared to the need of RMG, Agro based industries, but it can highly contribute to other non-potable uses such as toilet flushing, car washing, industrial cooling, watering green spaces, construction process (*e.g.* concrete mixing), electronics industry etc.

Therefore, the provision for Rainwater Harvesting System (RHS) can be kept for industries of this economic zone on plot-by-plot basis. In this way, each plot owner will be responsible for designing and implementing RHS within their plot boundary. Installing RHS will reduce the pressure on the central water supply system which will be helpful for the manufacturer also as the system will then work more efficiently.

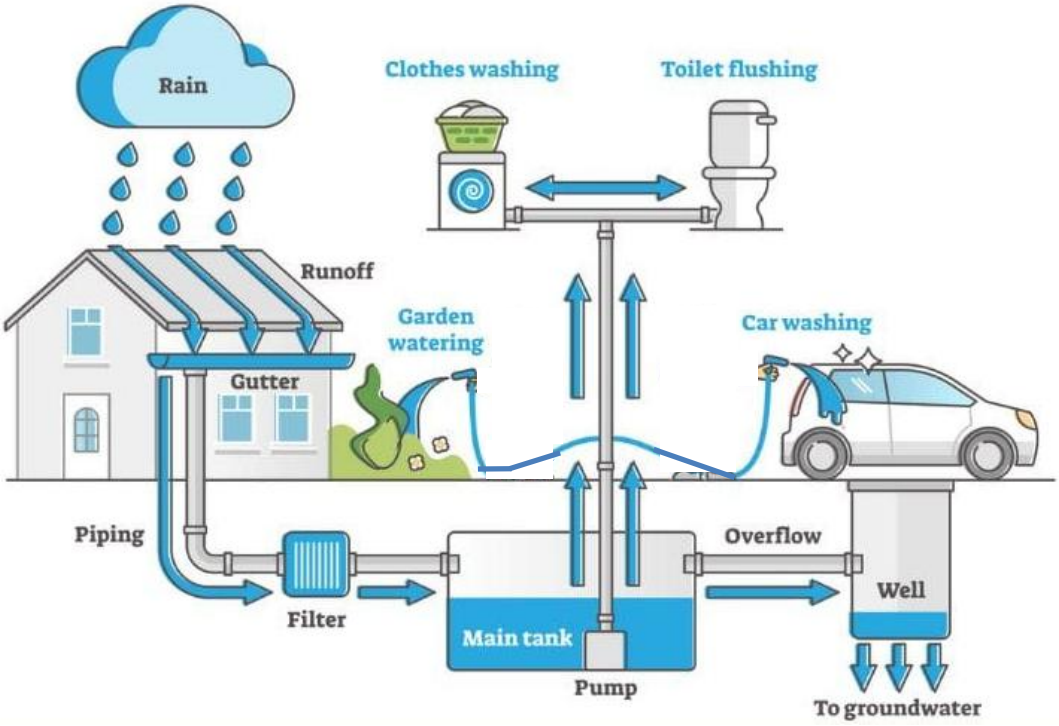


Figure 4.19: A conceptual diagram of Rainwater Harvesting System (RHS)

It is also recommended that measures should be taken for artificial recharge of groundwater aquifer in RHS. Several methods of groundwater recharge are practiced worldwide like spreading, pit, induced recharge and injection well etc. Among these techniques, recharge / injection wells allow direct feeding of depleted aquifers with fresh water by gravity from ground surface. Since except recharge pit, other structures of recharge well remain underground; there is hardly any loss of land.

Figure 4.20: Recharge pit of Rainwater Harvesting System (RHS)

Ground Water: The ground water is at 70 m (roughly) depth. Quality of water inside the proposed site is good and no treatment is needed for drinking. However, for industrial use, the water may need to be treated. We have also considered groundwater as an alternative source of water for the project area. It will reduce the risk of water crisis during dry season when the water level in the river reduces considerably. Six DTW (each of 0.7 cusec capacity) has been proposed.

4.12.6 Gas Distribution to EZ Industries

The specifications of the gas pipeline and mountings are provided below:

(1) For the supply, city gate station (CGS) pressure 1,000 psig -300 psig-150 psig
(2) Town boarding station (TBS) pressure 1,000 psig -300 psig-150 psig- 50 psig is required to be constructed.
(3) District regulation system (DRS) pressure 150 psig-50 psig.
(4) Regulating meter station (RMS) for bulk customer. Pressure 1000 psig-650psig-400psig-380 psig-85 psig-50 psig.

Based on the demand assessment, it is found that the total gas demand for the proposed EZ would be about ‘109,744 cum per day. The following figure shows the internal gas supply network in the EZ.

Figure 4.21: Internal Gas Distribution Network

4.12.7 Effluent System

Total water consumption of the EZ has been estimated at '15,866,390 liter/day. However, calculated effluent produce about '90% of total supplied or used water. Therefore, per day produced effluent volume shall be about '11,061,306 liter/day. Therefore, for CETP design, effluent volume of '11,061,306 liter/day has been considered.

The industrial effluents will be collected from the industries through an effluent pipe network and will be treated in the CETP. The industries will be responsible to do preliminary treatment for their industrial effluent. Maximum value for some critical wastewater parameters that can be discharged to the central effluent treatment plant will be set up to prevent overloading of the treatment operation. However, no hazardous fluid as defined in Hazardous Waste and Ship Breaking Waste Management Rules, 2011, beyond prescribed limits shall be discharged to the effluent network, rather shall be separately treated as per the said rules. Accordingly oily wastes exceeding prescribed limits shall be incinerated (as per Section 20, Clause 2 of Hazardous Waste and Ship Breaking Waste Management Rules,

2011. Other hazardous liquids[6] shall be sold (for recycling) to users/vendors licensed by DoE and/or relevant authorities to deal with such materials. (Reference: Section 20, Clause 1, Hazardous Waste and Ship Breaking Waste Management Rules, 2011)

The primary treatment of effluents will be carried out, if possible, with a Modular MBBR (Moving Bed Biofilm Reactor). Proposed advance MBBR module is a biological microbial solution. The post filtration with UF + NanoTech Membrane to reusable quality water. Tailor made nanotech membrane reduces COD, BOD, TDS and dye color. The effluent and sewage will flow through separate pipe lines from the side of different sources. Figure 4.22 shows Line 1 for pharmaceutical and chemical Industries, which produce high COD, BOD and TDS (mostly hazardous effluent); Line 2: textile and RMG produce dye color with high alkali effluent and Line 3: all domestic and industrial sewages.

Steps of Effluent Management

Step 1:	Line 1 effluent is collected to COD and BOD reduction tank for microbial pre-treatment to reduce COD, BOD and other chemical impurities and flow to equalization tank.
Step 2:	Line 2 effluent is collected to equalization tank
Step 3:	Air aeration at equalization tank to mix all effluent.
Step 4:	Equalization to sieving or screening
Step 5:	After screening, collected to pH balance buffer tank
Step 6:	After pH balance, collected to modular MBBR
Step 7:	After MBBR to ozonation and primary treatment
Step 8:	Produced sludge will be collected from MBBR drain line to the sludge management process
Step 9:	Post filtration with UF+NanoTech for reusable quality water (70%)
Step 10:	Discharge of 30% as DoE compliant.

The treated effluent shall be discharged to the Padma river down-stream from the position of river water intake point. The following figure shows the process flow of effluent treatment.

[6] like acidic, caustic, flammable or explosive

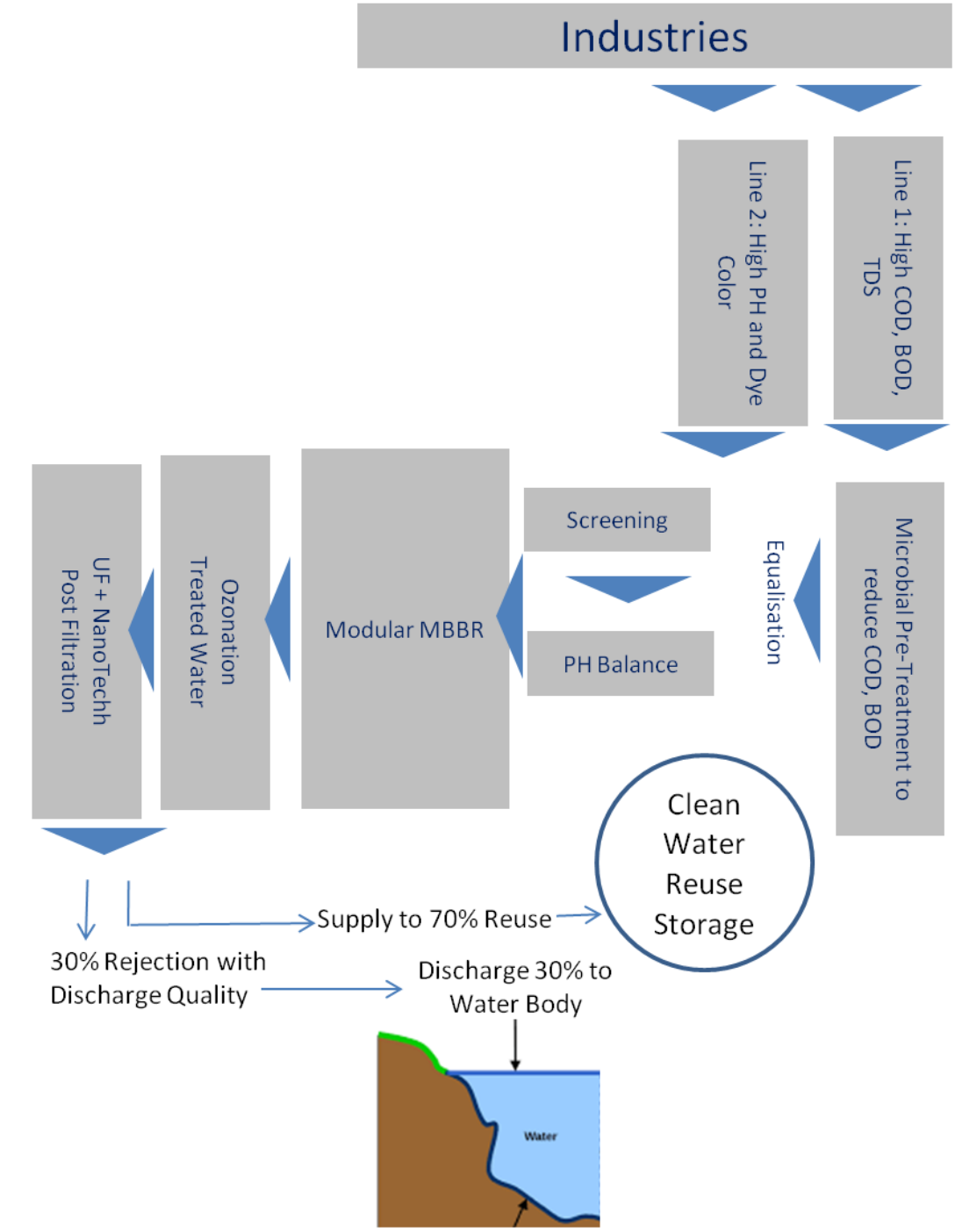


Figure 4.22: Effluent Treatment

Figure 4.23: Effluent Flow Network

Diameter-wise industrial effluent network length is given in the following table:

Table 4-10: Diameter-wise industrial effluent network with length

Diameter (mm)	Length (km)
200	0.877
300	3.773
350	1.741
400	1.779
600	0.598
800	1.567
1000	2.715
Total	13.05

4.12.8 Sewage Management

A complete sewer network has been proposed to collect the domestic wastewater from the whole project area and convey it to the Central Sewage Treatment Plan (CSTP). There will be one Central Sewage Treatment Plant (CSTP). The total capacity of CSTP will be around 8 MLD. The treated wastewater from the CSTP will be carried out through a proposed disposal pipe to the outfall. Sewage will be collected through pipe line from all sources to collection tank. After net screening direct pump to MBBR module as no need to pH balance requirement. The following picture shows the sewage network with discharge pipeline.

Figure 4.24: Sewage Network

Lengths of sewage network by diameters are provided in following table:

Table 4-11: Diameter wise sewage network length

Diameter (mm)	Length (km)
200	0.931
250	6.832
350	2.203
400	0.917
600	1.235

Diameter (mm)	Length (km)
1,000	2.715
Total	14.83

4.12.9 Sludge Management

Sludge generated by the ETP and industries shall follow further steps onward for appropriate environmental friendly treatment as per Bangladesh Standards and Guidelines for Sludge Management 2015. The guidelines allow disposing sludge to landfills designated for such sludge disposal or be incinerated. Disposing in land-fills bears the risk of reentering the hazardous waste into environment. Therefore, incineration is preferred to land fill. The relevant extracts from the guidelines are as following:

- Dried sewage sludge (~90% d.s.) is blown as dust into the furnace.
- Drained sewage sludge (~20 - 30% d.s.) is supplied separately through sprinklers into the incineration chamber and distributed on a grate. The sludge is integrated into the bed material by overturning the waste on the grates. Operational experiences show up to 20 mass-% sludge (at 25% d.s.). Other experiences have shown that if the sludge ratio is too high (*e.g.* >10%.), high fly ash content or unburnt material in bottom ash may occur.
- Drained, dried or semi-dried (~50 - 60% d.s.) sludge is mixed with the remaining waste or fed together into the incineration chamber. This can occur in the waste bunker through targeted doses by the crane operator, or controlled in a feeding hopper by pumping dewatered sludge into the hopper or by spreading systems into the bunker.

The following figure shows the process flow of sludge management as per DOE guideline:

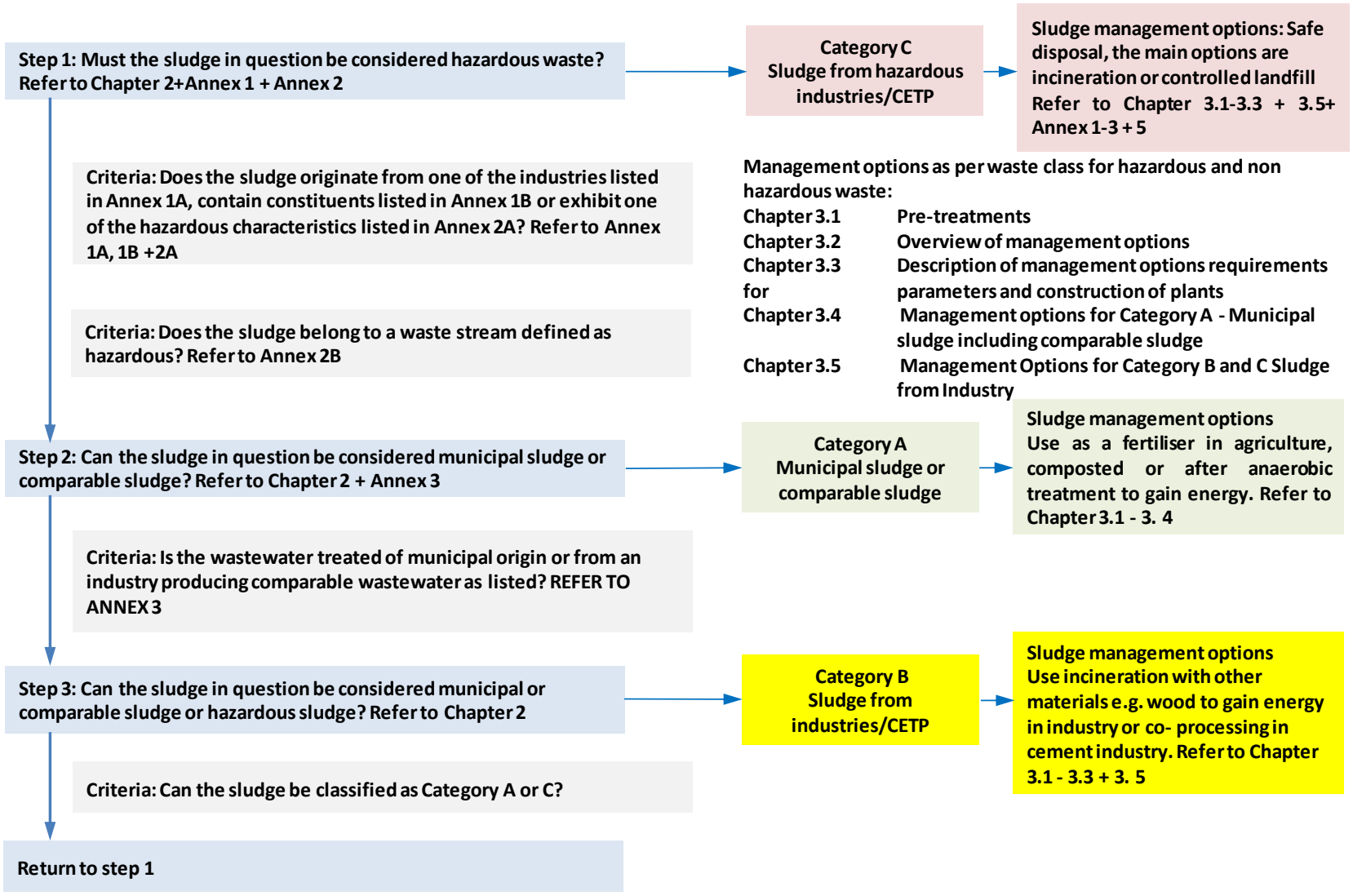


Figure 4.25: Sludge Management Flow Chart

4.12.10 Internal Drainage System

The drainage will be required mainly for discharging rain water. As a first step, rain fallen on the ground and factory roofs are expected to flow into the u- channel along the road. Next, the rainwater is planned to flow towards the discharge point onward to the river through a canal.

(1) The drainage system is planned to cater for the entire EZ through gravity flow;
(2) Drains are proposed to be provided on both sides of the roads;
(3) Open trapezoidal drain is considered for the surface runoff collection
(4) The main drain would be main drain '(3mx2.5m), branch drain '(2.5mx1.5m) and peripheral drain '(2mx1.1m).
(5) Stone pitching is considered for the side walls and plain cement concrete (PCC) for the base;
(6) Covered rectangular brick masonry drain is considered for the remaining areas for optimization of area under drainage;
(7) Reinforced cement concrete (RCC) box/pipe culverts of suitable sizes are considered for road crossings;
(8) Rainwater harvesting structures are envisaged all along the drain

For preventing the storm water entering from adjacent areas to the development area, a cut-off drain and embankment are to be provided all along the periphery of the site. The peak runoff and discharge capacities are computed based on the following design parameters:

$Q = C * I * A / 360$

Where, Q = Quantity of runoff, m^3/s
C = Coefficient of runoff
I = Intensity of rainfall, mm/hr
A = Catchment area, hectare

Considering the nature of soil/ surface, the coefficients of runoff adopted in the drainage computation are given below:
0.9 for built-up area;
0.5 for road and other paved area; and
0.2 for greenery and open area.

The sizing of the drains is designed based on the discharge capacity of Qc to cater adequately the estimated peak runoff using Manning's formula:

$Q_c = (1/n) * A * R^{2/3} * S½ (m^3/sec)$

Where
A = Area of cross-section of drain (m^2)
R = Hydraulic mean radius (m)
S = Hydraulic gradient
n = roughness coefficient

The above formulae translate to the following dimensions of the drains:

(1) Primary drain 3 m x 2.5 m
(2) Secondary drain 2.5 m x 1.5 m
(3) Tertiary drain 2 m x 1.1 m

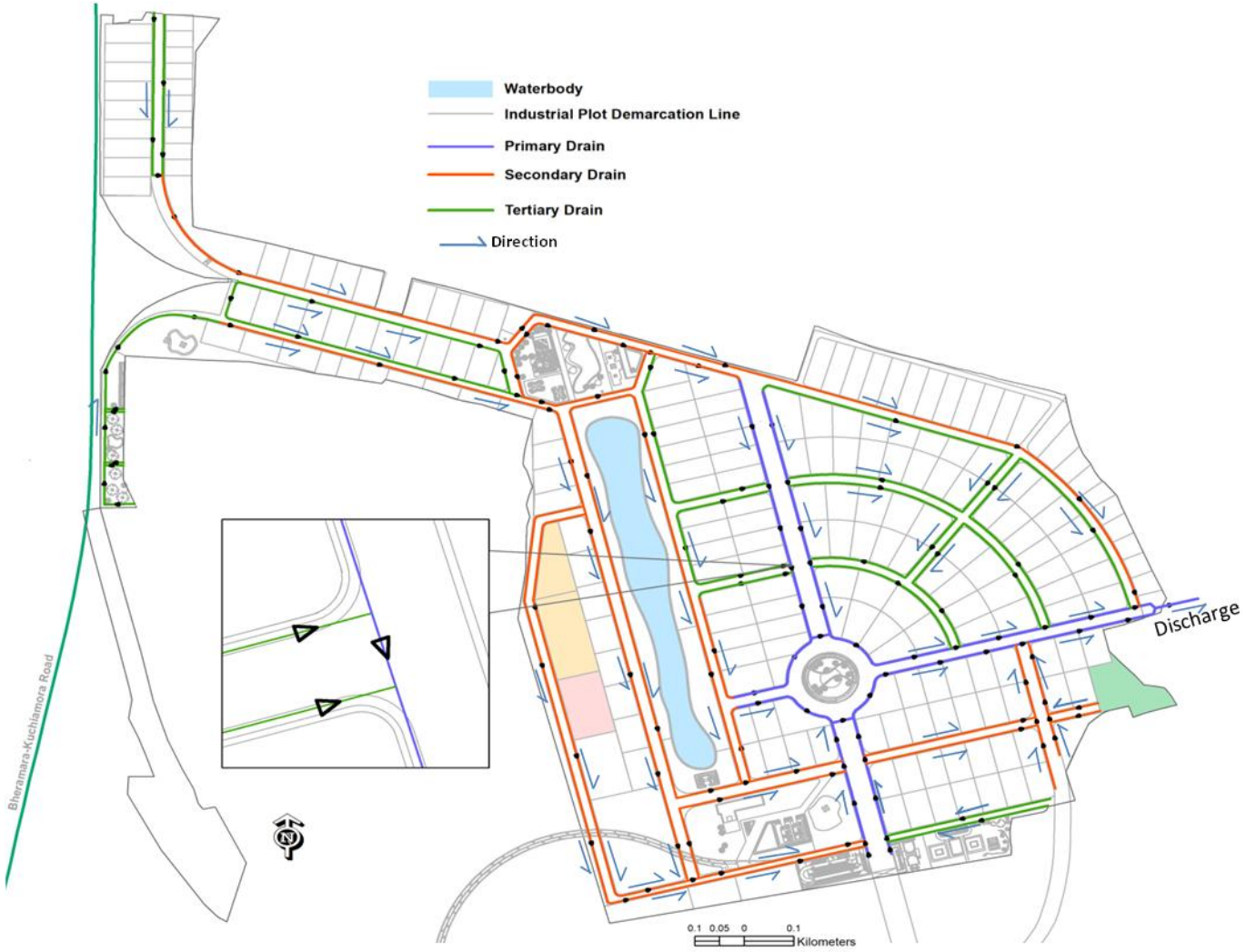


Figure 4.26: Internal Drainage Network

This drainage network will drain the storm water into the Padma River through discharge canal. A lake of 14.5 acres has been proposed in the project area which will also work as a detention pond. It will reduce pressure of surface runoff. More than 8% of the total project area has been kept for green and open space which will boost the infiltration rate of rainwater.

4.12.11 Fire Fighting System Network

The EZ is designed to be equipped with a self sufficient fixed fire fighting network with valve stations all over the EZ. It is planned that this network will be in addition to the mobile fire fighting system to be separately maintained by a fire fighting brigade. The following picture depicts the fire fighting system network.

Figure 4.27: Fire Fighting System Network

Proposed system is designed to provide water at required pressure to fight against fire from outside of the premises or inside of the premises. Proposed design does not meet the total requirement of individual factory building or premises. Separate firefighting arrangement for factory buildings or other area need to be established to make the building compliant as per local and international code or standard.

4.12.12 Solid Waste Management

Solid wastes of different types will be generated during construction and during operation. National 3R Strategy for Waste Management can be followed for the management of industrial solids during construction of the EZ. It is also important to follow and comply with recently gazetted Solid Waste Management Rules 2021. For implementation of the rules, it is required to carry out consultation with relevant stakeholders where the project is located *i.e.* local representatives, municipals, Union/Upazila Parishad, officers of Department of Environment (DoE), etc.

Such waste shall be handled and managed as per the requirements of Solid Waste Management Rules 2021 and Hazardous Waste (Handling and Management) Guidelines of DoE. A mechanical waste management system for sorting, drying, recycling and other process. However, all e-wastes shall be managed as per the e-waste rules 2021. Textiles will be highest solid waste generation sectors. The following table provides the amounts of solid waste that are likely to be generated from the proposed EZ, based on industry survey.

Table 4-12: Estimated amount of Solid Waste of Kushtia EZ

	Types of Industry	Area	Solid Waste Generation		
		acre	%	tons/year/acre	tons/day
	Industrial Sold Waste: [7]				
(1)	Electrical and Electronic Goods	‘31.6	1.06%	38.23	3.31
(2)	Textile	‘37.0	9.96%	121.44	12.32
(3)	Pharmaceuticals/ Chemicals/ Cosmetics	‘21.2	5.67%	0.03	Negligible
(4)	Leather Products/Footwear	‘4.0	13.28%	0.01	Negligible
(5)	Agro and Food Processing	‘31.8	8.87%	15.71	1.37
(6)	Jute Goods	‘13.9	Negligible	0.38	0.01
(7)	RMG	‘61.6	13.14%	0.03	0.01
	Personal Use Solid Waste[8]				3.34
	Total				20

It is derived that about 20 tons of solid waste will be generated daily from industries planned in the proposed EZ and from personal use of the officers, workers and residents in the EZ. The following table presents the process of managing solid waste.

Step 1	Transport from industries to SWM facility using of medium covered drum truck.
Step 2	Mechanical and manual sorting of materials: (1) inorganic non-hazardous (2) organic non-hazardous (3) hazardous

[7] Source: Industry Survey 2022.
[8] Source: Research Gate; https://www.researchgate.net/figure/Per-capita-generation-of-wastes-in-six-major-cities-of-Bangladesh

Step 3	Sale to local vendors for recycling of inorganic non-hazardous component like, large polythene, poly pack, plastic jar, aluminum can, metal, pet bottle etc.
Step 4	Organic non-hazardous components like fabric, yarn, leaf, wood, paper, paper, paper boxes, leather etc. after sorting shall be shredded and briquetted. The briquettes can be sold to the local market and/or sell to the brickfields.
Step 5	Hazardous materials shall be separately collected as per Hazardous Waste and Ship Breaking Waste Management Rules, 2011. Solid wastes which are non-iron in nature, but hazardous[9] shall be sold (for recycling) to users/vendors licensed by DoE and/or relevant authorities to deal with such materials. (reference: Section 20, Clause 1, Hazardous Waste and Ship Breaking Waste Management Rules, 2011).

4.12.13 Use of Solar Panels

The EZ will leverage on use of solar panels for reducing impact on environment and thereby lessened demand on national grid power. The batteries with solar panels are recommended to be installed over electric poles for street lighting. An alternative option might be to dedicate a space used for installing solar panels and supplying solar power centrally. The option will not be space and cost effective.

4.12 Eco-sensitive area

It is to be noted that none of the Ecological Critical Area (ECA)/Eco-Sensitive Area, Wildlife Sanctuary, National Park and Reserve Forest area including their corridors are found within 10 km buffer distance of the study area. The nearest Ecological Critical Area (ECA), Marjat Baor, is located about 85 km south side from the study area.

[9] like flammable or explosive solid waste

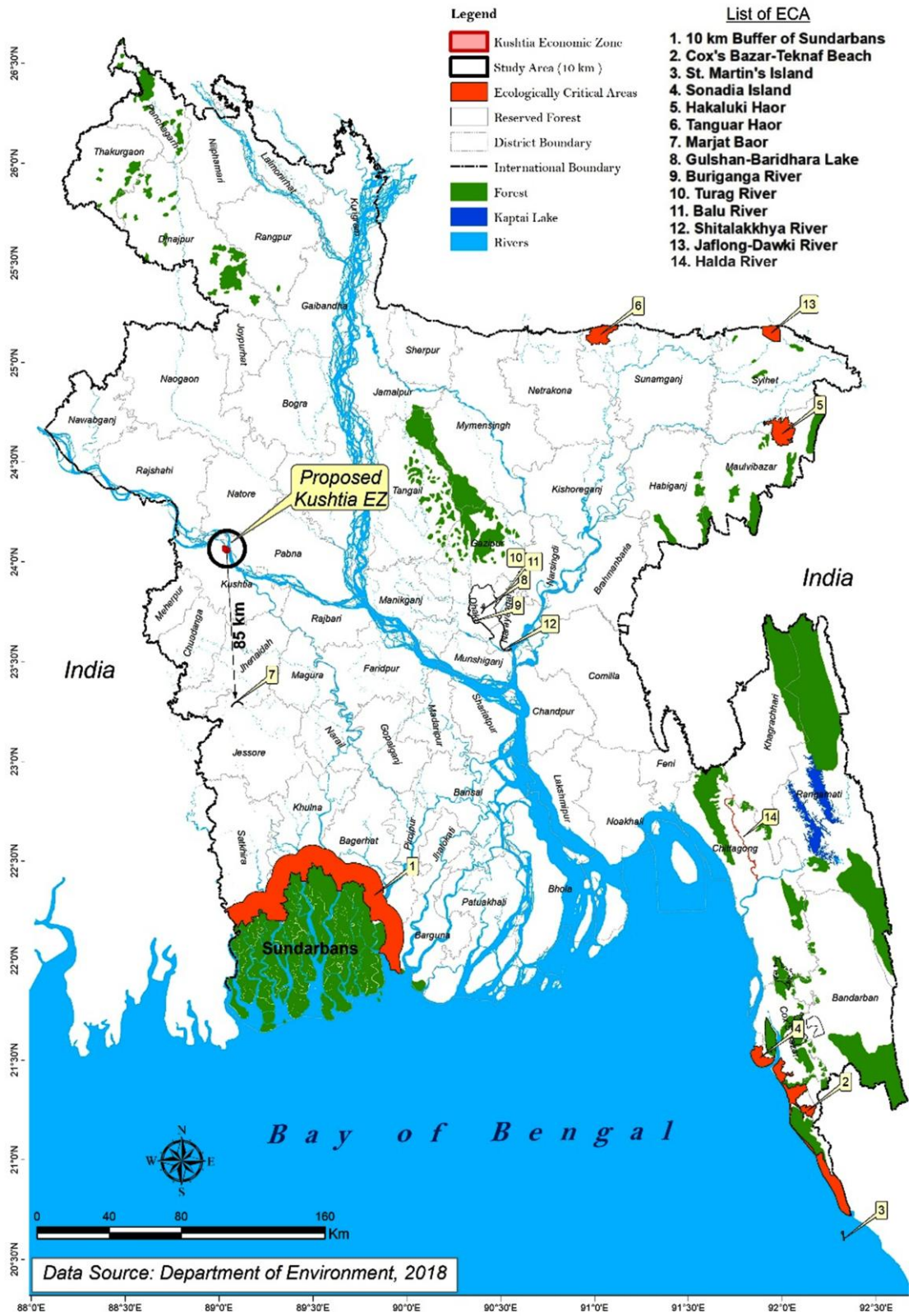


Figure 4.28: Ecologically Critical Area map of Bangladesh

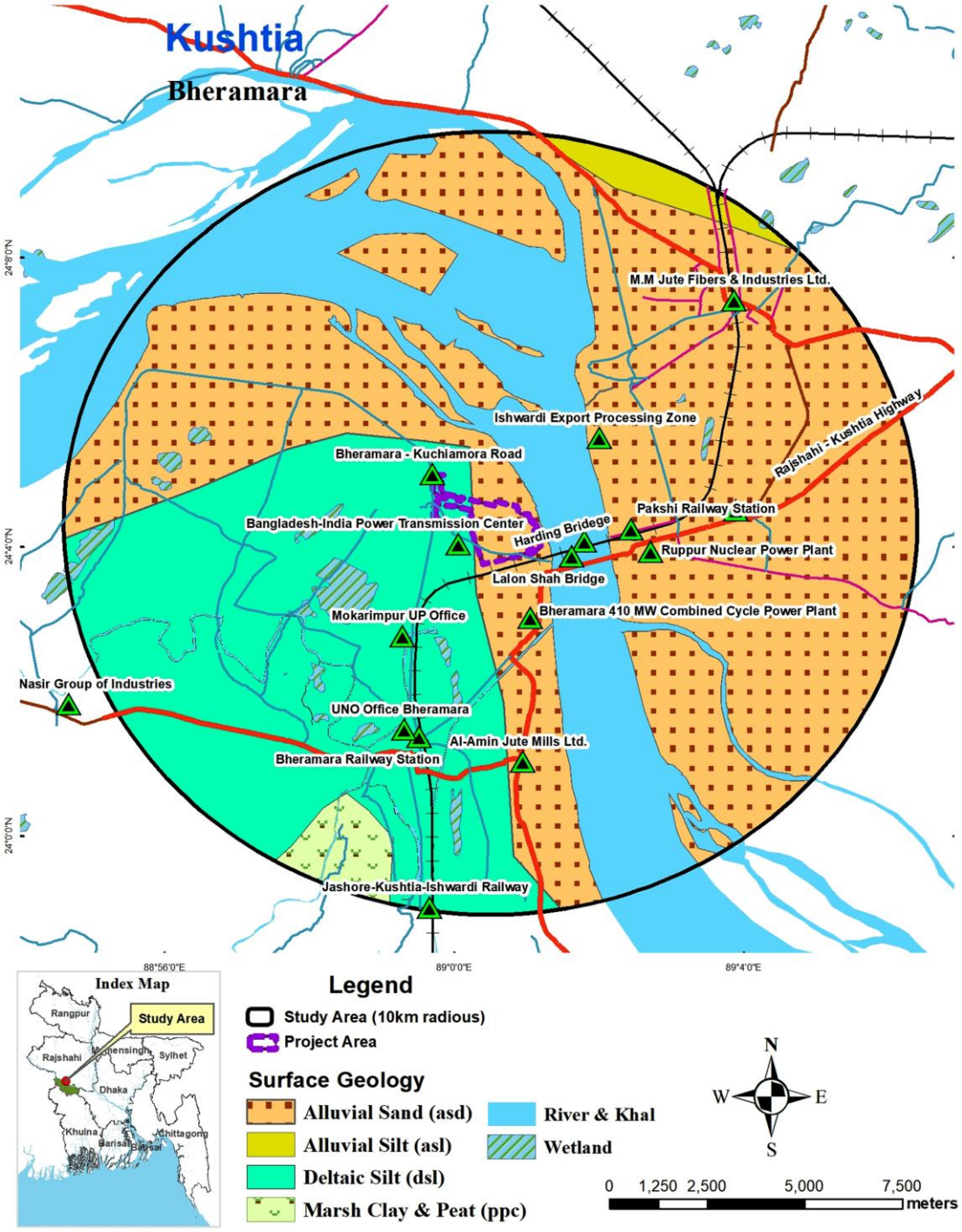


Figure 4.29: Geological map of the project area and study area

Table 4-13: Surface Geology of the Project Area and Study Area[10]

Surface Geology (Holocene Sediments)	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% of the NCA
Alluvial Sand (asd)	333	38,394	38,857	61.9
Alluvial Silt (asl)	0	1,004	1,004	1.6
Deltaic Silt (dsl)	87	21,752	21,839	34.8

[10] Source: Geological Survey of Bangladesh and United States Geological Survey, 1990, SCL Estimation

Surface Geology (Holocene Sediments)	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% of the NCA
Marsh Clay and Peat (ppc)	0	1116	1,116	1.8
Total	420	62,265	62,816	100.0

According to the information of Geological Survey of Bangladesh and United States Geological Survey, 1990, ESIA team has estimated that, 333 acres of land falls under Alluvial Sand and 87 acres of land falls under Deltaic silt of the project area.

There are four land types (Holocene Sediments) in the study area. Among the land types, Alluvial Sand is 61.9%, alluvial silt is 1.6%, Deltaic silt is 34.8% and Marsh clay and peat is 1.8%. There are no forests or protected area within the 10km radius of the project area. Moreover, no mineral resources have been found yet within the project and study area.

4.13 Tentative implementation schedule

The project is scheduled to be implemented in 36 months in a single phase.

Tasks	Activities	mons	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	**Preparation Work**																																					
1.1	Mobilization and Document finalization																																					
1.2	Organization of Staff																																					
1.3	Organization of Materials & Machines																																					
1.4	Construction of Site camp																																					
1.5	Construction of Construction Yards																																					
1.6	Site Survey works																																					
2	**Ground Improvement**																																					
2.1	Clearing & Grubbing																																					
2.2	Site levelling																																					
2.3	Sand Filling																																					
2.4	Levelling & Compacting																																					
3	**Security fencing, Boundary wall, Gate house & Gates**																																					
4	**Internal Road and Plots/area demarcation works**																																					
5	**Infrastructure & Utility networks**																																					
5.1	Underground pipe network																																					
5.2	Road foundation																																					
5.3	Road surface work																																					
5.4	Drainage																																					
5.5	Pedestrian Footpath																																					
5.6	Street Lighting																																					
5.7	Electrical power works																																					
5.8	Telecommunication																																					
5.9	Gas works																																					
5.10	Water supply network																																					
5.11	Fire fighting system																																					
6	**Administrative & Residential Buildings**																																					
6.1	Foundation works																																					
6.2	Upto floor level construction																																					
6.3	Superstructure RCC (columns, beams and slabs)																																					
6.4	Brick & plaster works and Door, windows & glass works																																					
6.5	Internal electrical and plumbing works																																					
6.6	Electrical and mechanical installations																																					
6.7	Flooring and Decorative works																																					
6.8	Finishing works and hand over																																					
7	**Utility Structures**																																					
	(CETP, CSTP, OHT, Underground Reservoir, RWH, Waste Collection Area etc)																																					
7.1	Foundation works																																					
7.2	Upto floor level construction																																					
7.3	Superstructure RCC (columns, beams and slabs)																																					
7.4	Brick & plaster works and Door, windows & glass works																																					
7.5	Internal electrical and plumbing works																																					
7.6	Electrical and mechanical installations																																					
8	**Waterbody Develoment and Landscaping**																																					
9	**Project Inspection Period**																																					
10	**Project Handover**																																					▲

4.14 Map and survey information

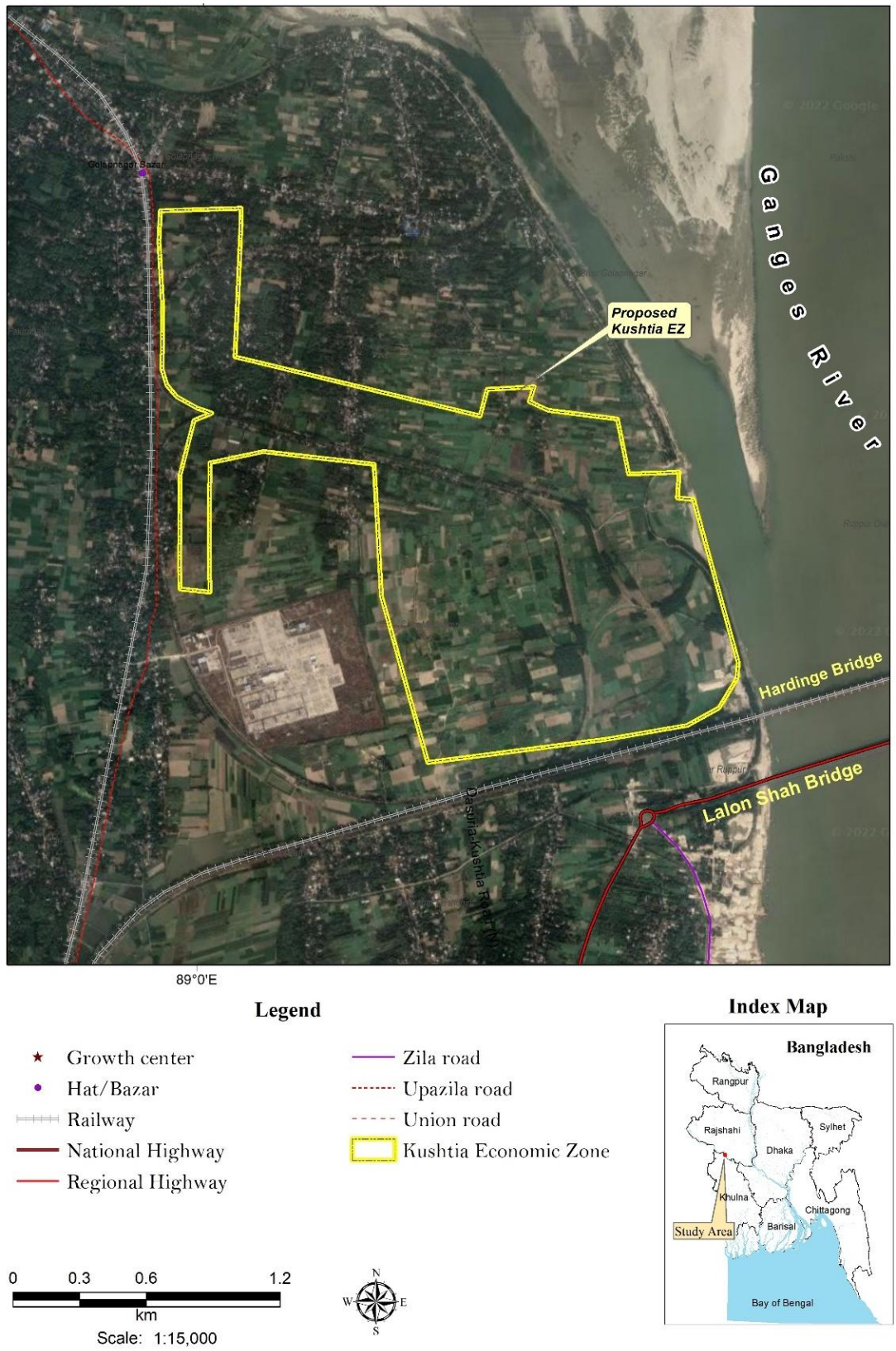


Figure 4.30: Location Map of Kushtia EZ

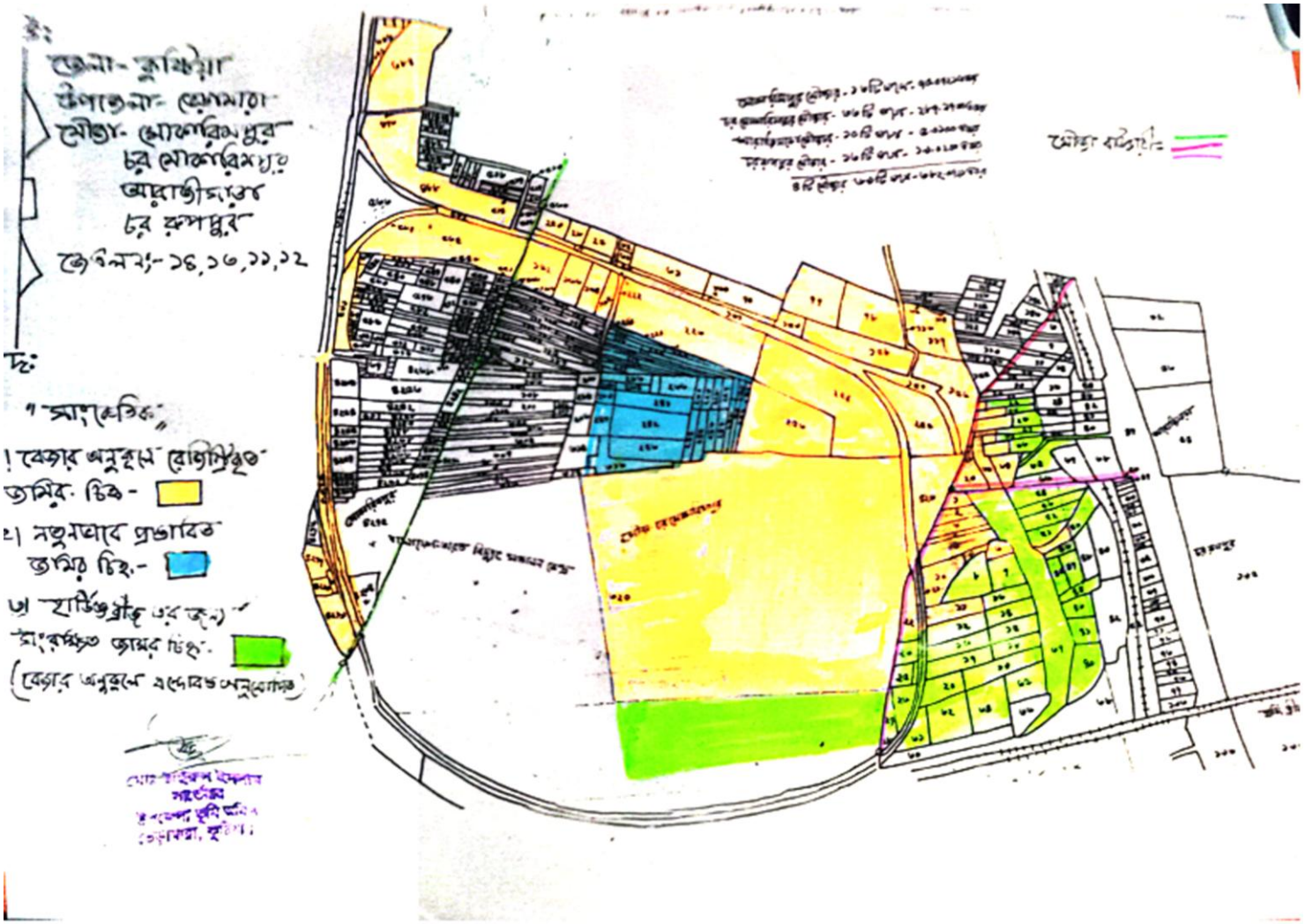


Figure 4.31: Cadastral map showing land plots (Project and adjacent area)

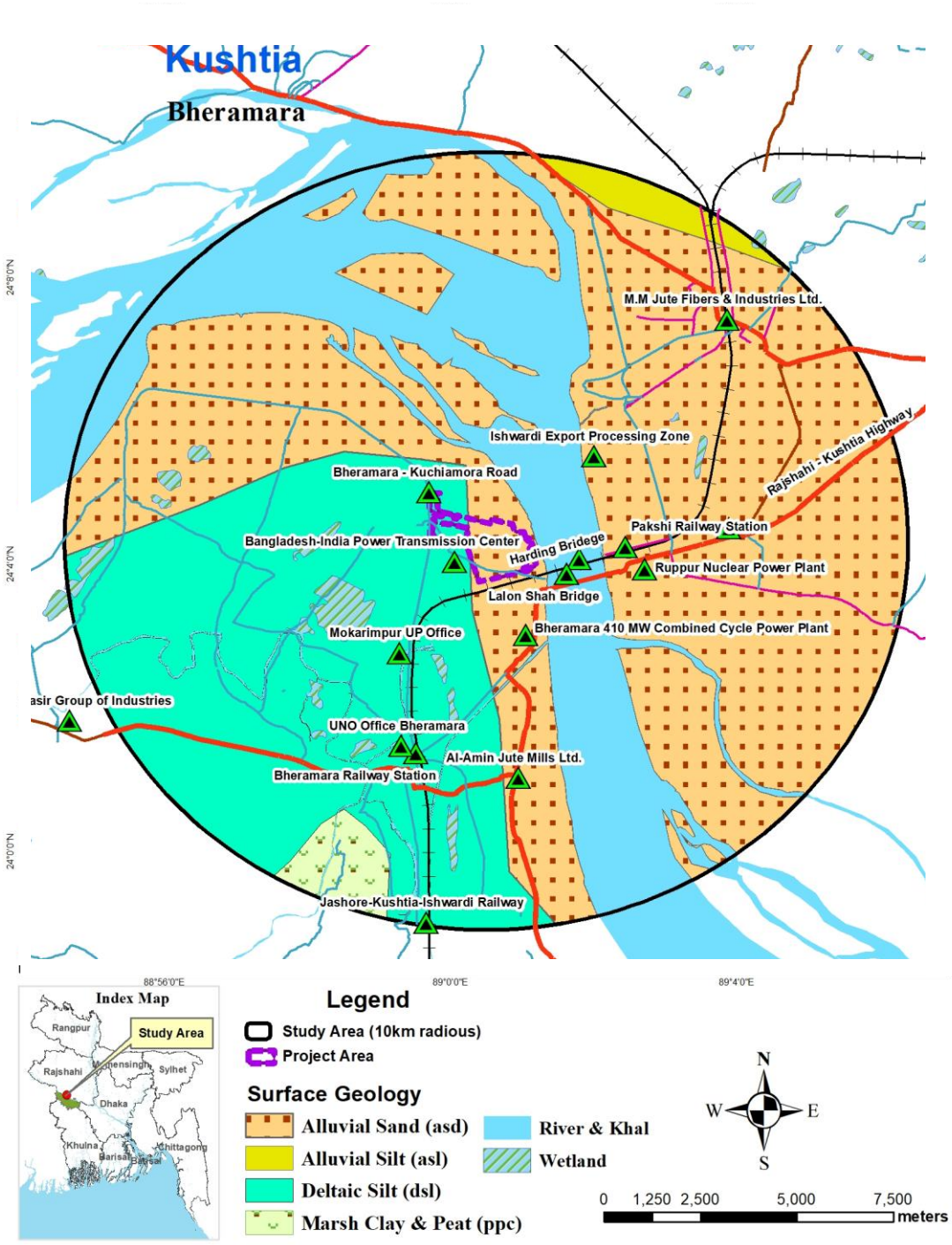


Figure 4.32: Geological map of the project area and study area

Table 4-14: Surface Geology of the Project Area and Study Area[11]

Surface Geology (Holocene Sediments)	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% of the NCA
Alluvial Sand (asd)	333	38,394	38,857	61.9
Alluvial Silt (asl)	0	1,004	1,004	1.6
Deltaic Silt (dsl)	87	21,752	21,839	34.8
Marsh Clay and Peat	0	1116	1,116	1.8

[11] Source: Geological Survey of Bangladesh and United States Geological Survey, 1990, SCL Estimation

Surface Geology (Holocene Sediments)	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% of the NCA
(ppc)				
Total	**420**	**62,265**	**62,816**	**100.0**

According to the information of Geological Survey of Bangladesh and United States Geological Survey, 1990, ESIA team has estimate that, 333 acres of land falls under Alluvial Sand and 87 acres of land falls under Deltaic silt of the project area.

There are four land types (Holocene Sediments) in the study area. Among the land types, Alluvial Sand is 61.9%, Alluvial silt is 1.6%, Deltaic silt is 34.8% and Marsh clay and peat is 1.8%. There are no forests or protected areas within the 10 km radius of the project area. Moreover, no mineral resources have been found yet within the project and study area.

5 Site Details

5.1 Location of the project

The proposed zone is located at following mouzas: Mokarimpur, Charmokarimpur, Arazisara, and Char Ruppur of Mokarimpur Union, Bheramara Upazila in Kushtia District. Geographically, the area is situated in the south-western part of Bangladesh between 24°00.220' north latitudes and 88°59.868' east longitudes. The total area of the proposed site is '420 acres. The Hardinge Rail Bridge and Lalonshah Road Bridge is situated within 1 km of the site. The project area mainly situated in the bank of Padma River.

Figure 5.1: Proposed Kushtia EZ Site[12]

5.1.1 Land Use Plan for the proposed Kushtia EZ

Land use plan is an important element under the present system of planning and development control. It lays out the land use zoning plan and infrastructure development proposals at town/area/economic zone site level. The land use plan is to provide a general pattern for the location, distribution and character of the future land uses within the projected growth area of the economic zone.

[12]Source: Field visit

5.1.2 Planning Standard and Land Requirements for proposed KEZ

Related Acts/Rules, previous economic zone master plans and discussion with related experts of BEZA are the fundamental basis preparing planning standard for proposed economic zone. Directives related to space use and construction found in the related acts/rules like: Bangladesh Economic Zone Authority Act, 2010; Bangladesh Economic zone (Construction of Building) Rules, 2017 etc. can be categorized under two distinguished group: 1) related to land use/space use in respect of total area and 2) related to land use/space use/building Construction in respect of any particular plot area. Standards those are not found in the relevant acts/rule, are formulated based on similar nature of practices and the consultation made between the consultant team and concern BEZA personnel.

5.1.3 Zoning

Zoning is a classification of land uses that limits what activities can or cannot take place on a parcel of land by establishing a range of development options. Zoning has been defined as an action through legislation provided to a development authority to control a) heights to which buildings may be erected; b) the area of lots that must be left un-built upon; and c) the uses to which buildings may be constructed.

Guidelines for broad land use zones come from the directives set in the Bangladesh Economic Zone Act, 2010. Standards for other functions are set based on related acts/rules and standards practiced in Bangladesh in physical planning practices.

Broad land Use categories considered for proposed Kushtia EZ Master Plan are:

- Processing Area (industrial plots, utility services)
- Non- Processing Area (residential, commercial and administrative)

Each of the broad land use categories/zones is comprised of some associated and homogeneous land functions based on requirements as well as directives. Some functions are essential for every broad categories like: Circulation and Utility Network, open space etc. These common functions are treated as crosscutting/common land use zones.

5.1.4 Designation of Specific Land Uses for the proposed KEZ

There should be definition and characteristics of each and every specific land uses that can guide the planners/other personnel preparing land use plan and its proper implementation. Following is a short description of recommended land according to the zone.

Table 5-1: Specific Land Uses for the proposed KEZ

	Broad Land Use Category	Land Use	Definition/Characteristics
(1)	Processing Area	1.1 Industrial Plots	Industrial plots refer to the area solely used for developing any sorts of industrial units/production either export oriented or for domestic markets.
		1.2 Utility Services	Water, drainage, gas, electricity, telecommunication, lighting, power office/control room, sewage office, waste disposal, fire service,

	Broad Land Use Category	Land Use	Definition/Characteristics
			water pump house, CETP, Water Treatment Plant (WTP), solid waste treatment station etc.
(2)	Non-processing Area	2.1 Residential	Residential land use refers to the area that predominate residential purposes. Housing facilities of officers, staffs and associated personnel of the Economic Zone (BEZA) will be placed on this zone including Dormitory, residential buildings etc. This includes residential buildings, GM bunglow, mosque, dormitory, police station, investors facilities block for social gathering and amusement like: club, restaurants, rest house etc., schools and training institutes, hospital, day care, security barrack, spaces for social, religious and cultural activities and structures to be formed on such space are denotes as Social Infrastructures; for example: club
		2.2 Commercial area	Shopping facilities like: shopping complex, kitchen market etc.
		2.3 Administrative	It includes zone services complex, customs and security office, area used for security purposes of the EZ like: security shed, guard barrack etc. Transport and communication services: truck terminal, bus bay/stand, container yard, filling station, garage, post office, passenger shed, container yard, telephone exchange, ticket counter, transport office etc.
		2.4 Empty Space	Open spaces like assembly area, lawn, park, play field or garden and relevant uses with minimum structure Green space: the green strip along the road network of the EZ, central green median, road side green strips, canal, water body are the part of these requirements.

5.1.5 Land Use Plan for the proposed Kushtia EZ

Land use planning of Master Plan is an important element under the present system of planning and development control. It lays down the land use zoning plan and infrastructure development proposals at town/area/economic zone site level. The land use plan is to provide a general pattern for the location, distribution and character of the future land uses within the projected growth area of the economic zone.

Planning Standard and Land Requirements for proposed KEZ

Related Acts/Rules, previous economic zone master plans and discussion with related experts of BEZA are the fundamental basis preparing planning standard for proposed economic zone. Directives related to space use and construction found in the related acts/rules like: Bangladesh Economic Zone Authority Act, 2010; Bangladesh Economic zone

(Construction of Building) Rules, 2017 etc. can be categorized under two distinguished group: 1) related to land use/space use in respect of total area and 2) related to land use/space use/building Construction in respect of any particular plot area. Standards those are not found in the relevant acts/rules are formulated based on similar nature of practices and the consultation made between the consultant team and concern BEZA personnel.

Zoning

Zoning is a classification of land uses that limits what activities can or cannot take place on a parcel of land by establishing a range of development options. Zoning has been defined as an action through legislation provided to a development authority to control a) heights to which buildings may be erected; b) the area of lots that must be left un-built upon; and c) the uses to which buildings may be constructed.

Guidelines for broad land use zones are come from the directives set in the Bangladesh Economic Zone Act, 2010. Standards for other functions are set based on related acts/rules and standards practiced in Bangladesh in physical planning practices.

Broad land Use categories considered for proposed Kushtia EZ Master Plan are:

- Processing Area (industrial plots, utility services)
- Non- Processing Area (residential, commercial and administrative)

Each of the broad land use categories/zones is comprised of some associated and homogeneous land functions based on requirements as well as directives. Some functions are essential for every broad categories like: Circulation and utility network, open space etc. These common functions are treated as crosscutting/common land use zones.

Designation of Specific Land Uses for the proposed KEZ

There should be definition and characteristics of each and every specific land uses that can guide the planners/other personnel preparing land use plan and its proper implementation. Following is a short description of recommended land according to the zone.

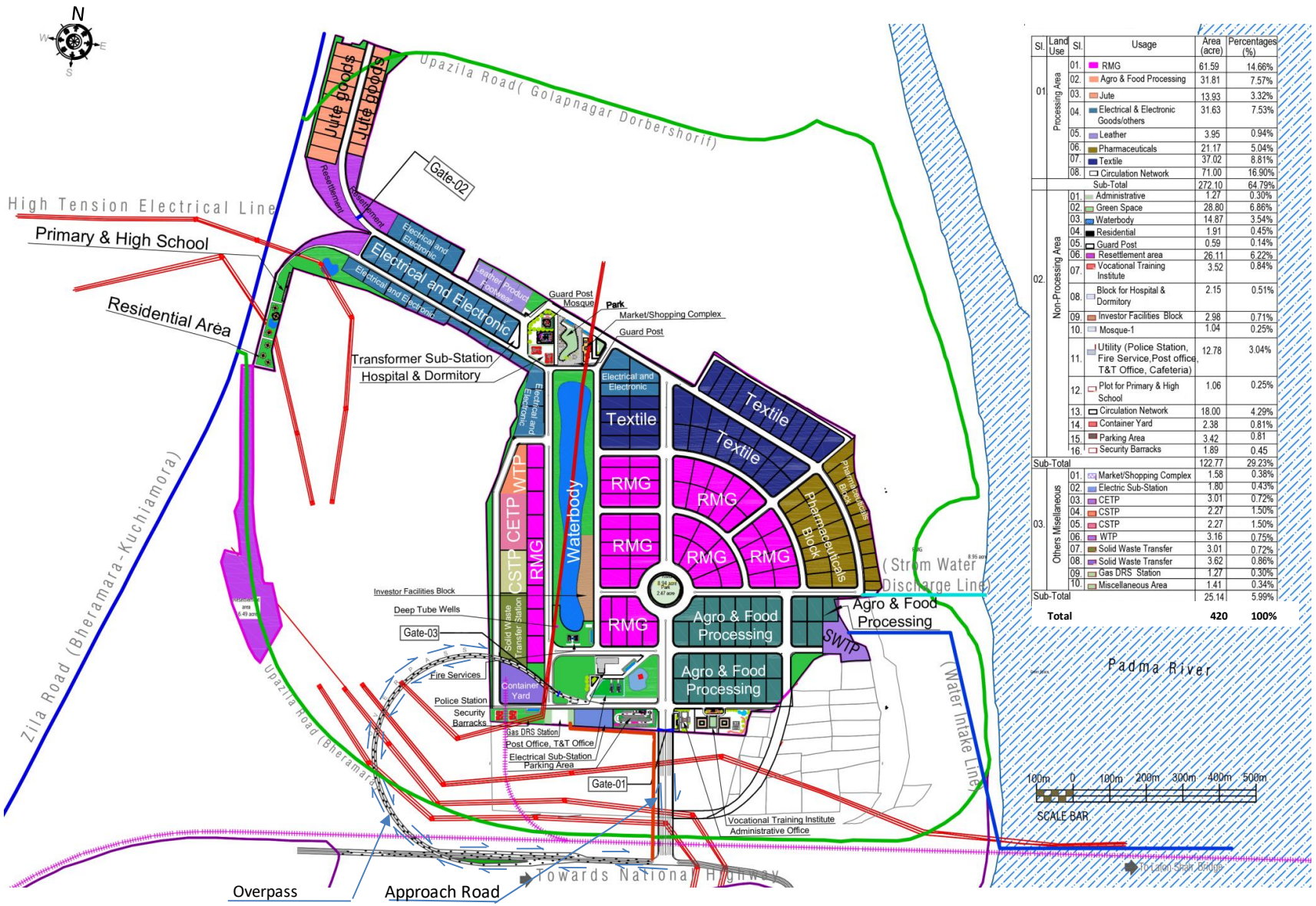
Table 5.2: Specific Land Uses for the proposed KEZ

	Broad Land Use Category	Land Use	Definition/Characteristics
(3)	Processing Area	1.1 Industrial Plots	Industrial plots refer to the area solely used for developing any sorts of industrial units/production either export oriented or for domestic markets.
		1.2 Utility Services	Water, drainage, gas, electricity, telecommunication, lighting, power office/control room, sewage office, waste disposal, fire service, water pump house, CETP, Water Treatment Plant (WTP), solid waste treatment station etc.
(4)	Non-processing Area	2.1 Residential	Residential land use refers to the area that predominates residential purposes. Housing facilities of officers, staffs and associated personnel of the Economic Zone (BEZA) will be placed on this zone including Dormitory,

	Broad Land Use Category	Land Use	Definition/Characteristics
			residential buildings etc. This includes residential buildings, GM bunglow, mosque, dormitory, police station, investors facilities block for social gathering and amusement like: club, restaurants, rest house etc., schools and training institutes, hospital, day care, security barrack, spaces for social, religious and cultural activities and structures to be formed on such space are denotes as Social Infrastructures; for example: club
		2.2 Commercial area	Shopping facilities like: shopping complex, kitchen market etc.
		2.3 Administrative	It includes zone services complex, customs and security office, area used for security purposes of the EZ like: security shed, guard barrack etc. Transport and communication services: truck terminal, bus bay/stand, container yard, filling station, garage, post office, passenger shed, container yard, telephone exchange, ticket counter, transport office etc.
		2.4 Empty Space	Open spaces like assembly area, lawn, park, play field or garden and relevant uses with minimum structure Green space: the green strip along the road network of the EZ, central green median, road side green strips, canal, water body are the part of these requirements.

Proposed Land Use Plan

Land use plan is prepared for proposed EZ considering some proposition like: optimum use of land, higher percentage of sealable land comprising with processing area and commercial and other uses, functionality of the area corresponding with function, movement and safety-security, sustainable ecology and environment. The following figure summarises the land use plan.



Sl.	Land Use	Sl.	Usage	Area (acre)	Percentages (%)
01	Processing Area	01.	RMG	61.59	14.66%
		02.	Agro & Food Processing	31.81	7.57%
		03.	Jute	13.93	3.32%
		04.	Electrical & Electronic Goods/others	31.63	7.53%
		05.	Leather	3.95	0.94%
		06.	Pharmaceuticals	21.17	5.04%
		07.	Textile	37.02	8.81%
		08.	Circulation Network	71.00	16.90%
	Sub-Total			272.10	64.79%
02.	Non-Processing Area	01.	Administrative	1.27	0.30%
		02.	Green Space	28.80	6.86%
		03.	Waterbody	14.87	3.54%
		04.	Residential	1.91	0.45%
		05.	Guard Post	0.59	0.14%
		06.	Resettlement area	26.11	6.22%
		07.	Vocational Training Institute	3.52	0.84%
		08.	Block for Hospital & Dormitory	2.15	0.51%
		09.	Investor Facilities Block	2.98	0.71%
		10.	Mosque-1	1.04	0.25%
		11.	Utility (Police Station, Fire Service,Post office, T&T Office, Cafeteria)	12.78	3.04%
		12.	Plot for Primary & High School	1.06	0.25%
		13.	Circulation Network	18.00	4.29%
		14.	Container Yard	2.38	0.81%
		15.	Parking Area	3.42	0.81
		16.	Security Barracks	1.89	0.45
Sub-Total				122.77	29.23%
03.	Others Misellaneous	01.	Market/Shopping Complex	1.58	0.38%
		02.	Electric Sub-Station	1.80	0.43%
		03.	CETP	3.01	0.72%
		04.	CSTP	2.27	1.50%
		05.	CSTP	2.27	1.50%
		06.	WTP	3.16	0.75%
		07.	Solid Waste Transfer	3.01	0.72%
		08.	Solid Waste Transfer	3.62	0.86%
		09.	Gas DRS Station	1.27	0.30%
		10.	Miscellaneous Area	1.41	0.34%
Sub-Total				25.14	5.99%
Total				**420**	**100%**

Figure 5.2: Proposed Land Use

5.1.6 Land use break up of total land of the project site

Total area of the site is '420 acres. Processing area covers 272.10 acres and non-processing 122.77 acres and others 25.14 acres.

	Land Use		Usage	Area (acre)	Percentages (%)
1	Processing Area	1.1	Electrical and Electronic Goods/others	31.63	7.53
		1.2	Textile	37.02	8.81
		1.3	Pharmaceutical/Chemical/Cosmetics	21.17	5.04
		1.4	Leather Product/Footwear	3.95	0.94
		1.5	Agro and Food Processing	31.81	7.57
		1.6	Jute goods	13.93	3.32
		1.7	RMG	61.59	14.66
		1.8	Circulation Network	71.00	16.90
Sub-Total				**272.10**	**64.79**

	Land Use		Usage	Area (acre)	Percentages (%)
2	Non-Processing Area	2.1	Administrative	1.27	0.30
		2.2	Circulation Network	18.00	4.29
		2.3	Waterbody	14.87	3.54
		2.4	Residential	1.91	0.45
		2.5	Electric Sub-Station		
		2.6	Container Yard (Truck)	2.38	0.81
		2.7	Block for Hospital and Dormitory	2.15	0.51
		2.8	Utility (Police Station, Fire Service, Post office, T&T Office, Cafeteria)	12.78	3.04
		2.9	Vocational Training Institute	3.52	0.84
		2.10	Investor Facilities Block	2.98	0.71
		2.11	Plot for Primary and High School	1.06	0.25
		2.12	Resettlement area	26.11	6.22
		2.13	Green Space	28.80	6.86
		2.14	Guard Post	0.59	0.14
		2.15	Mosque 1	1.04	0.25
		2.16	Parking Area	3.42	0.81
		2.17	Security Barracks	1.89	0.45
Sub-Total				**122.77**	**29.29**

	Land Use		Usage	Area (acre)	Percentages (%)
3	Others Miscellaneous	3.1	Market/ Shopping Complex	1.58	0.38
		3.2	Electric Sub-Station	1.80	0.43
		3.3	CETP	3.01	0.72
		3.4	CSTP	2.27	1.50
		3.5	CSTP	2.27	1.50
		3.6	WTP	3.16	0.75
		3.7	Solid Waste Transfer	3.01	0.72
		3.8	Solid Waste Transfer	3.62	0.86
		3.9	Gas DRS Station	1.27	0.30
		3.10	Miscellaneous Area	1.41	0.34
Sub-Total				**25.14**	**5.99**
Total				**420**	**100**

5.2 Zoning of the Area

5.2.1 Screening and Classification

The consultant has initially screened to understand the nature and significance of anticipated environmental impacts by using the rapid environmental assessment checklist as under ECR, 2023 by DOE. Based on that the proposed zone following cluster of industries have been considered:

(1) Electrical and Electronic Goods
(2) Textile
(3) Pharmaceutical/Chemical/Cosmetics
(4) Leather Product/Footwear
(5) Agro and Food Processing
(6) Jute Goods
(7) RMG

This industry comes under Secondary Industry with light and heavy industry. It includes industries that are involved in construction and manufacturing using primary industry products as raw materials and manufacture different products that they deliver to the final consumer or the tertiary industry. As per feasibility study, require electricity around 60.46 MW in different sector which details are given in the following table.

Table 5-3: Projection of Estimated Emission Load Sector Wise

Sector	Load Capacity (MW)	Operation Time (hr)	Operation Day	Emission Factor	GHG (ton/yr)
Electrical and Electronic Goods	2.27	8	260	0.64	378
Textile	1.20	8	260	0.64	200
Pharmaceutical/Chemical/ Cosmetics	9.63	8	260	0.64	1,605
Leather Product/Footwear	0.16	8	260	0.64	27
Agro and Food Processing	0.83	8	260	0.64	138
Jute Goods	0.16	8	260	0.64	27
RMG	2.44	8	260	0.64	407
Misc. Industrial Use*	4.27	8	260	0.64	712
Provision for Uncertainty of Peak Load Demand	5.24	8	260	0.64	873
Other than Industrial Use	6.61	8	260	0.64	1,102

Around 32.8 MW electricity will be required. Gas is required with respect Burner capacity =CFH (Approx. 11000 CFH for 1000KW Electricity Generation). GHG emission of proposed project will be around 434.45 e tones/year:

Table 5-4: GHG emission rate as per gas consumption of proposed industries

Land Use Pattern	GHG	GHG Emissions/yr (tons e/yr)	
Electrical and Electronic goods	CO_2	91,60,03,942	9.1600
	CH_4	65,312.22	0.0007
	N_2O	16,328.06	0.0002
Textile and RMG	CO_2	4,15,65,24,735	41.5652
	CH_4	2,96,365.40	0.0030
	N_2O	74,091.35	0.0007
Pharmaceutical/Chemical/Cosmetics	CO_2	12,31,27,24,215	123.127
	CH_4	8,77,912.60	0.0088
	N_2O	2,19,478.15	0.0022
Leather Product/Footwear	CO_2	3,92,12,498	0.3921
	CH_4	2,795.90	0.0000
	N_2O	698.98	0.0000
Agro and Food processing	CO_2	12,52,83,92,951	125.284
	CH_4	8,93,290.05	0.0089
	N_2O	2,23,322.51	0.0022
Total emission of Economic Zone (tons e/yr)			**299.555**

Environmental Selection

The following criteria were applied for selection of sites:

(1) The municipality is eligible based on the project administration manual.
(2) The proposed site is nominated by the municipal government attesting their ownership and the absence of encumbrances to include but not limited to informal settlers, environmental protected areas, physical cultural resources, and heritage sites.
(3) Consistent with the municipal land use and zoning plans.
(4) Minimize the climate change risk and vulnerability by referring to the rapid urban climate change assessment

However, industrial zone generates the most noise, pollution, and other noxious uses out of all three types of manufacturing process. For this our team has studied the area with following check list before the selection of the site some are given below;

(1) Location accessibility and infrastructure: it is necessary to keep into consideration the access to the site. The easily accessible factory is essential not only for the workforce but also for getting raw materials, sending out finished goods. Customers and Suppliers would prefer an easily accessible place. The economic zone is well connected with road, railway and inland water transportation.

(2) Zonal Classification: The product to be manufactured in the proposed factory also plays a vital role while selecting the site. The statutory norms prohibit some industries, especially those who are polluting to come up near residential areas. The proposed area is having minimal population and situated in the bank of Padma River, demography change of the area will induce minimal impact on the regional population which is controlled by environment management plan.

(3) Site cleaning and clearing: The current situation of the site, including the level of cleaning and clearing necessary, has to be considered while making factory layout designs. We also should find any local restrictions on the disposal of material. The area is open and exposed without any settlement, therefore, such restriction will not happen in this economic zone.

(4) Topo and geotechnical survey: A topographic survey and soil test is necessary for taking an informed decision about the land purchase. An area with uneven contour may require excavation and /or filling. Soil conditions also determine the type of foundation to be provided for the industry. The proposed economic zone not having flood hazard, earthquake prone, mineral deposit or any archaeological and social conflict site.

(5) Sewage and effluent discharge: Some industrial areas have treatment plants located near them. The utilization of these plants by the industries may reduce the environmental pollution caused by Industries. This will also reduce the burden for the industries of putting up a new treatment plant of its own.

(6) Power and water supply conditions: Before the Industrial site selection, we must check the power supply company and the substation. Before industrial zone we have considered factors like incoming lines, the stability of voltage, classified industrial power lines, etc. The availability of water in Padma River is about 1109.84 m3/day.

(7) CNG, LPG, and fuel oil supply conditions: The availability of a piped supply of Gas is a necessity for many factories layout designs. Many industries use fuel for their process. Dependable supply to the site is an advantage. These factors help in making a decision while selecting an industrial site. The economic zone having 55393 m3/day gas demand which will be directly purchased from government organization.

5.3 Site Justification from Environmental Perspective

The proposed Economic Zone contains various types of industries. Details investigations have been performed in order to check the viability for project establishment. From perspective of environment, significant indicators or factors have been studied, *i.e.* meteorology, air, water, noise, soil, loss of agricultural and ecological assets, and hydro-meteorological parameters. The following Table 5-5 contains details about each indicator whether the proposed industries would encounter any environmental concerned issue or not. The summary of the outcome can be stated that the site and existing environmental condition is feasible for establishment of proposed industries without any extra interventions.

Table 5-5: Environmental Suitability of the Project Site

Criteria	Findings
Meteorology	The area falls under tropical climatic region. Existing condition of the Temperature, Annual Rainfall, Humidity, Wind speed and direction, Sunshine hour etc. has been studied and is found suitable for the proposed project operation. As there is no industrial area in and around the site, and it is composed of agricultural lands and some settlements, so the area is perfectly viable from environmental perspectives.
Air Quality	The results of ambient air quality parameters for eight monitoring locations showed that all the parameters are well and within the national ambient standards. Particulate load of the area suggests the area having slightly dust pollution due to unpaved road, mixed urban and rural settlement surrounding the study area. Similarly, gaseous parameters at

Criteria	Findings
	all location were also observed well within the standard which is also justifying the minimum pollution surrounding the study area.
Water Quality	Both Surface water and ground water are available in abundance for use. pH of the groundwater sample has been found slightly alkaline in nature which is well suited for any industrial use. Other parameters like EC, Chloride, Nitrate and Dissolved Oxygen have been found within the Standard level. Similarly, the pH of Surface water also shows slightly alkaline nature, Turbidity of studied samples were found higher in range and varied from 22 to 40 NTU which mainly due to naturally high deposition of the plant residue and agricultural waste in water bodies. Similarly, TSS varied from 35 to 05 mg/l in the study area which also justify the availability of organic residue in the water. High depositional pattern of Padma River in catchment area enhances the silt load in the water and is responsible for high TSS in the water during turbulence. Therefore, treatment is required in case of using the surface water for industrial purpose. DO, BOD and COD were found within suitable level but salinity was found which is responsible for the deterioration of various machineries of industry. Therefore, treatment and removal of salinity is a prerequisite for the site.
Noise Quality	The values of noise level, which were recorded, and the level was well within the permissible limit as per the ambient noise standard. Elevated noise level was found at 11:00 hr to 16:00 hr which indicates that are belonged to mixed zone with residential and commercial settlement.
Soil	The soil sample collected from the study area revealed that the soil belongs to moderate nutrient load with clay loam. The Organic matter of all the samples were found low amount due sandy nature which indicates high depositional pattern of the study area. Loam is the best soil type for construction due to its ideal combination of silt, sand, and clay. It combines the best of all their qualities into the ideal balance for supporting a foundation. Therefore, from lithological perspective, the site is well suited for construction of various industrial zones.
Land Use	The major land use of the area is Single crop. Most of the land is barren and some plantation (Banana, Mango, Guava, Lichu) has been found in that area. Some homestead vegetation is also dominant in prospect of land use in that area.
Ecosystem	No critically endangered fish or Flora and Fauna have been found in and around the project area.
Roadway Communication	The Kushtia-Jhenaidah Highway (N704) is passing through on the south-east side over a nearly 155 km distance. This route connects Jashore, a neighbouring area, with Mongla and Khulna via highways. At present the capacity of the local access roads adjacent to project area are quite limited and the width of existing roads are inadequate to cater to the new volume of traffic. Hence, the roads network will need to be upgrade and improved.
Natural Hazard and Flooding Condition	The land elevation of the proposed Kushtia EZ is between 14 to 16 mPWD, therefore, this area is less vulnerable to riverine flood. Most of other natural calamities as Water logging, River bank erosion, Drought, Earthquake, Salinity etc. have negligible impact over the proposed project

Criteria	Findings
	site.
Socio-Economic Status	The Kushtia EZ falls under Mokarimpur Union, Bheramara Upazila of Kushtia District. According to 2011 Bangladesh census, Bheramara had a population of 200,084. Males constituted 49.39% of the population and females 50.61. Muslims formed 97.760% of the population, Hindus 2.216%, Christians 0.005% and others 0.019%. Bheramara had a literacy rate of 48.74% for the population 7years and above. Agriculture is the main occupation of the people and the major crops are paddy, wheat, mustard, sweet potato, sunflower, onion, garlic, betel leaf, tobacco, and sugarcane. The Kushtia EZ will promote balanced development of multi-product industries in the region, create employment opportunities for the local people and promote FDI through industrialization.

6 Environmental and Social Baseline

The environmental and social baseline is the existing status of environment and society around the proposed project site. It has been analyzed through assessment of environmental components like air, water, land, noise, soil, etc. and environmental characteristics like physical, biological and socio-economic status of the study area, within the 10 km radial zone of the project site. Physical environment includes topography, land, soil, meteorology, air, water, noise, etc. and the biological environment includes flora and fauna. Socio-economic environment of the study area includes demography, ethnicity, religion, education and employment opportunity, occupation, income, poverty, social relations, etc. Baseline environmental conditions are based on the data collected from various related agencies and the secondary documents from published sources and websites. The baseline provides the basis for assessment of impact (potential changes in the baseline conditions) due to the development of the proposed zone. Mainly there are two objectives in examining and defining the existing environment:

(1) To recognize potential environmental impacts of the project and enable mitigation measures to be identified; and
(2) To provide a baseline against which environmental conditions can be measured throughout the Project lifetime.

6.1 Meteorology

To investigate the climatic condition of the study area different meteorological parameters have been collected from multiple secondary sources. The proposed study area falls under tropical climate. Basically, this region has a distinct monsoonal season which influences all other climatic parameters. Figure 6.1 shows the location of the study area in the climatic sub-regions of Bangladesh.

Beyond weather forecasting, meteorology is concerned with long-term trends in climate and weather, and their potential impact on human populations. Various meteorological parameters are necessary to study for developing an EZ. The air quality is dependent on the temperature and wind condition of the area. Rainfall and precipitation are needed to know for calculating precipitation index in order to have a clear idea about the drainage condition and how to develop/maintain it. The wind speed and its direction are needed to establish the stack height and it will also affect the flow of air pollutant. A proper level of humidity eliminates the risk of static electricity build-up, which makes the processing of the material more difficult and which may even cause damage to the equipment. Therefore, knowing the existing meteorological condition of an EZ area is necessary. Without knowing the present condition impact assessment is not possible.

The ambient mean temperature of the study area is found as 17°C-18°C in winter and 28°C-30°C in summer. On the other hand, the annual average rainfall in this region varies from 1000 mm – 1800 mm, which is relatively lower than the Eastern areas of the county. The study area falls in the western climatic zone of Bangladesh. Climatological information in terms of Rainfall, Temperature, Relative Humidity, Wind speed, Sunshine Hour, Evaporation, and Evapotranspiration of the BMD station at Ishwardi. This is the nearest station of the

study area and represents the meteorological condition of the area. Summary of the analyses of meteorological parameters are given in the following sections:

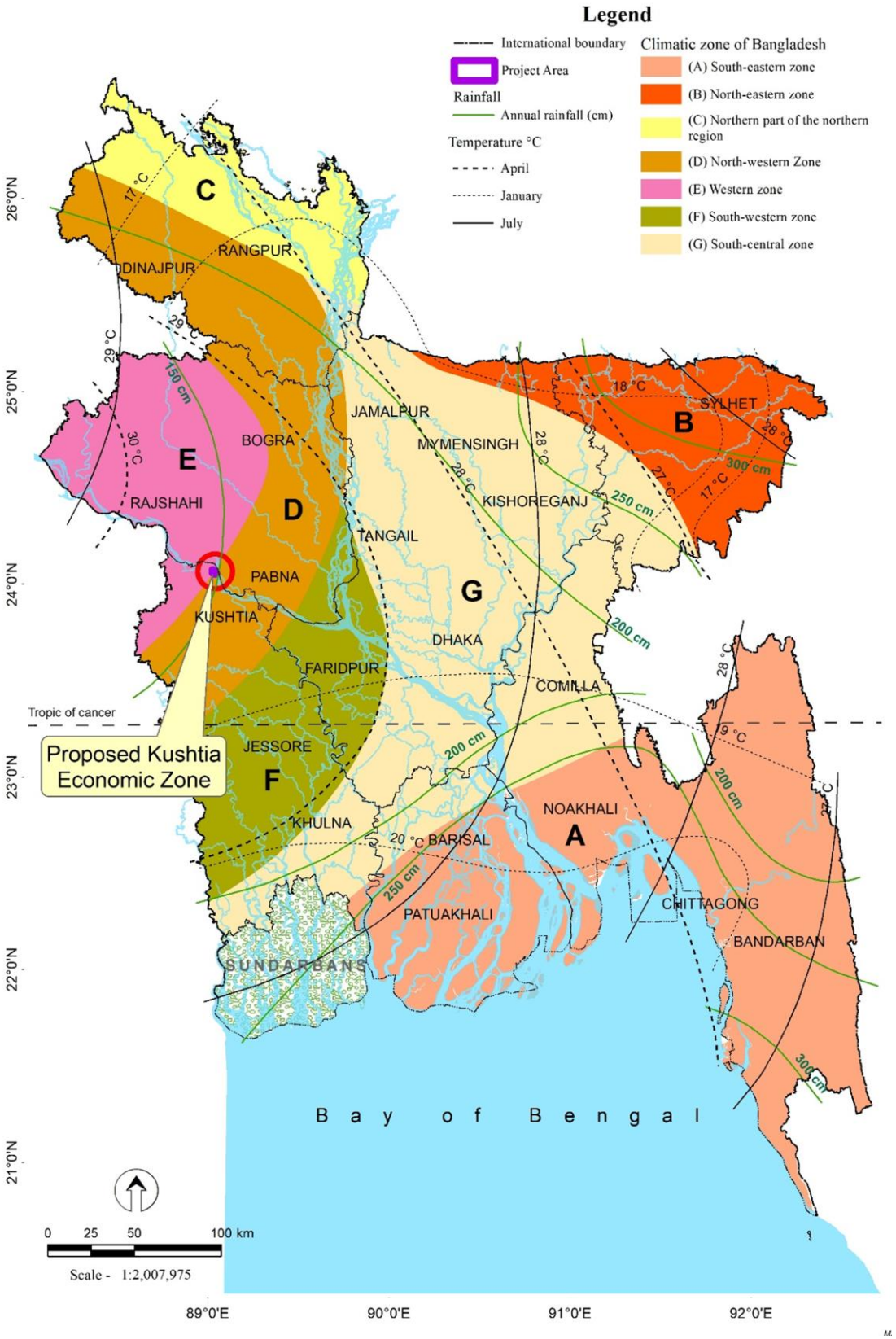


Figure 6.1: Climatic sub-regions of Bangladesh

6.1.1 Temperature

The summer is hot and dry interrupted by occasional heavy rainfall. The rainy season is also hot and humid having about 88 percent of the annual rainfall. The winter is predominantly cool and dry. The average low temperature occurs in November to January while the average high temperature high temperature may be occurring in May.

Table 6-1: Annual Distribution of maximum temperature (°C) at Kushtia EZ

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.	Annual
2011	26.8	32.5	38	37.5	36.3	37.5	35.8	35.5	36.4	35	31.2	30	38
2012	27.5	32.5	38.8	40.2	41.8	40.8	35.7	35.6	36.8	34.5	30.8	27.6	41.8
2013	27	31.6	37.2	40	38	36.8	35.5	36.2	35.6	34.2	32	29.4	40
2014	27.7	29.5	38.4	41	42	38	36	35.4	36.6	34.6	33	28.5	42
2015	29.5	33.7	36.5	36.5	39.2	37.5	36.2	35.2	36.5	35.7	32.4	30	39.2
2016	28	33.5	36	40.2	39	37.5	35	36.2	35	35.8	33.6	29.5	40.2
2017	29.3	33.1	36.8	38	37.2	37	36	35.5	36.2	35.8	32.5	28.8	38
2018	26.8	32.5	35.3	36.2	35.8	39	37.2	37	36.3	36	33	28.2	39
2019	28	32	36.5	39	39	38	36.3	36	36	34	31.7	30.2	39
2020	28.6	30.2	36	38.7	37.4	36.6	36	36.7	35.8	35.8	33.1	29.3	38.7
2021	29.2	35	37.5	40	38.5	37.7	36.4	35.8	36.2	36	31	29.7	40

Table 6-2: Average minimum temperature (°C) in Ishwardi Station near Bheramara

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.	Annual
2011	4.6	9.5	10	19.5	21.2	23.6	24.5	24.2	25	17.5	13.8	7.5	4.6
2012	6.5	7.5	13.5	18	19.4	22.8	25.2	25.5	24.5	16.5	11	7.8	6.5
2013	3.9	9.2	11.5	19	21.5	23	24.6	25	24.5	18.4	12.4	8.5	3.9
2014	6	8.8	13	19	19.5	22.8	25	24.4	24.4	17.5	11.4	7.2	6
2015	7.2	7	12.4	18.6	20.5	23.3	24.4	24.5	24	18.5	15	8.8	7
2016	6.8	10.2	15.5	18	21.2	23.5	25.3	23.5	24.8	21.7	14	9.4	6.8
2017	5.5	10.8	12.8	18.7	20.6	23.5	24.8	25	23.5	18.5	12.5	11	5.5
2018	5.5	11	14.2	19	19.8	23.5	25	26	24.5	16.6	13.6	7	5.5
2019	7.5	9	10	17.5	21.7	21.5	24.4	25	24	19.6	14.5	8	7.5
2020	8.2	6.8	14.2	18	20	24.3	25.2	26	25	22	11.5	7.6	6.8
2021	6.2	6.4	14.8	16.7	21	24	23	24.5	25	18.7	14.4	9	6.2

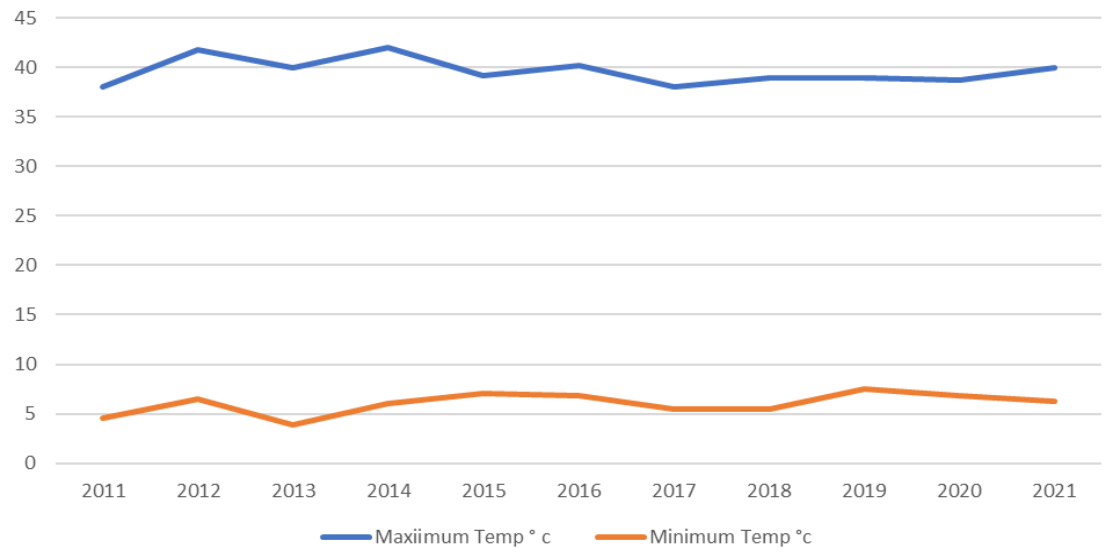


Figure 6.2: Annual Average Temperature at the Project Area

6.1.2 Humidity

Due to heavy rainfall and proximity to the Bay of Bengal, the humidity level in Bangladesh remains high. Humidity data of Ishwardi station has been considered for the project area. The monthly variation of humidity patterns from the Ishwardi station has been given. Relative Humidity data was also collected from the BMD station at Ishwardi station and analyzed. The analysis of monthly relative humidity data for the period from 2011 to 2021 is shown in Figure 6.3. The analysis shows that the highest Relative Humidity in all the months was recorded as 79% whereas the minimum values 77%.

Table 6-3: Monthly relative humidity variation (%) of Kushtia

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
2011	79	71	65	71	78	82	83	87	85	81	79	84	78
2012	79	66	60	68	71	81	87	86	86	83	80	86	77
2013	81	74	63	63	81	83	82	85	84	85	78	81	78
2014	83	76	64	61	69	83	85	84	83	82	77	83	77
2015	82	77	65	75	77	82	85	85	82	81	80	80	79
2016	82	77	69	70	77	82	88	84	86	82	79	83	79
2017	77	71	70	72	77	82	87	85	85	85	80	83	79
2018	82	73	67	77	81	80	85	82	81	80	77	75	78
2019	75	74	65	75	75	81	83	83	85	84	81	82	78
2020	83	75	70	70	79	83	85	83	86	83	77	81	79
2021	82	72	66	65	77	83	83	84	83	82	78	79	77

Source: Bangladesh Meteorological Department, BMD

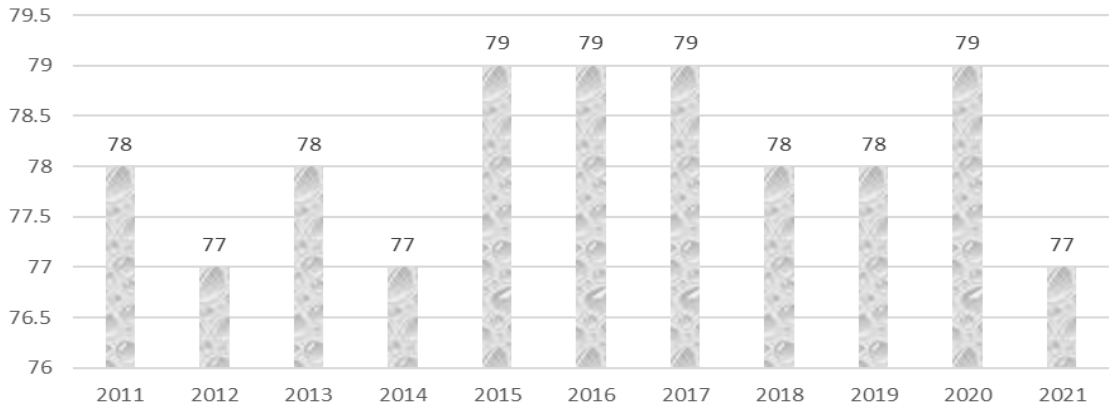


Figure 6.3: Annual Average Humidity (%) of Kushtia EZ.

6.1.3 Rainfall

Rainfall data was collected from Ishwardi meteorological station. From the available data, the analysis at Ishwardi station was done for the period from 2011 to 2021. The area receives high rainfall during April to October while November to March is the drier part of the year with very less rainfall. The historical data of rainfall of the project site is given below. From the observation of last ten years data highest annual rainfall data is 1799 mm and lowest annual rainfall data is 1062 mm.

Table 6-4: Average monthly Rainfall over the last 10 years at Kushtia EZ

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.	Annual
2011	4	1	30	96	155	253	289	645	261	2	0	0	1736
2012	12	0	5	51	69	177	215	97	178	157	86	15	1062
2013	1	14	0	69	182	264	130	218	121	130	0	0	1129
2014	3	33	32	19	129	525	182	249	179	89	0	0	1440
2015	0	8	38	111	147	332	394	254	213	82	3	2	1584
2016	30	12	112	52	177	136	240	132	381	42	2	0	1316
2017	1	0	21	118	111	159	456	274	278	323	19	39	1799
2018	0	9	47	220	190	149	426	90	73	94	4	19	1321
2019	0	53	8	82	126	286	300	148	179	220	36	6	1444
2020	23	0	21	29	380	237	437	157	264	165	0	3	1716
2021	0	0	1	41	179	396	315	324	182	114	18	16	1586

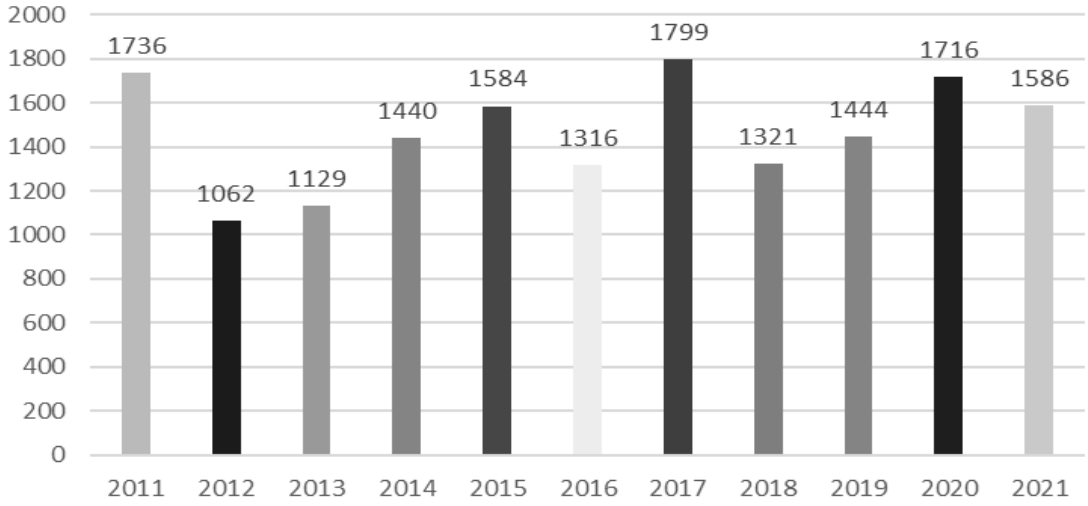


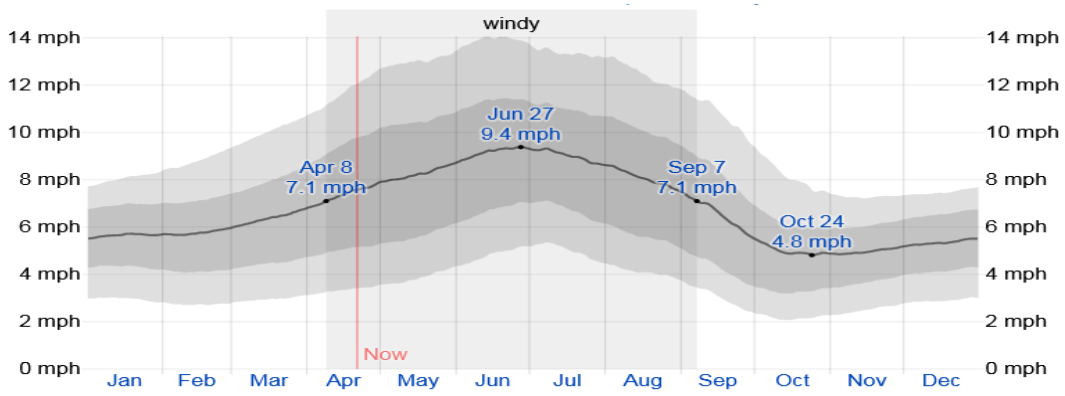
Figure 6.4: Average monthly Rainfall over the last 10 years at Kushtia EZ

6.1.4 Wind Speed and Wind Rose Analysis

From the observation of last 11 years (2011-2021) data of wind speed, wind direction of this area, a wind rose diagram was created by WARPLOT software. This section discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages. The average hourly wind speed in Kushtia experiences significant seasonal variation over the course of the year.

The windier part of the year lasts for 5.0 months, from April 8 to September 7, with average wind speeds of more than 7.1 miles per hour. The windiest month of the year in Kushtia is June, with an average hourly wind speed of 9.2 miles per hour.

The calmer time of year lasts for 7 months, from September 7 to April 8. The calmest month of the year in Kushtia is November, with an average hourly wind speed of 5.0 miles per hour.



The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind Speed (mph)	5.6	5.8	6.4	7.4	8.3	9.2	9.0	8.0	6.5	5.0	5.0	5.4

Figure 6.5: Average monthly wind speed at Kushtia EZ

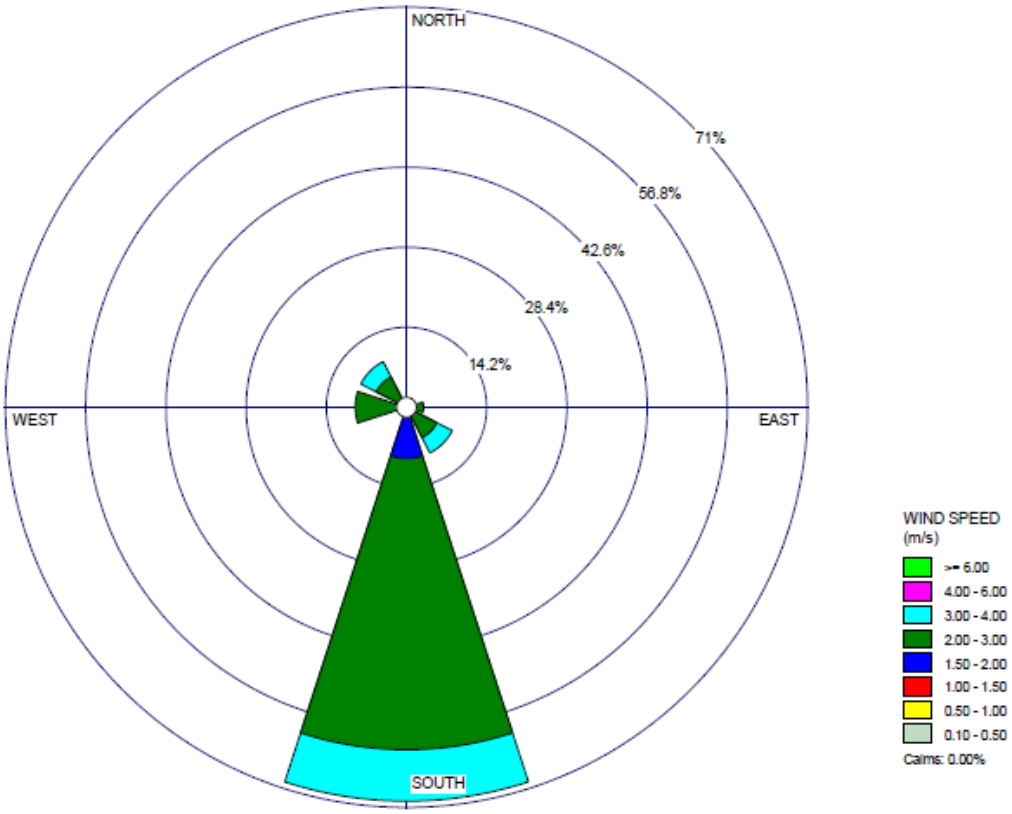


Figure 6.6: Seasonal WR diagram for pre-monsoon of Kushtia EZ

During pre-monsoon the wind speed in the South direction is the highest and it is almost 71%. The average speed during this time is 2-3m/s and sometimes it is 3-4m/s.

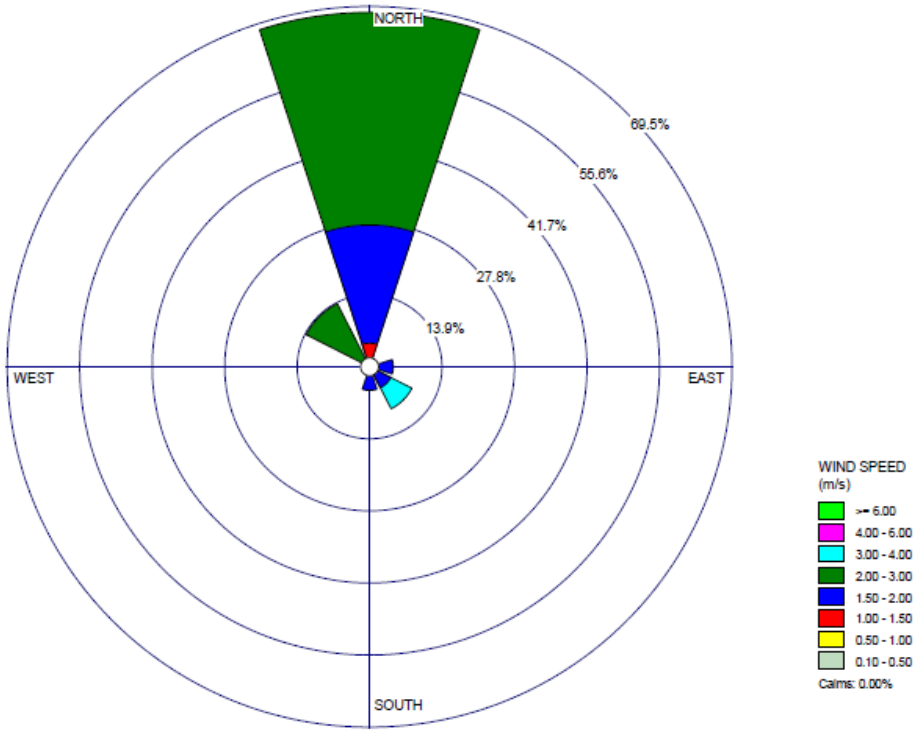


Figure 6.7: WR diagram for Monsoon season of Kushtia EZ

During Monsoon season the wind speed in the North direction is the highest and it is 69.5%. The average speed during this time is 2-3m/s.

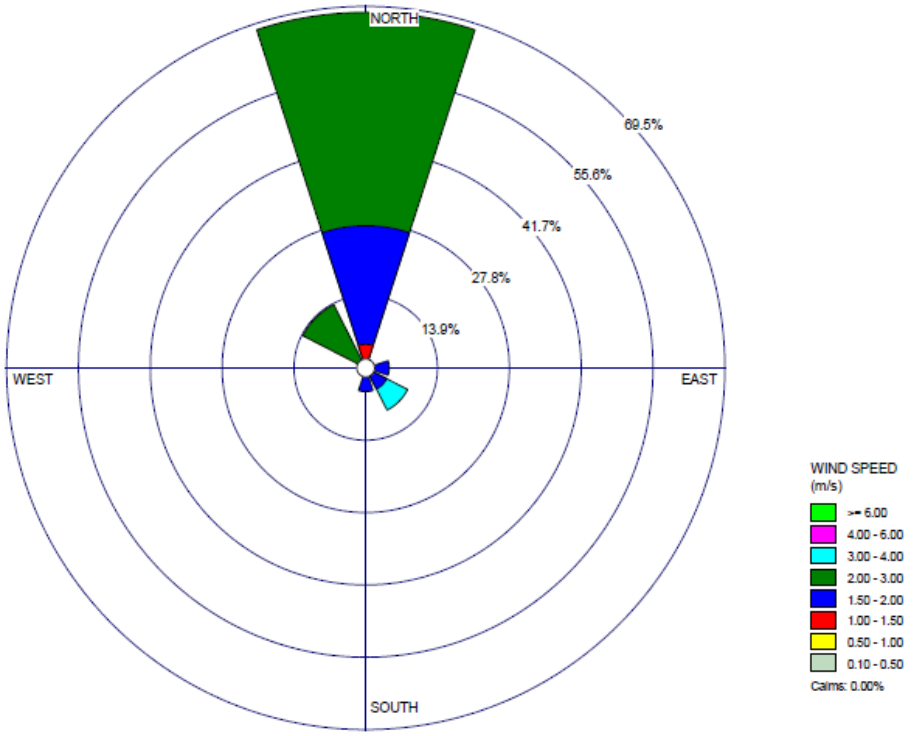


Figure 6.8: WR diagram for post-Monsoon season of Kushtia EZ

During Post-Monsoon season the wind speed in the North direction is the highest and it is almost 68%. The average speed during this time is 2-3m/s.

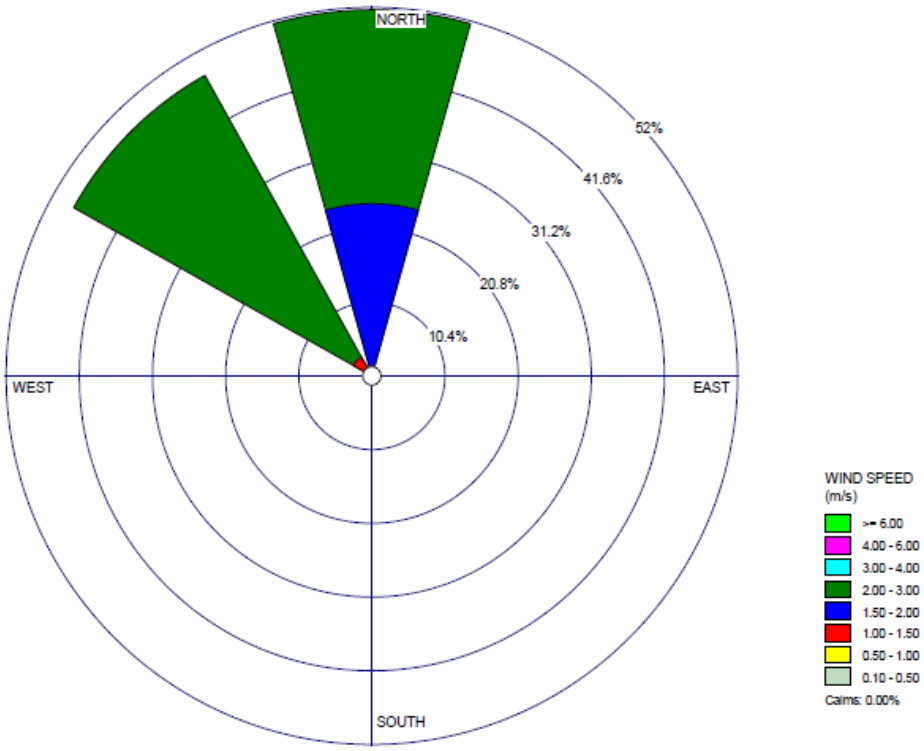


Figure 6.9: WR diagram for Winter season of Kushtia EZ

During winter season the highest speed is in the North and North-West direction. 20% in the North direction have wind speed at 1.5-2m/s and 52% remains in 2-3m/s speed.

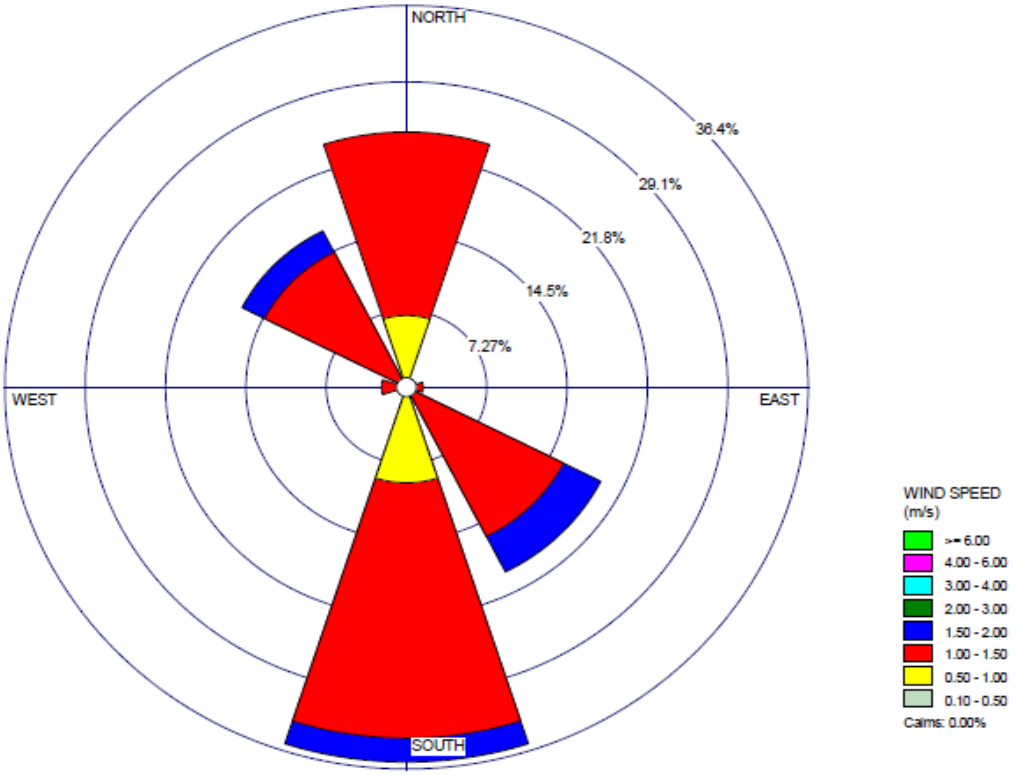


Figure 6.10: Distribution of average wind direction through WR diagram of KEZ

6.1.5 Sunshine Hour

Sunshine data was also collected from the BMD station at Ishwardi station and analyzed. The analysis of monthly sunshine data for the period from 2010 to 2020 is shown in the following table. From the observation of last 11-years data, the maximum sunshine data is 6.5 in 2010 and minimum sunshine data is 5.7 in 2015 in this area.

Table 6-5: Average monthly Sunshine hour over the last 11 years at Kushtia EZ

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
2010	5.4	7.5	8.6	7.5	6.9	5.2	6.1	5.8	5.7	7.2	6.5	5.6	6.5
2011	5.5	7.7	8.1	7.6	7	5.2	5.4	3.8	6	7.5	6.3	4.2	6.2
2012	4.5	8	8.2	8.3	7.9	4.6	3.9	5.6	5.6	7.9	6.5	4.3	6.3
2013	5.2	8	8	7.5	3.8	5.8	6.3	4.4	5.7	5.1	8.4	5.2	6.2
2014	5.2	6.9	8.2	8.8	7.4	3.3	4.1	4.2	6.5	6.9	6.2	4.2	6
2015	4.5	6.2	8.3	7	7.4	5.3	3.4	3.6	5.9	6.9	7	2.6	5.7
2016	3.2	5.9	6.7	7.8	6.5	6	3	6.3	5.4	7.7	7.3	5.3	6
2017	6.6	6.9	6.1	6.8	7.2	5.6	2.9	4.2	3.9	5.6	7.4	6.1	5.8
2018	5.7	6.2	7.8	7.3	4.7	5.4	3.8	4.9	6.1	6.6	6.8	6	6
2019	6.8	8.1	8	7.2	7.2	5.3	4.2	5.8	4.5	6.7	7.4	5.4	6.4
2020	5.6	7.1	7.6	6.8	6.2	2.4	3.5	4.5	4.3	7	8.2	6.1	5.8

6.2 Environmental Quality

6.2.1 Air Quality

Site Selection
The ambient sampling locations were chosen based on the background of the area keeping in mind of point source and other interference. Additionally, height of the sampling point has been considered based on the presence of wall and other obstruction surrounding the project location. Before installation of machine, some environmental key points were observed like free-flowing air, wind direction and well mixed air. The elevation angel of nearby buildings and other obstruction has been considered during site selection.

All steps have been carried under consideration of ECR and IFC guideline for Ambient Air Quality Monitoring Program. Eight locations (n=08) were monitored randomly for 24 hr and with the help of automated Respirable Dust Sampler (RDS) and Fine Dust Sampler (FDS) for ambient air quality in the month of June, 2022 Table 6-6.

Table 6-6: Ambient air monitoring location with their geographical coordinates

Parameters Monitored	Location code and coordinates
Monitoring Frequency	24 hours
Location 01	AQ1- Project Site at 24°4'42.60"N; 89° 0'39.41"E
Location 02	AQ2-Shahpara Jame Mosque at 24° 5'8.39"N; 88°59'46.85"E
Location 03	AQ3-Lalon Shah Bridge at 24°3'46.04"N; 89°1'8.97"E
Location 04	AQ4- Munsi Para Mosque at 24° 3'36.32"N; 89° 0'21.72"E
Location 05	AQ5- Bangladesh _ India Power Transmission Centre at 24° 3'59.80"N; 88°59'53.51"E
Location 06	AQ6- Gopal Nagar Jame Mosque at 24° 4'30.40"N; 88°59'39.52"E
Location 07	AQ7- Solamain Sah Chisti Majar at 24° 5'14.03"N; 89° 0'35.69"E
Location 08	AQ8- Paksy Babupara at 24° 4'52.08"N; 89° 2'9.84"E
Date of Sampling	22-06-2022 to 24-06-2022
Site Selection	To evaluate the ambient air quality at Kushtia

A well-designed monitoring programmed was carried out to assess the status of ambient air quality in the project area. The 24 hrs monitoring was carried out to cover above mentioned parameters. The monitoring was done by using Respirable Dust Sampler (RDS) and Fine Dust Sampler (FDS). The samples were collected and analyzed as per methods specified by WHO/IFC guideline. The objective of this study was to assess the existing level of air pollutants surrounding proposed economic zone. In regard to the techniques for collection of samples of particulate matter (PM10 and PM2.5) the “Respirable Dust Sampler (RDS) Envirotech Model APM 860 and “Fine Dust Sampler (FDS)” Envirotech Model APM 154 were used for air monitoring.

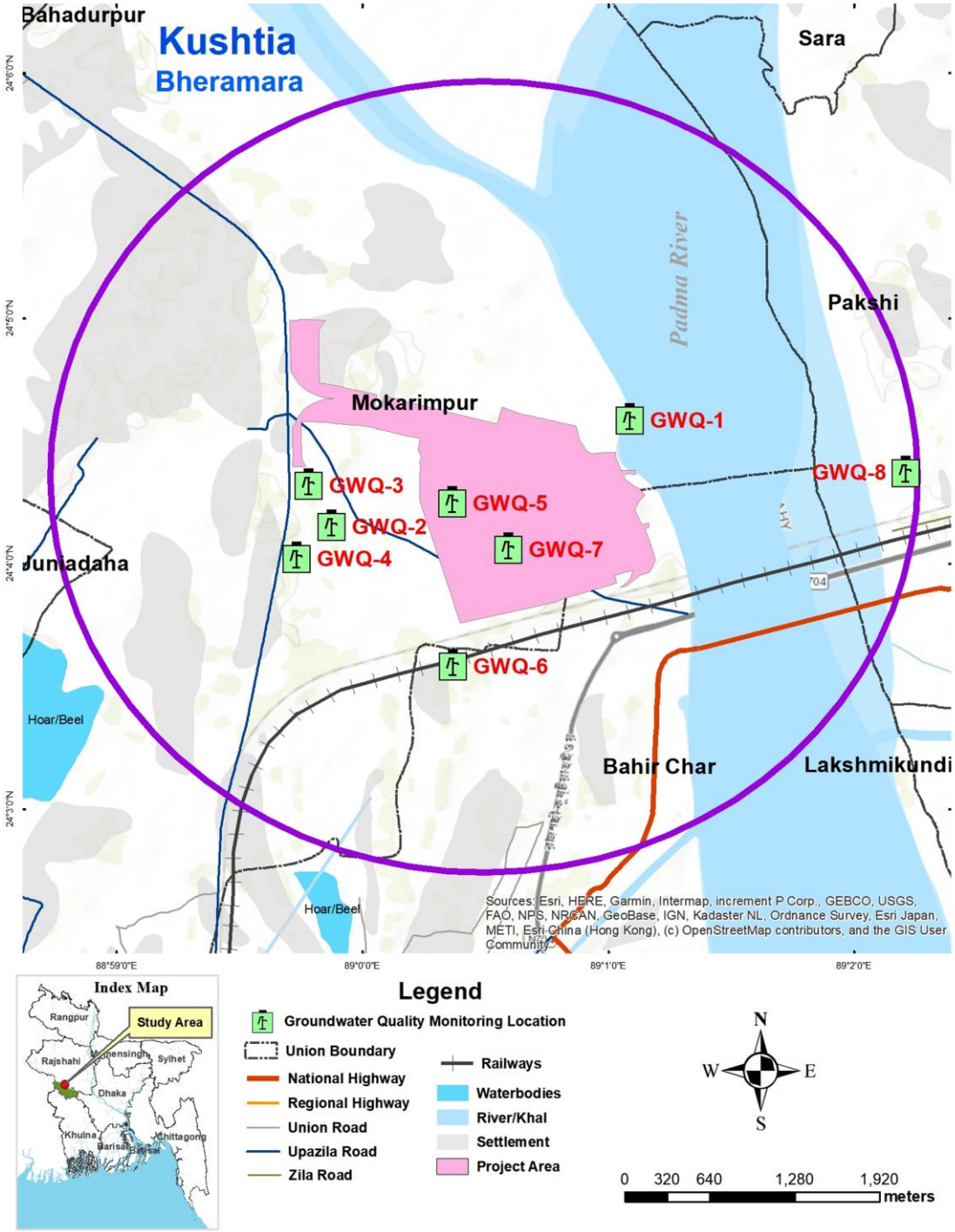


Figure 6.11: Ambient Air Sampling Locations

Table 6-7: Analytical technique for air quality sampling and analysis

	Ambient Air	Sampling Material	Instrument	Method of Estimation
1	SPM,	Dust Duck PG	Respirable Dust Sampler	IS 5182: Part4:1999
2	PM10,	GF filter 20 cm x 25 cm sizes	Respirable Dust Sampler	IS 5182 (PT-24),2019
3	PM2.5	46.2mm. PTFE filter	Find Dust Sampler	IS: 5182 (Part 23)

	Ambient Air	Sampling Material	Instrument	Method of Estimation
4	NOx,	Glass impinges	Respirable Dust Sampler	IS: 5182 (Part 2)
5	SO2	Glass impinges	Respirable Dust Sampler	IS: 5182 (Part 6)
6	CO	Tedlar Bag	CO Sampler	IS: 5182 (Part 10)
7	CO2	Tedlar Bag	CO Sampler	IS: 5182 (Part 10
8	O3	Glass impinger Dark Bottle	Respirable Dust Sampler	TPM/MSK/ENV(AP)/01/07

Figure 6.12: Ambient air quality sampling picture of study area AQ-1

Figure 6.13: Ambient air quality sampling picture of study area AQ-2

Figure 6.14: Ambient air quality sampling pictures of study area (Kushtia) AQ-3

The dust particulate matter was collected on filter paper (size GF/A20.3x25.4 cm) and the gaseous pollutants were collected simultaneously by a known volume of air through a number of bubblers of different flow rate through appropriate solution for absorbing different gases. The principle involved in Particulate Matter (PM) sampling method is that the particles are filtered from known volume of an air sample by a suction apparatus and the

particle are deposited on a filter paper. Generally, the gaseous pollutants in air are made to react with liquid absorbing media at atmospheric temperature and pressure when air is bubbled through the absorbing solution in the impinger. The analyzed results for different pollutants were compared as prescribed by Environment Conservation Rule (ECR, 1997) and WHO/IFC guideline which details given in the following table.

Table 6-8: Environment (Protection) Seventh Amendment Rules, NAPCR 2022

	Parameter	Concentration (mg/m3)			Averaging Time
		ECR	WHO/IFC	NAPCR 2022	
1	Carbon Mono-oxide	0.01	-	5	8 hours
		0.04	-	20	1 hour
2	Nitrogen Oxides	0.1	0.04	0.04	Year
		-	0.2	0.003	1 hour
3	Suspended Particulate Matter	0.2	-		8 hours
4	Particulate Matter 10 µm (PM10)	0.05	0.02	0.05	Year
		0.15	0.05	0.15	24 hours
5	Particulate Matter 2.5 µm (PM2.5)	0.015	0.01	0.035	Year
		0.065	0.025	0.065	24 hours
6	Ozone	0.235	-	0.18	1 hour
		0.157	0.160	0.1	8 hours
7	Sulphur Dioxide	0.08	-	0.25	1 hour
		0.365	0.125	0.08	24 hours
8	Carbon dioxide	-	-		1 hour

Source: IFC Guideline, WHO Guideline and ECR, 2023, National Air Pollution Control Rules 2022.

Particulate Matter (PM10)

The sampling of ambient air for evaluating PM10 levels were performed with a RDS Sampler fitted with a cyclone separator. Air exiting the separator is drawn at a measured rate through pre-weighed glass fiber filter sheets of 20 cm x 25 cm sizes. The concentration of PM10 were computed from the average air flow rate, sampling period and the mass of particulate matter collected over the filter surface.

[PM10 (µg/m3) = (Final weight of filter paper– initial weight of filter paper) / volume of air]

Particulate Matter (PM2.5)

PM2.5 is determined as per USEPA (United State Environment Protection Agency) guidelines with the help of Fine Dust Sampler (FDS). Ambient air @ 16.67 lpm is allowed to pass through Louvered inlet and WINS Impactor assembly having a 37mm dia. filter paper. Particulate matter of size <2.5 microns is deposited on 46.2mm dia. PTFE filter. The difference of final weight and initial weight of filter paper gives the weight of particulate matter of size <2.5 microns. The concentration of PM2.5 is computed as the weight of dust deposited on the filter divided by volume of air sampled.

[PM2.5 (µg/m3) = (Final weight of filter paper– initial weight of filter paper) / volume of air]

Sulphur Dioxide (SO2)

The sampling of ambient air for evaluating the gaseous pollutants were performed with a Multigas Sampler, using the vacuum created by the FDS Sampler for drawing the air samples

through the impingers. For SO2, air was drawn at a measured and controlled rate of 400 to 500 ml/min and passed through a solution of potassium tetra chloro mercurate (TCM). After sampling, the absorbing reagent was treated with dilute solutions of sulphuric acid, formaldehyde and para-rosaniline hydrochloride. The absorbance of the intensely coloured para-rosaniline methyl euphonic acid was measured at the wavelength of 560 nm using spectrophotometer and the amount of SO_2 in the sample was computed. The ambient SO_2 concentrations were computed from the amount of SO_2 collected and the volume of air sampled.

[SO_2 (µg/m3) = (A – A0) x 1000 x B x D/ V]

Where, A = Sample Absorbance, A_0 = Reagent blank Absorbance, B = Calibration factor (g/absorbance), D = Volume of absorbance solution in impinger during monitoring / volume of absorbing solution taken for analysis and V = Volume of Air Sample in liters.

Oxides of Nitrogen

Air was drawn at a measured and controlled rate of about 200 ml/minute through an orifice-tipped impinger containing solutions of sodium hydroxide and sodium arsenite. After completion of the sampling, an aliquot of the used absorbing solution was treated with solutions of H2O2, sulphanilamide and NEDA. The nitrite ion present in the impinger was calculated from the absorbance of the resulting solution measured at 540 nm using spectrophotometer. The ambient NOx concentrations were computed from the total nitrite ion present in the impingers, overall efficiency of the impinger and the procedure, and the volume of air sampled.

[NOx (µg/m3) = (A – A0) x 1000 x B x D/ 0.82V]

Where, A = Sample Absorbance, A0 = Reagent blank Absorbance, B = Calibration factor (g/absorbance), D = Volume of absorbance solution in impinger during monitoring / volume of absorbing solution taken for analysis and V = Volume of Air Sample in liters.

Carbon Monoxide

Rubber Bladder and Aspirators have been used to collect the 8 hourly samples for carbon monoxide. The CO levels were analyzed through NDIR Spectroscopy method.

Assessment Results

The results of ambient air quality parameters for eight monitoring locations were showed that all the parameters are well and within the national ambient standards. Particulate load viz. SPM varied from 135 to 148.6 µg/m3, PM10 varied from 78 to 88.6 µg/m3 and PM2.5 varied from 39.7 to 49.6 µg/m3 in the study area. Particulate load of the area suggests the area having slightly dust pollution due to unpaved road, mixed urban and rural settlement surrounding the study area. Similarly, gaseous parameters at all location were also observed well within the standard which is also justifying the minimum pollution surrounding the study area. However, overall, dust generating out of the site for any activity specifically and atmospheric aerosol over proximity of urban development area and natural soil erosion through wind in the catchment of Padma River would dissipate quite well without resulting to any gross dust (particle matter) pollution.

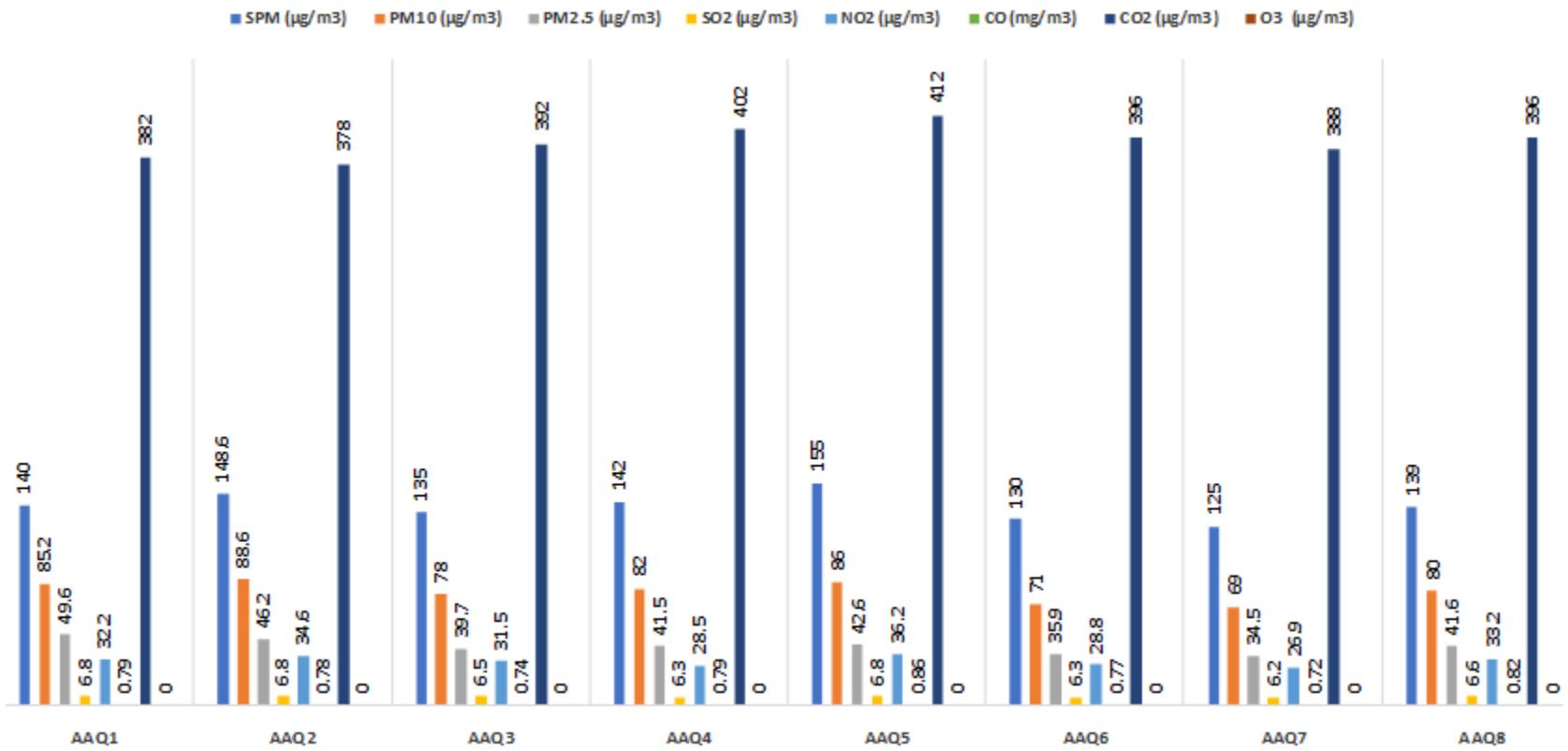


Figure 6.15: Ambient air quality level of the study area

Table 6-9: Air Quality Level of the Study Area (Kushtia EZ)

Parameters		SPM (µg/m3)	PM10 (µg/m 3)	PM2.5 (µg/m 3)	SO_2 (µg/m 3)	NO_2 (µg/m 3)	CO (mg/m 3)	CO_2 (µg/m 3)	O_3 (µg/m 3)
AAQS 2022		200	150	65	25	40	5	-	100
Sample Sites	AAQ1	140	85.2	49.6	6.8	32.2	0.79	382	<20.0
	AAQ2	148.6	88.6	46.2	6.8	34.6	0.78	378	<20.0
	AAQ3	135	78	39.7	6.5	31.5	0.74	392	<20.0
	AAQ4	142	82	41.5	6.3	28.5	0.79	402	<20.0
	AAQ5	155	86	42.6	6.8	36.2	0.86	412	<20.0
	AAQ6	130	71	35.9	6.3	28.8	0.77	396	<20.0
	AAQ7	125	69	34.5	6.2	26.9	0.72	388	<20.0
	AAQ8	139	80	41.6	6.6	33.2	0.82	396	<20.0

6.2.2 Noise Quality Assessment Report

Site Selection

During the construction or any machinery activities induced noise level in the ambient environment *e.g.* heavy earth, shipyard, moving machinery, compressors, welding machine, small generators and other activities has been monitored. In addition, there would be movement of vehicles for construction activities which would also add to the noise levels. The noise level was measured for eight locations (n=08) by sound level meter LUTRON, SL-4001-Q627552 (digital Instrument).

Table 6-10: Details of Noise monitoring location with their geographical coordinates

Parameters Monitored	Location code and coordinates
Monitoring Frequency	24 hours
Location 01	NQ1- Project Site at 24°4'42.60"N; 89° 0'39.41"E
Location 02	NQ2-Shahpara Jame Mosque at 24° 5'8.39"N; 88°59'46.85"E
Location 03	NQ3-Lalon Shah Bridge 24°3'46.04"N; 89°1'8.97"E
Location 04	NQ4-Munsi Para Mosque at 24° 3'36.32"N; 89° 0'21.72"E
Location 05	NQ5-Bangladesh_India Power Transmission Centre at 24° 3'59.80"N; 88°59'53.51"E
Location 06	NQ6-Gopal Nagar Jame Mosque at 24° 4'30.40"N; 88°59'39.52"E
Location 07	NQ7-Solamain Shah Chisti Majar at 24° 5'14.03"N; 89° 0'35.69"E
Location 08	NQ8-Paksy Babupara at 24° 4'52.08"N; 89° 2'9.84"E
Date of Sampling	22-06-2022 to 26-06-2022
Site Selection	To evaluate the Noise quality at Kushtia

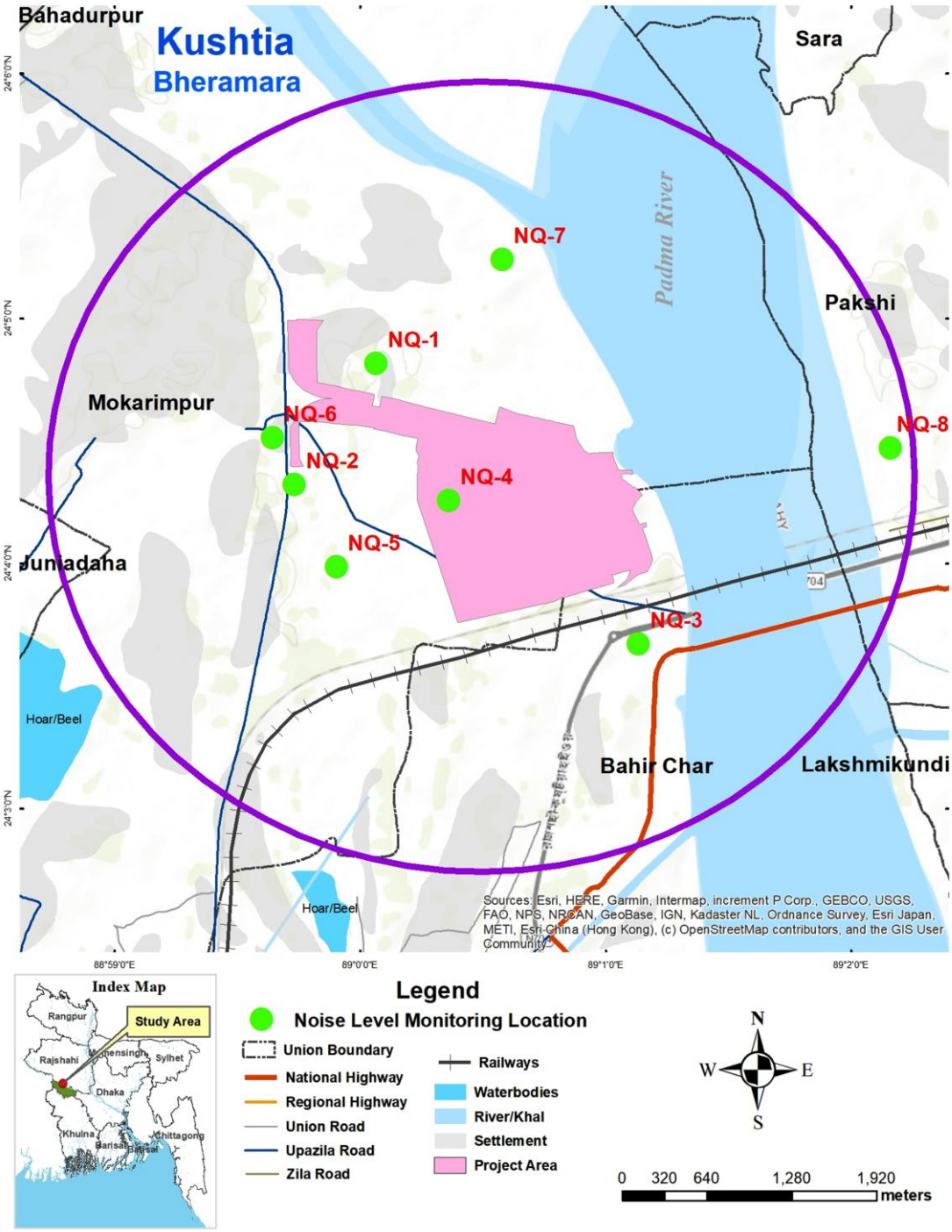


Figure 6.16: Noise Monitoring Location- Kushtia EZ

Figure 6.17: Picture of Noise Monitoring locations NQ-1

Figure 6.18: Picture of Noise Monitoring locations NQ-2

Figure 6.19: Picture of Noise Monitoring locations NQ-3

Methodology

The Sensor or Microphone: The sensor is a high precision electrode condenser microphone, which must be protected from physical abuse, dirt, oil, water or ingress of any such substance.

The Range Selector: These switches can be used for selecting the relevant range of the sound level. The calibrated and charged sound level meter is adjusted for slow time response. The noise level was measured at different sites for 24 hrs continuously and maximum and minimum level of noise was recorded for the particular site and then average was calculated which gave the final readings. Readings were taken in each division of north; south, east and west around each source and at various distances and the maximum minimum for particular hours were recorded. The obtained result of the noise will be compared with the department of environment, Bangladesh Standards for Noise (Revised 7th September in 2006).

Table 6-11: Bangladesh Standards for Noise

Location Category	Standards determined at dB(A) Leq unit	
	Day	Night
Silent Zone	50	40
Residential Area	55	45
Mixed Zone	60	50
Commercial Area	70	60
Industrial Area	75	70

Source: ECR Schedule 1 (Revised 7th September 2006), a Compilation of Environmental Laws, DOE

Table 6-12: Noise level Guidelines, IFC Standard 2007.

Receptor	Day Time 7:00-22:00	Night Time 22:00-7:00
Residential; institutional; Educational	55	45
Industrial; commercial	70	70

Assessment Results

Assessment of noise level was carried out at eight (n=08) locations to evaluate the ambient noise levels and possible impacts due to project and other man-made activities. The values of noise level were well within the permissible limit as per the ambient noise standard. This study shows that the noise level of all location was very comparable to each other in terms of noise level. Similarly, noise levels of all locations were found within the regulatory standard which indicates the absence of any anthropogenic activity in this area. The values of noise level, which were recorded, and the level was well within the permissible limit as per the ambient noise standard. It is interesting to note that at all location, elevated noise level was found at 11:00 Hr to 16: Hr which indicate that are belonged to mixed zone with residential and commercial settlement that induce the noise in the evening through high traffic movement. In addition, there are number of activities that could generate noise emission like project development activity, power generator, and other natural source like animal snoring, rain, thunderstorm and wind blow etc.

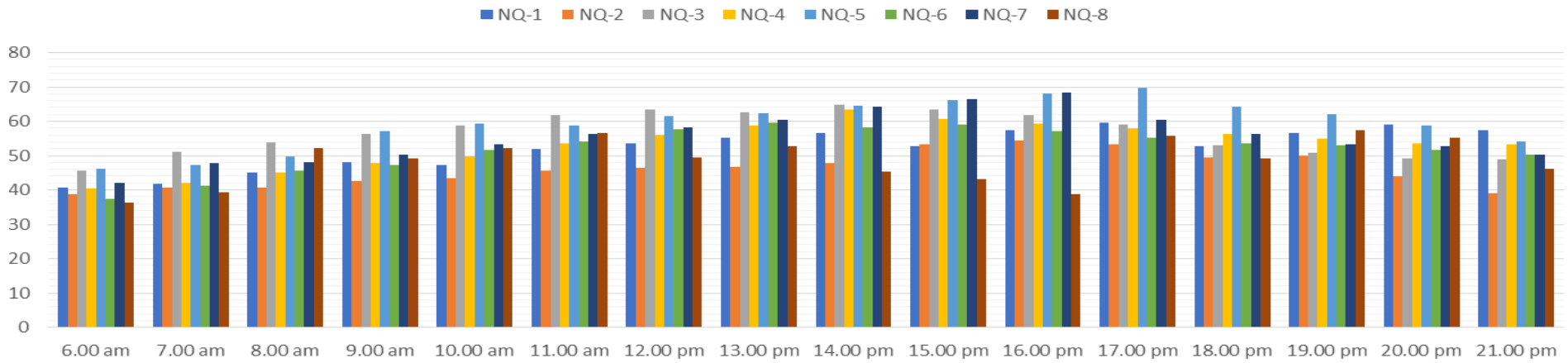


Figure 6.20: Noise level at day time (6am-9pm) for eight monitoring locations

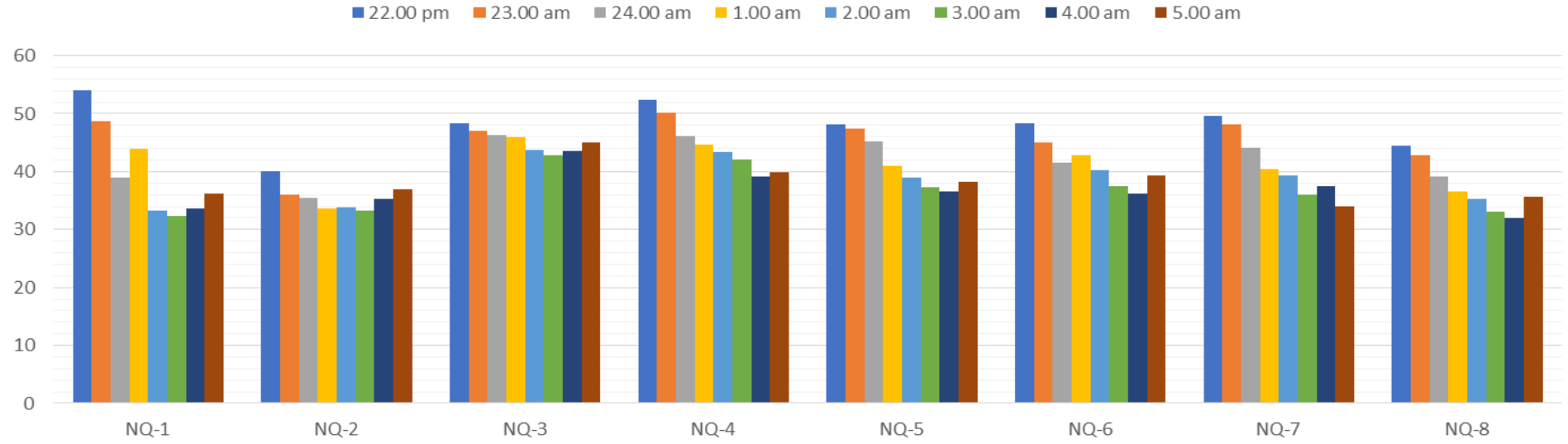


Figure 6.21: Noise level at night time (9pm-5am) for eight monitoring locations

Table 6-13: Noise Quality monitoring result at eight locations

Time	NQ-1	NQ-2	NQ-3	NQ-4	NQ-5	NQ-6	NQ-7	NQ-8
6.00 am	40.8	38.7	45.7	40.3	46.2	37.4	42.1	36.4
7.00 am	41.7	40.6	51.1	42.2	47.3	41.3	47.7	39.4
8.00 am	45.0	40.6	53.8	45.1	49.8	45.6	48.2	52.3
9.00 am	48.0	42.6	56.2	47.9	57.1	47.2	50.4	49.2
10.00 am	47.4	43.5	58.8	49.7	59.3	51.7	53.3	52.3
11.00 am	52.0	45.7	61.9	53.6	58.9	54.2	56.4	56.7
12.00 pm	53.7	46.4	63.5	56.0	61.4	57.7	58.2	49.4
13.00 pm	55.3	46.8	62.7	58.7	62.3	59.5	60.4	52.8
14.00 pm	56.5	47.7	64.8	63.5	64.5	58.3	64.2	45.3
15.00 pm	52.8	53.2	63.4	60.7	66.2	59.1	66.5	43.2
16.00 pm	57.3	54.5	61.9	59.3	68.1	57.2	68.3	38.9
17.00 pm	59.5	53.4	59.0	57.9	69.7	55.2	60.3	55.7
18.00 pm	52.8	49.6	52.9	56.4	64.4	53.7	56.4	49.3
19.00 pm	56.6	50.1	50.9	54.9	62.1	52.9	53.2	57.5
20.00 pm	59.0	44.0	49.3	53.7	58.7	51.6	52.7	55.3
21.00 pm	57.3	39.2	48.9	53.4	54.2	50.4	50.4	46.3
22.00 pm	54.1	40.0	48.4	52.3	48.1	48.3	49.7	44.4
23.00 am	48.7	36.1	47.1	50.2	47.4	45.1	48.1	42.8
24.00 am	38.9	35.5	46.3	46.2	45.2	41.5	44.2	39.2
1.00 am	43.9	33.7	45.9	44.6	41.0	42.9	40.4	36.6
2.00 am	33.2	33.8	43.8	43.3	38.9	40.3	39.3	35.3
3.00 am	32.4	33.2	42.8	42.0	37.3	37.5	36.1	33.1
4.00 am	33.6	35.2	43.6	39.2	36.5	36.2	37.5	32.0
5.00 am	36.2	36.9	45.0	39.9	38.2	39.4	34.0	35.7
Leq-day	54.9	48.7	59.8	56.8	63.2	55.0	60.6	52.2
Leq-night	46.70	36.1	45.8	47.0	43.7	43.1	44.3	39.4
Leq-max	59.5	54.5	64.8	63.5	69.7	59.5	68.3	57.5
Leq-min	32.4	33.2	45.7	39.2	36.5	36.2	34.0	36.4

Monitoring Schedule	Day	Night
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2007		
Residential; Institutional; Educational	55	45
Industrial	70	70

6.2.3 Water Quality Assessment Report

Site Selection

Reviewing the project area and background information regarding water, and soil characteristics, suitable analytical and sampling techniques has been chosen for testing under prevailing geographical conditions.

Evaluations has been done on the details scope of study which includes physicochemical parameters, biochemical parameters, Major ions, metals, metalloids and other essential micro-nutrients in water, soil and sediment commodity. Planning for Execution including identification for manpower, checking of instrument for Sampling, move to field with all instruments and identify the field location as per schedule. Collecting the necessary secondary data is to identify regional geology, population, climatic condition etc.

Eight Surface water (n=08) and eight (n=08) groundwater sampling sites have been chosen for the investigation based on the physiographical condition. The selection of sites was done considering the location of different project components, junction of streams course, spots of high-water velocity and some of the stagnated pools along with the areas having human interference. All eight sites were targeted based on availability of human activities.

Table 6-14: Details of water quality monitoring locations

Parameters Monitored	Location code and coordinates
Location 01	SWQ-1- Upstream Padma River at 24° 5'7.93"N; 89° 0'50.31"E
Location 02	SWQ-2- Down Stream Padma River at 24° 3'52.61"N; 89° 1'29.16"E
Location 03	SWQ-3- Kuchiamara Rd Pond at 24° 4'35.69"N; 88°59'55.68"E
Location 04	SWQ-4- Midstream Padma River at 24° 4'33.04"N; 89° 1'31.64"E
Location 05	SWQ-5- Pond Near Project Site at 24° 4'43.07"N;89° 0'36.97"E
Location 06	SWQ-6- Pond Near BIPTC center at 24° 4'3.39"N; 88°59'48.19"E
Location 07	SWQ-7- Pond Near NehrulIsalm at 24° 4'49.88"N; 89° 0'6.19"E
Location 08	SWQ-8- Padma River Oxbow Water 24° 5'30.98"N; 89° 0'34.59"E
Location 01	GWQ-1- Moni Park at 24° 4'33.81"N; 89° 1'4.52"E
Location 02	GWQ-2- BIPTC office at 24° 4'7.11"N; 88°59'53.05"E
Location 03	GWQ-3-Damukdia at 24° 4'57.49"N; 88°59'43.07"E
Location 04	GWQ-4-Shahpara Jame Mosque at 24° 5'8.39"N; 88°59'46.85"E
Location 05	GWQ-5-Munsi Para Mosque at 24° 3'36.32"N; 89° 0'21.72"E
Location 06	GWQ-6-Gopal Nagar Jame Mosque at 24° 4'30.40"N; 88°59'39.52"E
Location 07	GWQ-7-Solamain Sah Chisti Majar at 24° 5'14.03"N; 89° 0'35.69"E
Location 08	GWQ-8-Paksy Babupara at 24° 4'52.08"N; 89° 2'9.84"E
Rationale for Site Selection	To evaluate the Surface and groundwater quality and their current state in respect with drinking water quality of national standard

Methodology

(1) Initially, water samples were taken from project location as per given by customer based on the sampling method as suggested by American Public Health Association (APHA) and United State Environmental Protection Agency (USEPA) respectively.

(2) The physical parameters were measured at the sampling site itself since these are very sensitive to change after sampling.

(3) Appropriate collection of samples and mixing of the composite sample and its proper preservation, labeling and storage were carried out carefully during sampling time.

(4) To avoid mixing of samples and for accurate record keeping, a label with date time, name of sampling point and their coordinates had been attached to each sample bag during sampling time.

(5) All collected water samples were transported in laboratory after preservation as per standard procedures described by APHA.

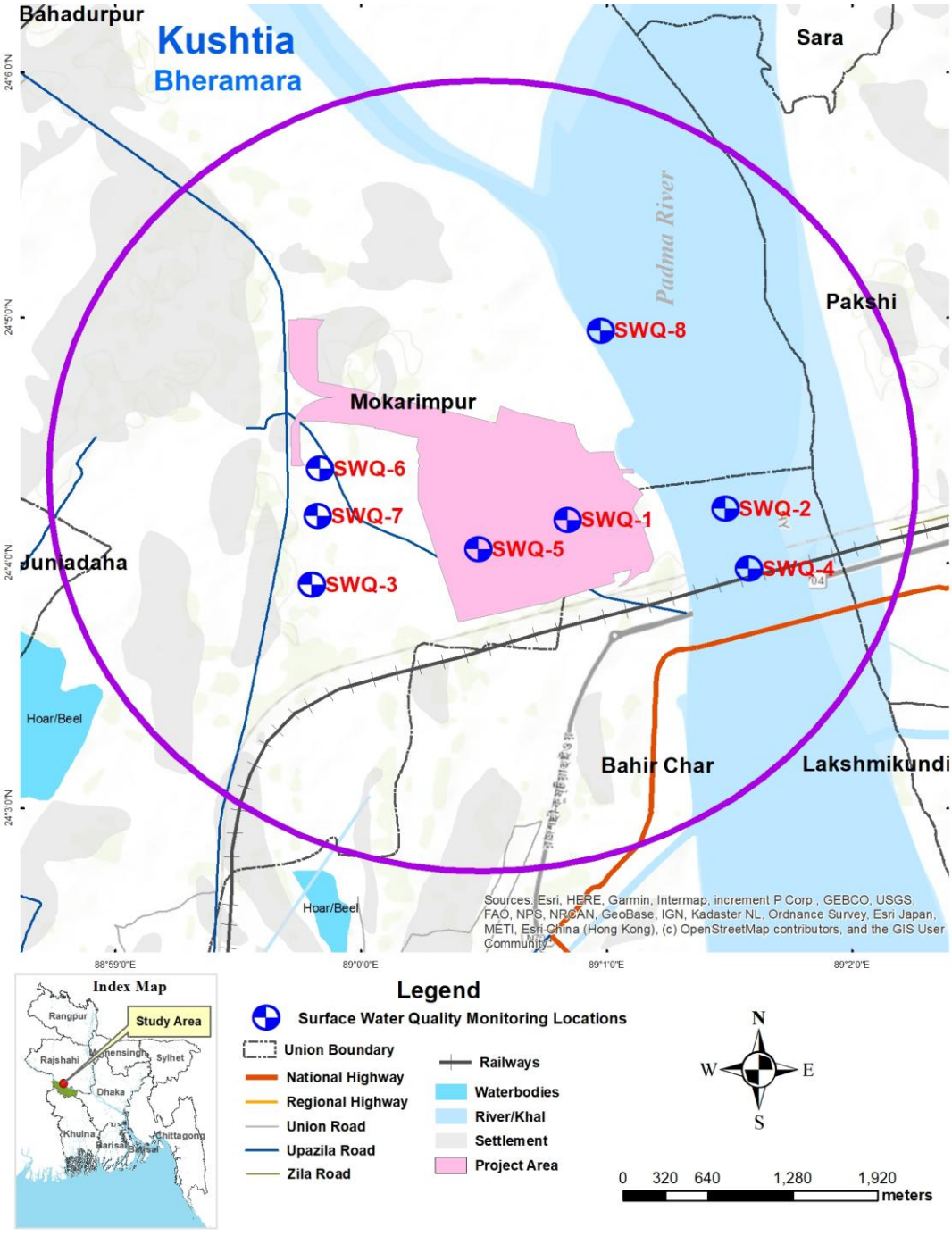


Figure 6.22: Surface water Quality monitoring Locations

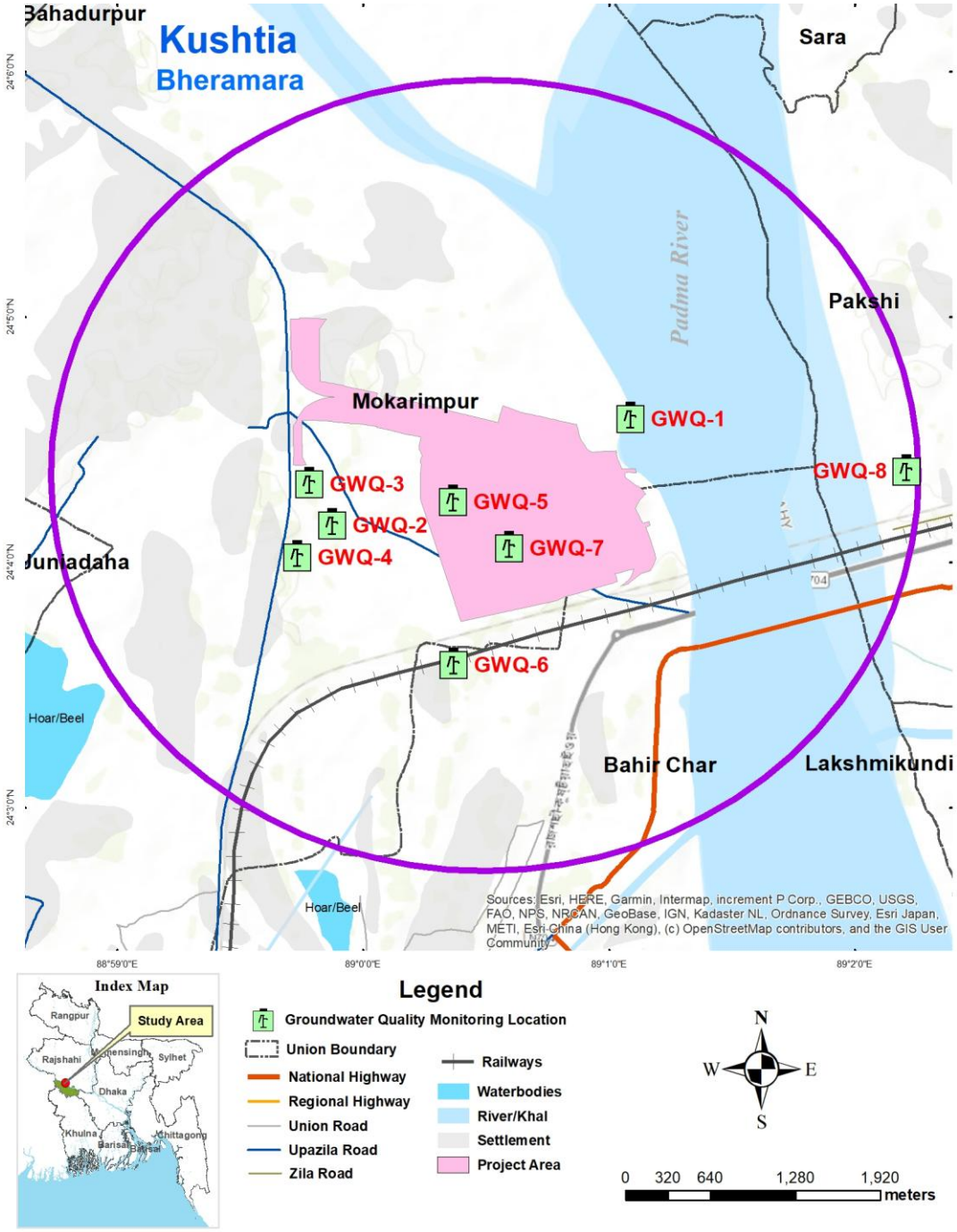


Figure 6.23: Groundwater Quality monitoring Locations

The study includes the various baseline parameters of water quality. Integration of water quality parameters give an overall perception of positive and negative impacts due to agriculture, industrial and some other human activities, if any. The collection of samples for water sample, different methods and techniques were applied separately based on the international standards method like American Public Health Association (APHA 23rd edition) Table 6-15. Samples for chemical analysis were collected in polyethylene containers. Samples collected for metal content were acidified with 1 ml. HNO_3. Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico-chemical parameters have been analyzed at site laboratory for projecting the status of existing water

quality. Data on existing aquatic environmental conditions in and around proposed project has been generated as per biological characteristics of water.

Table 6-15: Description of sampling and analytical methodology

Paramete	Sampling	Instrument Uses	Method pf Estimation
Groundwater			
pH	On Field/Lab-PG	Potentiometric	APHA (23rd Edition)4500-H-B
TP	PG	Titrimetric /instrumental	APHA (23rd Edition) 4500- P D, 2017
Mn	PG	instrumental -ICP OES	APHA (23rd Edition)3120B 2017
Fe	PG	instrumental -ICP OES	APHA (23rd Edition)3500 Fe B 2017
As	PG	instrumental -ICP OES	APHA (23rd Edition)3120B 2017
E-coli,	PG	Incubation	IS 1622: 1981 (RA 2014
COD	PG	Titrimetric	APHA (23rd Edition) 5220B, 2017
EC	on Field/Lab-PG	Potentiometric	APHA (23rd Edition) 2510B
Temp	on Field/Lab-PG	Potentiometric	APHA 23rd EDITION,2550 B
Zn	PG	instrumental-ICP OES	APHA (23rd Edition)3120B 2017
F	PG	Titrimetric	APHA (23rd Edition)4500 - F C/D,
Cl	PG	Titrimetric	APHA (23rd Edition)4500-Cl B 2017
PO4	PG	Titrimetric	APHA (23rd Edition) 4500- P D,
NO3,	PG	Titrimetric	APHA (23rd Edition) 4500- NO3-E,
NO2	PG	Titrimetric	APHA (23rd Edition) 4500- NO3-E,
DO	PG	Titrimetric	APHA 23rd Ed. 2017-4500-O-C/G
Surface water			
pH	on Field/Lab-PG	Potentiometric	APHA (23rd Edition) 4500-H-B
Turb	on Field/Lab-PG	instrumental	APHA (23rd Edition) 2130B
DO	on Field/Lab-PG	Titrimetric	APHA 23rd Ed. 2017-4500-O-C/G
BOD	BOD Glass bottle	Titrimetric-incubation	APHA (23rd Edition) 5210B 201
COD	PG	Titrimetric	APHA (23rd Edition) 5220B, 2017
TSS	on Field/Lab-PG	Gravimetric/ instrumental	APHA (23rd Edition)2540D
TDS	PG	Gravimetric/	APHA (23rd Edition) 2540C
Cr	PG	instrumental -ICP OES	APHA 23rd Edtn-2017, 3500 Cr B
Hg	PG Dark Bottle	instrumental -ICP OES	IS 3025(Part 48)-1994; Rffm:2014

Figure 6.24: Ground Water sampling locations GW-1

Figure 6.25: Ground Water sampling locations GW-2

Figure 6.26: Ground Water sampling location GW-3

Figure 6.27: Surface Water sampling locations SW-1

Figure 6.28: Surface Water sampling locations SW-2

Figure 6.29: Surface Water sampling locations SW-3

Groundwater quality

Eight sampling locations were targeted to estimate the groundwater quality. The results of groundwater quality monitoring are summarized below;

(1) pH of the samples was found alkaline (7.65 to 7.72) but suitable in range (6.5-8.5) as per ECR 2023 standard for potable uses.
(2) EC was found slightly moderate ranges from 402 to 469 uS/cm in the studied sample which mainly dominance of rock water interaction in to the aquifer that enhance the natural mineralization process in the groundwater.
(3) Dissolve oxygen of the sample is well oxygenated and suitable for human consumption.
(4) Chloride and nitrate were found in all studied sample and are suitable in range as per ECR 2023 standard for drinking water.

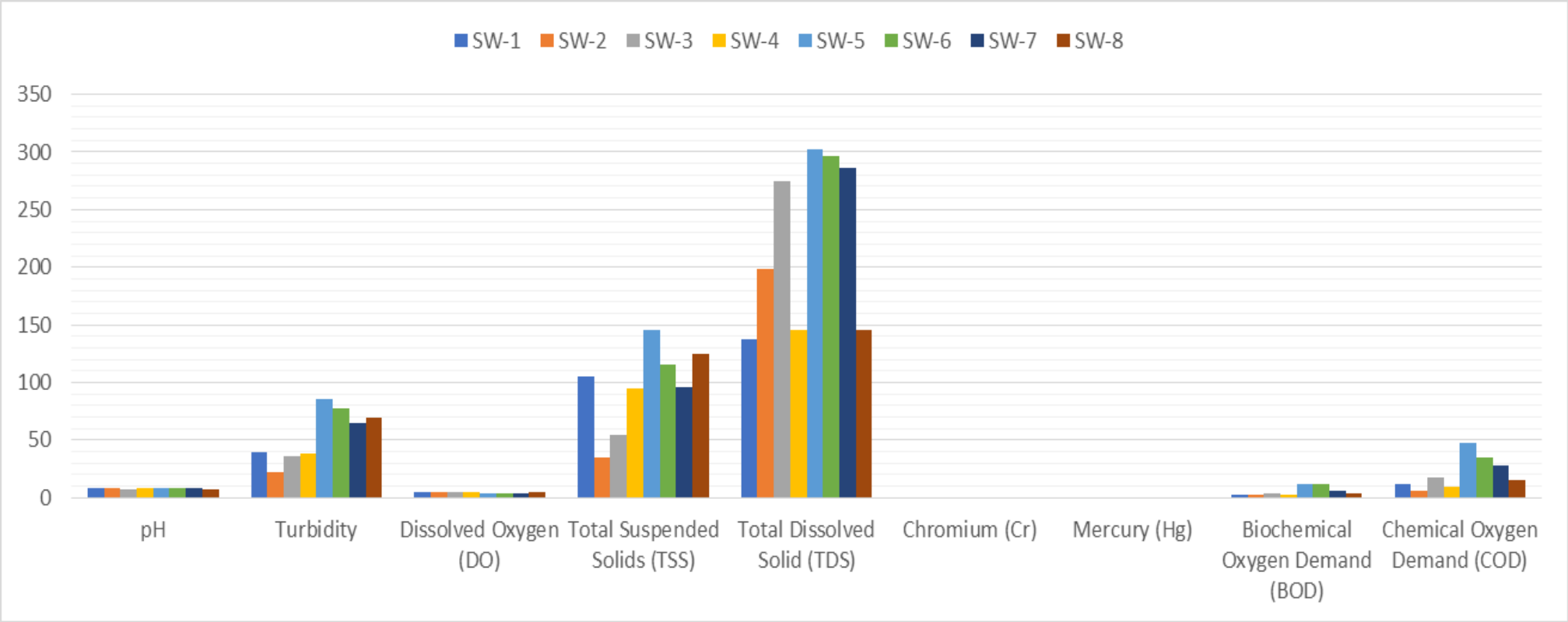


Figure 6.30: Ground Water Quality Level of studied samples

Table 6-16: Baseline groundwater quality monitoring

Parameters	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	Standard13
pH	-	7.65	7.65	7.72	7.65	7.62	7.69	7.77	7.79	6.5-8.5
Temperature	°C	25	25	25	25	25	25	25	25	20-30
Electrical Conductivity (as EC)	Us/cm	402	409	469	455	475	504	495	509	-
Dissolved Oxygen (as DO)	mg/l	5.6	5.4	5.2	5.4	4.8	5.1	5.3	5.0	6
Fluoride (as F)	mg/l	0.21	0.44	0.18	0.12	0.13	0.21	0.33	0.35	1
Chloride (as Cl)	mg/l	20	35	21.2	19.5	27.5	23.6	18.2	33.6	150-600
Phosphorous (as PO4)	mg/l	0.15	0.17	0.08	0.06	0.05	0.09	<0.05	0.11	0
Total Phosphate (as PO4)	mg/l	0.35	0.31	0.12	0.09	0.08	0.13	<0.05	0.25	0
Nitrate (as NO3)	mg/l	1.6	1.8	2.3	<0.01	1.6	1.6	<0.01	4.6	10
Nitrite (as NO2)	mg/l	0.6	0.88	0.06	<0.01	<0.01	0.05	<0.01	1.2	<1.0
Iron (as Fe)	mg/l	0.58	0.3	0.28	0.18	0.22	0.29	0.26	0.34	0.3-1.0
Manganese (as Mn)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.1
Arsenic (as As)	mg/l	<0.005	<0.005	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Zinc (as Zn)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	5
Chemical Oxygen Demand (as COD)	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	4
E-coli	/100ml	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0

On the other hand, chemical analysis shows some spatial deviation in the studied samples

(1) Fluoride is geogenic contaminate of world aquifer and is responsible for tooth decay and Skeleton diseases. However, In the study area fluoride concentration were found in minimal range also support the portability of the groundwater.

(2) Other parameters like Arsenic, Manganese, Zinc, were noted below the detection limits except Fe content (0.28 to 0.58 mg/l).

(3) Overall study suggests that water quality of the studied area is well and within suitable range. Additionally, the area is untouched with any organic or inorganic pollution from any human activities.

[13] **National Standard:** Environment Conservation Rules 2023, GoB, Standards for Drinking Water, schedule 2

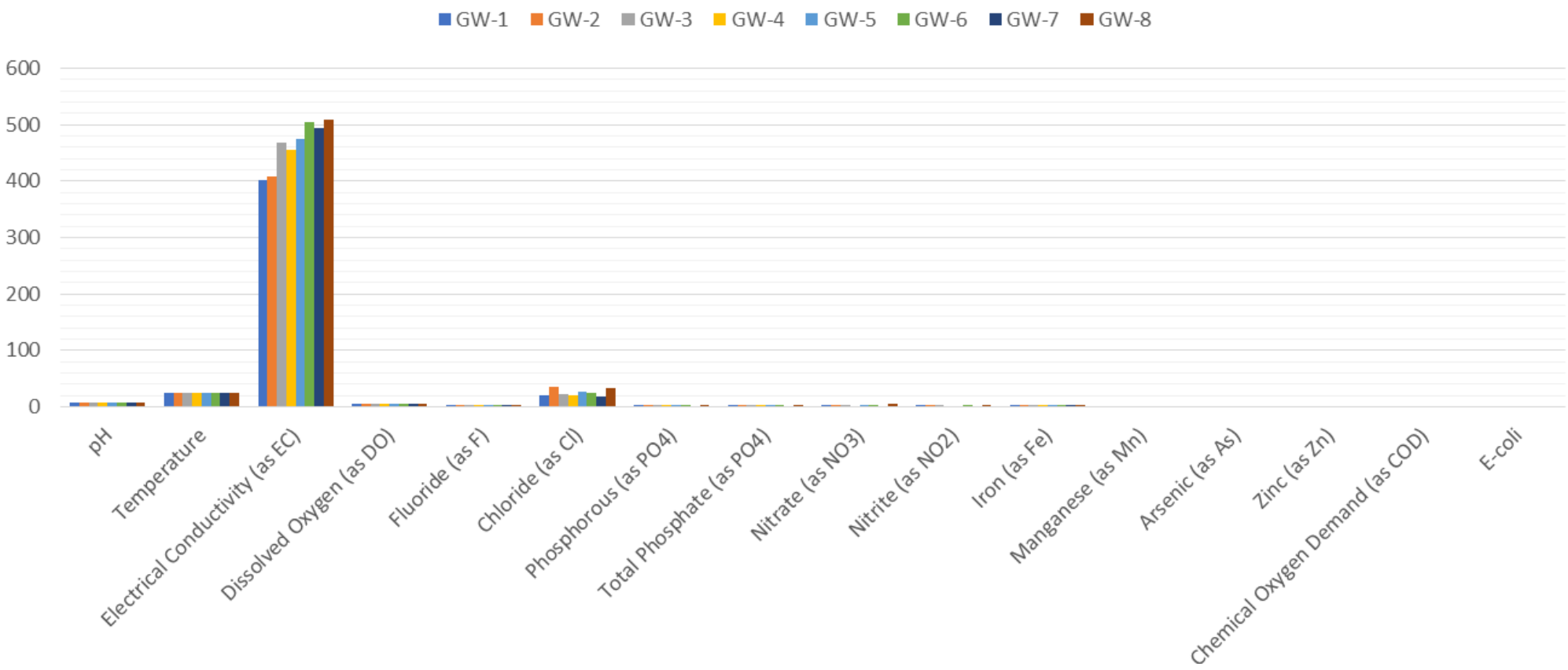


Figure 6.31: Major chemical constituents in the studied water sample

Surface water quality

Eight sampling locations were targeted to estimate the surface water quality and their results have been shown in Figure 6.32. The results of surface water quality monitoring are summarized below:

(1) pH of surface water samples has been found alkaline in the nature and varied from 7.72 to 7.89 in all samples. The value of pH is suitable for aquatic habitat as no deviation were found in the results.

(2) Furthermore, Turbidity of studied samples were found higher in range and varied from 22 to 40 NTU which mainly due to naturally high deposition of the plant residue and agricultural waste in water bodies. Similarly, TSS were varied from 35 to 05 mg/l in the study area which also justify the availability of organic residue in the water.

(3) In addition, high depositional pattern of Padma River in catchment area enhances the silt load in the water and is responsible for high TSS in the water during turbulence.

(4) Dissolved oxygen shows good condition of water and varied from the 4.8 to 5.2 mg/l in all samples which indicate water bodies are well oxygenated and suitable for aquatic life.

(5) TDS varied from 138 to 275 mg/l in eight samples which mainly due to naturally abundance of salts in the water which enhance the TDS value in the water.

(6) BOD and COD were found within suitable level that evidence of minimal organic load in the water bodies of the study area.

(7) The heavy metals like Cr and Hg were found below the detection limit at all location which indicates that the water is not contaminated from any anthropogenic sources.

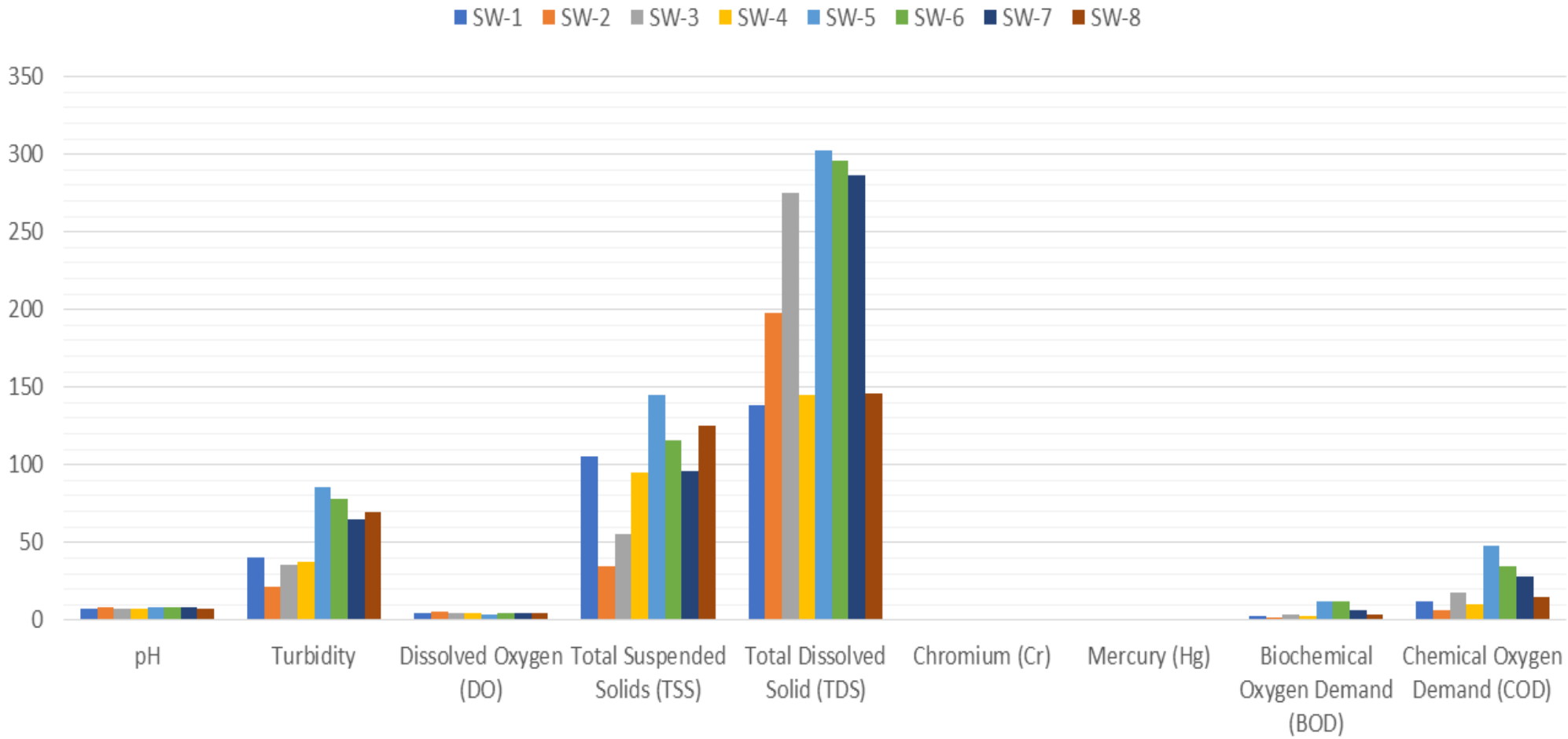


Figure 6.32: Surface Water quality parameters level in the studied samples

Table 6-17: Baseline surface water quality monitoring

Parameters	Unit	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	Standard[14]
pH	-	7.78	7.89	7.72	7.77	8.3	7.86	8.2	7.75	6.5-8.5
Turbidity	NTU	40	22	36	38	86	78	65	70	-
Dissolved Oxygen (DO)	mg/l	4.8	5.2	4.9	5.0	3.8	4.1	4.2	4.6	≥6
Total Suspended Solids (TSS)	mg/l	105	35	55	95	145	116	96	125	-
Total Dissolved Solid (TDS)	mg/l	138	198	275	145	302	296	286	146	1000
Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Mercury (Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Biochemical Oxygen Demand (BOD)	mg/l	2.8	2.2	4	3	12	12	6	4	≤2
Chemical Oxygen Demand (COD)	mg/l	12	6	18	10	48	35	28	15	10

6.2.4 Soil Quality Assessment Report

Site Selection

Reviewing the project area and background information regarding soil characteristics, suitable analytical and sampling techniques had been chosen for testing under prevailing geographical conditions.

Evaluation on the details scope of study includes physicochemical parameters, biochemical parameters, Major ions, metals, metalloids and other essential micro-nutrients in water soil and sediment commodity. Planning for Execution including identification for manpower, checking of Instrument for Sampling, move to field with all instruments and identify the field location as per schedule.

The monitoring of the soil quality was carried out to understand the impacts on the soil especially on the fertility of the soil. The soil quality was monitored at three (n=03) locations.

[14] **National Standard:** Environment Conservation Rules 2023, GoB, Standards for Drinking Water, schedule 2

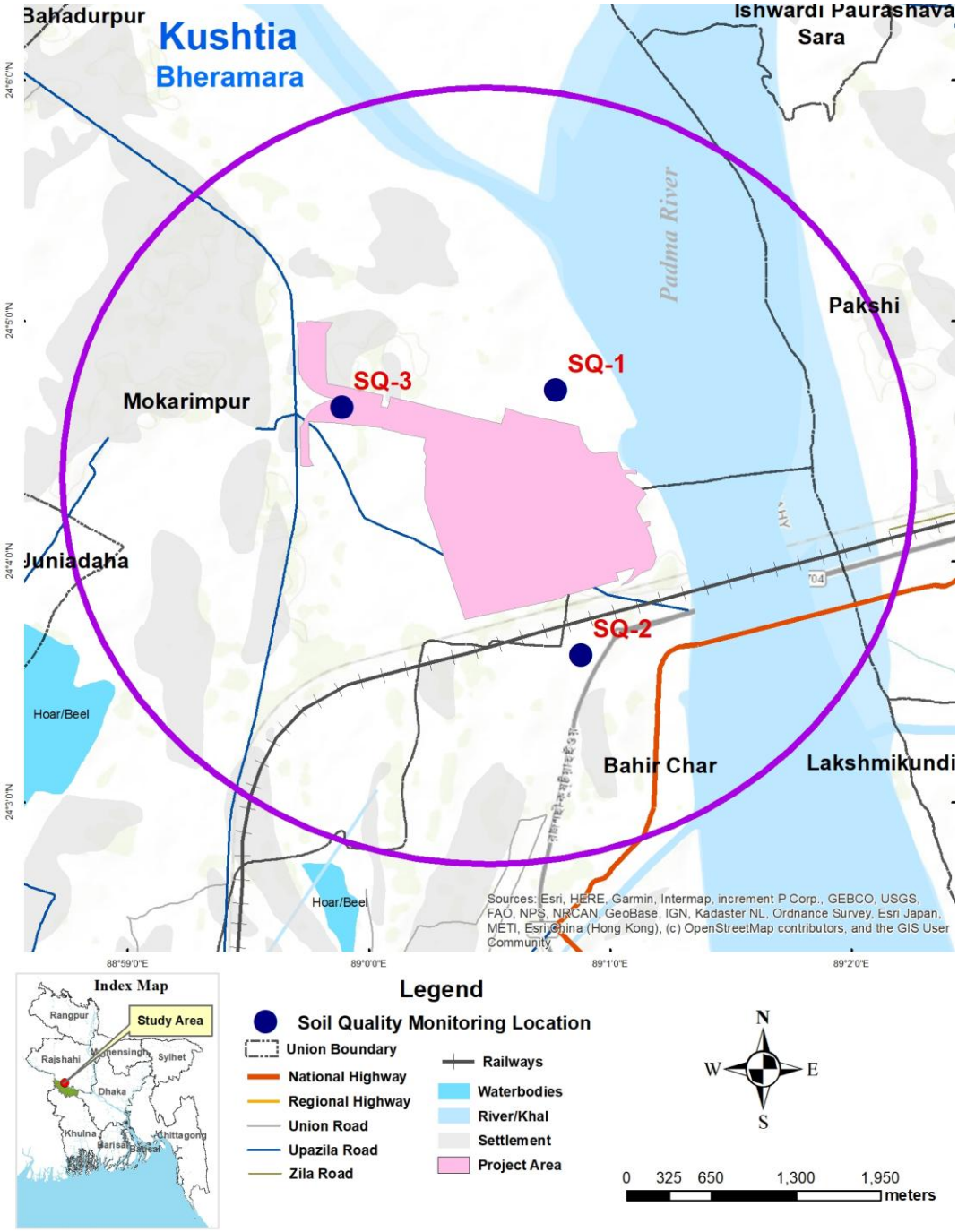


Figure 6.33: Soil Quality Monitoring Locations

Table 6-18: Soil Sampling Locations

Parameters Monitored	Location code and coordinates
Location 01	SQ-1- Project Site at 24° 4'42.72"N; 89° 0'46.54"E
Location 02	SQ-2- Lalon Ash Bridge at 24° 3'36.66"N; 89° 0'52.88"E
Location 03	SQ-3- Bheramara-Kuchiamara road at 24° 4'38.42"N; 88°59'53.29"E
Date of Sampling	22-06-2022 to 24-06-2022
Rationale for Site Selection	To evaluate the current soil quality of the Kushtia Site and its feasibility for future constructions

Methodology

Considering the topography, slope, vegetation, land type, drainage condition and suitable sampling technique was applied in each site.

(1) For dry or moist soil, sampling was done by either using auger or opens a V-shaped pit in the topsoil by using spade.

(2) Topsoil sample was collected at 15 -20 cm depths from the surface. In case of plough pan soil, sample was collected at 10-15 cm depth from surface.

(3) Each location 5 to 10 simple sample was collected. Then the entire sample of each site was mixed thoroughly in a plastic sheet to have a composite sample. Then remove the grasses, roots, stubbles or nodules etc. properly.

(4) For moist soil sample, the simple samples of each site were put together leveling with suitable ID number and information and bring to the laboratory for air drying at room temperature.

(5) For sediment, sediment core sampler was applied for quarry of bottom sediment from sea bed.

(6) For the sampling, cleaned polyethylene bags for soil/sediment (1kg) collection were used and transferred to laboratory as per United States Environmental Protection Agency (US EPA, 1992) guidelines.

(7) To avoid mixing of samples and for accurate record keeping, a label with date time, name of sampling point and their coordinates has been attached to each sample bag during sampling time.

Figure 6.34: Soil sampling location SQ-1

Figure 6.35: Soil sampling location SQ-2

Figure 6.36: Soil sampling location SQ-2

Assessment Report

The soil sample collected from the study area revealed that the soil was belongs to moderate nutrient load with clay loam which is evident from the analytical results of soil samples. The following conclusions could be made from the above tabulated data;

(1) All-soil samples pH shows slightly neutral alkaline in nature and ranges from 7.66 to 8.22. pH of the study area indicates that soil can hinder the plant growth especially due to presence of elevated level of calcium, sodium and magnesium that make less soluble of nutrients to the plants.

(2) The organic matter of all the samples were found low amount due sandy nature which indicates high depositional pattern of the study area. Result of pH and organic matter suggest the uses of organic matter like mulch, pine, needles, sphagnum peat moss, compost and coffee grounds or application of acidifying fertilizer which will restore the soil quality.

(3) The concentration of metals contents was found within suitable range along the study area. The metal like Cd was found below the detection limit.

Similarly, in the temporal behavior, metal content did not show any major deviation in result during study period which revel that soil is well and untouched with any serious contaminates from human activities.

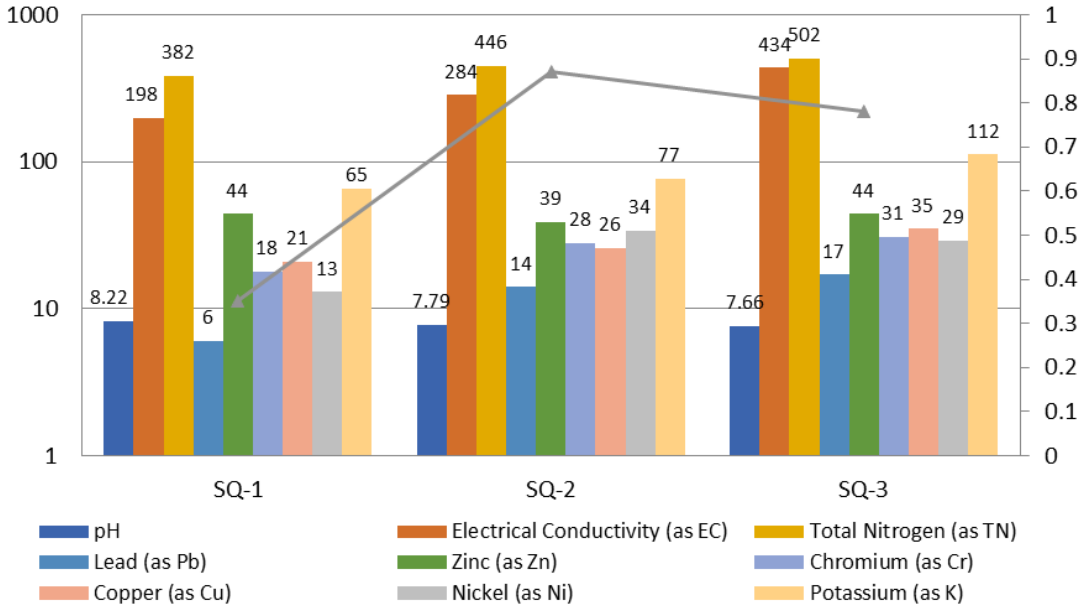


Figure 6.37: Soil quality parameter level in the studied sample

Table 6-19: Baseline soil quality monitoring

Location Code: SQ-1 at 24°4'42.72"N; 89° 0'46.54"E
SQ-2 at 24° 3'36.66"N; 89° 0'52.88"E
SQ-3 at 24° 4'38.42"N; 88°59'53.29"E

Parameters	Unit	SQ-1	SQ-2	SQ-3	Standard[15]	Method of Estimation
pH	-	8.22 (1:2.5)	7.79(1:2.5)	7.66 (1:2.5)	-	IS 2720 (Part 26)-1987; Rffm:2011
Electrical Conductivity (as	Us/cm	198 (1:2)	284 (1:2)	434(1:2)	-	IS 14767:2000, RA 2016
Organic Matter (as OM)	%	0.35	0.87	0.78	-	IS 2720 (Part 22)-1972; Rffm:2015
Total Nitrogen (as TN)	mg/kg	382	446	502	-	TPM/MSK/P&E/1/35

[15] ***Dutch Standard:*** *Dutch Target and Intervention Values, 2000, for soil and sediment and National Environment*

Location Code: SQ-1 at 24°4'42.72"N; 89° 0'46.54"E SQ-2 at 24° 3'36.66"N; 89° 0'52.88"E SQ-3 at 24° 4'38.42"N; 88°59'53.29"E						
Parameters	Unit	SQ-1	SQ-2	SQ-3	Standard[15]	Method of Estimation
Lead (as Pb)	mg/kg	6	14	17	85	EPA 6010D
Zinc (as Zn)	mg/kg	44	39	44	140	EPA 6010D
Chromium (as Cr)	mg/kg	18	28	31	100	EPA 6010D
Copper (as Cu)	mg/kg	21	26	35	36	EPA 6010D
Nickel (as Ni)	mg/kg	13	34	29	35	EPA 6010D
Cadmium (as Cd)	mg/kg	<2.0	<2.0	<2.0	0.8	EPA 6010D
Potassium (as K)	mg/kg	65	77	112	-	TPM/MSK/P&E/1/5
Phosphorous (as PO4)	mg/kg	<3.0	<3.0	<3.0	-	TPM/MSK/P&E/1/12
Sand	%	43	42	45	-	TPM/MSK/P&E/1/36A
Silt	%	20	19	23	-	TPM/MSK/P&E/1/36A
Clay	%	37	39	32	-	TPM/MSK/P&E/1/36A
Texture	-	Clay	Clay	Loam	-	TPM/MSK/P&E/1/36A

6.2.5 Traffic Volume

Traffic surveys are the means of obtaining information about traffic which is an important input required for planning, design, analysis, and operation of any roadway connecting project to determine the number, movements, and classifications of roadway vehicles at a project location. Proposed Kushtia EZ located at Bheramara union in Bheramara upazila of Kushtia district. The site is situated on the bank of the Padma River, 2 km away from Lalon Shah Bridge and 5 km away from Bheramara (Kushtia–Rajshahi) national highway.

The site is situated adjacent to the Bheramara-Kuchiamara road which is only one connecting road of Kushtia EZ for this reason this road is selected for traffic survey. Traffic Survey has been carried out in front of EZ site on Bheramara-Kuchiamara road using Manual Classified Traffic Count (MMC) method for 16 hours at one location on 26 January 2023 on Thursday from 7:00 a.m. to 11:00 p.m.) to assess the existing traffic characteristics with respect to type, category and number of vehicles plying on the connecting road of the project. The details of the traffic monitoring location have been provided in the following Table 6-20 and shown in Figure 6.38.

Table 6-20: Traffic monitoring location

Traffic monitoring location	GPS Coordinates	Date of Survey	Day of Survey	Duration of Survey
At Natunhat, Bheramara (Bheramara-Kuchiamara Rd)	24° 4.666'N 88° 59.713'E	26-01-2023	Thursday	16 hours

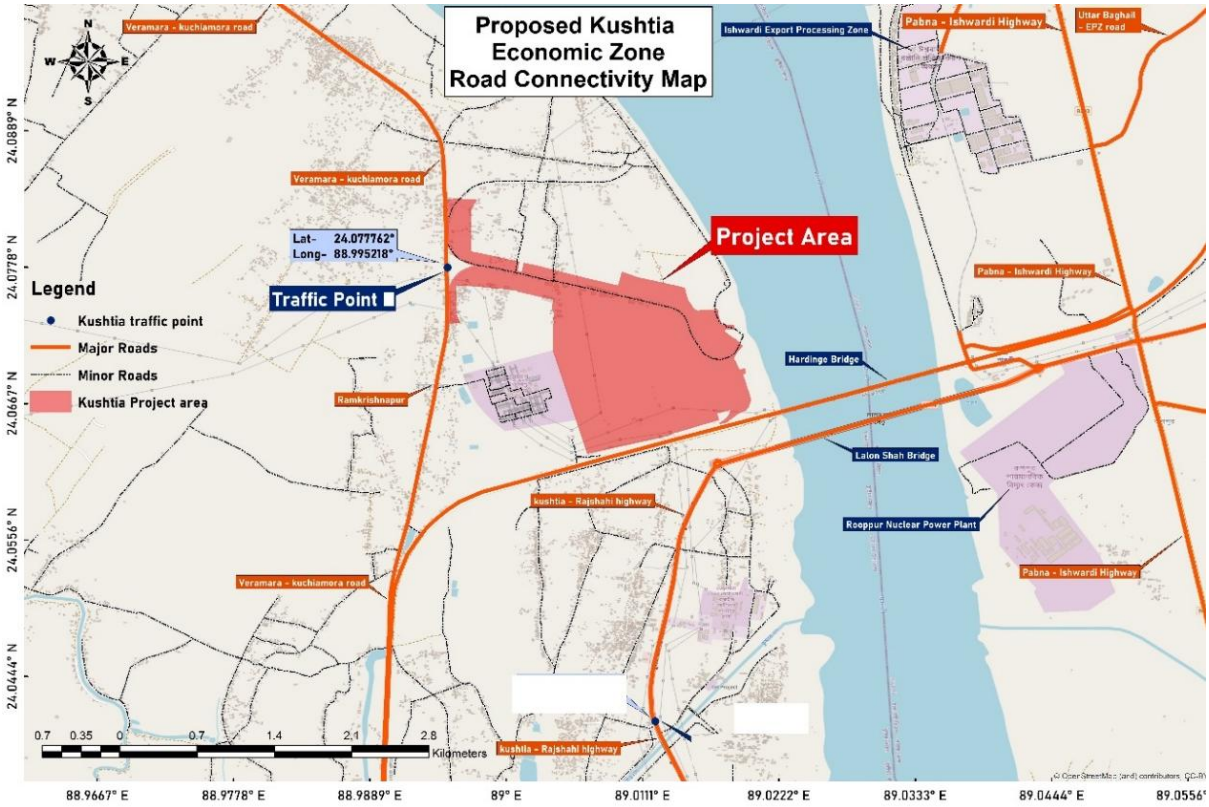


Figure 6.38: Road Traffic Monitoring Location

For this survey, traffic counted has been sub-divided into nine categories/classes viz.

(1) Car
(2) Bus
(3) Trucks/Lorries
(4) Auto Rickshaw
(5) Bicycle
(6) Rickshaw
(7) Motor Cycle
(8) Light Vehicle (Tempo/Pick-up/Laguna/Nosimon etc.)
(9) Bullock Cart

Since the vehicles are of different types, a factor needs to be accounted for each of them in order to express them as par in single unit terms. The factors, commonly known as Passenger Car Unit (PCU) factors that have been adopted and shown in the following Table 6-21.

Table 6-21: Passenger Car Unit (PCU) factors[16]

Vehicle Type	PCU Factor
Car	1.0
Bus	3.0
Truck	3.0
Auto Rickshaw	0.5

[16] Source: Bangladesh Road Design Standards Act-2004 (Transport Research Laboratory (UK) Overseas Road Note 13)

Vehicle Type	PCU Factor
Bicycle	0.3
Rickshaw	1.0
Motor Cycle	0.3
Tempo	1.0
Bullock Cart	4.0

The traffic volume counts have been tabulated in the following table. The hourly traffic volume has been illustrated in the Figure 6.39.

Table 6-22: Hourly Traffic Volumes at Natunhat, (Bheramara-Kuchiamara Rd)

Time	Truck/Lorries	Car/Micro	Bus	Tempo/Nosimon/Leguna/Pickup Van	Motor-Cycle	Auto Rickshaw/Van	Rickshaw	CNG	Tractor	Bicycle	Bullock Cart	Total Hourly Traffic
	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour	PCU / hour
07:00-08:00AM	51	4	3	14	11	22	0	8	0	13	0	126
08:00-09:00AM	42	6	6	54	38	60	0	19	9	28	0	260
09:00-10:00AM	30	9	3	46	57	88	1	17	0	18	0	268
10:00-11:00AM	24	3	0	60	61	123	1	28	0	17	0	316
11:00-12:00AM	48	18	0	42	80	94	2	29	3	16	0	331
12:00-01:00PM	54	3	0	40	74	93	1	33	0	27	0	324
01:00-02:00PM	48	7	0	29	50	55	0	19	0	7	0	214
02:00-03:00PM	87	13	0	28	65	55	0	24	0	12	0	284
03:00-04:00PM	45	8	3	31	61	78	1	31	0	13	0	270
04:00-05:00PM	69	19	3	35	51	60	0	31	0	20	0	287
05:00-06:00PM	69	13	6	32	61	72	0	35	0	29	0	317
06:00-07:00PM	81	15	9	26	57	67	1	36	3	23	0	317
07:00-08:00PM	99	10	0	10	36	41	0	24	0	6	0	225
08:00-09:00PM	99	4	0	20	18	39	0	15	0	4	0	199
09:00-10:00PM	57	10	0	5	14	20	0	14	0	2	0	121
10:00-11:00PM	84	4	0	3	7	5	0	3	0	1	0	106
				Total PCU/hour								**3965**

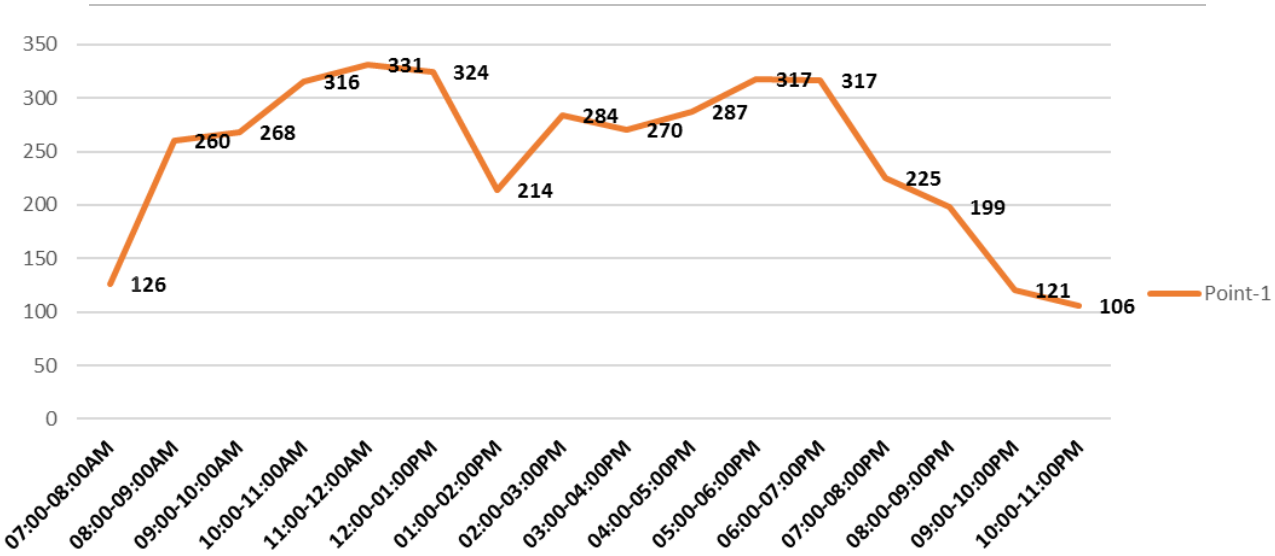


Figure 6.39: Traffic volume Trend at Natunhat, Bheramara (Bheramara-Kuchiamara Road)

The peak hour is happened at traffic point 11:00 am and 06:00 pm. It was found that local transportation vehicles such as auto rickshaw, van and motorcycle are moving on this road.

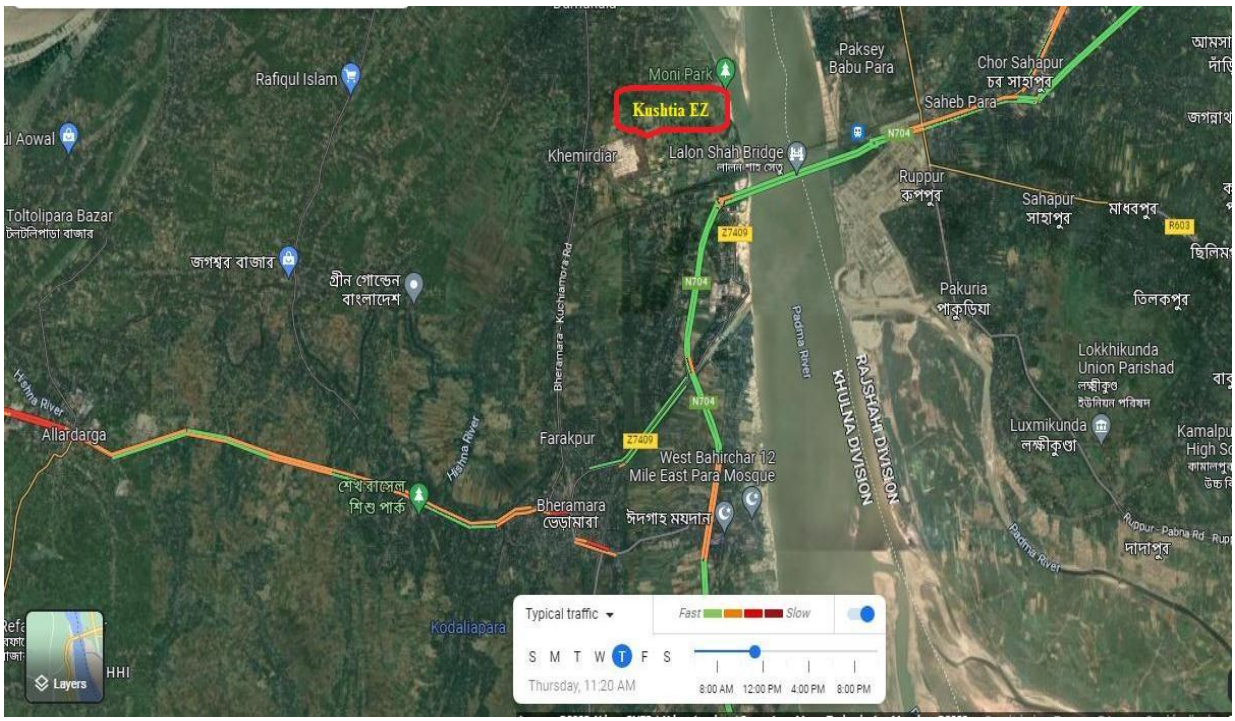


Figure 6.40: Present Traffic Situation of Proposed Kushtia EZ

Traffic count by Enumerators, Natunhat, Bheramara (Bheramara-Kuchiamara Rd)
Date: 26/01/2023, Time: 10:45 am

Traffic count by Enumerators, at Natunhat, Bheramara (Bheramara-Kuchiamara Rd)
Date: 26/01/2023, Time: 2:30 pm

Figure 6.41: Photos of Traffic Survey

Traffic count by Enumerators, Natunhat, Bheramara (Bheramara-Kuchiamara Rd)
Date: 26/01/2023, Time: 09:45 am

Traffic count by Enumerators, Natunhat, Bheramara (Bheramara-Kuchiamara Rd)
Date: 26/01/2023, Time: 11:45 am

Figure 6.42: Present Traffic Situation

Inference

Weekday traffic was 6,869 vehicles for 16 hours during 7:00 am to 11 pm at Natunhat, of Bheramara (Bheramara-Kuchiamara Rd) in both directions. The composition of vehicles at this point indicates that 35.84% (2462 nos.) of the vehicle were motor cycle followed by auto rickshaw/van 28.20% (1937 nos.), bicycle 11.28% (775 nos.), CNG 10.51% (722 nos.), Tempo/Nosimon/Leguna/Pickup Van 6.92% (475 nos.) Truck/Lorries 4.79% (329 nos.), Bus

0.16% (11 nos.), rickshaw 0.10% (7 nos.) and tractor 0.07% (7 nos.). The status of vehicle movement illustrated in the Figure 6.43.

Daily traffic volume was found to be 3,965 PCU/hour at Natunhat, of Bheramara (Bheramara-Kuchiamara Road).

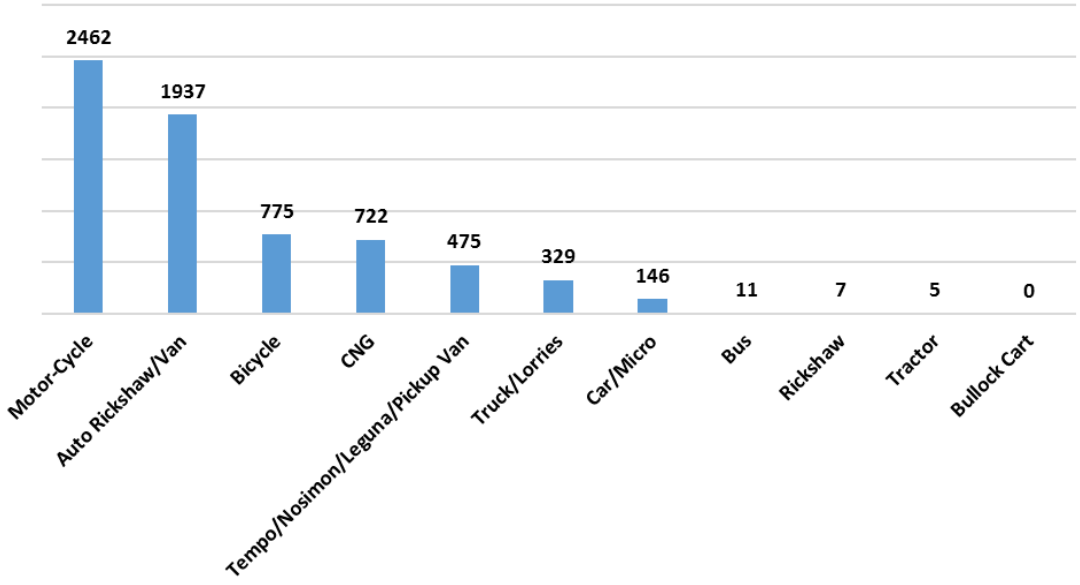


Figure 6.43: Status of Vehicle Movement at Bheramara-Kuchiamara Rd

Traffic Demand Forecast

The demand of traffic is an important factor for understanding the future vehicle movement in the project area. In this regard, the future traffic demand can be forecasted by calculating demand of vehicles will be moving in the economic zone during operational phase. The vehicle demand for Kushtia EZ shown in Table 6-23. It was estimated that around 57,358 (heavy and medium truck) vehicles forecasted annually (157 vehicle/day) will be added during operation period of proposed EZ. Considered this demand, the future traffic volume is calculated for Kushtia EZ is 4,300 PCU/hour.

Table 6-23: Vehicle demand for Kushtia EZ (Heavy and medium Truck)

Sector	Total Raw and Finished Goods Demand	Vehicle demand (Heavy and medium Truck with average capacity 7.5 ton per vehicle)	
	tons/year	Vehicle demand/year	Vehicle demand /day
Electrical and Electronic Goods	133,801	17,840	49
Textile	123,906	16,521	45
Pharmaceuticals/Chemicals/Cosmetics	48	6.40	0.02
Leather Product/Footwear	0.82758621	0.11	0.00
Agro and Food Processing	172,321	22,976.09	62.95
Jute Goods	76.8	10.24	0.03
RMG	32.8998447	4.39	0.01
Total	430,186	57,358	157

Implication

Vehicle composition of traffic stream shows that the most of the vehicles are local transports such as auto rickshaw, van and motor cycle. Due to intervention of Kushtai Economic Zone, existing traffic shall be increased from 3,964 PCU/hour to 4300 PCU/hour *i.e.* traffic flow may increase in the road as Bheramara-Kuchiamara Rd will be an important link road of Kushtia EZ. BEZA shall ensure traffic management, necessary traffic signs, speed limit and speed breaker in order to prevent any accident.

6.2.6 Soil Characteristics

Physiographically the proposed Kushtia EZ and its adjoining area falls under Ganges River Floodplain Physiographic units of Bangladesh (Figure 6.46). The Ganges River floodplain comprises the active floodplain of the Ganges and the adjoining meander floodplain. The latter mainly comprises a smooth landscape of ridges, basins and old channels. The Ganges channel is constantly shifting within its active floodplain, eroding and depositing large areas of new char land each flood season, but it is less braided than that of the Brahmaputra-Jamuna. Ganges alluvium is calcareous when deposited, but most basin clays and some older ridge soils have been decalcified and acidified in their upper layers; lime is found only in the subsoil or substratum of such soils. Clay soils predominate in basins and on the middle parts of most ridges, with loamy soils (and occasionally sands) occurring mainly on ridge crests.

Seasonal flooding is mainly shallow in the west and north, with the highest ridge crests remaining above normal flood levels, but flood depths increase towards the east and the south. Flooding is mainly by accumulated rainwater and the raised groundwater table, except on the active Ganges floodplain and close to distributary channels which cross the meander floodplain. This physiographic unit is almost triangular in shape and bounded by the Ganges tidal floodplain on the south. On its southern end it traps the Gopalganj-Khulna Beels.[17]

Land Type

There are five land types in the study area. Among the land types, Highland and Medium Highland 2 is dominant (84.1%) followed by Medium Highland 1 which is 6.5% and Low land is 1.8%. Distribution of area under different land type is presented in the following table.

Table 6-24: Area under land types of the project and study area

Land Type	Project Area (acre)[18]	Study Area excluding Project Area (acre)	Total Study Area (acre)	% of the NCA
Highland	292	30,099	30,482	46.2
Medium Highland 1	16	4,287	4,308	6.5
Medium Highland 2	112	24,868	25,016	37.9
Medium Lowland	-	5,025	5,025	7.6
Lowland	-	1,168	1,168	1.8
Total	**420**	**65,447**	**65,999**	**100**

[17] (Source: http://en.banglapedia.org/index.php?title=Physiography)
[18] approximate

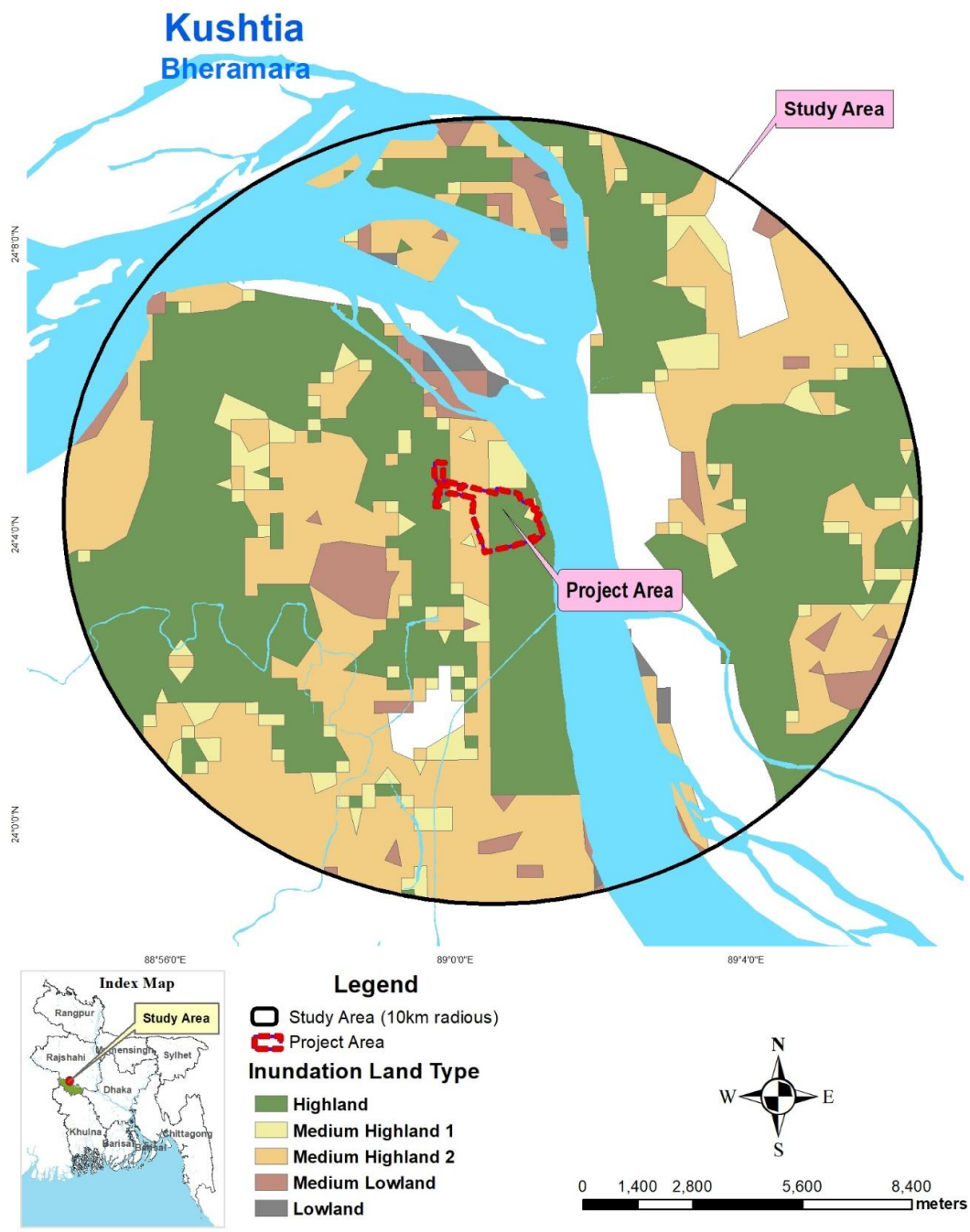


Figure 6.44: Land Type map in the study area[19]

Soil Texture

Soil texture is the relative proportions of sand, silt and clay. It influences many other properties of great significance to land use and management. There are three types of soil texture in the project area which are Silty clay with silt loam, Sandy loam and Loamy fine sand. Detailed distribution of soil texture in the project area and Study area is presented in Table 6-25 and Figure 6.45.

[19] Source: Bangladesh Agricultural Research Council (BARC)

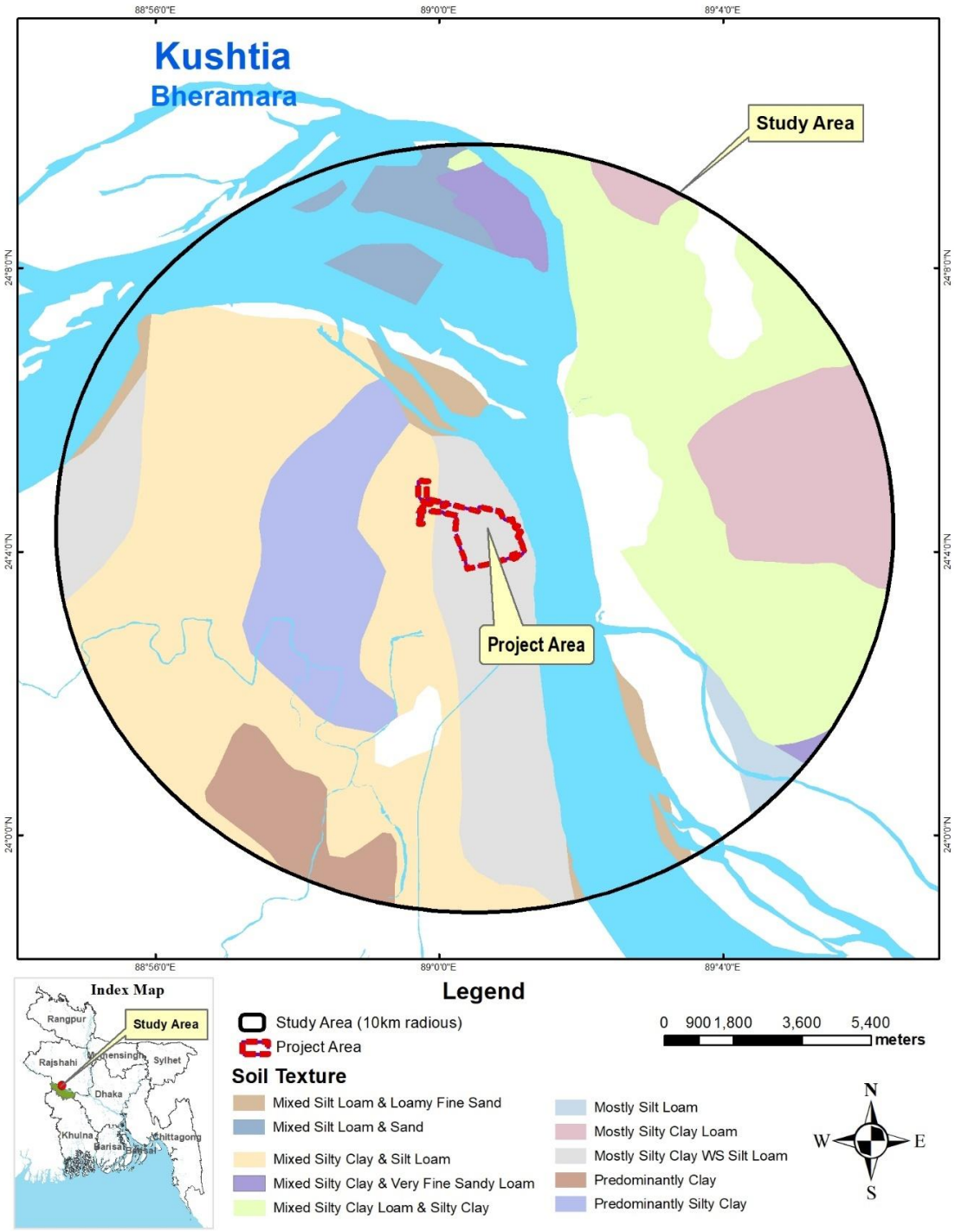


Figure 6.45: Soil Texture Map of the Project and Study Area

Table 6-25: Soil Texture in the Project Area and Study Area[20]

Soil Texture	Project Area (acre)[21]	Study Area excluding Project Area (acre)	Total Study Area (acre)	% Of the NCA
Predominantly Silty Clay	-	5,180	5,180	7.8
Predominantly Clay	-	2,312	2,312	3.5
Mostly Silty Clay WS Silt Loam	383	8,322	8,831	13.3
Mostly Silty Clay Loam	-	5,410	5,410	8.2
Mostly Silt Loam	-	877	877	1.3
Mixed Silty Clay Loam and Silty Clay	32	12,851	12,888	19.4
Mixed Silty Clay and Very Fine Sandy Loam	-	1,568	1,568	2.4
Mixed Silty Clay and Silt Loam	-	18,762	18,762	28.3
Mixed Silt Loam and Sand	-	4,499	4,499	6.8
Mixed Silt Loam and Loamy Fine Sand	5	5,934	5,939	9.0
Total	**420**	**65,715**	**66,266**	**100.0**

Physiography

The surface geology is important to understand the lithological exposure of the surface, soil characteristics, capacity to hold irrigation water and groundwater conditions. From a stratigraphic point of view, the tectonic platforms of Bangladesh which started in the Precambrian age, can be divided into two divisions: stable platform in the northwest part (found at a very shallower depth and mostly made up by coal, sandstone and shale) and deep basin in the southeast part (found at a higher elevation and mostly made up by sandstone and shale) (Alam and Islam, 2018). The study area falls within the deep basin platform. From a geological standpoint, the depositional history and development of Bengal fan began in the Early Eocene age (Curray J., 1971). The Bengal basin has more than 20 km of Tertiary-Holecene sedimentary fill derived mostly from the eastern Himalayas (Alam and Islam, 2018). Considering the upper surface, there are 27 geological formations of Holocene sediments that covers the whole country (Whitney, 2001). The project area of KEZ falls under 'Alluvial Silt and Clay' zone which were created from alluvial deposition This means the upper surface of the project area were formed through the deposition of alluvial materials, mostly silt and clay, deposited from the bed of a flowing river. Besides, the geology of the major parts of the surrounding area are associated with 'Marsh Clay and Peat' zone from Paludal deposition meaning the accumulation of clay materials were influenced by marshy environment.

[20] Source: Bangladesh Agricultural Research Council (BARC)
[21] derived

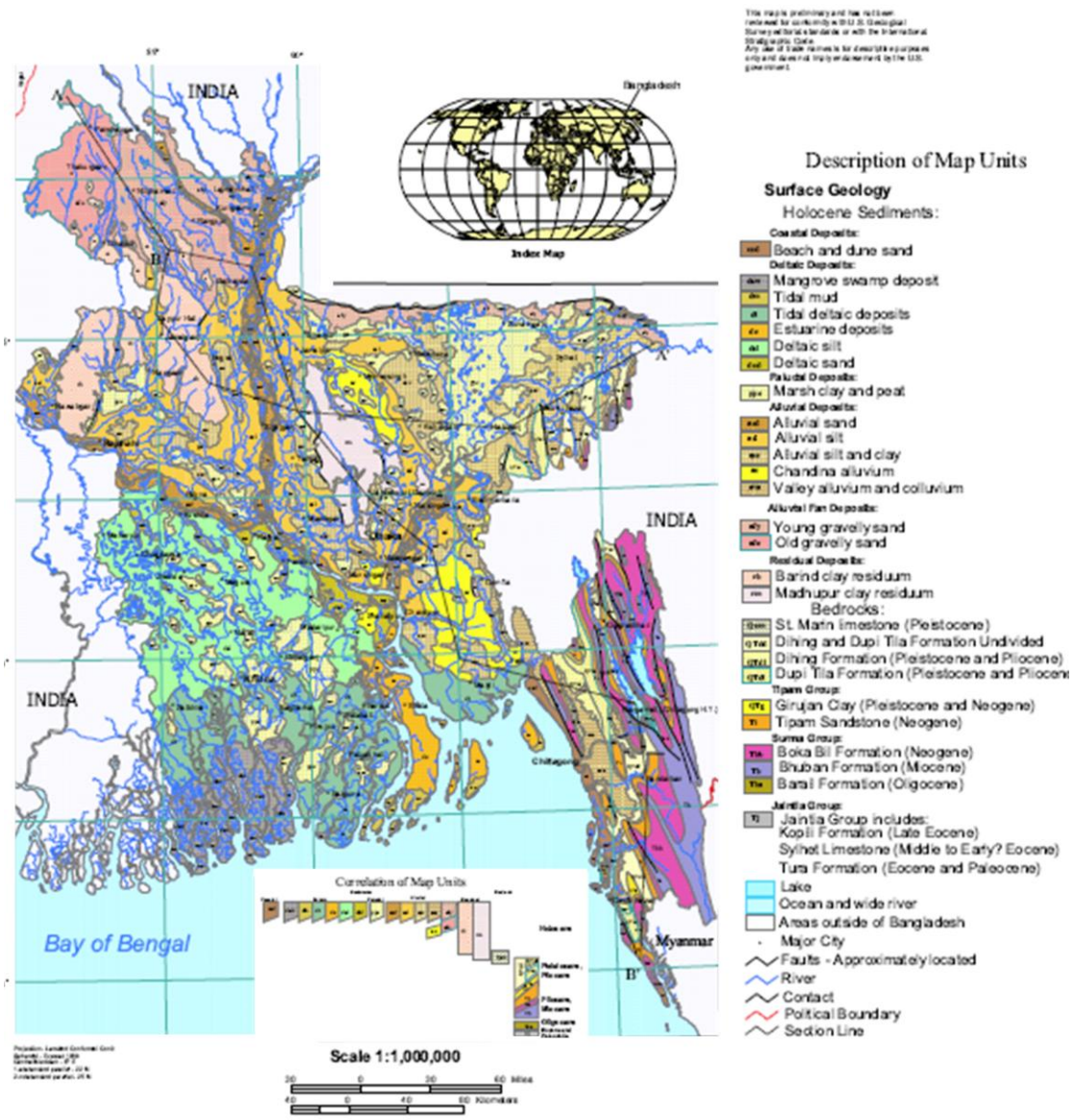


Figure 6.46: Surface Geology of Bangladesh

Seismicity

Analysis of earthquake hazard is more regional concern than that of local. For example, an earthquake occurred in Nepal may cause damage in Bangladesh. Therefore, regional earthquake analysis is necessary to predict any earthquake hazard in Bangladesh.

According to Bangladesh National Building Code (BNBC), 2020, whole land area of Bangladesh has been divided into four seismic zones. The zone coefficients (Z) for four zones respectively are: Z= 0.12 (Zone-1), Z= 0.20 (Zone-2), Z=0.28 (Zone-3) and Z= 0.36 (Zone-4).

The study area is located under the earthquake Zone II (Z= 0.20). The Zone-II comprising the central part of Bangladesh consist of the regions of recent uplifted Pleistocene blocks of the Barind and Madhupur and the western extension of the folded belt and the Bask coefficient for this zone is 0.20 g. If any civil structure is constructed here in the study area, it must be designed to withstand a maximum of 6.5 magnitudes in Richter's Scale.

A summary table of seismic intensity and the historical records of earthquakes in and around the Bangladesh that occurred during the last 450 years is presented in Table 6-26 as a ready reference for future planning and design purposes for this project. From the overall consideration, it is suggested that during designing and constructing of the civil structures Bangladesh National Building code (2010) covering the earthquake guidelines should strictly be followed:

Table 6-26: The regional earthquake history of Bangladesh for last 450 years[22]

	Year	Source Area	Magnitude (Richter Scale)	Depth (Km)
1	1548	Sylhet	-	-
2	1664	Shillong-Plateau	-	-
3	1762	Chittagong-Arakan	≤8.8	-
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	1943	Numaligarh, Assam, India	7.2	13
14	1938	Mawlaik, Myanmar	7.2	60
15	1950	Assam, Himalaya	8.6	25
16	1950	Chittagong, Bangladesh	6	-
17	1954	Manipur, India	7.4	180
18	1975	Assam, India	6.7	112
19	1981	Sundarbans, Bangladesh	4.9	-
20	1984	Cachar, India	5.7	4
21	1988	Bihar, India-Nepal	6.6	65
22	1988	Phek, Manipur, India	7.3	90
23	1995	Monipur, India	6.4	-
24	1997	Sylhet, Bangladesh	5.6	35
25	1997	Bangladesh-Myanmar	5.3	56
26	1999	Maheshkhali, Bangladesh	4.2	10
27	2003	Rangamati, Bangladesh	5.6	-
28	2011	Sikim, India	6.9	-
29	2015	Gorkha, Nepal	7.8	8.2
30	2016	Imphal, India	6.7	-
31	2016	Baniachang, Sylhet, Bangladesh	4.4	30

[22] Banglapedia

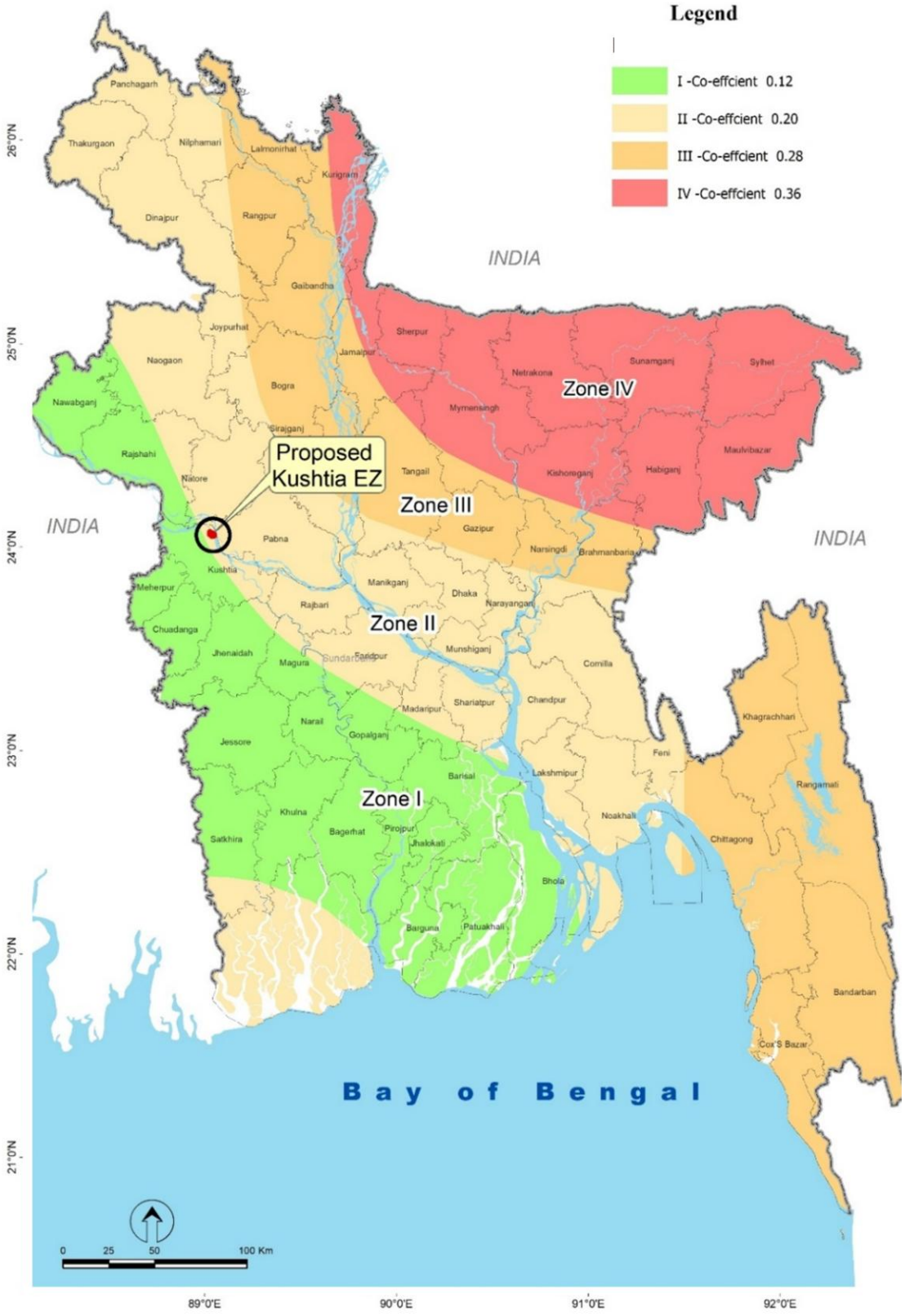


Figure 6.47: Earthquake Zones of Bangladesh showing the project area[23]

[23]https://www.google.com/search?q=Earthquake+Zones+of+Bangladesh+showing+the+project+area&sxsrf=ALiCzsYxU6yx01av4P9RnHS-R

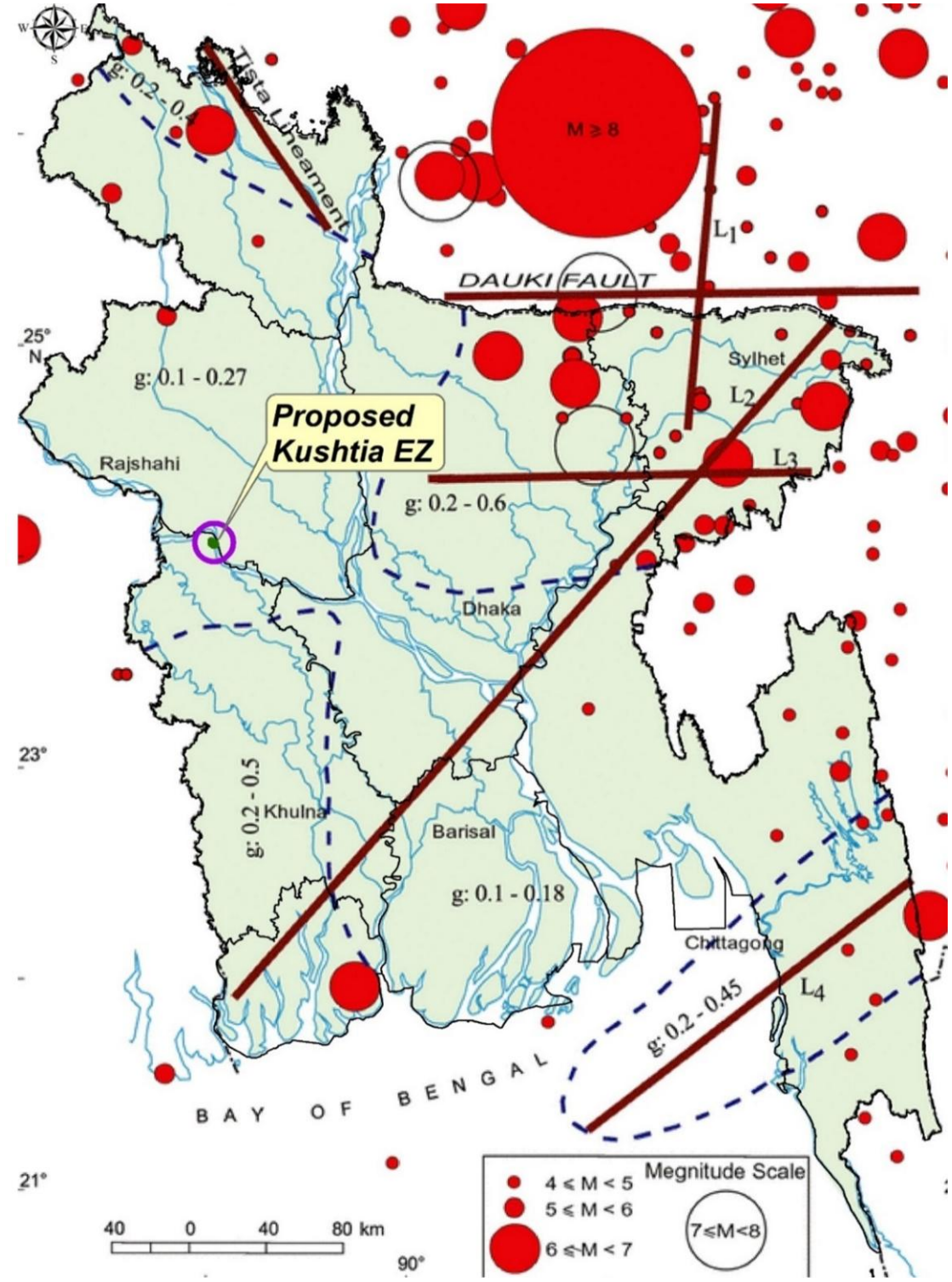


Figure 6.48: Seismic map of Bangladesh showing the Study Area[24]

[24] https://www.google.com/search?q=Seismic+map+of+Bangladesh+&tbm=isch&ved=2ahUKEwi-t_Cu_cX7AhU-3TgGHbveDI4Q2

6.3 Natural Environment

6.3.1 Topography

Kushtia district is in the Khulna division of Bangladesh. It is bounded by Rajshahi, Nator and Pabna district on the North, Jhinaidaha, Chuadanga and Meherpur district on the South, Rajbari district on the East and India on the West. The proposed land is beside Hardinge Bridge. There are 90 nos dwellings, 10 ponds, 6 nos cowsheds and three HT Tower inside the proposed land. There are countless temporary irrigation pumps to irrigate the land. The southeast corner of the proposed land is located just 262 meters from the river bank. Most of the entire land is agricultural land. The total volume of the surveyed land is '420 acres. As per the discussion with the local inhabitants, this is not a flood-affected area. At present most of the land is being used for cultivation. The highest flood level was 15.19 m in 1998 as per data collected from Bangladesh Water Development Board. It reveals from the analysis of the Digital Elevation Model (DEM) that the Reduced Levels (RLs) inside the project vary from 14.00 to 16.00 m PWD. Figure 6.49 shows the land elevation of the study area.

6.3.2 Hydrological Situation

Surface Water System in the Vicinity of the Project Site

Water is an indispensable natural resource for the sustenance of human life and other biotas of a region. The hydrology of the study area comprises both surface water and ground water. The sources of surface water are rivers, canals, ponds and other wetlands. Besides surface water, groundwater is also available in the area. The details of hydrology are provided in the subsequent sections.

Ganges River

The Ganges is a very dynamic meandering river and main surface water source in this area. Originated from the Himalayas, the combined flow of *Bhagirathi* and *Alakananda* forms the river Ganges. Along its course from the west of the *Nanda Devi* to the confluence of the *Jamuna* River at *Aricha*, this river flows through northern India and passes over the Indian state of West Bengal and then enters Bangladesh through the *Chapai Nawabganj* district and flows about 116 km along the international border of Bangladesh and India occupying the territory of both countries. The river Ganges meets with the Mohananda River inside Bangladesh, one of its major tributaries. Further downstream near Kushtia district, the Ganges River enters totally inside Bangladesh. The average width of this reach of the river is 5.3 km but varies from 1.5 km to 14 km. After joining with the Jamuna, the Ganges River takes the name Padma River and flows southwest for about 105 km to join with the Meghna River near Chandpur. At this length, the river becomes tidal. The combined flow turns southward for about 150 km and falls in the Bay of Bengal.

The catchment area of the river is about one million sq. km, where more than 400 million people are living. In Bangladesh, the catchment area of Ganges is about 46,300 sq. km. The mean annual flow is 11,000 m^3/s and maximum discharge is 78,000 m^3/s. Bankfull discharge of the Ganges River has been estimated as a value between the range 40,000 and 45,000 m^3/s. Unlike the Jamuna, the characteristics of the bank materials along the Ganges are not homogeneous. Less erodible bank materials are present at several locations along the left bank of the Ganges. Regime width and depth vary from naturally constricted reaches to the reaches where bank materials are highly susceptible to erosion. The average bed slope of this river is 5 cm/km and the bed material (D_{50}) is 0.15 (at Hardinge Bridge).

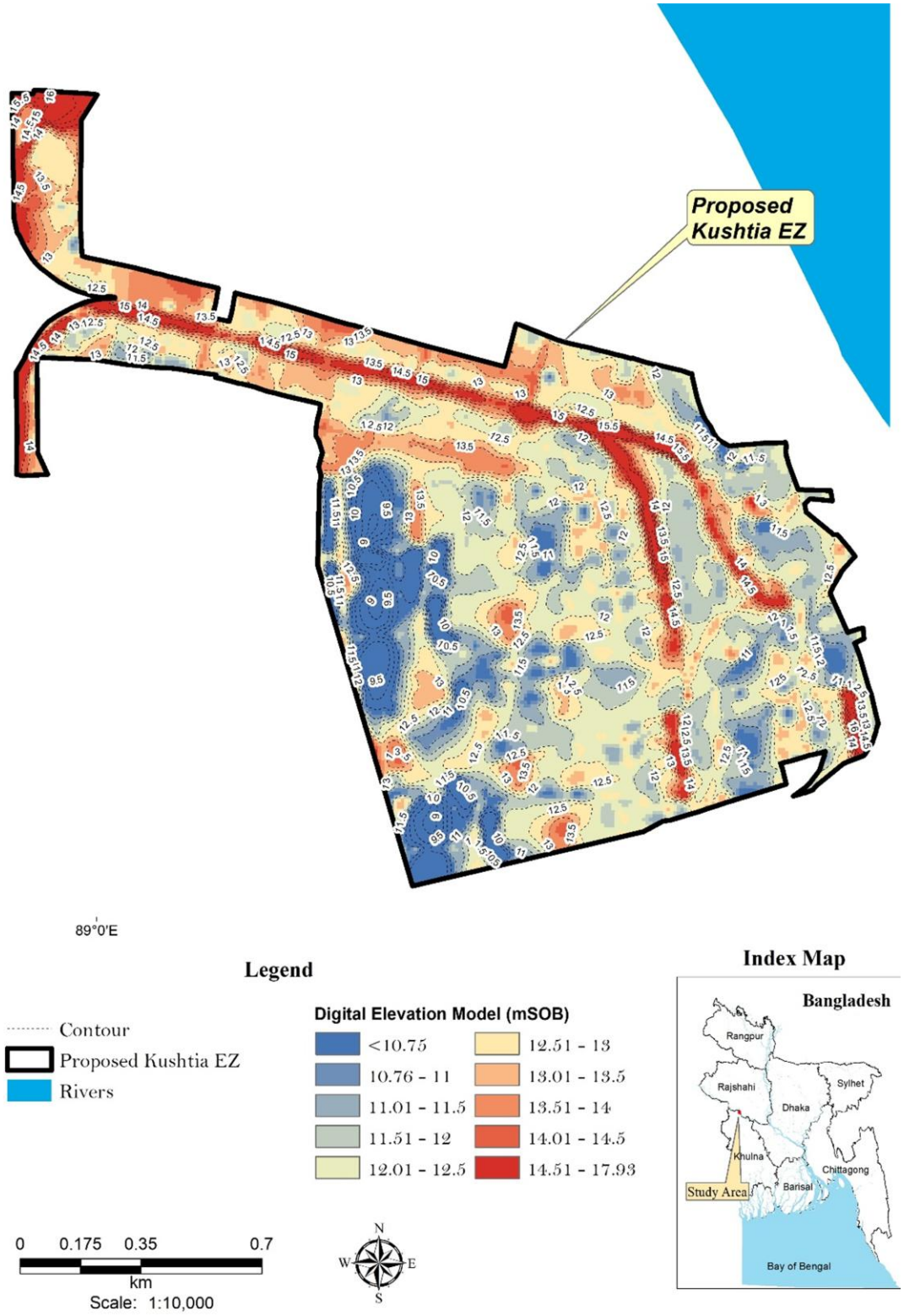


Figure 6.49: Digital elevation model of the study area

The freshwater availability of Bangladesh depends on flows at Farakka barrage which is shared between the two countries as per Ganges Water Treaty (GWT) 1996. The flow from the main Ganges River was summed up for the enumeration of regional inflow, and inflow from tributaries and distributaries within Bangladesh subtracted or added to derive the border inflows. The Ganges River provides direct inflow to the *Gorai-Madumati* and

Mathabanga rivers in the SW region. The major distributaries of the Ganges in Bangladesh *e.g.* the *Bairab*, the *Baral*, the *Kumar* and the *Kaliganga* used to carry sufficient flows in the past and remained perennial round the year. The small distributors *e.g.* the *Ichhamoti* and the *Chandana* received only flood spills. As the consequence of prolong siltation of the *Bairab*, the *Kumar* and the *Kaliganga*, the *Gorai* and *Arial Khan* rivers emerged as the major distributaries of the Ganges from its right bank. Figure 6.50 illustrates the water resources connectivity within the periphery of the project boundary. The summary of data and information of the Ganges River in Bangladesh is presented in the following table.

Table 6-27: Significant historical characteristic of the Ganges River in Bangladesh

Parameters		Ganges
Catchments area (10^3 km^2)		46,300
Average annual discharge (m^3/s)		17,000
Discharge (m^3/s)	Maximum	78,000
	Minimum	600
Water level (m+PWD)	Maximum	13.7
	Minimum	5.4
Slope (cm/km)		5
Total Sediment transport (M tons/y)		550
Bed material transport (M tons/y)		195
Bed material size (D_{50}) (mm)		0.15
Planform		Meandering

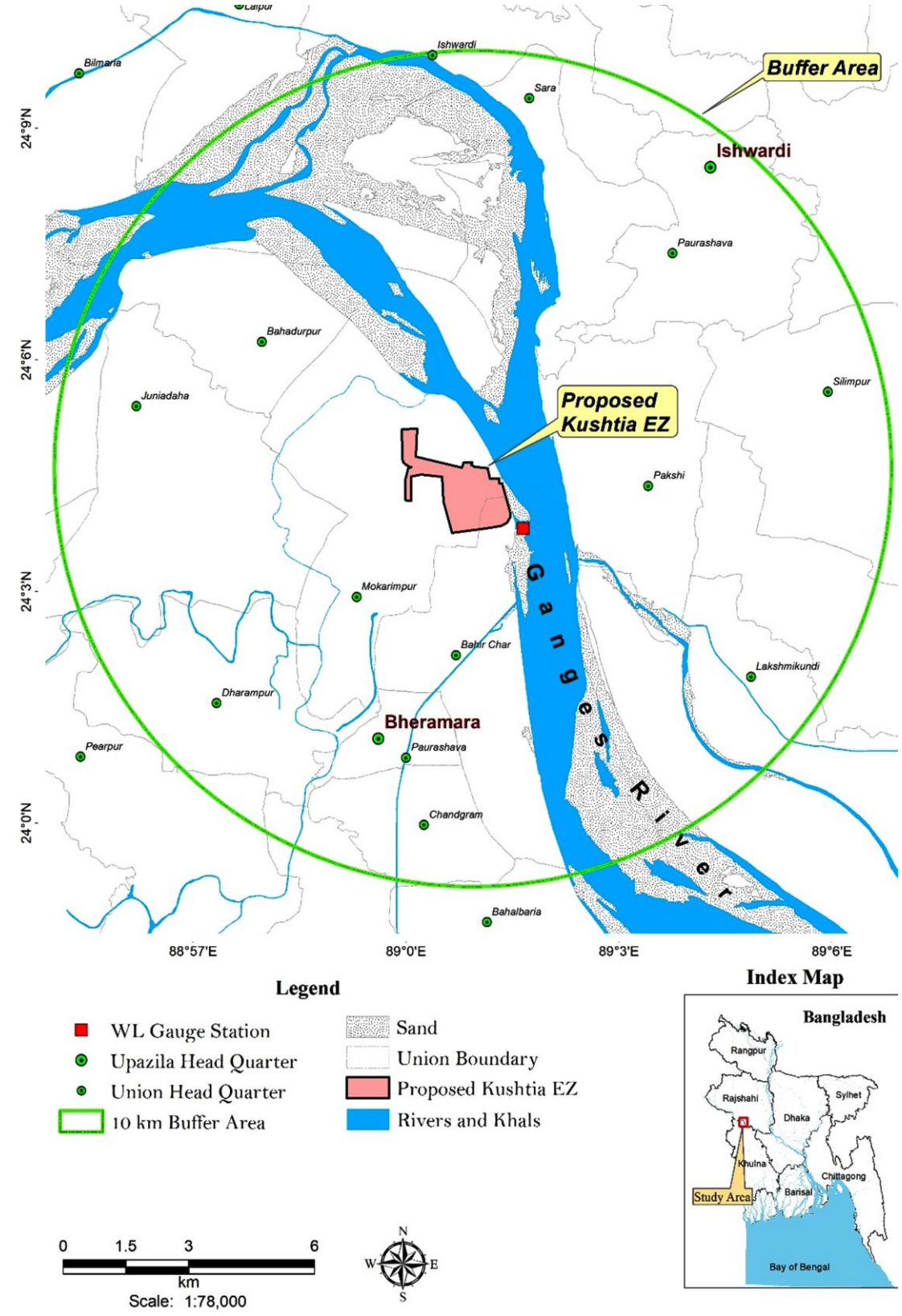


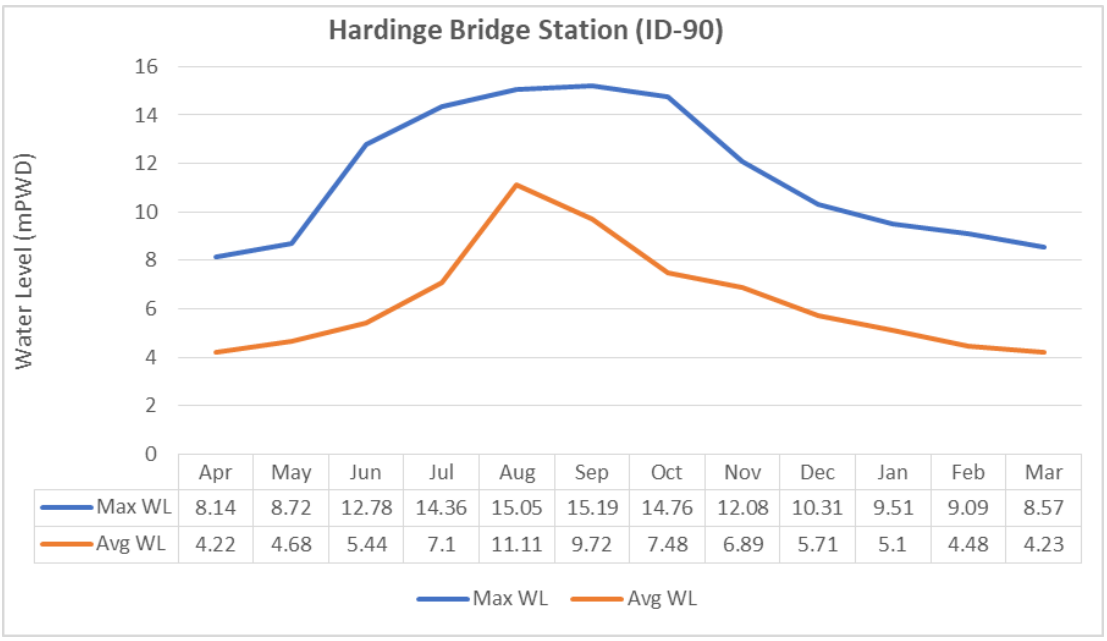
Figure 6.50: Surface water system in the study area

Monthly Average Flow (Maximum, Minimum and Average), Seasonal Variation

To assess the surface water characteristics of the study area, water level data were collected from two non-tidal gauge stations of BWDB: Hardinge Bridge (ID: 90) and Talbaria (ID: 91). The location of the gauge stations has been shown in Figure 6.51 and Figure 6.52.

Ganges River at Hardinge Bridge Station (ID-90)

The water level data of the Ganges River at Hardinge Bridge station was collected for the period from 1980 to 2020. The monthly maximum, and minimum water level data were analyzed and plotted in Figure 6.51. It appears from the graph that the water level raises in monsoon (June to October). During this period, the maximum water level of 15.19 m PWD was recorded in September 1998 while the minimum water level of 4.22 m PWD occurred in April 1993.



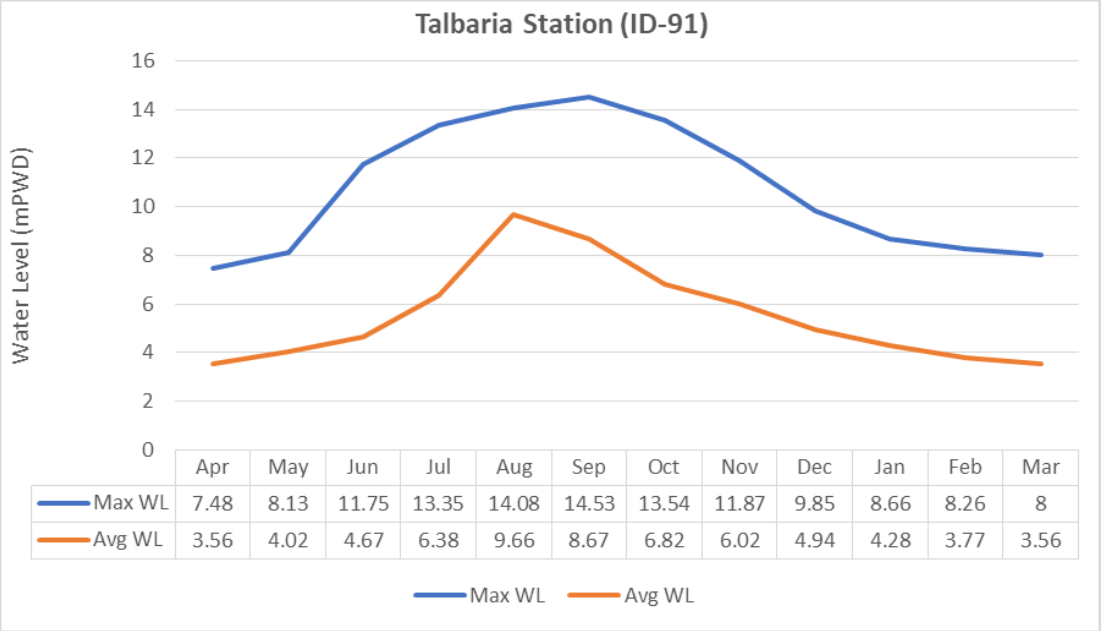
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Max WL	8.14	8.72	12.78	14.36	15.05	15.19	14.76	12.08	10.31	9.51	9.09	8.57
Avg WL	4.22	4.68	5.44	7.1	11.11	9.72	7.48	6.89	5.71	5.1	4.48	4.23

Source: BWDB station SW-90

Figure 6.51: Water level of the Ganges River Hardinge Station

Ganges River at Talbaria Station (ID-91)

The water level data of the Ganges River at Talbaria station was collected for the period from 1980 to 2020. The monthly maximum, and minimum water level data were analyzed and plotted in Figure 6.52. It appears from the graph that the water level raises in monsoon (June to October). During this period, the maximum water level of 14.53 m PWD was recorded in September 1998 while the minimum water level of 3.56 m PWD occurred in March 1993, and April 1993.



	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Max WL	7.48	8.13	11.75	13.35	14.08	14.53	13.54	11.87	9.85	8.66	8.26	8
Avg WL	3.56	4.02	4.67	6.38	9.66	8.67	6.82	6.02	4.94	4.28	3.77	3.56

Source: BWDB station SW-91

Figure 6.52: Water level of the Ganges River at Talbaria Station

Discharge Analysis

After the commissioning of the Farakka Barrage, the flow pattern of the Ganges River has changed considerably. Flow reduction is becoming significant during dry season. The velocity varies from 15 to 25 km/hr during the wet season while it is 4 to 8 km/hr during the dry period. The river flow reaches its peak at the end of August or beginning of September. The historically recorded maximum and minimum flow at *Hardinge* Bridge was 78,091 m^3/s in September 1998 and 275 m^3/s in March 1993. Important data of the Ganges flows at Hardinge Bridge are given in Table 6-28.

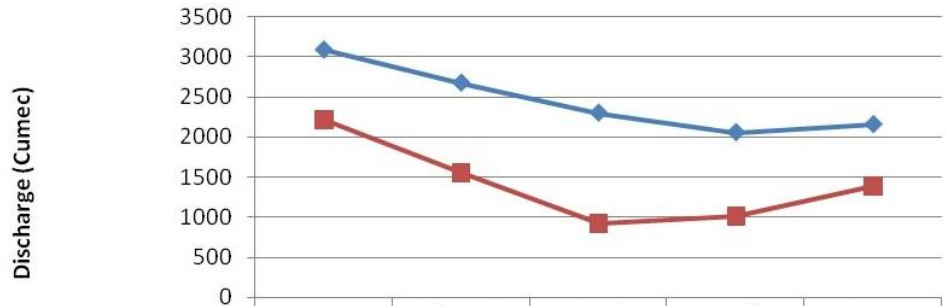
Table 6-28: Comparative discharge through Ganges River at Hardinge Bridge

Parameter	Pre-Farakka (1934-1974)	Post Farakka (1975-1996)	After Ganges Water Treaty		
			(1997-2005)	2008	2020
Mean annual maximum flow (m^3/s)	24,000	16,200	18,000	24,370	43,412
Mean annual minimum flow (m^3/s)	3,600	2,400	4,200	2,430	1,358

Source: BWDB, 2020

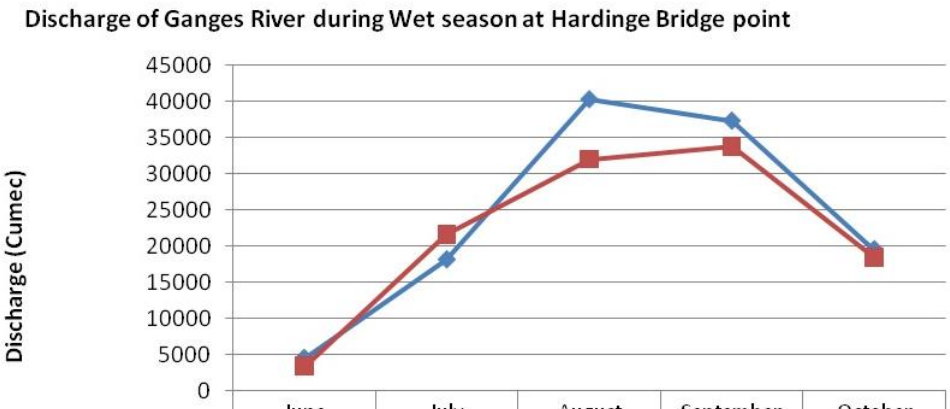
Statistics of 1996-2020 reveal that maximum wet and minimum dry seasonal flows from the Ganges River are 78,091m^3/sec (1998) and 330m^3/sec (1997) respectively. The ratio of water volume in the dry and wet seasons is very high in the Ganges River in Bangladesh.

A decreasing trend of discharge is observed in the last Nineteen years. However, in the year of 2014 maximum discharge (43412m^3/s) was recorded. The lowest flow was recorded in the year of 2014 (1318 m^3/s).



	January	February	March	April	May
Pre-Farakka (1948-1974)	3089	2675	2299	2054	2156
Post-Farakka,1996-2020 (After Ganges Water sharing Treaty,GWT,1996)	2211	1554	921	1012	1390

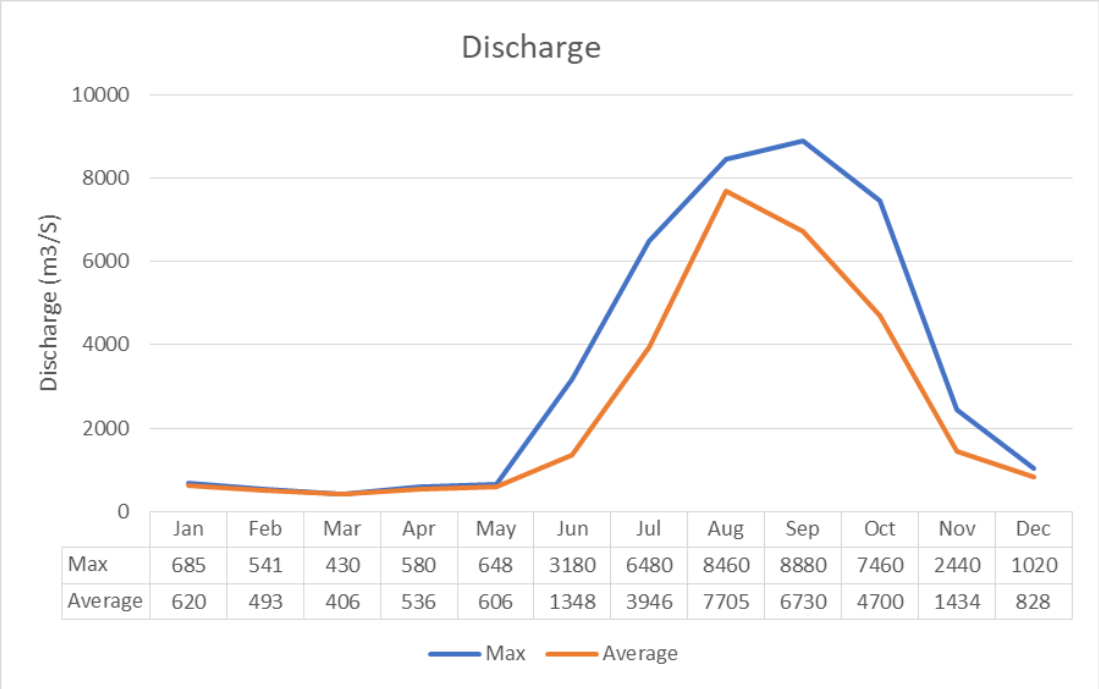
Figure 6.53: Discharge of Ganges River of Dry season during Pre-Farakka and GWT



	June	July	August	September	October
Pre-Farakka (1948-1974)	4538	18171	40335	37368	19583
Post-Farakka,1996-2020 (After Ganges Water sharing Treaty,GWT,1996)	3387	21603	32031	33799	18438

Figure 6.54: Discharge of Ganges River of Wet season during Pre-Farakka and GWT

It reveals from the statistics that the peak wet and minimum dry season discharge ratio during pre-Farakka period is 19.6 which is almost double (34.8) in post–Farakka (Ganges water sharing treaty, GWT, 1996) period. This indicates that there has been drastic reduction of dry season flow after operation of Farakka barrage.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	685	541	430	580	648	3180	6480	8460	8880	7460	2440	1020
Average	620	493	406	536	606	1348	3946	7705	6730	4700	1434	828

Source: BWDB

Figure 6.55: Monthly Max and Avg Discharge of the Goral Railway Bridge Station

6.3.3 Vulnerability to Climate Change and Natural Hazards

Historical Analysis of Flood, Cyclone, Tidal Surges

Flooding

Frequency analysis of rainfall and water level were made in this study. The main purpose of this analysis is to select the extreme events, which would facilitate the selection of different extreme scenarios for fixation of the land formation level of the Economic Zone above the flood level. Frequency analysis of water level was carried out for BWDB water level station (Hardinge Bridge Station ID-90). Annual maximum water levels from 1980 to 2020 were considered for flood frequency analysis. The Gumble EV1 distribution was found the best fit distribution. The flood level for different return periods is shown in Table 6-29. The estimated water level for different probability distributions is very close Gumble Extreme Value Type 1. The land elevation of the proposed Kushtia EZ is between 14 to 16 mPWD, therefore, this area is less vulnerable to riverine flood.

Table 6-29: Frequency Analysis of Annual Maximum Water Level

Return Period (Years)	Water Level (mPWD)
2	13.98
2.3	14.06
5	14.41
10	14.70
20	14.97
50	15.33
100	15.59

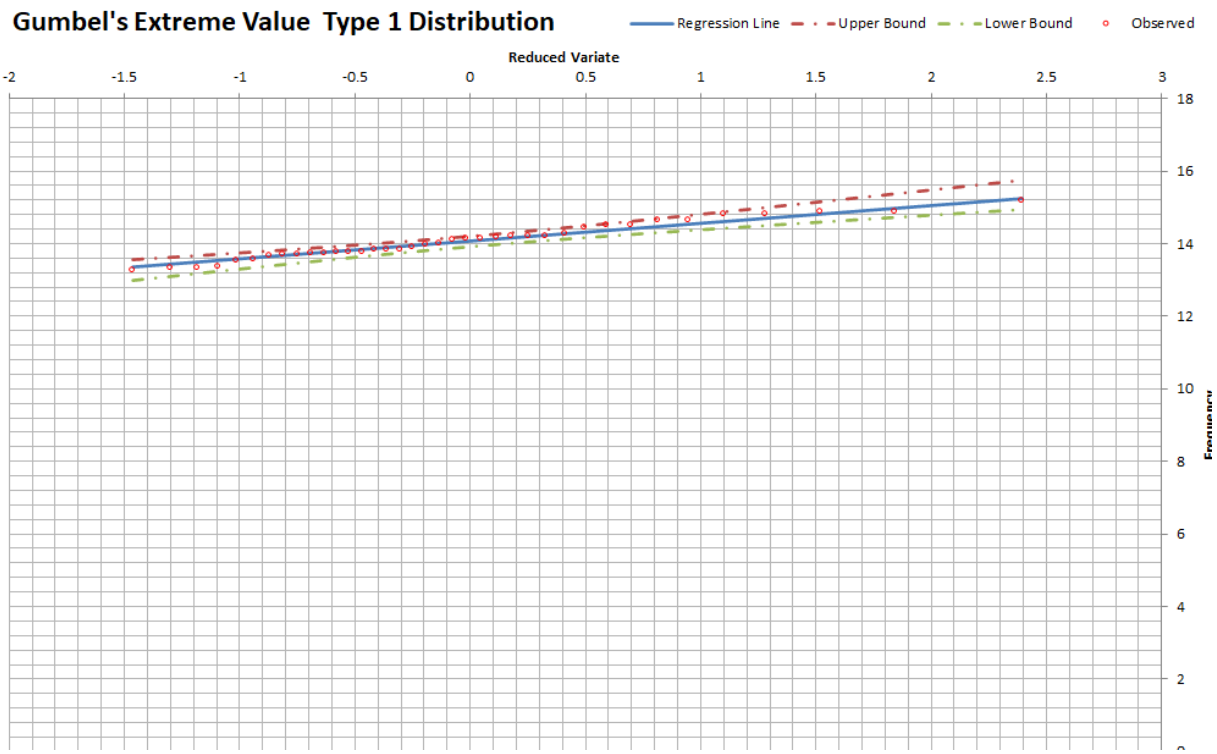


Figure 6.56: Gumbel's Value Distribution

BWDB Water Level Data

The following figure shows the location of the BWDB gauge SW90. Daily water level and discharge data were obtained from 1988 to 2020. The following graphs show the time vs water level and time vs discharge data. There are some missing data from 1994-1996. Based on the data it can be seen the highest flood level for this location occurred in 1988 and 1998. The flood level in 1998 was approximately 15m PWD.

Figure 6.57: Site location with respect to gauge

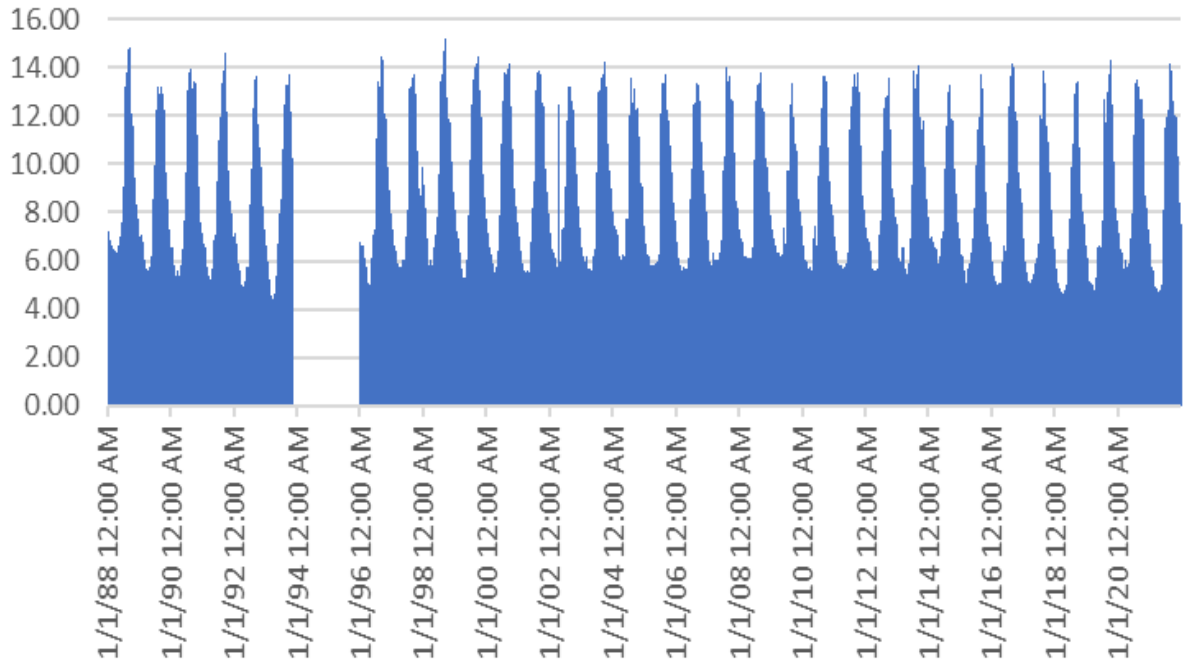


Figure 6.58: Time vs Water Level graph for SW 90

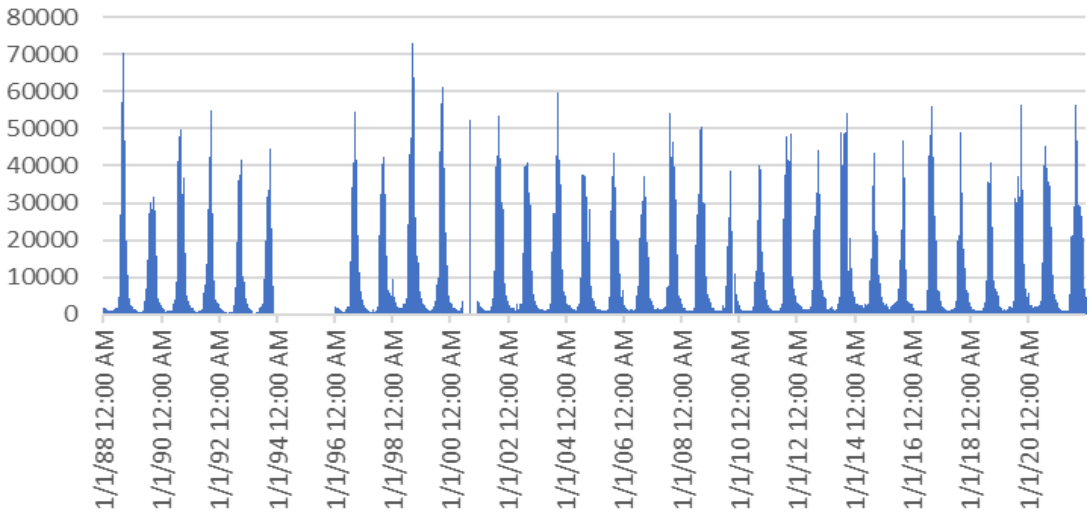


Figure 6.59: Time vs Water Level graph for SW 90

Natural Hazard

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 condition and the impact of climate change make the country vulnerable to natural hazards.

Tropical Cyclones

Natural disasters are not very frequent in the study area. Flood and cyclones are the most common natural disasters. Crops are sometimes damaged due to excessive flood and housing structures are reported to have been partially affected by cyclones in the study area. By analyzing the tracks of different cyclonic storm and cyclone affected area, it is clearly seen that, the proposed Kushtia EZ falls low Cyclone affected area. However, to minimize the flood vulnerability, the final land formation level of the Kushtia EZ needed to be fixed considering 50 years return period considering height highest flood level.

Bangladesh Meteorological Department (BMD) regularly monitors the tropical cyclones. The following table shows the recorded major historical cyclones that occurred in and around Bangladesh from 2005 to 2021.

Table 6-30: Recent historical cyclone at the Bangladesh coast

	Cyclone Name	Status	Landfall Area	Landfall Date
1.		Severe Cyclonic Storm	Chittagong	11.10.60
2.		Severe Cyclonic Storm	Chittagong	31.10.60
3.		Severe Cyclonic Storm	Chittagong	09.05.61
4.		Severe Cyclonic Storm	Chittagong (Near Feni)	30.05.61
5.		Severe Cyclonic Storm	Chittagong- Cox's Bazar	28.05.63
6.		Severe Cyclonic Storm	Chittagong-Barisal Coast	11.05.65
7.		Severe Cyclonic Storm	Chittagong	05.11.65
8.		Severe Cyclonic Storm	Cox's Bazar	15.12.65
9.		Severe Cyclonic Storm	Chittagong	01.11.66
10.		Severe Cyclonic Storm	Chittagong	12.11.70

	Cyclone Name	Status	Landfall Area	Landfall Date
		with a core of hurricane wind		
11.		Severe Cyclonic Storm	Cox's Bazar	28.11.74
12.		Cyclonic Storm	Chittagong	15.10.83
13.		Severe Cyclonic Storm	Cox's Bazar	09.11.83
14.		Severe Cyclonic Storm	Chittagong	24.05.85
15.		Cyclonic Storm (crossed as a depression)	Cox's Bazar Coast	18.12.90
16.		Severe Cyclonic Storm with a core of hurricane wind	Chittagong	29.04.91
17.		Severe Cyclonic Storm with a core of hurricane wind	Cox's Bazar-Teknaf Coast	02.05.94
18.		Severe Cyclonic Storm	Cox's Bazar	25.11.95
19.		Severe Cyclonic Storm with a core of hurricane wind	Sitakundu	19.05.97
20.		Severe Cyclonic Storm with a core of hurricane wind	Sitakundu	27.09.97
21.		Severe Cyclonic Storm with core of hurricane winds	Chittagong Coast near Sitakunda	20.05.98
22.		Cyclonic Storm	Teknaf-Akyab Coast	19.05.04
23.	BAAZ	Cyclonic Storm	Weakened into a well-marked low-pressure area over southwest Bay	02.12.2005
24.	AKASH	Cyclonic Storm	Crossed south Bangladesh coast close to south of Cox's Bazar	14.05.2007
25.	SIDR	Very Severe Cyclonic Storm	Crossed Bangladesh coast near Baleshwar River	15.11.2007
26.	RASHMI	Cyclonic Storm	Crossed Bangladesh coast near Khepupara	26.10.2008
27.	BIJLI	Cyclonic Storm	Crossed Bangladesh coast near Chittagong	17.04.2009
28.	MAHASEN	Cyclonic Storm	Crossed Bangladesh coast between Chittagong and Feni	16.05.2013
29.	KOMEN	Cyclonic Storm	Chittagong-Cox's Bazar Coast	30.07.2015
30.	ROANU	Cyclonic Storm	Barisal-Chittagong Coast near Patenga	21.05.2016
31.	MORA	Severe Cyclonic Storm	Chittagong-Cox's Bazar Coast near Kutubdia	30.05.2017
32.	FANI	Cyclonic Storm	Bay of Bengal, Khulna, Rajshahi, Dhaka	25.04.2019

	Cyclone Name	Status	Landfall Area	Landfall Date
33.	BULBUL	Cyclonic Storm	Bay of Bengal, Khulna, Barisal, Chottogram	28.10.2019
34.	AMPHAN	Cyclonic Storm	Khulna, Rajshahi, Dhaka, Rangpur	15.05.2020
35.	YAAS	Tropical Storm	The cyclone did not make direct landfall	24.05.2021
36.	GULAB	Tropical Storm	The cyclone did not make direct landfall	24.09.2021
37.	JAWAD	Tropical Storm	The cyclone did not make direct landfall	03.12.2021
38.	SITRANG	Tropical Storm	Barisal, Dhaka	23.10.2022

Source: Bangladesh Meteorological Department, 2021; World Data.info

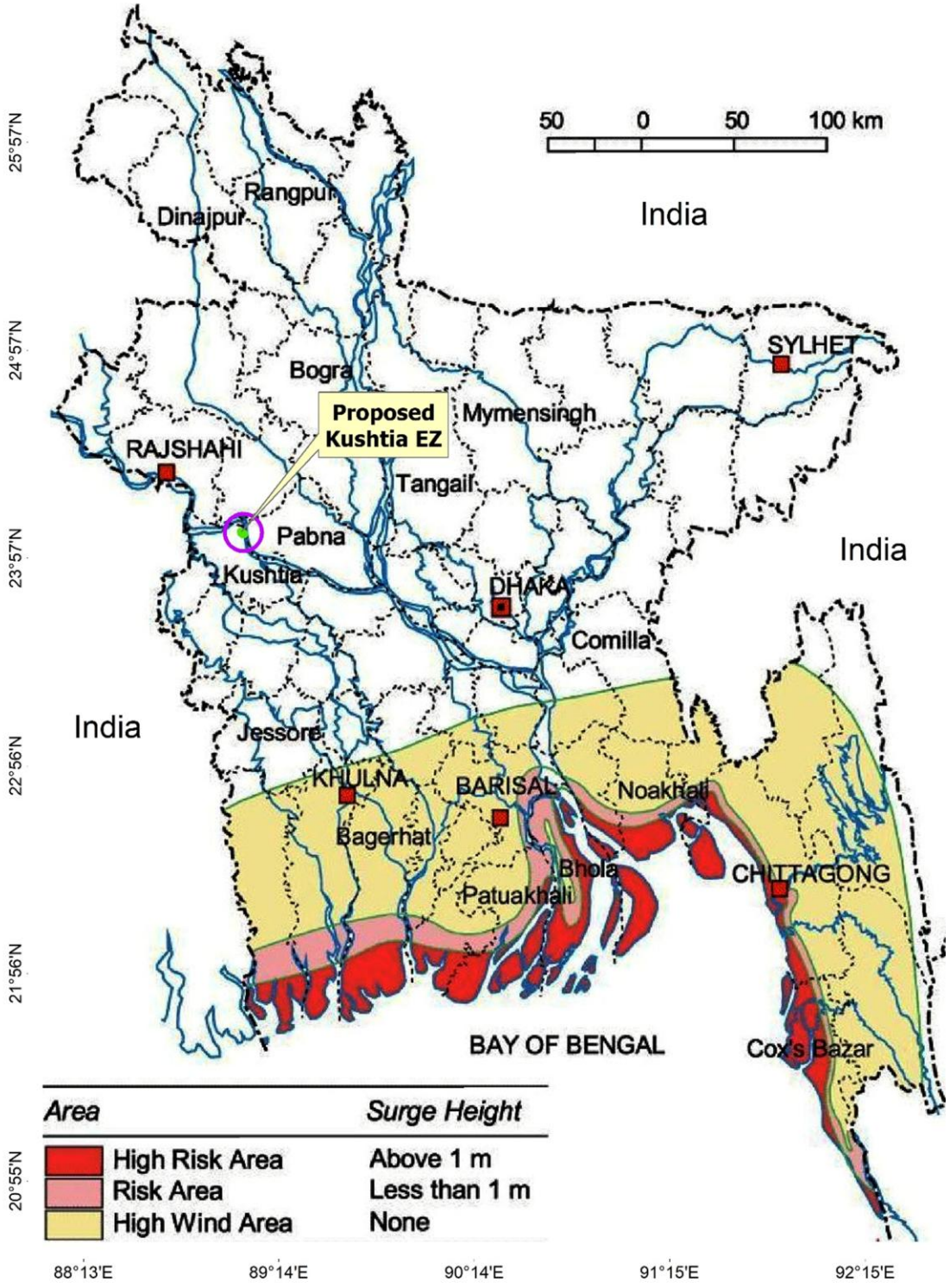


Figure 6.60: Cyclone Affected area of Bangladesh

6.3.4 Ground Water System in the Vicinity of the Project Site

The data of groundwater depth for different periods from Kushtia (KUS001 and KUS002) stations of BWDB were collected and analyzed. Figure 6.61 shows the location of the Ground Water observation well and the analyses are provided below:

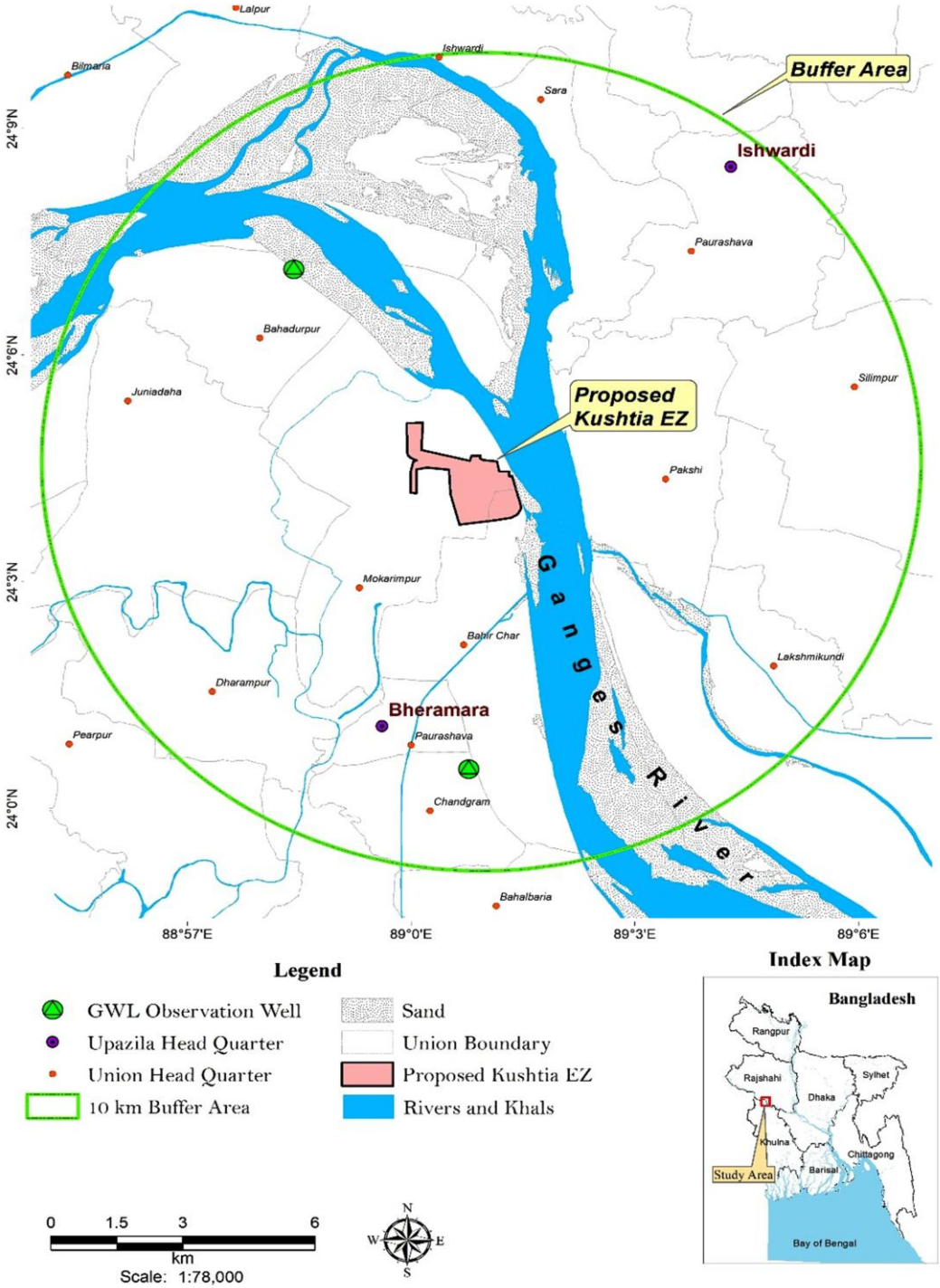


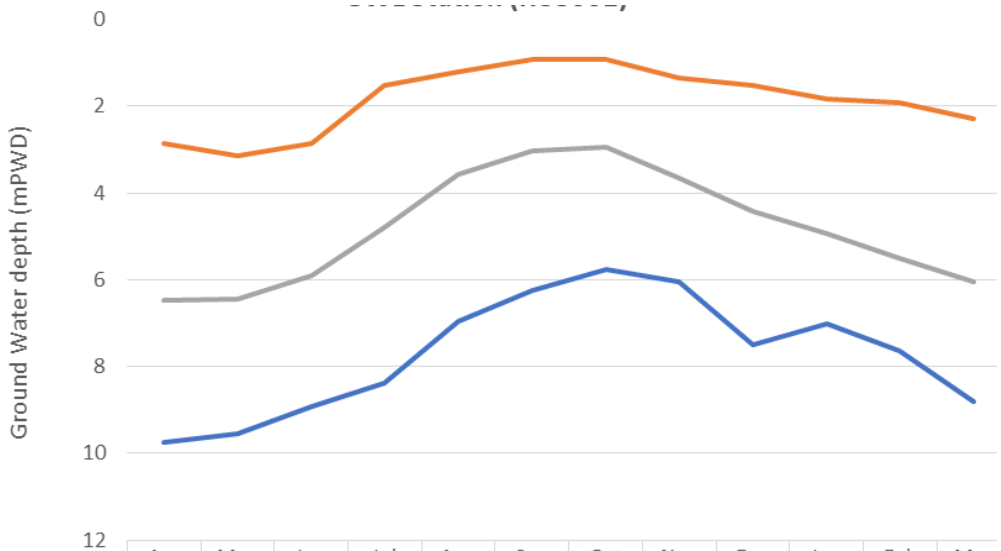
Figure 6.61: Location of the BWDB Observation Well

Flow Regime, Direction, Depth of each existing Wells (including water level)

Kushtia (Station KUS001)

The groundwater data of BWDB observation Station KUS001 for the period from 1985 to 2020 were collected and analyzed. It is observed from the average of 35 years data that the depth of groundwater level from the ground surface in dry season goes downward, and depth is highest in April. On the other hand, the water table rises in monsoon, and the lowest depth of groundwater level from the ground surface is observed in September due to recharge by rainwater, and peripheral river water. The monthly maximum and minimum

depth of groundwater from the ground surface during this period are also shown in Figure 6.62.



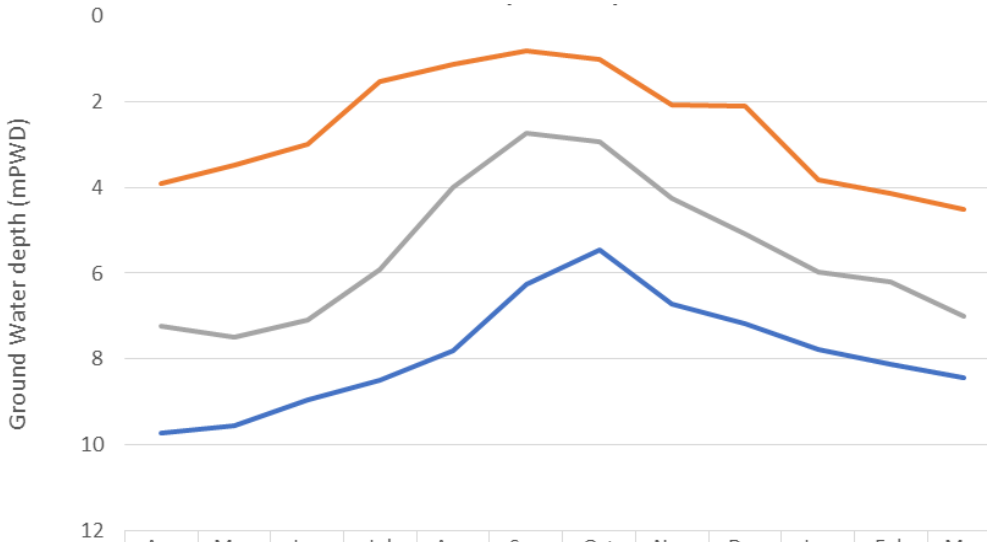
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Monthly Max	9.74	9.56	8.92	8.39	6.95	6.25	5.76	6.04	7.5	7	7.65	8.8
Monthly Min	2.85	3.15	2.86	1.53	1.22	0.91	0.91	1.35	1.52	1.83	1.91	2.29
Monthly Avg	6.5	6.5	5.9	4.8	3.6	3.0	2.9	3.7	4.4	4.9	5.5	6.0

Figure 6.62: Depth of Groundwater of Station KUS001

Kushtia (Station KUS002)

The groundwater data of BWDB observation Station KUS002 for the period from 1985 to 2020 were collected and analyzed. It is observed from the average of 35 yrs. data that the depth of groundwater level from the ground surface in dry season goes downward, and depth is highest in April. On the other hand, the water table rises in monsoon, and the lowest depth of groundwater level from the ground surface is observed in September due to recharge by rainwater, and peripheral river water. The monthly maximum and minimum depth of groundwater from the ground surface during this period are also shown in Figure 6.63.[25]

[25] *NWRD*



	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Monthly Max	9.74	9.56	8.96	8.5	7.8	6.25	5.46	6.73	7.19	7.77	8.11	8.45
Monthly Min	3.91	3.47	3	1.53	1.12	0.81	1	2.08	2.11	3.81	4.15	4.52
Monthly Avg	7.24	7.49	7.10	5.92	4.00	2.73	2.92	4.27	5.09	5.98	6.20	7.00

Figure 6.63: Depth of Groundwater of Station KUS002 near Ganges River [26]

Drought

Drought in general sense refers to an agro-ecological condition when precipitations together with residual soil moisture fail to meet the water requirements of standing agricultural crops. From this fact it is apparent that drought is the result of adverse climatic condition together with unfavorable soil and hydrological characteristics.

Kharif drought

This kind of drought occurs intermittently between June/July-October and affect mostly T.aman on Highland and Medium Highland–1 areas of the country. The situation results from the dominance of dry sub-humid (P<0.5 PET) and dry decades (P=0) with the kharif humid period. Percentages of dry sub-humid and dry decades were taken into consideration for delineating the kharif drought prone areas. Total numbers of dry days present were derived from the percent of decades within each kharif humid period. Drought severity classes were determined by combining other relevant factors such as soil texture, permeability, drainage, land type and available moisture holding capacity with the frequency of those decades. As per the review the project area falls under moderate Kharif Drought Prone area. Details has been shown in the Table 6-31 and Figure 6.64.

Table 6-31: Kharif Drought Areas in the Project and Study Area[27]

Drought Category	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% Of the NCA
Moderate	420	51,514	5,2066	67.3
Very Severe	-	6,933	6,933	9.0
Severe	-	699	699	0.9

[26] *NWRD*
[27] Source: Bangladesh Agricultural Research Council (BARC)

Drought Category	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% Of the NCA
Other Areas (Rivers, Forests etc.)	-	11,626	11,626	15.0
Non T.Aman Areas (MLL, LL, VLL and Hills)	-	6,000	6,000	7.8
Total	**420**	**76,772**	**77,324**	**100**

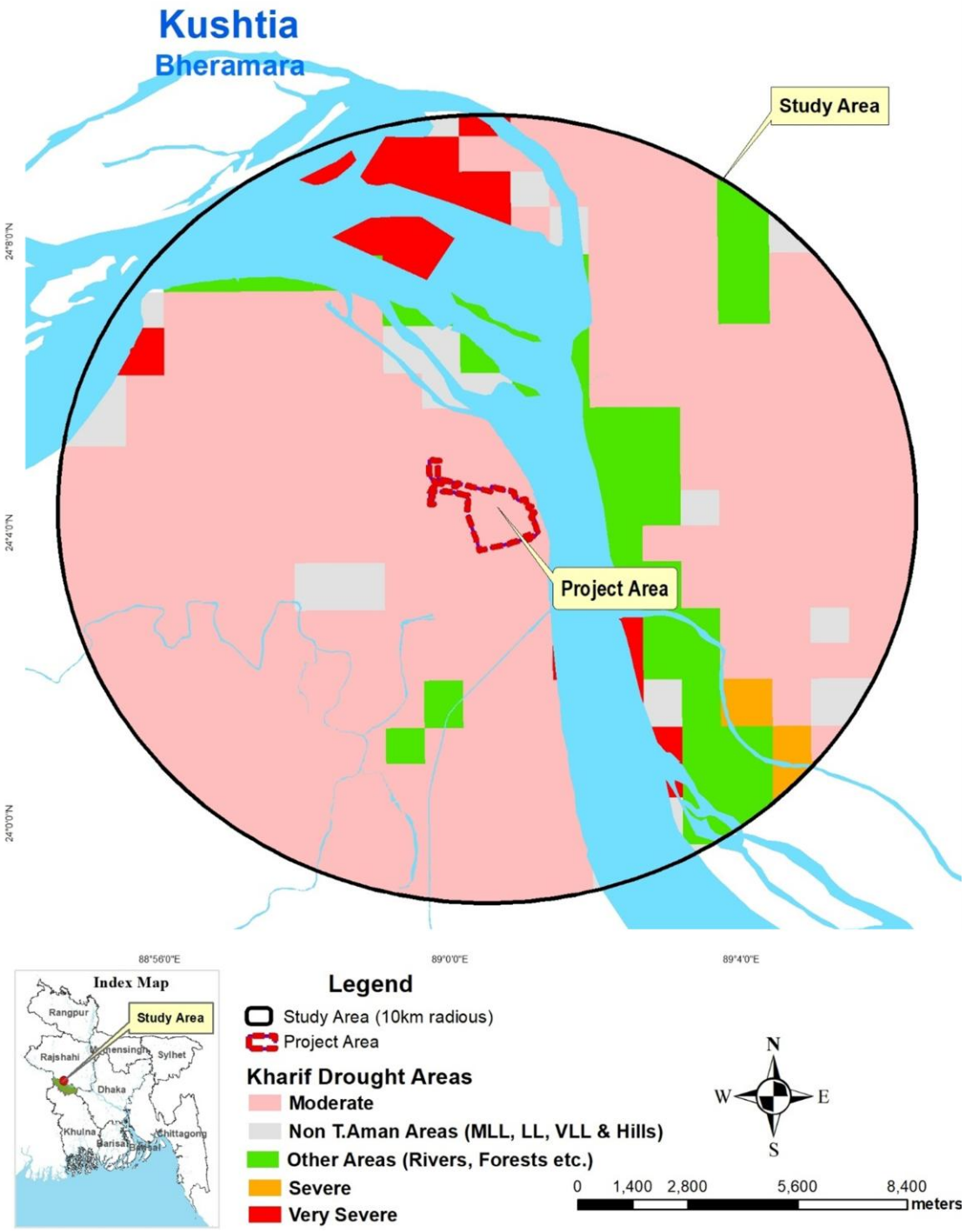


Figure 6.64: Kharif Drought Areas showing the project and study area

Rabi Drought

Drought during this period is caused mainly due to the combined effect of dry day, extremely high temperature (>400C), very high rate of evapotranspiration accentuated by unfavorable soil properties related to soil moisture storage capacity. Dry days within the Rabi season as well as pre-kharif transition period and number of days with maximum temperature exceeding 400C between March-May were considered as climatic parameters. These were combined with the soil and hydrological parameters to arrive at the severity rating categories where residual soul moisture storage is one of the most important components.

The major categories are:

(1) Very severe: Yield reduction may be >50 percent from normal.
(2) Severe: Yield reduction ranges between 30-50 percent.
(3) Moderate: Yield reduction ranges between 15-30 percent.
(4) Slight: Yield reduction ranges between <15 percent.

Table 6-32: Rabi Drought Areas in the Project and Study Area[28]

Drought Category	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% of the NCA
Slight	-	1,826	1,826	2.4
Moderate	420	47,917	48,469	62.7
Severe	-	4,716	4,716	6.1
Very Severe	-	10,422	10,422	13.5
Other Areas (Rivers, Forests, etc.)	-	11,893	11,893	15.4
Total	**420**	**76,774**	**77,326**	**100**

[28] Source: Bangladesh Agricultural Research Council (BARC)

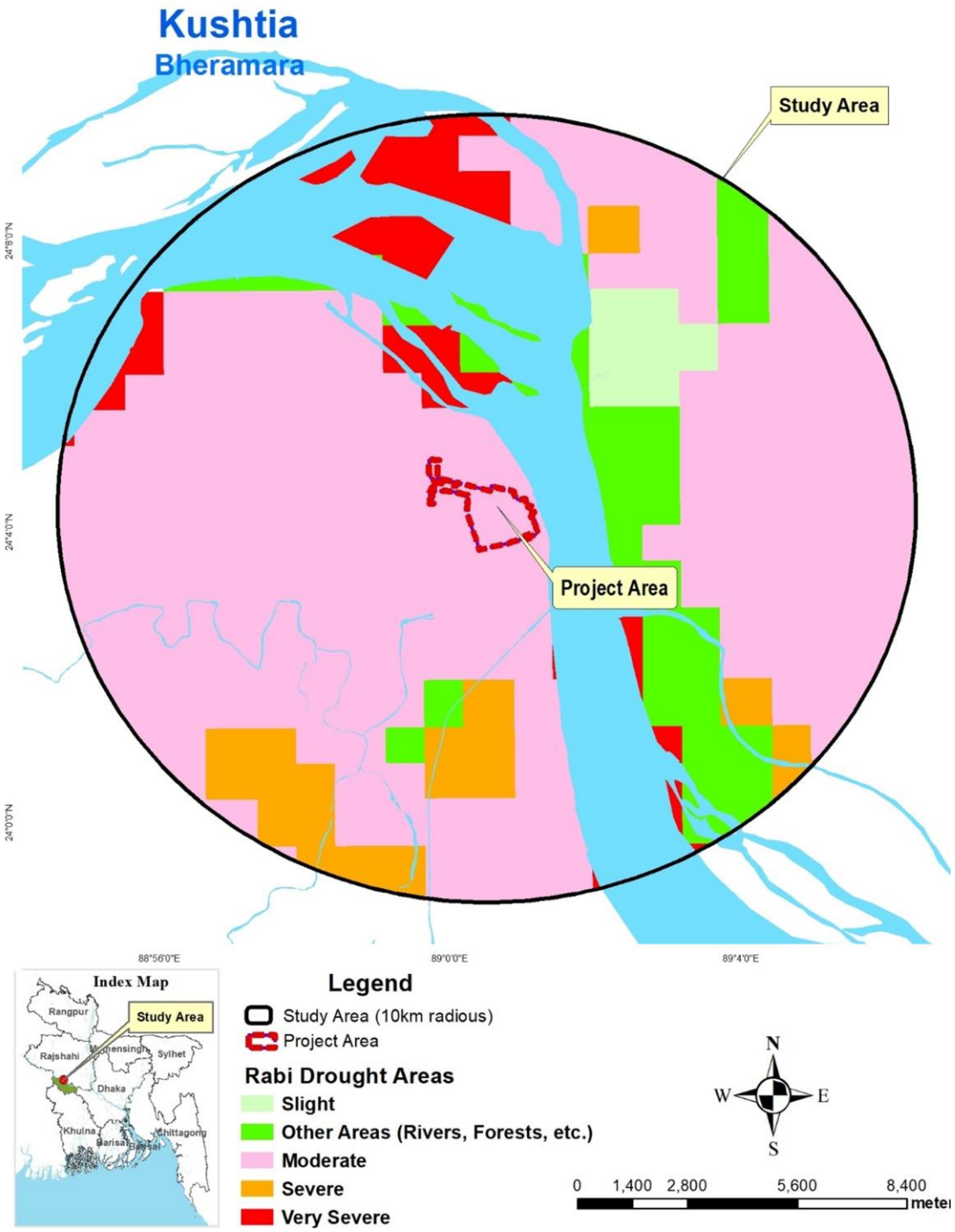


Figure 6.65: Rabi Drought Areas in the Project and Study Area

Pre-Kharif Drought

According to the study of drought severity by crop seasons the project area falls under severe drought during pre-Kharif season. The details have been shown in the following table and figure

Table 6-33: Pre-kharif Drought Areas in the Project and Study Area[29]

Drought Category	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% of the NCA
Moderate	-	13,949	13,949	18.0
Other Areas (Rivers, Forests, etc.)	-	11,893	11,893	15.4
Severe	420	40,154	40,706	52.6
Very Severe	-	10,778	10,778	13.9
Total	**420**	**76,774**	**77,326**	**100**

[29] Source: Bangladesh Agricultural Research Council (BARC)

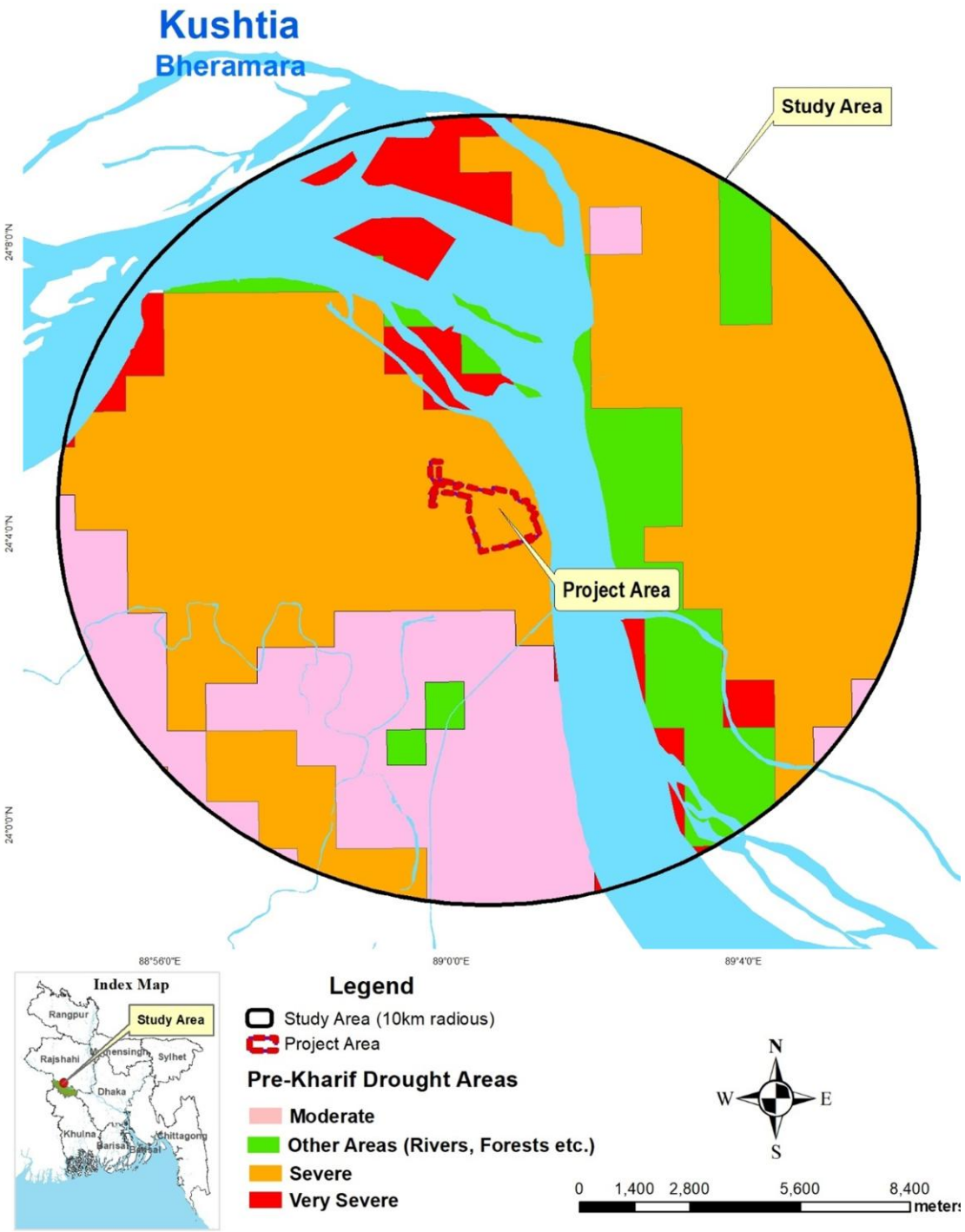


Figure 6.66: Pre-kharif Drought Areas in the Project and Study Area

6.3.5 Soil Erosion

Physiographically the proposed Kushtia EZ and its adjoining area falls under Ganges River Floodplain Physiographic units of Bangladesh. The Ganges River floodplain comprises the active floodplain of the Ganges and the adjoining meander floodplain. The latter mainly comprises a smooth landscape of ridges, basins and old channels. The Ganges channel is constantly shifting within its active floodplain, eroding and depositing large areas of new char land each flood season, but it is less braided than that of the Brahmaputra-Jamuna. Ganges alluvium is calcareous when deposited, but most basin clays and some older ridge

soils have been decalcified and acidified in their upper layers; lime is found only in the subsoil or substratum of such soils. Clay soils predominate in basins and on the middle parts of most ridges, with loamy soils (and occasionally sands) occurring mainly on ridge crests.

Seasonal flooding is mainly shallow in the west and north, with the highest ridge crests remaining above normal flood levels, but flood depths increase towards the east and the south. Flooding is mainly by accumulated rainwater and the raised groundwater table, except on the active Ganges floodplain and close to distributary channels which cross the meander floodplain. This physiographic unit is almost triangular in shape and bounded by the Ganges tidal floodplain on the south. On its southern end it traps the Gopalganj-Khulna Beels.[30]

6.3.6 Geomorphology and Geotechnical Characterization

Planform Analysis

The study team has investigated the banks of the Ganges River using 1972, 1992, 2002 and 2022 time-series satellite images to delineate Bankline changes and estimate the erosion and accretion of the proposed Kushtia EZ. Analysis of Satellite images approves that there are no significant Bankline changes was observed near the proposed economic zone. The existence of stable bank lines that could indicate the presence of less erodible materials. The soil properties of the Ganges River banks are erosion resistant and cohesive materials.

Besides, bank protection measures along the left bank associated with the construction of the Hardinge Bridge are the Sara hard point and the left guide bund. Along the right bank these are the Raita and Dhamukdia hard points and the right guide bund. Along the right bank, the first natural control at the downstream of the Hardinge Bridge is Talbaria, which is located at the immediate upstream of the Gorai off-take. The main flow of the Ganges River remains at this location for several decades causing bank erosion at a milder rate, for example 5 to 20 m/year. Shilaida is another location at the downstream of the Gorai off-take where the rate of bank erosion is very low ranging from 2 m/year.

[30] (Source: http://en.banglapedia.org/index.php?title=Physiography)

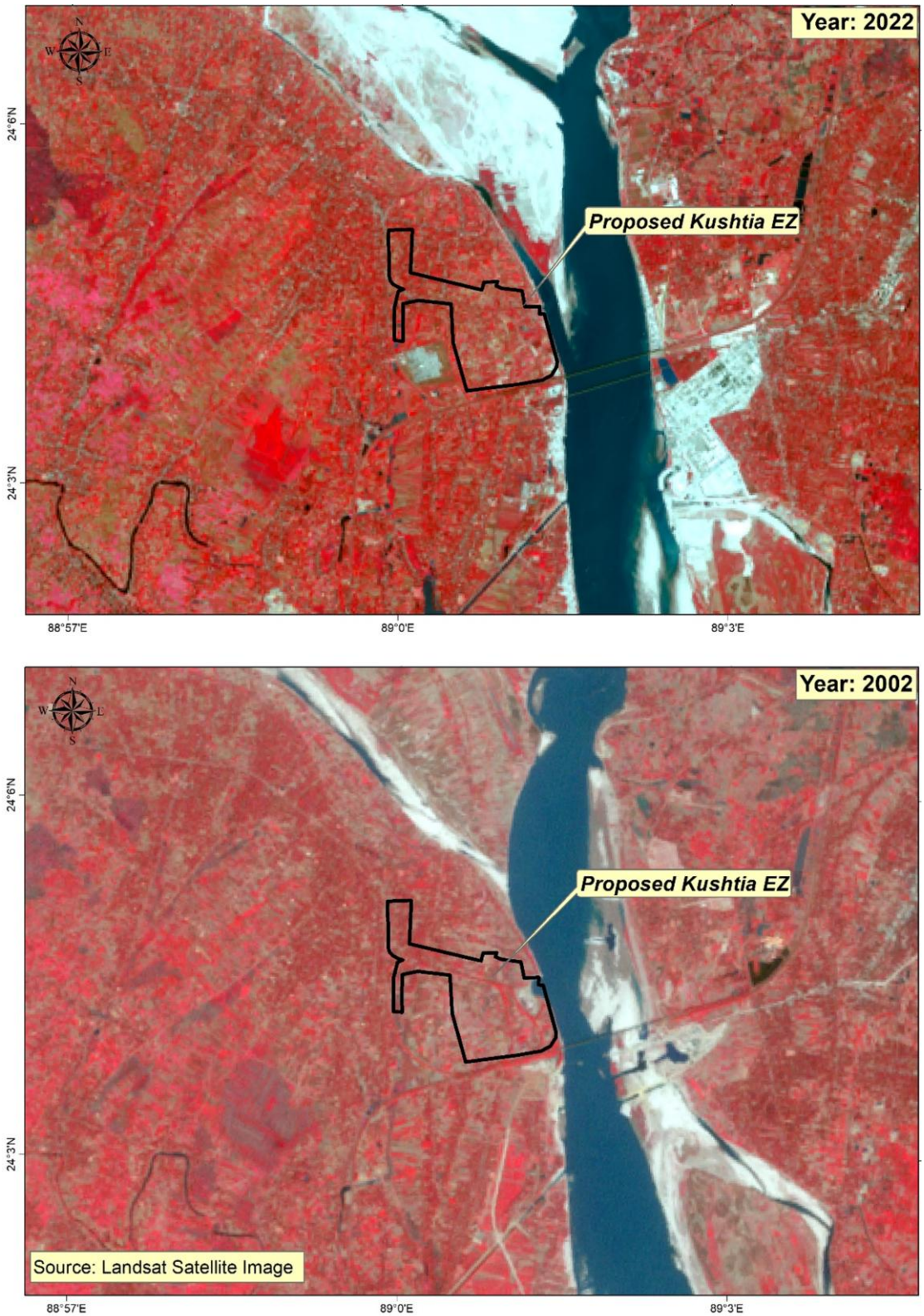


Figure 6.67: Historical Changes of Planform at Kushtia from 2002 to 2022

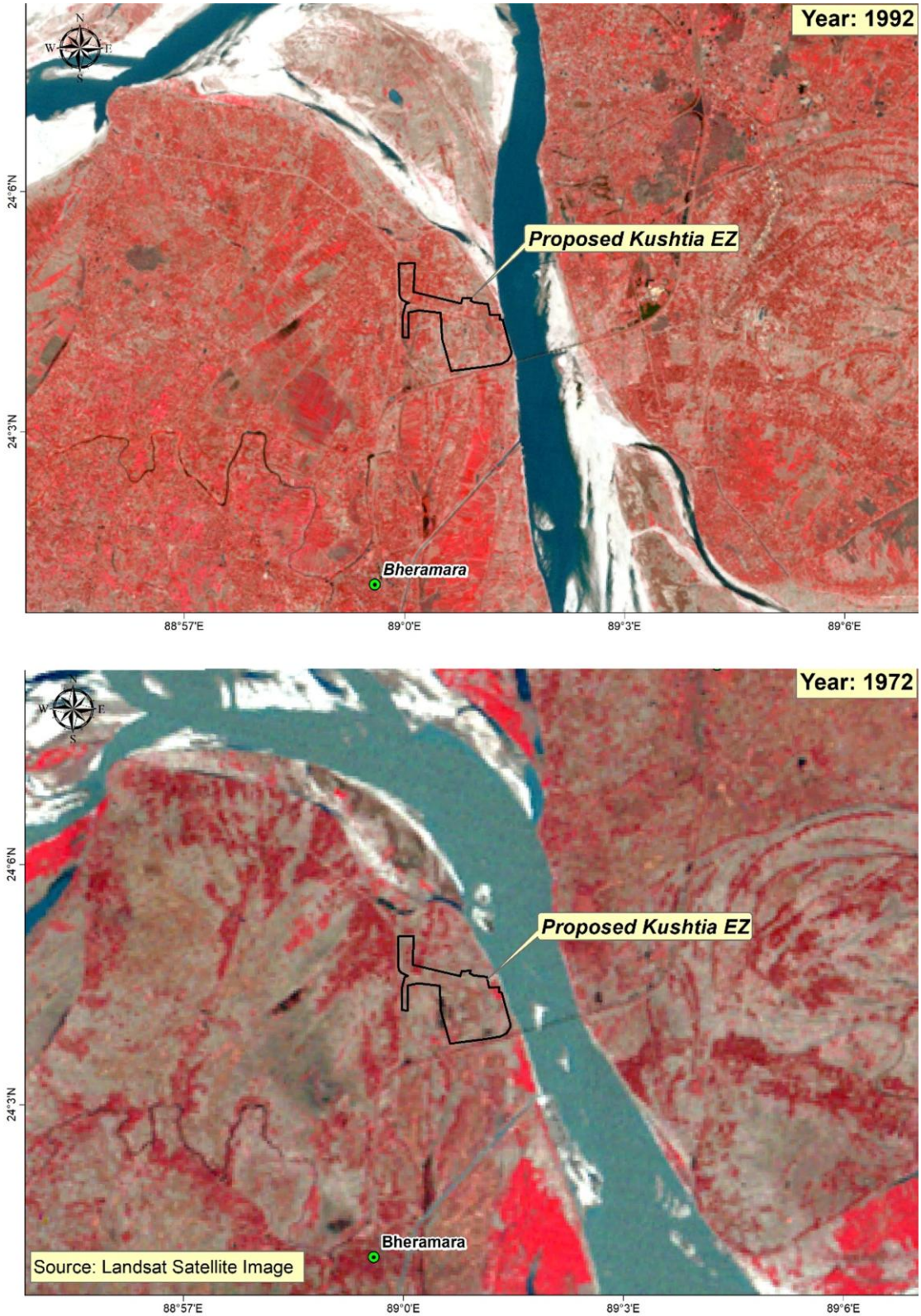


Figure 6.68: Historical Changes of Planform at Kushtia from 1972 to 1992

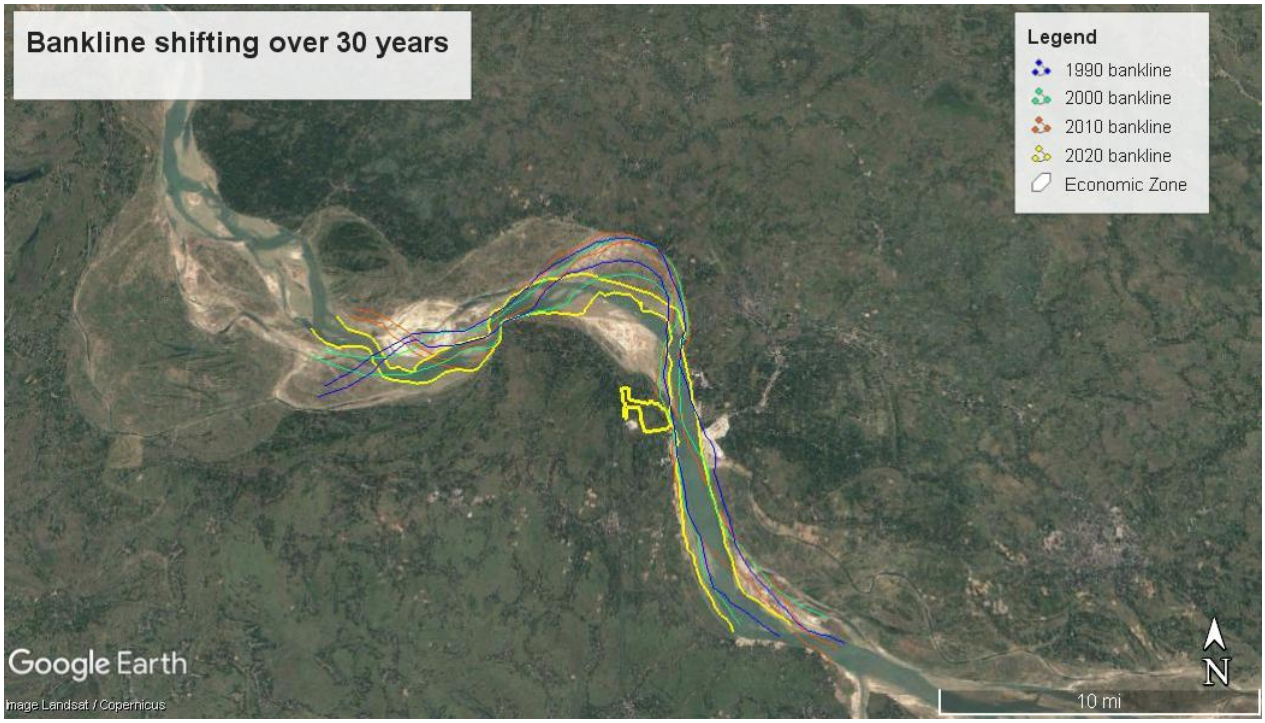


Figure 6.69: Bankline overlay assessment for 30 years of changes

The Kushtia EZ is situated beside the Padma River. By nature, the Padma is a meandering river with different degree of sinuosity at different reach. A reach of about 50 km is taken beside the project area. In last 30 years, adverse changing is noticed. The sinuosity of the reach lies between 1.1-1.3 which is a clear indication of meandering category. But the mighty Padma consists some braided characteristics also which is evident in the selected reach. The island erosion and deposition incidents induced island chars in between the two banks.

Though not like braided river, the classification falls under wandering pattern where braided index is less than 3. The channels are not divided in many sections within the reach. In upstream section, the meandering approaching the downstream firstly the bending pressure falls in left bank. In some distance of 20 km the bending feature turned to right bank side. Over the years the bank line shifting is maintaining the same pattern.

In the upstream of the economic zone there is a possibility of creating “Ox-bow Lake” as the loop joints have chances to come closer, but eventually the possibility will take another more than 50 years to take. The dynamic of bank line shifting and generation of island char due to erosion and deposition prove the reach unstable with respect to morphological aspect. The width of the reach varies to 0.9km to 2.19km in selected length.

Table 6-34: Lithological Analysis from Borehole data

Bore ID	GPS Location	Depth	GW Level	Soil type with strata depth
1.	E 88.996183 N 24.079648	30	1.91	Mostly silt with little clay: 0-10.5m Mostly sand with some silt and few clay: 12-13.5 Mostly sand with few silts and trace clay: 15-30m

Bore ID	GPS Location	Depth	GW Level	Soil type with strata depth
2.	E 89.011644 N 24.076258	30	4.46	Mostly silt with some sand and few clays: 0-12 m Mostly sand with trace silt: 13.5-21m Mostly sand with little silt and trace clay: 22.5-30m
3.	E 89.009583 N 24.067852	30	5.98	Mostly sand with few silts: 0-6m Mostly silt with little sand and few clay: 7.5-9m Mostly sand with few silts: 10.5-30m
4.	E 89.016467 N 24.071172	30	0.15	Mostly silt with little clay: 0-7.5m Mostly sand with some silt and few clay: 9-12m Mostly sand with few silts: 13.5-22.5 Mostly sand with some silt and few clay: 24-30m
5.	E 89.013117 N 24.069554	30	4.37	Mostly silt with few clays: 0-3m Mostly sand with little silt and trace clay: 4.5-30m
6.	E 89.018028 N 24.065785	30	2.61	Mostly silt with few clays: 0-1.5m Mostly sand with few silts and trace clay: 3-30m
7.	E 89.007387 N 24.063463	30	(-) 1.72	Mostly sand with little silts and few clay: 0-9m Mostly sand with few silts: 10.5-30
8.	E 89.005049 N 24.070436	30	0.25	Mostly sand with little silt and trace clay: 0-30m
9.	E 89.007571 N 24.075069	30	0.59	Mostly silt with little sand and few clay: 0-9m Mostly sand with little silt and trace clay: 10.5-25.5m Mostly silt with little clay: 27-30m
10.	E 89.018362 N 24.072326	18	3.55	Mostly silt with some clay: 0-12m and 15-19.5m Mostly sand with little silts and few clay: 13.5m

Feasibility study report, IIFC

From the borehole data analysis, it can be concluded that the upper portion of soil is mostly silt with few clays, the middle to lower portion is mostly sandy with little silt and trace clay soil.

6.3.7 Drainage Characteristics

Drainage plays a vital role in the management of soil. Drainage classes of the project area and Study area is Mixed Imperfectly Drained (37% of NCA) followed by Poorly Drained (19% of the NCA) as shown in Figure 6.70 and Table 6-35.

Table 6-35: Drainage Characteristics in the Project and Study Area[31]

Drainage Characteristics	Project Area (acre)	Study Area excluding Project Area (acre)	Total Study Area (acre)	% Of the NCA
Poorly Drained_Early	-	5,939	5,939	9.0
Mostly Poorly drained_Early	-	9,256	9,256	14.0
Mostly Poorly DR_Early WS Imperfectly DR	-	1,2489	12,489	18.8
Mostly Imperfectly DR WS Poorly DR_Early	-	462	462	0.7
Mixed Poorly DR_Early and Imperfectly DR	-	13,503	13,503	20.4
Mixed Imperfectly DR and Poorly DR_Early	420	24,066	24,617	37.1
Total	**420**	**65,715**	**66,266**	**100**

[31] Source: Bangladesh Agricultural Research Council (BARC)

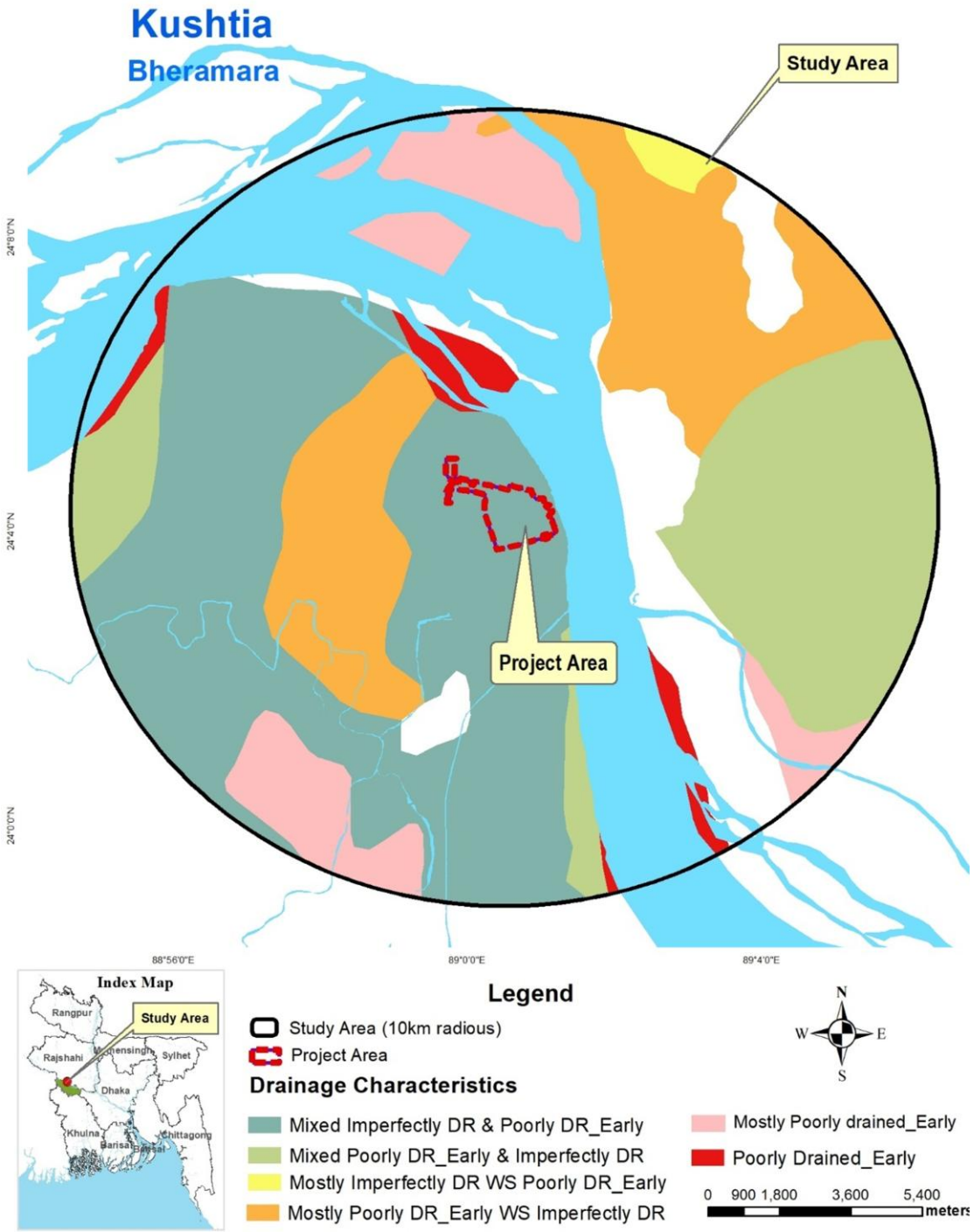


Figure 6.70: Drainage Characteristics Map in the Project and Study Area

6.3.8 Ecosystem of the project and study area (Flora Fauna and Biodiversity)

The section mainly describes the preliminary assessment of the floral and faunal diversity of Project area. A wide variety of wildlife, fish, as well as plant species are available in the project area. The area is one of the most important bio-habitats of Bangladesh.

Terrestrial Ecosystem

A terrestrial ecosystem is a land-based community of organisms and the interactions of biotic and abiotic components in a given area.[32]

Terrestrial Flora

Road and River side vegetation

The study area and nearby roads and river side area is enriched with diversified terrestrial flora. One very important medicinal plant was once grown in these sandy soils of Kushtia district known as Gokhur, Chotagokhur in Bengali and Puncture Vine or Devilis thora in English and *Tribulus terrestris L.* as scientific name is almost extinct from this district. Mostly Banana (*Musa sapiantum*) coconut (*Cocos nucifera*), betel, nut/supari (*Areca catechu*), mango (*Mangifera indica*), black berry/jam (*Syzygium cumini*), babla (*Acacia nilotica*), koroi (*Albizia procera*), chattim (*Alstonia scholaris*), kadam (*Anthocephallus chinensis*), nim (*Azadirechta indica*), sishoo kath (*Dalbergia sisoo*), krishnachura (*Delonix regia*), mandar (*Erythrina varigata*), simul (*Bombax ceiba*), banyan/bot (*Ficus benghalensis*), assawath (*Ficus religiosa*), , rain tree (*Samanea saman*), mehagoni (*Swietania mehagoni*), arjun (*Terminalia arjunai*) and pitali (*Trewia polycarpa*) are commonly found as terrestrial flora in the area.

Crop Field Vegetation

Some local varieties of rice have been cultivated in freshwater shrimp culture regions. Other species like chilli (*Capsicum frutescens*), brinjal (*Solanum melongena*), potato (*Solanum tuberosum*), tomato (*Lycopersicon lycopersicum*), ladies' finger/dheros (*Abelmoschus esculentus*), puishak (*Basella alba*), sugarcane (*Saccharum officinarum*), jute (*Corchorus capsularis*) and sesame/til (*Sesamum indicum*) are also commonly grown crops in this block.

Some grasses like *Cynodon dactylon*, *Axonopus compressus*, *Dactyloctenium aegipticum*,*Eragrostis tenella, Cyperus kyllinga* etc. are commonly found in this area.

Table 6-36: Herbs, grasses and shrubs of the study area

	Local Name	*Scientific name*	Status	
			Outside the project area	Project area
	Herbs			
1	Assamlata/Baraty	*Eupatorium odoratum*	Vc	C
2	Bish-katali	*Polygonum hydropiper*	C	R
3	Badaeya	*Andropogon aciculatus*	C	F
4	Banna danga shak	*Amaranthus viridis*	F	F
5	Bilai achra	*Mucuna pruriens*	E	F
6	Dubba ghas	*Cynodon dactylon*	Vc	C
7	Fenkachu/Mankachu	*Alocasia indica*	F	R
8	Fanimonasha	*Euphorbia neriifolia*	R	R
9	Gimashak	*Glinus oppositifolius*	C	R
10	Kukurmuta	*Blumea lacera*	C	F
11	Khuirakata/Kata danga	*Amaranthus spinosus*	F	F
12	Kachu	*Colocasia esculenta*	Vc	C
13	Kashjar	*Saccharum spontaneum*	F	R
14	Lajjabati	*Mimosa pudica*	F	R

[32] *National Geographic Societyhttps://www.nationalgeographic.org*

	Local Name	*Scientific name*	Status	
			Outside the project area	Project area
15	Marich (Banna)	*Croton bonplandianum*	C	F
16	Shealmotra	*Vernonia patula*	F	F
17	Telakucha	*Coccinea cordifolia*	C	F
	Shrubs			
18	Varanda/Venna	*Ricinus communis*	F	R
19	Bhat	*Clerodendrum viscosum*	C	F
20	Bet	*Calamus sp.*	F	E
21	Dhaincha/Dhanchi	*Sesbania cannabina*	F	R
22	Gagra	*Xanthium strumarium*	C	F
23	Chitki	*Phyllanthus reticulatus*	C	F
24	Titabegun	*Solanum torvum*	F	F

Status: Vc-very common, C-common, F-fairly common, R-rare, E-endangered, T-threatened, Et-extinct (Source: Field study 2022).

Table 6-37: Natural woody plants and fruit trees of the study area

	Local Name	Scientific Name	Status	
			Outside the Project Area	Project Area
	Natural woody plants			
1	Bannay	*Crataeva religiosa*	F	Et
2	Debdaru	*Polyalthia longifolia*	F	R
3	Jobb dumur	*Ficus racemosa*	F	R
4	Kharajura	*Litsea monopetala*	F	R
5	Kadam	*Anthocephalus chinensis*	F	R
6	Gab	*Diospyros peregrine*	F	Et
7	Gudu/Pitadonga/Medda	*Trewia nudiflora*	F	F
8	Khoksha/dumur	*Ficus sp.*	C	F
9	Kharchuna/Teet gila	*Derris indica*	F	R
10	Chattim/Chaitan	*Alstonia scholaris*	F	R
11	Shaora	*Streblus asper*	F	R
12	Titijam	*Eugenia sp.*	F	Et
13	Iika	*Alangium salvifolium*	R	Et
14	Pitraj	*Amoora rohituka*	C	F
15	Jarul	*Lagerstroemia speciosa*	F	R
16	Hijal	*Barringtonia acutangula*	F	Et
17	Harhari/Shola	*Trema orientalis*	F	F
18	Nim	*Azadirachta indica*	F	R
19	Shimul	*Salmalia malabarica*	F	R
	Fruit trees			
1	Aam	*Mangifera indica*	Vc	C
2	Amloki	*Phyllanthus emblica*	F	R
3	Amrah	*Spondias pinnata*	F	F
4	Ata (Sharpha)	*Annona squamosa*	F	F
5	Ata (Nuna)	*Annona reticulata*	F	F
6	Bel	*Aegle marmelos*	F	F
7	Boroi/Kul	*Ziziphus jujuba*	C	F
8	Chalta	*Dillenia indica*	R	R

	Local Name	Scientific Name	Status	
			Outside the Project Area	Project Area
9	Dalim	*Punica granatum*	F	F
10	Deophal	*Artocarpus lacucha*	R	E
11	Jam	*Syzygium cumini*	C	F
12	Jambura	*Citrus grandis*	F	R
13	Jamrul	*Eugenia javanica*	F	F
14	Kala	*Musa* spp.	C	F
15	Kamranga	Averrhoa carambola	F	F
16	Karamcha	*Carissa carandas*	R	R
17	Kadbel	*Feronia elephantum*	C	C
18	Kanthal	*Artocarpus heterophyllus*	C	F
19	Khejur	*Phoenix sylvestris*	C	F
20	Lebu	*Citrus* spp.	C	C
21	Narikel	*Cocos nucifera*	C	C
22	Pepe	*Carica papaya*	C	F
23	Peyara	*Psidium guajava*	C	C
24	Sajna	*Moringa oleifera*	C	F
25	Supari	*Areca catechu*	C	C
26	Safeda	*Achras zapota*	C	C
27	Tal	*Borassus flabellifer*	C	F
28	Tetul	*Tamarindus indica*	F	R

Status: Vc-very common, C-common, F-fairly common, R-rare, E-endangered, T-threatened, Et-extinct (Source: Field study 2022).

Table 6-38: Wild medicinal plants and non-fruit trees of the study area

	Local Name	Scientific Name	Status	
			Outside the project area	Project area
	Wild medicinal plants			
1	Akanda	*Calotropis procera Br.*	C	Et
2	Anantamul	*Hemidesmus indicus L.*	E	Et
3	Apang/Shisakanda	*Achyranthes aspera L.*	C	R
4	Bandhonia/Chinigura.	*Scoparia dulcis L.*	C	F
5	Basak	*Adhatoda vasica Nees.*	F	R
6	Chui Jhal	*Piper chaba Hunter*	R	R
7	Dhutura	*Datura metel Linn.*	F	R
8	Durba ghas	*Cynodon dactylon Pers*	C	C
9	Ghritakumari	*Aloe indica Willd.*	R	R
10	Hatisur	*Heliotropium indicum L.*	C	F
11	Kalokasunda.	*Cassia occidentalis L.*	C	R
12	Kalokeshi	*Eclipta alba (Hassk).*	F	R
13	Kalomegh	*Andrographis paniculata*	R	Et
14	Kumarilata.	*Smilax zeylanica L.*	C	R
15	Lajjabati (white)	*Mimosa pudica Linn.*	C	Et
16	Mehedi.	*Lawsonia inermis L.*	F	R
17	Nayantara.	*Catharanthus roseus.*	F	F
18	Nisinda	*Vitex negundo L.*	R	R
19	Olotkombol	*Abroma augusta L.*	R	R

	Local Name	Scientific Name	Status	
			Outside the project area	Project area
20	Pathor kuchi	*Kalanchoe pinnata (Lam.)*	C	F
21	Pipul	*Piper longum Linn.*	E	Et
22	Pudina	*Mentha arvensis L.*	F	R
23	Sharpagandha.	*Rauwolfia serpentina*	E	Et
24	Shoti	*Curcuma zedoaria Rosc.*	R	Et
25	Shotomuli	*Asparagus racemosus L.*	E	Et
26	Telakucha	*Coccina cordifolia (L)*	C	R
27	Thankuni	*Centella asiatica (L) Urban.*	C	R
28	Tulshi	*Ocimum basilicum Linn.*	C	F
	Non-fruit trees			
1	Arjun	*Terminalia arjuna*	C	F
2	Asawatha	*Ficus religiosa*	C	R
3	Bansh	*Bambusa spp.*	C	R
4	Bot	*Ficus benghalensis*	C	R
5	Jilapi	*Acacia sp.*	F	R
6	Krishnachura	*Delonix regia*	C	F
7	Mandar	*Erythrina variegata*	F	R
8	Zigha	*Lannea coromandelica*	C	R

Status: Vc-very common, C-common, F-fairly common, R-rare, E-endangered, T-threatened, Et-extinct (Source: Field study 2022)

Table 6-39: Social Forest plants and aquatic plants of the study area

	Local Name	Scientific Name	Status	
			Outside the project area	Project area
1	Social forest plants			
2	Akashmoni	*Acacia moniliformis*	F	F
3	Rendi koroi	*Samanea saman*	C	C
4	Shil koroi	*Albizia sp.*	F	R
5	Mahogany	*Swietenia mahagoni*	C	C
6	Piya	*Melia sempervirens*	F	R
7	Eucalyptus	*Eucalyptus citriodora*	F	F
8	Shegun	*Tectona grandis*	C	R
9	Shishu	*Dalbergia shishu*	C	C
10	Babla	*Acacia arabica*	C	F
11	Ipil ipil	*Leucaena latisiliqua*	C	F

Status: Vc-very common, C-common, F-fairly common, R-rare, E-endangered, T-threatened, Et-extinct (Source: Field study 2022).

Aquatic Ecosystem

An aquatic ecosystem is an ecosystem in and surrounding a body of water, in contrast to land-based terrestrial ecosystems. Aquatic ecosystems contain communities of organisms that are dependent on each other and on their environment.

Aquatic Flora

	Local Name	Scientific Name	Status	
			Outside the project area	Project area
1	Azola	*Azolla pinnata*	R	R
2	Buripana	*Spirodela polyrhiza*	C	C
3	Chaicha	*Scirpus articulatus*	C	C
4	Dhol kalmi	*Ipomoea fistulosa*	F	F
5	Helencha	*Alternanthera philoxeroides*	C	F
6	Jhanji	*Utricularia aurea*	R	R
7	Kachuri pana	*Eichhornia crassipes*	C	F
8	Kalmi	*Ipomoea aquatica*	F	R
9	Keshordam	*Ludwigia adscendens*	C	F
10	Khudipana	*Lemna minor*	C	C
11	Malanchi	*Enhydra fluctuans*	F	R
12	Shapla	*Nymphaea stellata*	F	R
13	Shusni shak	*Marsilea quadrifolia*	C	F
14	Topapana	*Pistia stratiotes*	F	R

Aquatic Fauna

Aquatic fauna is the aggregate of animals that inhabit aquatic land. Terrestrial fauna comprises approximately four-fifths of all of the earth's animal species and the rest is comprised of aquatic fauna.

Fisheries Resources

Bangladesh possesses enormous area of wetlands including rivers and streams, freshwater lakes and marshes, haors, baors, beels, water storage reservoirs, fish ponds, flooded cultivated fields and estuarine systems.

Habitat Characteristics

Fish habitats of the project area is classified into two broad categories based on land use, such as capture fishery which includes river, khal, Baor, wetland, Mudflats and intertidal area and culture fishery is practiced in fish pond and Freshwater aquaculture. The seasonal and perennial depressions along with floodplains of the study area become connected to the Padma River during pre-monsoon through a number of drainage canals (Khals). Connectivity is usually restored on the onset of monsoon. These seasonal and perennial water bodies function as fresh water fish habitats. Open water fish habitats that are found in the study area are; (i) rivers and (ii) Khals.

Table 6-40: Fish habitat and production assessment

Habitat Category	Habitat type	Study Area (ha)		
		Area (ha)	Total Yield/Production (MT)	Growth Rate (%)[33]
Capture Fishery	River and Khal	3222 ha	1253.358	1.94
		Total 1253.4 MT		
Culture Fishery	Fish Ponds	31 ha	156.8	3.63
	Fresh water aquaculture	133 ha	197.8	3.96
	Baor	53 ha	102.5	6.05
		Total 457.102 MT		
Grand Total 1710.502 MT/ha				

Source: Yearbook of Fisheries Statistics of Bangladesh 2019-20; KOMPSAT 2,3 satellite image Calculation

Table 6-41: Shrimp, crab, mollusks and fishes of the study areas

	Bangla Name	Scientific Name	Habitat	Status	
				Outside the project area	Project area
	Shrimp, crab and mollusks				
1	Golda-chingri	*Macrobrachium rosenbergii*	RB	C	R
2	Guara-chingri	*Palaemon spp.*	RBP	C	F
3	Boro- kakara	*Scylla serrata*	RBP	F	R
4	Choto-kakra	*Gelasimus annulipes*	RBP	C	F
5	Boro-shamuk	*Pila globosa*	BP	F	R
6	Guli-shamuk	*Vivipara bengalensis*	BP	C	F
7	Choto-shamuk	*Lymnaea spp.*	BP	C	F
8	Choto-shamuk	*Bithynia tentaculata*	RBP	C	F
9	Lamba-shamuk	*Melania tuberculata*	RB	F	R
10	Zinuk	*Lamellideus marginalis*	RBP	F	R
	Fishes				
1	Kakila	*Xenentodon cancila*	RBP	C	R
2	Shol	*Channa striatus*	RB	C	R
3	Taki	*Channa punctatus*	RB	C	F
4	Gazar	*Channa marulius*	RB	R	Et
5	Darkina	*Esomus danricus*	RB	C	F
6	Chela	*Onygaster phulo*	RB	F	Et
7	Mola	*Amblypharyngodon mola*	RB	F	R

[33] *Yearbook of Fisheries Statistics of Bangladesh 2019-20*

	Bangla Name	Scientific Name	Habitat	Status	
				Outside the project area	Project area
8	Rui	*Labeo rohita*	RBP	C	C
9	Catla	*Catla catla*	RBP	C	C
10	Mrigal	*Cirrhinus mrigala*	RBP	C	C
11	Tatkini	*Cirrhinus reba*	RB	F	Et
12	Silver carp	*Hypophthalmichthys molitrix*	RBP	C	C
13	Grass carp	*Ctenopharyngodon idella*	RBP	F	F
14	Carpio	*Cyprinus carpio*	RBP	E	Et
15	Tit punti	*Puntius ticto*	RBP	F	R
16	Punti	*Puntius stigma*	RB	C	F
17	Thai punti	*Puntius gonionotus*	RBP	F	F
18	Gutum	*Lepidocephalus guntea*	RB	F	R
19	Shingi	*Heteropneustes fossilis*	RB	C	F
20	Magur	*Clarias batrachus*	RB	R	Et
21	Boal	*Wallago attu*	RB	C	Et
22	Kani pabda	*Ompok bimaculatus*	RB	R	Et
23	Pangas	*Pangasius pangasius*	RBP	C	C
24	Rita	*Rita rita*	RB	F	Et
25	Ayre	*Mystus aor*	RB	C	Et
26	Tengra	*Mystus vittatus*	RB	C	F
27	Chitol	*Notopterus chitala*	RB	R	Et
28	Foli	*Notopterus notopterus*	RB	F	Et
29	Chapila	*Gudusia chapra*	RB	C	Et
30	Baim	*Mastacembelus armatus*	RB	C	Et
31	Gochi baim	*Mastacembelus pancalus*	RB	C	F
32	Tara baim	*Macrognathus aculeatus*	RB	R	Et
33	Khalisha	*Colisa fasciatus*	RB	C	F
34	Chata/Boichn	*Colisa lalius*	RB	F	R
35	Koi	*Anabas testudineus*	RB	F	R
36	Telapia	*Oreochromis niloticus*	RBP	C	C
37	Baila	*Glossogobius giuris*	RB	C	R
38	Baro chanda	*Chanda nama*	RB	R	R
39	Choto chanda	*Chanda ranga*	RB	F	R
40	Khorshula	*Rhinomugil corsula*	RB	F	Et
41	Vetki	*Lates calcarifer*	RB	C	F
42	Parshe	*Liza spp.*	RB	C	F
43	Datina	*Pomadasys hasta*	RB	C	F
44	Roop chanda	*Pampus chinensis*	R	F	Et
45	Taposhi	*Polynemus paradiseus*	R	F	Et
46	Khorkuno	*Mugil spp.*	RBP	C	F
47	Ilish	*Hilsa ilisha*	R	F	Et

Habitat: R=River, B=Beel/ Gher and P=Pond; Status: Vc =Very Common, C = Common, F =Fairly Common, R =Rare and T =Threatened, Et = Extinct (Source: Field study 2022)

Figure 6.71: Pangas (*Pangasius pangasius*) fish of the study area

Figure 6.72: Rui *(Labeo rohita)* fish of the study area

Figure 6.73: *Notopterus notopterus* fish of the study area

Fish Production Assessment

The total fish production of the study area is about 1710.502 MT/ha. The capture fishery production is 1253.358 MT/ha and culture fish production is 457.102 MT/ha.

Fish Migration

During the monsoon period, some riverine fishes migrate to the floodplain area for breeding, grazing and nursing purpose. But in winter season, the floodplain area dries up (observed during field visit) and farmers cultivate crops in that low land area. There are some small ditches that dries up during winter season. Basically, the low-lying muddy lands are used for grass cultivation by the dwellers. But at rainy season they catch various migratory fishes there. During that time floodplain habitats and river channels act as a lateral fish migratory route or connectivity.

Fishing Efforts

During monsoon, some of the cultivable lands go under water and become a single water body; and as such people avails free access opportunity for fishing. According to upazila fisheries officer, there are 198 fishermen in Bheramara but almost 50% of fishermen are now working in Ruppur Nuclear Powerplant. Fishermen catch fishes and sell them to nearest local markets but some of the fishes are taken to Ishwardi fish market. These fishermen are directly engaged in fishing. But because of EPZ and Ruppur nuclear powerplant many of them are changing their livelihood pattern. In the project area there are few (3-4) ponds which are not that deep so they dried up quite easily. Fish cultivation is not a common practice in that area. Mainly captured fisheries meet up their daily needs as well as contribute to their earnings.

Table 6-42: Amphibians and reptiles of the study areas

	Bangla Name	English Name	Scientific Name	Status	
	Amphibians			Outside of the Project Area	Project Area
1	Kotkoti/Baiya bang	Skipper frog	*Rana cyanophlyctis*	F	R
2	Sonalibang	Bull frog	*Rana tigrina*	F	R
3	Kunobang	Toad	*Bufo melanostictus*	F	F
	Reptiles				
1	Tiktiki	Wall lizard	*Hemidactylus flaviviridis*	C	C
2	Anjali/Nenja	Shink	*Mabuya carinata*	C	F
3	Kalo Gui shap	Monitor lizard/Grey lizard	*Varanus bengalensis*	C	F
4	Sonali/Haldey Gui	Yellow lajnd monitor	*Varanus flavescens*	F	R
5	Bara-kasim	Soft shell turtle	*Trionyx gangeticus*	R	Et
6	Kaitta /Kori kaitta	Roofed turtle	*Kachuga tecta*	F	R
7	Saundi kasim	Spotted flap shell tortoise	*Lissemys punctata*	F	Et
8	Paina/Matia shap	Common water snake	*Enhydris enhydris*	C	F
9	Dora Shap	Checkered keelback	*Xenochrophis piscator*	C	F
10	Daras shap	Rat snake	*Ptyas mucosus*	F	R
11	Gokhra shap	Cobra	*Naja naja*	F	R
	Birds				
1	Bhuban cheel	Black kite	*Milvus migrans*	F	F

	Bangla Name	English Name	Scientific Name	Status	
2	Tila baz	Kestre eagle	*Falco tinnunculus*	R	Et
3	Mala ghughu	Ring dove	*Streptopelia decaocto*	F	R
4	Tila ghughu	Spotted dove	*Streptopelia chinensis*	F	R
5	Jalali kobutor	Blue R. pigeon	*Columba livia*	C	C
6	Teya	Parakeet	*Psittacula krameri*	F	R
7	Kokil	Koel	*Eudynamys scolopacea*	F	F
8	Kanakoka	Lesser coucal	*Centropus bengalensis*	F	Et
9	Lokhi pecha	Bran owl	*Tyto alba*	F	R
10	Bhutum pecha	Spotted owlet	*Athene brama*	F	R
11	Katthokra	Golden-backed wood pecker	*Dinopium javanense*	F	R
12	Ababil	House swift	*Apus affinis*	C	C
13	Shipahi-bulbul	Red-whiskerdbulbul	*Pycnonotus cafer*	C	C
14	Doyal	Magpic robin	*Copsychus saularis*	C	C
15	Tuntune	Tailor bird	*Orthotomus sutorius*	F	F
16	Fingae	Black drongo	*Dicrurus macrocercus*	C	C
17	Pati kak	House crow	*Corvus splendens*	C	C
18	Dar kak	Jungle corw	*Corvus macrorhynchos*	C	C
19	Baht salik	Common myna	*Acridotheres tristis*	C	C
20	Jhuti-salik	Pied myna	*Sturnus contra*	C	C
21	Chorui	House sparrow	*Passer domestica*	C	C
22	Babui	Baya	*Ploceus philippinus*	C	F
23	Kutum	Black headed oriole	*Oriolus chinensis*	F	R
24	Shakun	White backed vulture	*Gyps bengalensis*	R	Et

Status: Vc =Very Common, C = Common, F =Fairly Common, R =Rare and T =Threatened, Et = Extinct (Source: Field study 2022)

Table 6-43: List of mammals in the project area

	Bangla Name	English Name	Scientific Name	Status	
		Amphibians		Outside of the Project Area	Project Area
(1)	Borobadur	Flying fox	*Pteropus giganteus*	F	R
(2)	Shial	Jackal	*Canis aureus indicus*	R	Et
(3)	Khak shial	Fox	*Vulpes bengalensis*	T	Et
(4)	Beji	Mongoose	*Herpestes edwardsii*	T	R
(5)	Banbiral/Bona	Jungle cat	*Felis chaus*	T	Et
(6)	Khorgosh	Black-naped hare	*Lepus nigricollis*	Et	Et
(7)	Katbirali	Irrawadedy squirre	*Callosciurus pygeregthrus*	R	Et
(8)	Udd	Otter	*Lutra lutra*	T	Et
(9)	Gaso indur	L.bandicoot rat	*Bandicota bengalensis*	C	F
(10)	Indur	G.bandicoot rat	*Bandicota indica*	Vc	C

	Bangla Name	English Name	Scientific Name	Status	
		Amphibians		Outside of the Project Area	Project Area
(11)	Chika/Sucho	House shrew	*Suncus murinus*	C	C

Livestock and Poultry

During the discussion with Livestock Officer, it was found that almost 60% people of the area is dependent on livestock and there is one animal hospital. There are two large dairy farms (Feeda Agro) where the number of cows is more than 100 and lots of small household farms in that area. Almost every household has a small poultry or dairy farm.

At the same time, livestock not only help with financial medium, but also provides us crucial animal protein. Also, there are enough grazing areas for the existing livestock but if these lands are taken for industrial purpose, it will affect the supply of food for the animals. Dairy and small-scale farms are increasing in the area.

Figure 6.74: Cattle farm at the project area

Figure 6.75: Goats at the project area

Ecosystem Services and Function

Ecosystem services are the set of ecosystem functions that are useful to humans. These services make the planet inhabitable by supplying and purifying the air we breathe and the water we drink.

Contribution of ecosystem services from the Ganges River is widely recognized. Ganges River is a very dynamic meandering river and main surface water source in this area. The Ganges and its tributaries provide a perennial source of irrigation to a large area of the project, in addition to recharging the groundwater table all along their course. By supporting agriculture, animal

husbandry and fisheries, tourism, river-based trade and transport, the river contributes significantly to the livelihood, food and nutritional security of about one-third of Indian and two-thirds of the Bangladeshi population. Most of the people living on its banks use it for daily needs such as bathing and fishermen depend on it for fishing. The existing farmers in the area mostly use the river water for their irrigation. As there is no forest land in the study area so no ecosystem services will be provided from forests.

In addition, terrestrial ecosystem also provides services via plants used mainly for medicinal purposes for common diseases from the bark and roots of the Mango, Tulsi, Simul and other generally useful trees. The wood apple (Aegle marmelos), Gab (Diospyros precatorius) and Babla (Acacia arabica) provide gum, the seeds of the tamarind produce oil which is used in painting idols, and the bark of the guava is used for tanning.

Threats to ecosystem

The anthropogenic pressure is the main threat to ecosystem like hunting of waterfowl, and overexploitation of natural resources like overfishing that has triggered scarcity of nourishment for waterfowl in their feeding habitat.

6.3.9 Agricultural Resources

The land use of the study area has been used for the assessment of the environmental impact of the proposed Kushtia EZ. The total study area has been considered as 10 km radius from the centre of the economic zone and area is about 77,576.14 acres. Land use of the study area has been prepared using high resolution *KOMPSAT-2,3 Satellite Image* dated 2019-20.

The images show that the major land use category is single crop is 27,146.96 acres (35.0% of the gross area) and rural settlement is 17,255.34 acres (22.24% of the gross area). Besides other landuse area rivers and khals, herb dominated area, sand area and freshwater aquaculture. The detailed land use data is presented in Table 6-44 and land use map is presented in Figure 6.76.

An area of 382.07 acres is currently under custody of BEZA which almost baren with no agriculture activities. But there are some single-crop cultivation in additional 37.93 acres of private land which is required to be acquired.

Table 6-44: Land Use/Land Cover of the Project and Study Area[34]

Land Use	Project Area (acres)	% of gross project area	Study Area (acres)	% of gross study area
Single Crop	150	93	27,146.96	34.99
Multiple Crop	19	5	7,801.10	10.06
Orchards and Other Plantations (Trees)	20		4,045.11	5.21
Rural Settlement	6	1.4	17,255.34	22.24
Road	3	0.6	3,335.92	4.30
Brickfield	-		313.82	0.40
Air Port	-		370.66	0.48
Dump Sites/ Extraction Sites	-		56.83	0.07
Herb Dominated Area	50		896.99	1.16
Rivers and Khals	-		7,961.72	10.26
River Banks	-		14.83	0.02
Lake	-		24.71	0.03
Baor	-		130.97	0.17
Ponds	-		76.60	0.10
Fresh Water Aquaculture	-		328.65	0.42
Low land	67			
Fallow Land	105		7,810.99	10.07%
Grand Total	**420**	**100**	**77,576.14**	**100**

[34] Source: KOMPSAT 2,3 satellite image data

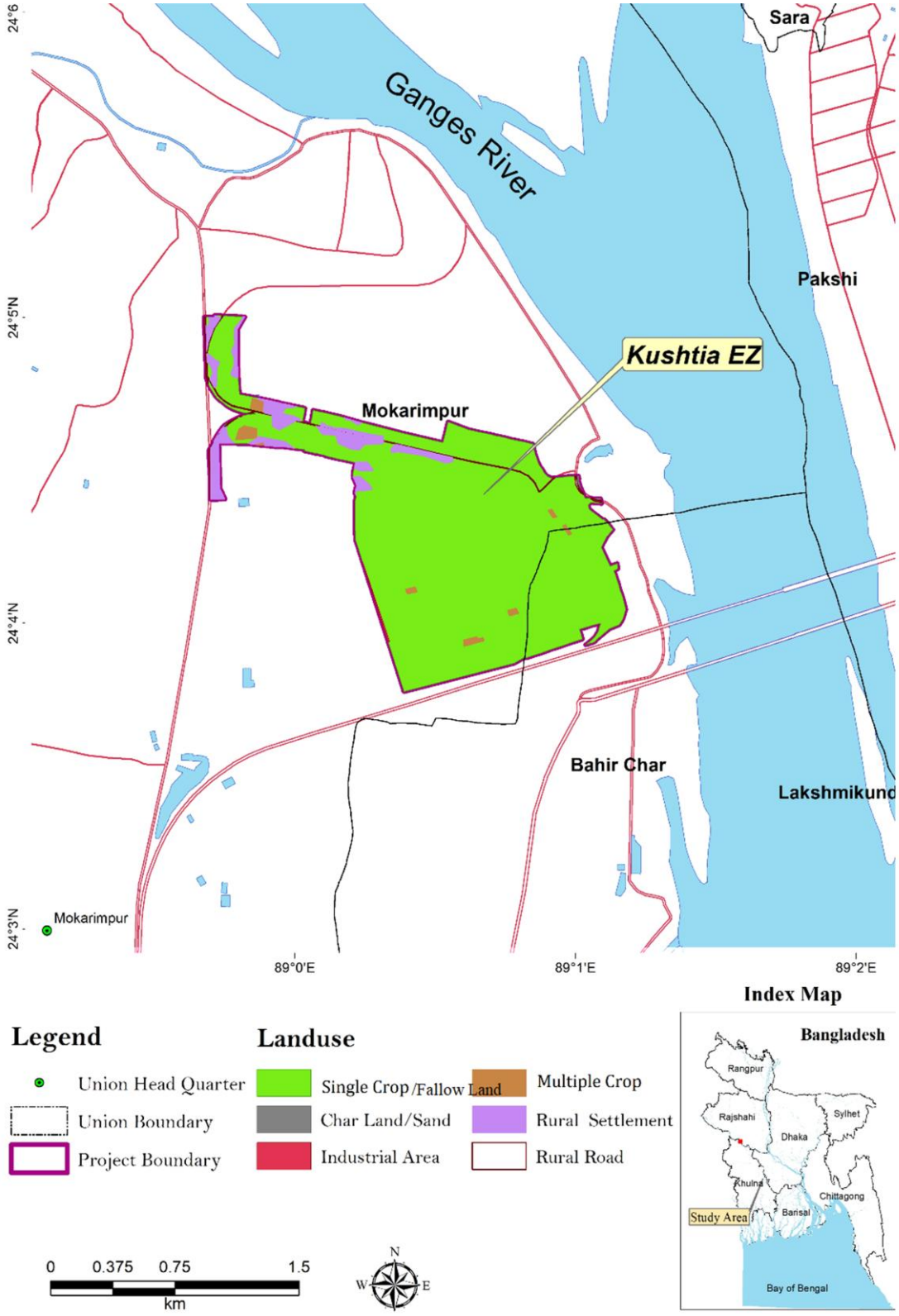


Figure 6.76: Land use Map of the project and study area[35]

[35] Source: KOMPSAT 2,3 satellite image

6.3.10 Bio-Ecological Zone

IUCN-The World Conservation Union has identified 25 bio-ecological zones (2002) in Bangladesh. The aspects on which these zones are primarily cantered are physiographic, climate, soil type, flooding depth and biodiversity. The proposed Kushtia EZ has fallen under three Bio-ecological Zones namely; Ganges Floodplain, Major River and Teesta Floodplain.

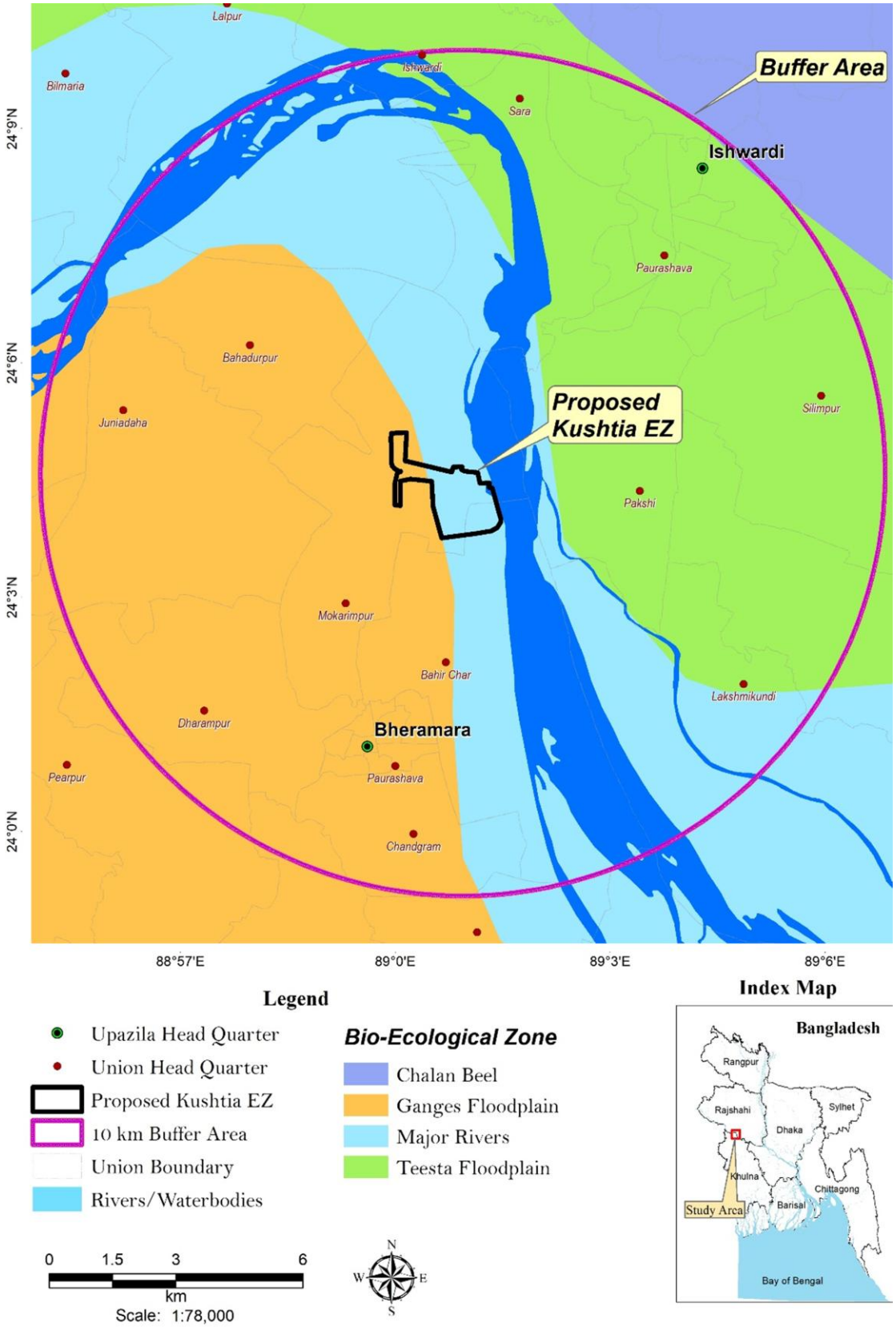


Figure 6.77 show the Bio-ecological zones, which are present inside and in the surroundings of the study area. The surroundings area such as river, chars, homestead, channels, canals, crop field, and floodplain are consisting with flora and fauna.

Ganges Floodplain (BEZ-4b)

Ganges Floodplain is the active meandering floodplain[36] of the Ganges River. The floodplain mainly comprises a smooth landscape of ridges, basins and old channels. The Ganges channel is constantly shifting within its active floodplain, and eroding depositing large areas of char lands in each flooding season. Both plants and animals move and adapt with the pattern of flooding (Brahmer, 1996). The floodplains are characterized by mixed vegetation and support a habitat of rich biodiversity to some extent for presence of a lot of stagnant water bodies and channels, rivers and tributaries. *Beels* and other water bodies support good amount of free-floating aquatic vegetation. Homesteads forest include both cultivated and wild plant species.

Major groups of oriental birds are presented in this zone by one or more species. In addition, a large number of migratory birds are found here during the winter. Beside this, different species of freshwater tortoise and turtles are found in the rivers and ponds. Among the amphibian species, toads, frogs and tree frogs are well known. Foxes, Jackals, rats, mice, squirrels, bats etc. are the common mammals of this zone (GoB, IUCN, 1992).

Major Rivers (BEZ-11)

Major Rivers comprises of approximately 1500 miles of rivers, streams and canals represent the four (4) rivers: the Ganges-Padma, Brahmaputra-Jamuna, Meghna and Teesta. Together, these systems cover about 7% of the country's total surface and are noticeably rich in biodiversity. These major rivers also contain numerous chars. Jamuna River provide the highest amount of char lands in Bangladesh. Many of the species' natural distribution, migration and storage primarily function via these rivers into other wetland ecosystems (GoB, IUCN, 1992).

A diverse range of waterfowl are directly or ecologically dependent on these rivers and its associated ecosystems, such as cormorants, darters, grebes, egrets and herons, storks, gulls and terns, ducks and geese, waders (*e.g.* plovers, sandpipers, shank, godwit, etc.) and some prey birds (*e.g.* fish eagle, kites, harriers, falcons, etc.). However, it is quite alarming that with the exception of a few species of turtles, all other river biodiversity is threatened with extinction, which include the Ganges River dolphin (*Platanista gangetica*), Gangetic gharial (*Gavialis gangeticus*), Indian skimmer (*Rynchops albicollis*), Brahminy river turtle (*Hardella thurjii*) and Spot-billed duck (*Anas poecilorhyncha*) (GoB, IUCN, 1992).

Teesta floodplain (zone 4a)

Teesta floodplain spreads over several different landscapes in greater Rangpur and the adjoining regions. The diversity results from the fact that the Teesta River had occupied and later abandoned several different channels during the last few thousand years including the valleys now are occupied by the Mahananda, Punarnava, Atrai, Choto Jamuna, Karatoya and Ghaghat rivers. There were large patches of forests in this zone, but they have in most cases been ruthlessly cut down. However, this zone is still fairly wooded with many valuable indigenous timber species. Important faunal species are: Jangle cat, Palm squirrel, Tomb bat, Darter Brown, Fish owl, Black francolin etc. It possesses a unique variety of plants, medicinal herbs, fruit bearing trees, jungle shrubs, creepers and climbers etc. Numerous native and migratory birds are observed during the winter and dry season. Although most of the large mammals have been disappeared- form this area but most of common bird species are still

[36] *Meandering river channels are asymmetrical. The deepest part of the channel is on the outside of each bend. The water flows faster in these deeper sections and erodes material from the riverbank. The water flows more slowly in the shallow areas near the inside of each bend. The slower water can't carry as much sediment and deposits its load on a series of point bars.*

found in this location. Among Fauna, Jackals, Foxes, Squirrels are still present and different species of Rats, Mice, and Shrews occur in the suitable areas. The commonly found reptile species include Bengal Monitor, Skinks, Freshwater Tortoises and Turtles; and different species of poisonous and non-poisonous snakes. (IUCN, 2002).

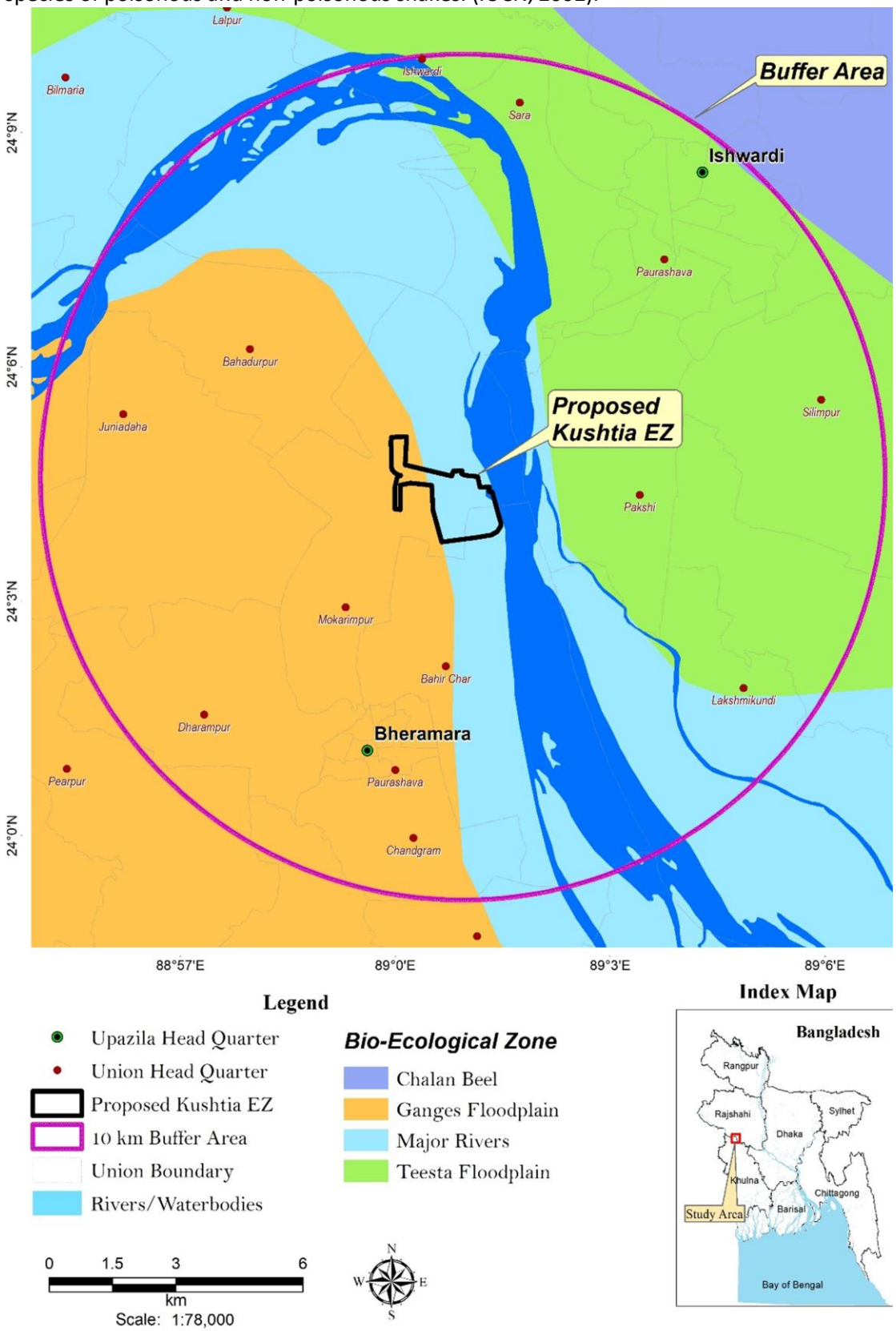


Figure 6.77: Bio-ecological zones of the study area

6.3.11 Environmental Critical Area

It is to be noted that none of the Ecological Critical Area (ECA), Wildlife Sanctuary, National Park and Reserve Forest area including their corridors are found within 10 km buffer distance of the study area. The nearest Ecological Critical Area (ECA), Marjat Baor, is located about 85 km south side from the study area.

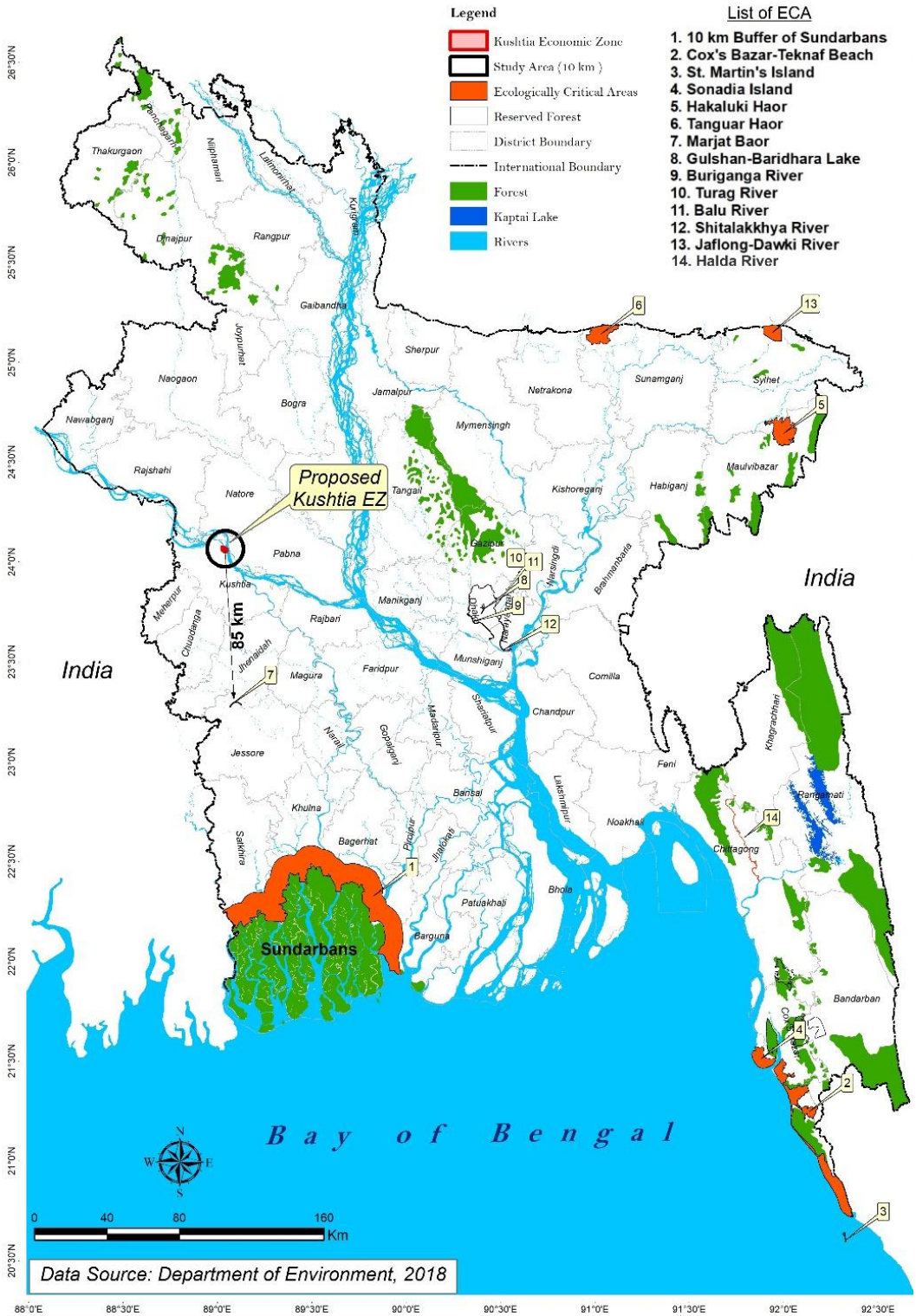


Figure 6.78: Ecologically Critical Area map of Bangladesh

6.4 Socio-Economic Status

The zone falls under Mokarimpur Union, Bheramara Upazila of Kushtia District. The total area of Mokarimpur Union is 10,098 acres. On the other hand, the total area of Bheramara Upazila is 37,983 acres. The key parameters of the socio-economic stutus of the population within the project's area include cocio-economic condition, quality of life, income and

poverty, gender and women, common poperty resources, conflict of interest, law and order situation and historic, cultural, archeological sites, etc. The following sections present the socio-economic condition of the study area.

6.4.1 Socio Economic Condition

Population, Density, and Gender

In the survey of 900 respondents living in the project intervention area, 52.89% are male and 47.11% are female. The sex ratio (male/female) among the respondents of the survey is 112.26. Although according to the BBS report, the average household size in Mokarimpur union is 4.2. The average household size found during the household survey in Mokarimpur union is 3.96.

Table 6-45: Population, Density and Gender of Mokarimpur Union

Union	Total Respondents	Male	Female	Sex Ratio	HH Size
Mokarimpur	900	52.89%	47.11%	112.26	3.96

Source: Socio-economic Survey, Mokarimpur, 2022

Religion and Ethnicity

Based on religious identity the following split of population was found from the survey.

Table 6-46: Religious Identity of People in Study Area

Union	Muslim	Hindu	Total Respondents
Mokarimpur	92.44%	7.56%	900

Source: Socio-economic Survey, Mokarimpur, 2022

The survey reveals that out of 900 respondents interviewed under the socio-economic study, almost 93% of them are Muslims, and more than 7% are Hindus in Mokarimpur union.

Age Structure

Age structure breakdown shows that the age group of 35-44 forms the largest segment (36.27%) for Mokarimpur Union followed by 25-34, which are regarded economically active slots of population. The following figure shows the age distribution.

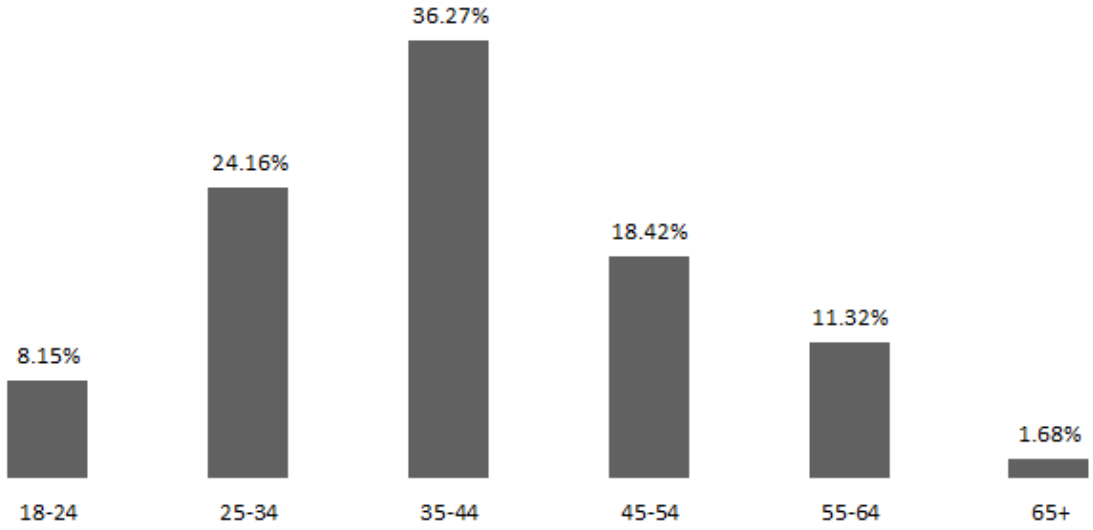


Figure 6.79: Age Structure of Respondents in Mokarimpur Union[37]

Marital Status

The following table presents the marital status of the residents. It reflects that significant majority of the population in Mokarimpur union is married, followed by 'never married.'

Table 6-47: Marital Status of Male and Female of Mokarimpur Union[38]

Union	Male Population (%)				Female Population (%)			
	Never Married	Married	Widowed	Divorced/ Separated	Never Married	Married	Widowed	Divorced/ Separated
Mokarimpur	28.34%	71.38%	0.28%	0%	14.48%	79.42%	5.8%	0.3%

Literacy

It can be analyzed that the literacy rate of Mokarimpur Union is lower in comparison with the national statistics of Bheramara Upazila and/or Kushtia District. The following table presents the literacy rate of males and females of the study participants.

Table 6-48: Literacy Rate of Mokarimpur Union

Union	Population			Literacy Rate		
	Both	Male	Female	Both	Male	Female
Mokarimpur	900	476	424	47.89	48.95	46.70

Source: Socio-economic Survey, Mokarimpur, 2022

[37] Source: Socio-economic Survey, Mokarimpur, 2022

[38] Source: Socio-economic Survey, Mokarimpur, 2022

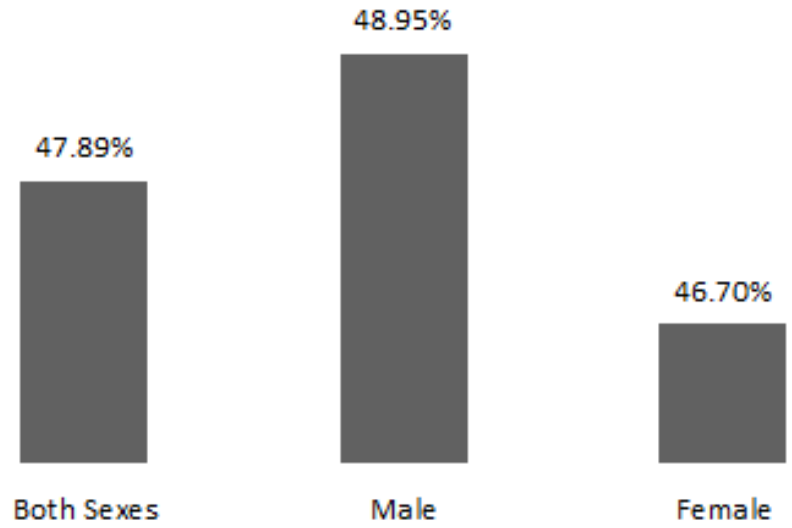


Figure 6.80: Literacy Rate of Mokarimpur Union[39]

Housing Condition

Of 900 households covered in the household survey, 47.61% of houses in Mokarimpur union are Kutcha. Although 49.69% houses in Mokarimpur union are Semi-pucca, and 2.5% in Mokarimpur houses are Pucca. Minimal percentages of dwellings in the union are living in Jhupri. The predominant 'Semi Pucca' and 'Katcha' houses indicate the low social and economic status of the study area. The Kutcha houses are vulnerable and increase the risk to life during natural disasters such as floods or cyclones. Providing suitable housing will be challenging for the administration and will have to be dealt with effectively. The housing pattern is shown in the figure below:

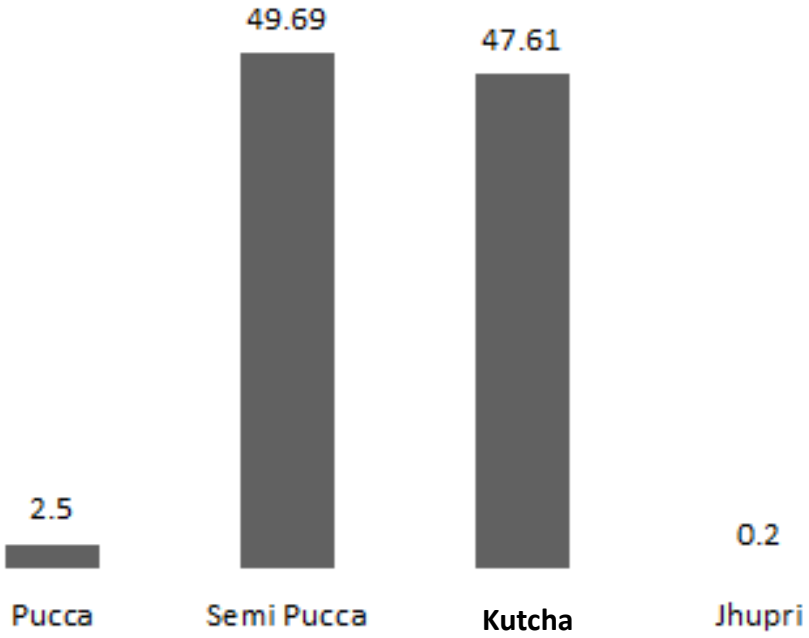


Figure 6.81: Housing Pattern in Mokarimpur Union[40]

[39] Socio-economic Survey, Mokarimpur, 2022

Housing tenancy of the study area is owned by (96.10%), rented (0.18%, and Rent-free (3.72%) for Mokarimpur Union whereas housing tenancy for Bheramara Upazila is owned by (94.2%), rented (3.3%) and Rent-free (2.5%).

Table 6-49: Housing Tenancy in the Study Area (%)[41]

Union	Owned	Rented	Rent Free
Mokarimpur	96.10%	0.18%	3.72%
Bheramara	94.2%	3.3%	2.5%

Access to Drinking Water

The following table shows the sources of drinking water in the study area. It indicates most of the inhabitants avails water from tubewells for drinking.

Table 6-50: Source of Drinking Water (%)[42]

Union	Tap	Tube well	Others
Mokarimpur	0.3	96.5	3.2
Bheramara	1.9	95.1	3.1

Access to Sanitation Facility

Figure 6.82 portrays the sanitation facilities among respondents of the household survey prevailing in the study area. 29.10% HHs have water-sealed and 24.5% HHs have non-water sealed sanitary toilet and 46.4% non-sanitary in Mokarimpur Union.

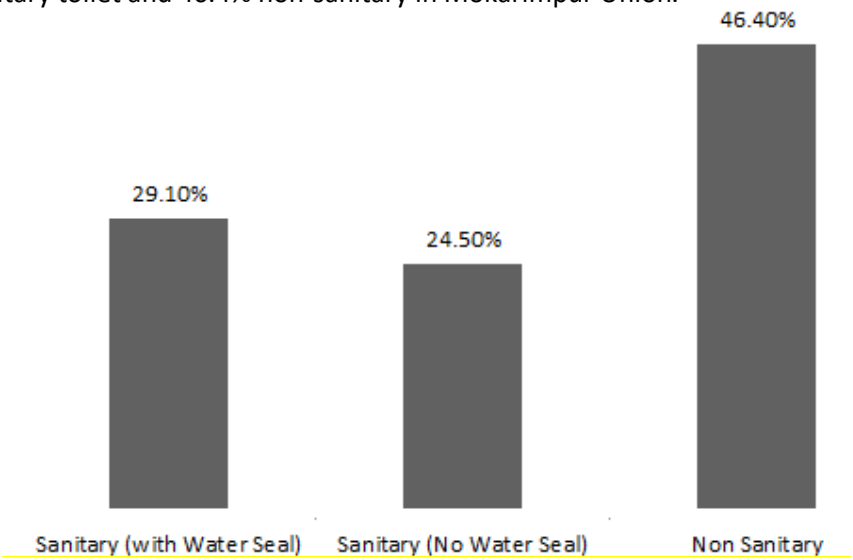


Figure 6.82: Sanitation Facility in the Mokarimpur union[43]

[40] Socio-economic Survey, Mokarimpur, 2022
[41] Socio-economic Survey, Mokarimpur, 2022
[42] Socio-economic Survey, Mokarimpur, 2022
[43] Socio-economic Survey, Mokarimpur, 2022

Access to Electricity Connection

The study area is 100% electrified.

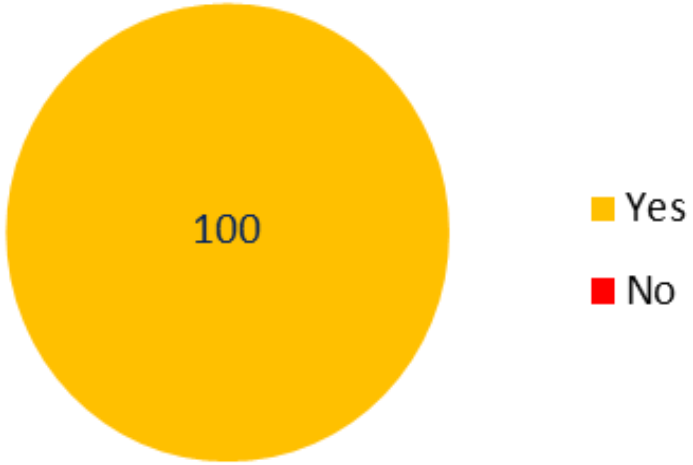


Figure 6.83: Access to Electricity Connection in the study area[44]

Employment status

The survey in Mokarimpur reflects that most of the inhabitants are employed in agriculture followed employment as day laborer.

Table 6-51: Employment Status of the Respondants[45]

Main Occupation	Mokarimpur	
	Male	Female
Agriculture	267	37
Teacher	17	9
Service	38	12
Household chores	-	344
Business	32	-
Day Laborer	86	-
Driver	8	-
Others	28	22
Total	**476**	**424**

Health

The top 5 child morbidity (age <= 5 years) of Bheramara Upazila are Diarrhoea and gastroenteritis of presumed infectious origin (74.7%), Pneumonia, organism unspecified (7.5%), Thalassaemia (5.5%), other viral infections of central nervous system, NEC (4.1%) and Other anaemias (2.0%). On the other Hand, the adults (30+ population) top 5 disease profile are Diarrhoea and gastroenteritis of presumed infectious origin (16.0%), Peptic ulcer, site unspecified (10.8%), Other anxiety disorders (8.6%), Assault by pesticides (7.8%) and Other anaemias (6.6%).[46] Besides, other seasonal diseases in the project area have been observed

[44] Socio-economic Survey, Mokarimpur, 2022
[45] Socio-economic Survey, Mokarimpur, 2022
[46] Local Health Bulletin, Bheramara Upazila Health Complex-2016

like cold, seasonal viral fever, etc. The condition of health services related institutions of the Bheramara Upazila are given in the following Table 6-52.

Table 6-52: Health Related Facilities in Bheramara Upazila

Health Related Facilities	Number of Health-Related Facilities
Government Health Complex	1
Private Hospital/Clinic	7
Diagnostic Center	8
Missionary hospital and charitable dispensary	1
Physician/Practitioner	48
Number of Health Center providing health and family planning services	6
Number of existing family planning personnel	44
Number of Community Clinics	18

Different NGOs are conducting awareness-raising programs on different health services as well as hygienic promotion activities through their sanitation programs. Department of Public Health Engineering (DPHE) is providing sanitary latrines, ring slab toilets through a sanitation health program from their Upazila office. They are providing an arsenic-free water supply to the people of the area.

6.4.12 Quality of Life Indication

Literacy

According to Census 2011, literacy rate, based on a definition 'ability to write a letter in any language' is 44.5% for both, where the male is 44.4% and female is 44.6% for Mokarimpur Union. The Upazila literacy rate of both male and female is 48.7% in which male is 48.7% and female is 48.7%.[47]

Table 6-53: Literacy Rate of Mokarimpur Union

Union	Population			Literacy Rate		
	Both	Male	Female	Both	Male	Female
Mokarimpur	900	476	424	47.89	48.95	46.70

Source: Socio-economic Survey, Mokarimpur, 2022

It can be analyzed that the literacy rate of Mokarimpur Union is lower in comparison with the national statistics of Bheramara Upazila and/or Kushtia District. Figure 6.80 presented below shows the literacy rate of males and females of the study participants.

[47] BBS Community Report, Kushtia, 2011

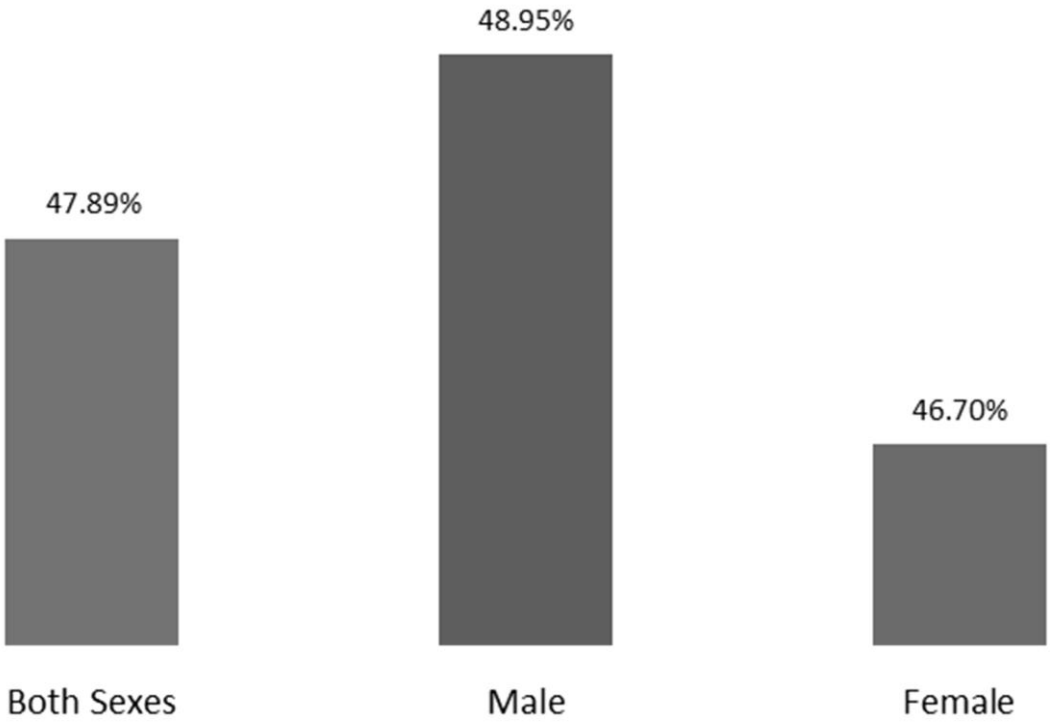


Figure 6.84: Literacy Rate of Mokarimpur Union[48]

Housing Condition

According to Population and Housing Census (2011), the predominant structure of the Mokarimpur Union is Kutcha (51.8%) followed by Semi-Pucka (44.7%), Jhupri (0.4%), and Pucka (3.1%). In the Bheramara Upazila, 45.4% of general HHs lives in Kutcha house, 47.8% in Semi-Pucka house, 6.1% in Pucka, and the remaining 0.7% live in Jhupri.[49] The predominant 'Kutcha' houses indicate the low social and economic status of the study area. The Kutcha houses are vulnerable and increase the risk to life in the event of natural disasters such as floods or cyclones. The need to provide good housing will be a challenge for the administration and will have to be dealt with effectively.

Of 900 households covered in the household survey, 47.61% of houses in Mokarimpur union are living in Kutcha house. Although 49.69% in Mokarimpur union of houses are Semi-pucca, and 2.5% in Mokarimpur houses are Pucca. Minimal percentages of dwellings in the union are living in Jhupri. The predominant 'Semi Pucca' and 'Katcha' houses indicate the low social and economic status of the study area. The Kutcha houses are vulnerable and increase the risk to life during natural disasters such as floods or cyclones. Providing suitable housing will be challenging for the administration and will have to be dealt with effectively. The housing pattern is shown in the figure below

[48] Socio-economic Survey, Mokarimpur, 2022
[49] BBS Community Report, Kushtia, 2011

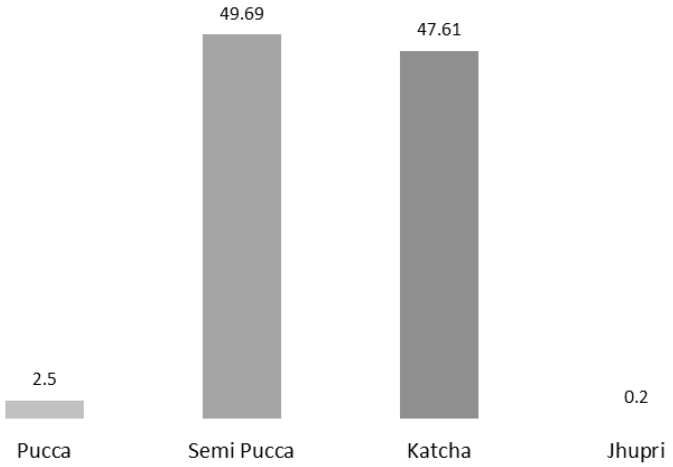


Figure 6.85: Housing Pattern in Mokarimpur Union[50]

Housing tenancy of the study area is owned by (97.9%), rented (0.3%), and Rent-free (1.8%) for Mokarimpur Union whereas housing tenancy for Bheramara Upazila is owned by (94.2%), rented (3.3%) and Rent-free (2.5%).[51]

Table 6-54: Housing Tenancy in the Study Area (%)

Union	Owned	Rented	Rent Free
Mokarimpur	96.10%	0.18%	3.72%

Source: Socio-economic Survey, Mokarimpur, 2022

Access to Drinking Water

Freshwater which is drinkable to maintain people's lives in a good manner is regarded as another indicator to assess the standard of living in the study area. Most of the HHs of Mokarimpur Union (96.5%) collects water from tube-well. Moreover, (0.3%) HHs use tap water and (3.2%) HHs of Mokarimpur collects water from other sources. On the other hand, the people of Bheramara Upazila also use Tube-well (95.1%), followed by Tap (1.9%), and other sources (3.1%) for drinking water.[52] The following table shows the sources of drinking water in the study area.

Table 6-55: Source of Drinking Water (%)

Union	Tap	Tube well	Others
Mokarimpur	0	100	0

Source: Socio-economic Survey, Mokarimpur, 2022

Access to Sanitation Facility

Figure 6.82 portrays the sanitation facilities among respondents of the household survey prevailing in the study area. Although, according to the national statistics (BBS, 2011), about 23.6% of the population of Mokarimpur Union are using the non-sanitary toilet which is not satisfactory. It is also noted that still 1.8% of HHs of Mokarimpur Union have no sanitation

[50] Socio-economic Survey, Mokarimpur, 2022
[51] BBS Community Report, Kushtia, 2011
[52] BBS Community Report, Kushtia, 2011

facility. Besides, 34%HHs have water-sealed and 40.7%HHs have non-water sealed sanitary toilet of Mokarimpur Union. On the other hand, in Bheramara Upazila 32.3% HHs use sanitary with water sealed latrine followed by sanitary with no water sealed 35.6%, non-sanitary 29.9%, and none 2.3%.[53]

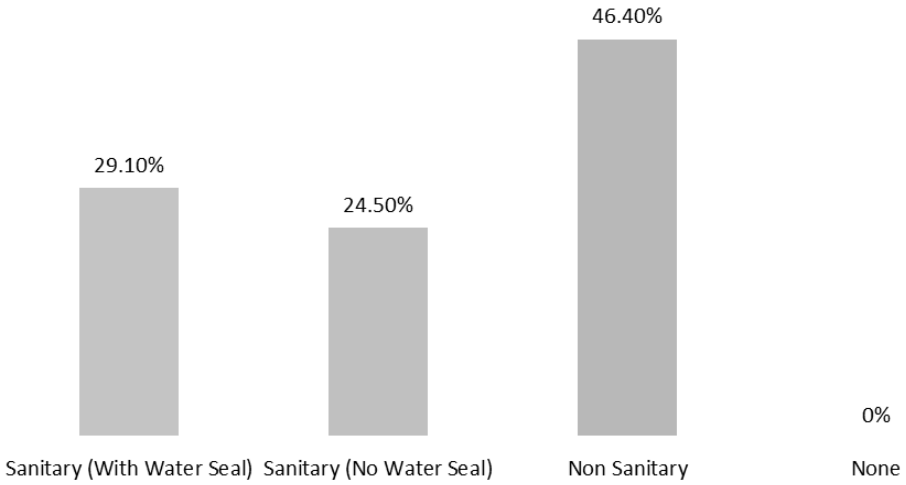


Figure 6.86: Sanitation Facility in the Mokarimpur union[54]

Access to Electricity Connection

In the study area, the electricity supply is found satisfactory. Although BBS Community Report Kushtia, 2011 shows that most of the households in Mokarimpur (62.7%) have electricity connection and the remaining 37.3% of households are out of electricity facilities, the household survey reveals that all the households of interviewed respondents (100%) have electricity facility. The below Figure 6.83 presents the electricity connection accessibility in the study area.

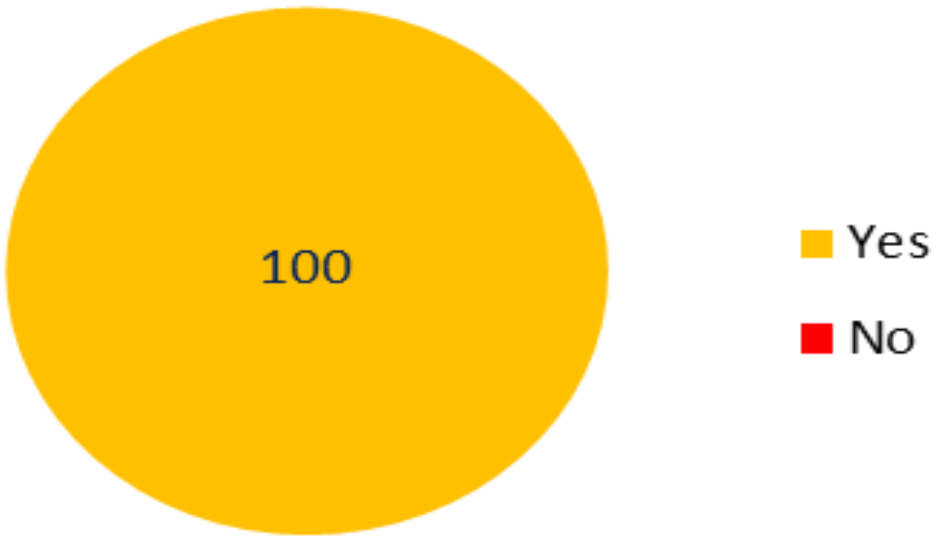


Figure 6.87: Access to Electricity Connection in the study area[55]

[53] BBS Community Report, Kushtia, 2011
[54] Socio-economic Survey, Mokarimpur, 2022

Employment status

According to Census 2011, employment status, based on a definition '7 years and above not attending school but employed by field of employment of the study area is mainly centered upon agriculture sector in Mokarimpur Union (Male- 3,839 and Female- 43). About 218 people of Mokarimpur Union are engaged in the industrial sector. In Bheramara Upazila 19,697 (Male- 19,376 and Female-321) people are engaged in the agricultural sector and 1,152 people (Male- 987 and Female- 165) are engaged in the industrial sector.[56]

Table 6-56: Employment Status of the Respondents

Main Occupation	Mokarimpur	
	Male	Female
Agriculture	267	37
Teacher	17	9
Service	38	12
Household chores	-	344
Business	32	-
Day Laborer	86	-
Driver	8	-
Others	28	22
Total	**476**	**424**

Source: Socio-economic Survey, Mokarimpur, 2022

Health

The top 5 child morbidity (age <= 5 years) of Bheramara Upazila are Diarrhoea and gastroenteritis of presumed infectious origin (74.7%), Pneumonia, organism unspecified (7.5%), Thalassaemia (5.5%), Other viral infections of central nervous system, NEC (4.1%) and other anaemias (2.0%). On the other Hand, the adults (30+ population) top 5 disease profile are Diarrhoea and gastroenteritis of presumed infectious origin (16.0%), Peptic ulcer, site unspecified (10.8%), Other anxiety disorders (8.6%), Assault by pesticides (7.8%) and other anaemias (6.6%).[57] Besides, other seasonal diseases in the project area have been observed like cold, seasonal viral fever, etc. The condition of health services related institutions of the Bheramara Upazilz are given in the following Table 6-52.

Table 6-57: Health Related Facilities in Study Area (Bheramara Upazila)

Health Related Facilities	Number Of Health-Related Facilities
Government Health Complex	1
Private Hospital/Clinic	7
Diagnostic Center	8
Missionary hospital and charitable dispensary	1
Physician/Practitioner	48
Number of Health Center Providing Health and Family Planning Services	6

[55] *Socio-economic Survey, Mokarimpur, 2022*
[56] *BBS Community Report, Kushtia, 2011*
[57] Local Health Bulletin, Bheramara Upazila Health Complex-2016

Health Related Facilities	Number Of Health-Related Facilities
Number of Existing Family Planning Personnel	44
Number of Community Clinic	18

Source: BBS District Statistis, Kushtia, 2011

Different NGOs are conducting awareness-raising programs on different health services as well as hygienic promotion activities through their sanitation programs. Department of Public Health Engineering (DPHE) is providing sanitary latrines, ring slab toilets through a sanitation health program from their Upazila office. They are providing an arsenic-free water supply to the people of the area.

6.4.13 Income and Poverty

Monthly household nominal income and consumption expenditure of Khulna Divison is (Tk. 19,628 and Tk. 12,413). Khulna Division recorded the highest monthly household nominal income exceeding the national average Tk. 15,988. The estimates of Head Count Rates (HCR) in 2016 using the lower poverty line for Khulna Division is 12.4% and the upper lower poverty line is 27.5%. School Enrollment of children aged 6-10 from poor households for the Khulna division is 94.15% and for non-poor households is 97.41% (Using lower poverty line). The average amount received per household in 12 months from Social Safety Nets Programme is Tk. 2766.7 in Khulna Division. The poverty rate of (using upper poverty lines) Kushtia District is 17.5.[58] The income of the respondents and poverty level of the study are given in the following Table 6-58.

Table 6-58: Income and Poverty Level in Study Area

Level of Income (BDT)	Mokarimpur	Poverty Line
2,000-5,000	24%	Below poverty line
5,001-8,000	43%	
8,001-10,000	16%	
10,001-14,000	13%	
14,000<	4%	

6.4.14 Gender and Women

Women in Bangladesh are at the forefront of awareness and empowerment on account of various interventions by the Government. Though, Bangladesh has already achieved gender parity in primary and secondary education (Promote Gender equality and empower women, UNDP Bangladesh), the female population, gender ratio, access to labor markets, and the role of females in decision-making still have gaps, and this calls for an improvement. This is especially true in the rural areas where women currently lack adequate access to resources and opportunities. In patriarchal society, men exercise control over women's access to labor and their income and assets. The following Table 6-59 depicts the status of women in the Mokarimpur unions.

Table 6-59: Female Population, Female Literacy Rate and Gender Ratio[59]

[58] HIES, 2016
[59] Source: Socio-economic Survey, Mokarimpur, 2022

Union	Female Respondants	Gender Ratio	Literacy Rate (%)
Mokarimpur	424	112.26	46.70

The male and female composition of the population of the proposed project area is relatively equitable. The number of female people in Mokarimpur Union is 18,033 and the gender ratio is 97(BBS, 2011). The Table 6-59 shows that 424 females from Mokarimpur union participated in the survey and the gender ratio (Male/Female) is 112.26. The overall literacy rate of women found in the household survey in Mokarimpur union is 46.70%. Women comprise 47.11% of the total respondents in the household survey, which more or less indicates a healthy sex ratio.

This indicates a lower disparity for the girl child. However, women in this Union may still be classified as vulnerable due to the fact that a significant fraction of them are not allowed to work or earn a living or pursue higher education due to cultural and religious beliefs. They are mostly engaged in household chores, raising families, and domestic chores like raising cattle and crop harvest. They are also occasionally attributed to social evils like child marriage, polygamy and domestic violence.[60]

6.4.15 Common Property Resources

Throughout the world, some assets are neither private nor state property, but common property. The term denotes a class of institutions that govern the ownership and rights of access to assets. Common property assets are to be distinguished from "public goods," in that, unlike the latter, used by someone of a unit of a common property asset typically reduces the amount available to others by one unit (in economic terminology, such an asset is rivalrous in use). The institution of the common property creates and harbors reciprocal externalities. As some of the most interesting examples of common property assets are natural resources, this entry is restricted to them. Social Institutions, Khals, Playgrounds can be referred to as common property resources. Hats, bazars, and fairs are a social institution or at least the mechanism of not only trade but also common property resources. The common property resources of the project area are havie been given in the following table.

Table 6-60: Common Property Resources of the Project Area

Common Property Resources	Number of Common Property Resources	Common Property Resources	Number of Common Property Resources
Daily Bazar	14	Temple	28
Weekly Hat	26	Bridge	4
Mosque	110	Baily bridge	-
Eid-Gah	65	Culvert	400

6.4.16 Conflict of Interest and Law and Order Situation

A total of 36 police stations/camps have been established in Kushtia. Two of them have been established to maintain the law and order of the commercial and residential area of Bheramara Upazila.

[60] Socio-economic Survey, Mokarimpur, 2022

6.4.17 Historic, Cultural, Archeological and Ceremonial Resources

The proposed project area does not have any key cultural heritage or resource of national and regional value. Some archaeological and tourist sites in Bheramara Upazila are Harding Bridge, Three Dome Mosque, Lalonshah Bridge, Ganga Kopotaksha Irrigation Project, Bheramara Power Station, Ghoreshah Shrine, Solaiman Shah Shrine. The project footprint is devoid of any cultural sites or heritage sites. If evidence of any other ancient heritage or any archaeological symbol is found during the execution of the project, actions will be taken following relevant Government acts and rules.

Table 6-61: Key Social Infrastructures in Kushtia

Educational Institutions	Hospitals
(1) Islamic University, Kushtia	(1) Kushtia General Hospital – (250 bed)
(2) Rabindra Maitree University, Kushtia	(2) Upazila Health Complex -5
(3) Kushtia Medical College	(3) School Health Center -1
(4) Kushtia Law College	(4) Jail Hospital -1 (27 bed)
(5) Government College-9	(5) Sub Health Center -28
(6) Non-government College-56	(6) Family Welfare Center-35
(7) Nursing Institute, Kushtia	(7) Private Hospital and Clinic-74
(8) Government Polytechnic Institute-1	(8) Private Diagnostic Center- 59
(9) Government Technical School and College-1	
(10) Secondary School- 307	
(11) Primary School- 805	
(12) Madrassa-75	
(13) Ebtedaye Madrassa -21	

Tourist Places	Training Center
(1) Shelaidaha Kuthibari, Kumarkhali, Kushtia	1 Primary Teachers Training Institute, Kushtia
(2) The Shrine of Lalon Fakir	
(3) Jhaudia Shahi mosque	
(4) Tagore lodge	
(5) Hardinge Bridge	
(6) Lalon Shah Bridge	
(7) Kushtia Pouro Bhaban	
(8) Gopinath Jiu Temple	
(9) Mohini Mill	
(10) Patharghat, Raita, Bheramara	

7 Environmental and Social Impact Assessment

The ESIA study of Kushtia EZ was carried out considering present environmental setting, nature and extent of the proposed activities of the zone. Potential environmental impacts associated with the proposed project activities are classified as:

(1) Impacts during site preparation or pre-construction phase,
(2) Construction phase, and
(3) Operation or post construction phase.

Some of the important impacts associated with the proposed project will be linked with land use, land stability (soil erosion), soil contamination, water availability, surface and groundwater quality, water pollution, waste and wastewater disposal, ambient air quality, ambient noise levels, vegetation, fauna (terrestrial and aquatic), drainage pattern, hydrology, climate change, socio-economic, places of social/cultural importance (religious structures, community structures), construction and raw material sourcing and storing, and OHS. Adequate mitigation measures are needed to mitigate/minimize all likely environmental impacts and those have been discussed along with the impacts.

During field visit, consultations were also held with people in the locality including those presently living in and around the project areas, local businessmen, students, nearby residents, etc. Outcome of these consultations were used in impact assessment and devising mitigation measures.

Identification and Analysis of Key Environmental Issues

This section presents results of environmental screening which were conducted before carrying out the impact assessment. This screening exercise helped to understand the key environmental issues, to identify environmental impacts and in general it helped to understand the scope of environmental and social impact assessment.

The screening exercise started with sensitivity analysis. Attempts were made to identify environmental and social components sensitive to the proposed KEZ construction and operation on the basis of reconnaissance field survey and stakeholder consultation. The preliminary results were presented in the inception report which was later disclosed to the high officials of BEZA in the inception workshop. This preliminary assessment and thereafter consultation and interactions helped to design the detail field investigations, analysis and overall scope of EIA. The sensitivity investigation helped to identify important environmental and social components which are presented in the sub-section below:

Environmental asset is defined by important environmental and social components. The Important Environmental and Social Components (IESC) were identified through a process of field investigation, stakeholder consultation including consultation with local people, and expert judgment. Thereafter, the preliminary results were shared with the ESIA team members and later finalized in an in-house workshop with all ESIA members and few designated experts. The IESCs and their rationale are presented as following.

IESCs	IESCs Rationale for Selection
Air Quality	During construction phase, interventions such as deposition of soil, civil constructions of roads and concrete structures, mobilization of construction vehicles etc. will create fugitive dust and emit gas. At post construction phase, the operations of heavy industries and transportation of logistics will emit smoke and gases. Also, the solid and liquid waste treatment plants may cause odor problem within the adjacent areas of the plants. As such air quality has been considered as an IESC.
Noise Quality	Additional noise will be generated during the construction phase by the movements of construction vehicles, operations of construction equipment, and construction activities. Furthermore, the installation of heavy industries and their operation for production will cause increased noise level during the operation phase. Eventually, the generated noise, in both phases, will affect both on campus people (such as construction workers, campus living officials/staffs, etc.) and adjacent living community people. Therefore, noise quality has been considered as an IESC.
Groundwater Availability	According to the Feasibility Study, groundwater has been proposed as one of the sources for the operation of the project. However, several studies/literatures already identified the study area as ground water-stressed, and therefore, this withdrawal of water will accelerate the depletion further, since industrial sector is one of the biggest water consumers. Therefore, groundwater availability is considered as an IESC.
Water Quality	During the construction and operation phases there could be a number of reasons for water quality deterioration. Spillage of oil from the construction vehicles and equipment, improper disposal of solid waste and wastewater produced by the construction activities as well as industrial production, untreated storm water discharge, leakage of the wastewater collection network etc. can cause contamination of surface water within the project area as well as at the nearby canals. Faulty operation of the wastewater treatment plant could deteriorate the water quality of Padma River where treated wastewater will be discharged. As such water quality has been chosen as an IESC.
Drainage congestion and Water Logging	As per the master plan of KEZ, the natural drainage pattern will be disrupted by developing a higher land than the adjacent area as well as isolating the project area from the connecting canals and thus, free flowing of water through the project area would be ceased. This might potentially cause drainage congestion and water logging problems during a heavy rainfall event in the construction phase as well as by the improper management of drainage during the operation phase. Therefore, drainage congestion and water logging are considered as an IESC.
Flooding	Due to the establishment of the KEZ, the natural drainage connection will be disturbed and the natural water storage capacity of the project area will be encroached. These might exacerbate both the flash flood and monsoon flood situation within and around the project area. Hence, flooding has been considered as an IESC.
Landscape and scenic beauty	Construction activities might change the visual landscape of the project area. Development of land, site preparation, mobilization of construction equipment and materials, construction of on-site road network, residential area on green field site might affect the scenic beauty. Therefore,

IESCs	IESCs Rationale for Selection
	landscape and scenic beauty has been taken as an IESC.
Land use	The existing land type in the study area will be changed by the construction of the proposed project as well as new industries and associated development in nearby area. Thus, present cultivable lands would be converted into non-cultivable land. Therefore, land use has been considered as one of the IESC.
Crop production	The crop production in the project site will be lost permanently due to its conversion for industrial use. As such, crop production in the surrounding area would be changed because of the changes in land type and land use pattern. Therefore, crop production is taken as an IESC.
Fish habitat	The project area is 'floodplain' as it is inundated with tidal and monsoon flood, which then becomes an ideal fish habitat during wet season. The land development for the proposed project will convert this floodplain into high land, and eventually would damage the seasonal fish habitat. Therefore, fish habitat has been considered as an IESC.
Fish Production	During monsoon, this floodplain area (proposed project area) becomes a source of fish capture, which thus provides considerable fish stock for both petty-commercial and subsistence fisherman. The proposed project would affect the fish production permanently. Therefore, fish production has been considered as an IESC.
Fish Species Diversity	The composition of fish species diversity might be changed due to loss of floodplain and alternation of the Padma River. Therefore, fish species diversity has been considered as an IESC.
Stock Susceptibility	Fishing susceptibility might increase due to loss of fish habitat, food unavailability and changing of fish movement. Therefore, it has been considered as an IESC.
Wildlife habitat	Wildlife habitat is an important component of any given ecosystem which is composed of various plant individuals. The land development activities and post-project operation in this intact environment would lead to changes in wildlife habitats and their mobility. Therefore, wildlife habitat has been identified as an IESC.
Species composition	The various interventions including set up of industries would change the existing species composition especially in the aquatic habitat. Hence, species composition has been taken as an IESC.
Land Acquisition and Dispossession	BEZA has already taken under its custody 382.07 acres of land for the project from Bangladesh Railway. Additional 37.93 acre of private land is proposed to be acquired. There are 200 homestead housing, 7 small shops and a mosque (A total of 279,004 sft structures will be affected by the project of which 138,944 sft is kutcha/tin shed, 112,284 sft is semi-pucca and 27,776 sft structures were identified as pucca) within the proposed acquired khas land will be evicted. Therefore, land acquisition and dispossession have been selected as an IESC.
Local Conflict of Interest	According to field data, the proposed acquired land is khas land. Therefore, the 200 households living in the land received from Bangladesh Railway does not have legal entitlements. Most of the households are so poor to buy a parcel of land and build house there. They are expecting and demanding some land for rehabilitation Therefore, local conflict of interest

IESCs	IESCs Rationale for Selection
	has been considered as an IESC.
Loss of Livelihoods	There is no resettlement and rehabilitation or land acquisition provision for development of off-site infrastructures. In the area received from Bangladesh Railway 200 households, 577 structures including 7 small shops and one Masjid will be displaced and would require rehabilitation. Number of affected people will lose their structure and livelihood. Therefore, the Loss of Livelihood has been selected as an IESC.
Employment Opportunity	Employment for local people is expected to be generated during both construction and operation period of the proposed project. Hence, Employment Opportunity has been selected as an ISC.
Traffic congestion	The site is situated on the bank of the Padma River, 2 km away from Lalon Shah Bridge and 5 km away from Bheramara (Kushtia–Rajshahi) national highway. The site is situated adjacent to the Bheramara-Kuchiamara road which is only one connecting road of Kushtia EZ. Heavy traffic for carrying construction materials may cause traffic congestion at different junctions, market places etc. Thus, Traffic congestion has been considered as an IESC.
Roadway communication	The road networks are expected to be improved/developed for smooth movement of vehicles for carrying materials, equipment during and operation phase of the project. This would have a positive impact in the locality of the project. Thus, the roadway communication has been considered as an IESC.
Community Health and Safety	Community health is anticipated to be negatively affected due to different construction activities, which would generate dust, particles and other emissions. This has thus been selected as an IESC.
Occupational Health and Safety	Occupational Health and Safety (OHS) for workers is an important issue during the construction phase, since a number of workers will need to stay at the project site, get involved in risky and hazardous activities etc. This health and safety measures usually include: availability of safe drinking water, proper sanitation, labor-friendly shed and restroom, first aid tool box etc. for workers. Therefore, OHS has been selected as an IESC.
Urbanization and Economic Development	The rural area of study area will be transformed into urban area due to the Economic Zone-led industrial development, which, on the one hand, will bring economic development, and on the other hand, affect local environment negatively. Therefore, this has been chosen as IESC.
Off-site development	Many off-site developments, *i.e.* infrastructural development, will be held in the area which will improve living standard of the local people, also affect local environment negatively.

The anticipated impacts driven by the proposed project on key environmental and social components in different phases of the project are discussed in this chapter. If there are no impacts, anticipated in any phase, also mentioned here. Project phase refers to timeframe for the project completion, and thus is divided into three: pre-construction phase, construction phase and operation phase. Pre-construction phase refers to the timeframe from project formulation to just before the land development activities are started. The land development work for Kushtia EZ is considered construction phase. Finally, when the KEZ becomes ready and invites investors and their subsequent operations are started, this timeframe is defined as operation phase.

7.1 Impacts during Pre-construction Phase

7.1.11 Physical Environment

Water Resources

No impact is anticipated against the selected IECs.

Bottom Sediment

During the pre-construction phase, land filling activities may result to sediment infiltration, but the impact is insignificant

Environmental quality

No impact is anticipated against the selected IECs

7.1.12 Biological Environment

Ecological Resources

No impact is anticipated against the selected IECs.

Fisheries Resources

Land development work converted low lying area into flood free area, where fisheries (seasonal) habitat may reduce.

Agriculture

The land use of the area demarcated for the EZ is predominantly agriculture which is also evident from the crop cultivation practices being followed in the region. Due to development of EZ, the agricultural activity will be impacted.

7.1.13 Socio-economic Environment

Land Acquisition and Dispossession

In the land currently under custody of BEZA from Bangladesh Railway, there are 200 homestead housing, 7 small shops and a mosque (A total of 279,004 sft structures will be affected by the project of which 138,944 sft is kutcha/tin shed, 112,284 sft is semi-pucca and 27,776 sft structures were identified as pucca) within the land under custody of BEZA. It will dispossess 200 households from the land received from Bangladesh Railway. In addition 37.93 acres of private land need to be acquired. The broad items of land and rates of compensation are provided in Section 10.4.

Local Conflict of Interest

The 200 households living in the land received from Bangladesh Railway do not have legal entitlements. Most of the households are so poor to buy a parcel of land and build house there. They are expecting and demanding some land for rehabilitation. BEZA decided to provide BDT 50,000 to each household and land in the resettlement area, so that the people will have no disappointment. An area of 26.11 acre has been dedicated for such resettlement, so that possibility of conflict with the authority is avoided.

Living and Livelihood

As found, in the land received from Bangladesh Railway, 200 households, 577 structures including 7 small shops and one Masjid on the said land will be displaced and would require rehabilitation. Number of affected people will lose their structure and livelihood.

Different tenurial patterns are found in the project area. Almost each of the affected household are engaged in livestock farming. Moreover, most of the affected households are engage in agricultural laborers and agricultural farming in particular period of time in each year on the khas land. Thus, the livelihoods of these people will be affected.

7.2 Impacts during Construction Phase

7.2.11 Physical Environment

The major activities include dredging of soil from a suitable source, preparation of sites and construction of labor sheds, mobilization of construction equipment and materials, carrying out of the soil to the project site, dumping of the soil to develop the land to a certain level. It also involves construction of boundary wall and gates, administrative and residential areas and other on-site infrastructures and supporting utility services such as road network, sewerage network, green areas, solid and liquid waste management facilities, parking, educational institute, playground, health care facility etc. The impacts of these interventions on various environmental aspects are described in the following sections.

Air Quality

The proposed project involves construction activities which include- site development (filling, leveling, and earth work), civil construction, construction material handling and stockpiling; and transportation of construction material, equipment and labors. Air quality will be impacted from the following sources during the construction phase:

(1) Emissions from diesel generator required for emergency power during construction period.

(2) Exhaust emissions from construction machineries, other heavy equipment as bull dozers, excavators, compactors; and

(3) Fugitive dust emissions from site clearing, excavation work, cutting and leveling work at sites and access roads, stacking of soils, handling of construction material, transportation of material, emission due to movements of vehicles, plying of heavy construction machinery etc.

(4) Vehicular emissions due to traffic movement on site and on the connecting roads;

Gaseous emissions containing PM_{10}, $PM_{2.5}$, SPM, CO, HC, NO_X, SO_2 and lead will be released from the vehicular and construction equipment exhaust. The vehicular movement on the unpaved roads will also result in the fugitive dust emissions. The movement of trucks carrying construction material to the site will lead to fugitive and exhaust emissions which would impact the people in the project area of influence. The movement of heavy trucks also increases the potential for road accidents.

Noise and Vibration

Operation of different machineries and equipment for construction activities, running of heavy load traffic for construction materials transportation, and regular traffic movement may generate noise during construction period. The heavy equipment, machineries, transportation and earthworks used for the construction activities are the major sources of noise. It is envisaged that there will be an increase in traffic and thereby in traffic noise impacts on the receptors near the approach road from the transportation of equipment, construction materials. The residents in the vicinity of the site would be impacted due to the noise emissions. The impact is expected to be temporary and localized. Noise levels will have compounding effect when multiple equipment and trucks operate at the same time.

Water Quality

The quality of both surface water and groundwater might get affected in the construction phase. If the soil, which will be used for land development, contains toxic concentrations, the toxicity could contaminate the surface water nearby. Toxicity could also leach through the ground slowly and contaminate groundwater in the long run. During the mobilization of soil carrying vehicles and operation of construction equipment, various wastes such as oil, mud, dust, scrap metal, paper etc. could be generated and dispersed around. Solid wastes and wastewater will be generated from the labor camps as well. Improper management of these wastes could contaminate river nearby and deteriorate the water quality. Especially, during the times of rainfall all the wastes from the project area could be washed away to the nearby water bodies and even be travelled to Padma River. During dredging the river water quality could get deteriorated from the turbulence of dredger equipment, spillage of oil and bilge water, improper management of waste inside the dredger etc. Contaminated water could potentially cause diseases to the local people in case of domestic uses such as cooking, drinking, bathing. The bad quality of water could also harm the existing fish resources as well as the health of the micro ecosystem of invertebrates.

Drainage Congestion and Water Logging

At the present situation, the project area is a seasonal wetland which will be changed to a comparatively higher and flat land. Significant amount of wetland area (mostly seasonal) will permanently be lost. As a consequence, water storage capacity of the project area will be reduced. Besides, natural drainage pathways might temporarily or permanently be blocked due to the development of land. Due to inadequate drainage capacity water logging might be caused within the project area. The existing drainage pathway connects the Padma. If this connection is lost, the adjacent areas around the project site might potentially face water logging problems.

Hydrology

During the construction period groundwater will be abstracted for the civil interventions as well as the domestic uses by the workers such as drinking, cooking, bathing and washing. The additional demand of water may pose some impact on the availability of groundwater within the study area, although the degree of impact cannot be predicted without detailed study (it is beyond the scope of this study). However, the water demand during construction phase will not have significant impact on ground water or on surface water hydrology.

Bottom Sediment

During rainy season, construction work may result some sediment infiltration to the nearest Padma River. But the impact on river discharge and velocity will be very insignificant.

Flooding

Though flooding is not predominant in the project area, during the monsoon times seasonal flooding occurs around the project area. Due to land development, the natural drainage system will be disrupted which could potentially increase the flood risk at the surrounding areas. Especially, the areas beside the Padma River might face more flood risks than the existing condition as water flowing capacity will be partially reduced. Also, during the events of heavy rainfall and flash flood might occur within the project area due to poor drainage capacity.

Solid Waste and Wastewater

Construction works produce a lot of debris and solid wastes that include construction wastes such as brick chips, stones, cement ash, torn boxes of paper, ripped polythene and plastic bags, broken glass and ceramic, scrap steel, aluminum and other metals etc. For several purposes' construction activities will generate wastewater. Also, from the labor camps both greywater (wastewater from kitchen) and black water (wastewater from toilet) will be discharged. If the wastes are not managed according to the best practices available, they could be dispersed and deteriorate the quality of the overall environment.

Hazardous and toxic wastes unless properly managed would have harmful effects on human health and the environment. Toxic chemicals from paint, junk batteries from equipment, oil from vehicles and machineries, chemicals used for cleaning and polishing etc. are the main sources of hazardous wastes. If proper precautions and guidelines are not maintained during handling of these hazardous substances, the health of the workers could be negatively affected. Also, improper and irresponsible dumping of such kinds of wastes could lead to deteriorate the air and water quality around the project area.

7.2.12 Biological Environment

Ecosystem

Wildlife habitat

The project area is the combination of terrestrial and aquatic ecosystem that includes large trees and roadside vegetation. Tree community is composed of small to tall trees with the peripheries of the project area. Some of them are providing shelter to local wildlife as breeding habitats. Besides, croplands within the project area also provide macro habitats to some tiny wildlife like Bengal Lizard, Checkered Keelback, Rat Snake, House Sparrow, Common Myna, Red-vented Bulbul, Rats, Common Mongoose, and so on. Wetland associated with different aquatic vegetation is also providing support to this wildlife for breeding and shelters for escaping from predators. As per land development requirement, all habitats with associated vegetation will permanently be damaged. In addition, wildlife habitat in project influence area will also get deteriorated during sand mining.

During installation of utility facilities like gas, water, electricity services to the project area will involve some earth works for pipe setting and overhead transmission lines for electricity those will definitely destroy existing micro habitats of wildlife in the project influence area. Of the shrub and herbs, Hill Glory Bower, Turkey Berry and Hairy Fig found associated with micro habitats might get damaged. Therefore, it is anticipated that a good numbers of wildlife habitats might be destroyed in this phase.

Species composition

There will be no impact on species composition with this intervention in this phase.

Fisheries

Impact on fish habitat

During construction period construction materials may be released to the nearby river or beel from the construction site. This may damage the fisheries ecosystem of the respective water body. Construction materials, oil and chemical materials of heavy machines, vehicles, etc. will be stored in an appropriate storage site to prevent any release into the water body.

Dredging in Padma River might impact fish habitat of the river. Especially Pelagic fishes would be shifted to nearby water areas while some demersal and sedentary fish species might die under the dredger. During dredging work, many toxic substances might be mixed in water column which would deteriorate riverine habitat quality. Turbidity generated from the dredging work might cause the habitat unsuitable for some fish species.

If run-on and run-off drainage are not adequately constructed in the project site during land development, during a heavy rainfall spillage of sediment to nearby water bodies might take place which would ultimately affect fish habitat of the nearby area.

Agriculture

Impacts on Land Type

Land development for construction of the KEZ would change the existing agriculture land type in ‘420 acres. However, such change would not directly affect land type of the area adjacent to the proposed project (KEZ) area.

Impacts on Landscape and Scenic Beauty

Construction activities might change the visual landscape of the project area. Stocking of construction material, mobilization of construction equipment, construction activities on the green field site might affect the scenic beauty.

7.2.13 Socio-Economic Environment

Occupational Health and Safety

The project would involve development of land, demolishing or eviction of existing structures. Besides, the project activities will involve movement of heavy construction machinery, vehicular traffic, excavation and filling operations. These activities might cause health hazards of the construction workers. The workers might also encounter accident while performing the activities around the construction areas due to the operation and movement of heavy equipment, vehicles and machinery. As such, Occupational Health and Safety (OHS) of the working laborers might be at risk. Besides, the Covid-19 is becoming a threat to human health, which is highly contagious disease. For tackling this pandemic, special measures/equipment for ensuring Occupational Health and Safety (OHS) of workers need to be taken into account.

Community Health and Safety

The health and safety of the local people might be impacted due to the hazards likely to be created during the construction period. The hazards could be in terms of increased noise, air

pollution due to dust while land filling, demolishing structures, construction of industrial infrastructures etc. There would also be risk of accidents due to operation and movement of heavy equipment, vehicles and machineries. The labour influx in the local area may have chance to spread COVID-19 disease, therefore, special measures are needed.

Employment Opportunities

Construction of the proposed EZ requires both skilled and non-skilled labourers, which would create employment opportunities for poor people near the study area. Employment opportunities will be ensured through two channels (i) direct employment for unskilled labour, (ii) indirect employment to the local community and women workers (both skilled and unskilled). Direct employment includes site clearance, excavation, loading and offloading of materials and deliveries, mason and construction works. The local community members could take advantage of these opportunities. Employment generation benefits improve the quality of life of the labourers and enhance their productivity and living standards. Employment generation, both direct and indirect, through Kushtia EZ will have a tremendous impact on human development and poverty reduction in this area.

Road and Communication

The site is beside the highway connecting Pabna and Rajshahi on the north and Khulna on the south through Jhenidaha and Jashore. The Kushtia-Jhenaidah Highway (N704) is passing through on the south-east side over a nearly 155 km distance. This route connects Jashore, a neighbouring area, with Mongla and Khulna via highways. There will be extra traffic on the highway once the EZ is operational.

The development project might disrupt the communication between adjacent villages. Besides, for the operation and movement of heavy equipment, vehicle, machineries, the normal communication might disrupt and could damage the road. In addition, Movement of heavy construction vehicle might create traffic congestion at connecting road to Mymensingh-Netrokona-Sunamganj and other places.

Off-site development

During the construction period, many infrastructural developments will take place, which on the one hand, will provide facilities to the local communities; on the other hand, the inhabitants will lose their native living place.

7.3 Impacts during Operation Phase

7.3.11 Physical Environment

All the large and medium industries will be under operation while KEZ will function at a full-scale. During this time, administrative units will be function, residential areas, parks, playgrounds, food plaza and shopping malls will be occupied by residents living inside and roads will be busy for movement of vehicles. Such operations will have a number of impacts on the various environmental aspects as described in the following sections.

Air Quality

During the operation stage, air quality might deteriorate due to different activities. The major sources of air pollution could be vehicles and the industries. Unless low emission measures are adopted by the industries, the emissions of toxic gases would deteriorate the

air quality. Deteriorated air quality has potential negative impacts on public health. In addition, the ecosystem could get affected by the air pollution.

Noise Quality

The noise level of the project area could be changed due to operation of industrial machineries. The movement of vehicles within the project would also raise noise level. The hydraulic horns and the sounds of engines could be other sources of noise pollution if honking could not be controlled. There would be three distinct zones (residential areas including offices, commercial and industrial zones) within the project area wherein of noise level should be maintained according to the standard noise rule of Bangladesh. If the distinction is not considered carefully in terms of noise generation, sensitive receptors such as residents living inside KEZ, patients in the hospital, young community at the schools or playgrounds, workers and officials working inside the production chambers would be badly impacted. Noise may potentially spread outside and increase the noise level of the environment. Exposure to loud noises for any length of time causes fatigue of the ear's sensory cells which results a temporary hear loss and if the time period is long term irreversible and permanent hearing problems can occur. For the young children learning disabilities, anxiety, attention-seeking behavior, reduced motivation and concentration are some of the most likely negative impacts of loud noises (Kozak and Grundfast, 2009).

Groundwater Availability

During the operation stage, water availability will be a major issue. As stated in the master plan, among the large industries, there will be integrated textile units, food processing factories, ceramic industries and pharmaceutical companies. Other small and medium industries will be light engineering and small/medium manufacturing units. The large industries consume a lot of water per day. Depending on the specific stages of a composite textile unit the water consumption ranges from 0.5 to 300 liter of water per 1 kg of production (Shaikh, 2009). Food processing unit is also one of the most water intensive industries and for the production of 1 kg of food (of various kinds such as potato, wheat, corn, rice chicken, beef etc.) approximately 500 to 70000 liter of water is required (Kirby, Bartram, and Carr, 2003).

Water is not only used for manufacturing purposes, but also for drinking and domestic purposes by the workers in the industries and the residents. According to the standard value used by WASA, averagely a person consumes 100 to 150 liter of water per day. According to the master plan, 7,366,130 liters of water will be required daily based on a rough estimation and groundwater was selected as the major reliable source of the water supply. Surface water from Padma River will also be used in the wet season. Hence, in the dry period's groundwater would be the only source of water.

As a result of various uses, the groundwater level might get depleted which would affect the surrounding area of KEZ as well. Water scarcity could potentially affect the agriculture if irrigation water would not be available as per requirement. The lowering of groundwater could even lead to land subsidence in the long run. To assess the availability problem in detail a separate study is recommended with more accurate data of demand and resources as well as scenarios with extreme demand condition such as the combination of dry period and maximum production of the industries.

Water Quality

Water quality of both surface water and groundwater could be impacted if proper management of solid and liquid wastes would not ensure. As per plan of the project, the pretreated effluents as well as the wastewater from the residential and administrative areas would be collected through a sewerage network and conveyed to a Common Effluent Treatment Plant (CETP) and Sewerage Treatment Plant (STP) respectively. Due any faulty operation or any leakage in the collection network the surface water quality of the nearby water bodies could be deteriorated and would not be fit for domestic use. Besides, it would also pollute the water of Padma River wherein it has been planned to be disposed finally. If this discharge is carried through open channel and the quality of treated water is not up to the required level, local agriculture might get affected due to contamination of pollution with irrigation water.

Hydrology

The Padma, traditionally considered a dominantly meandering river is almost adjacent to the proposed zone boundary. The river Padma shows different hydrodynamic characteristics such as variation in water level due to tidal effect, change in velocity, discharge and morphological characteristics such as sediment transport rate, cumulative erosion/deposition etc. River bank protective work, provision of jetty may cause some impact into the flow dynamics of the river.

On the other hand, the water will be extracted from both GW and SW. The foremost portion of water demand will be fulfilled by groundwater extraction. Mainly the SW body will be utilizing to discharge the treated wastewater and submissive portion of water will be extracted to satisfy the demand. Impact due to the extraction of surface water from Padma cannot be predicted without detailed study (it is beyond the scope of this study).

However, there will be a certain impact on the underground aquifer due to the extraction of GW. If in any case, the discharge gets over in quantity or poorly skilled maintenance the tube-well will be abundant before the design period. The depletion rate is hard to maintain within the allowable limit for factory purposes as a huge amount of water is extracted. This will affect the peripheral tube wells active for use. Moreover, the storage capacity and transmissivity will be affected by the aquifer if the sufficient opportunity for recharge is not given.

Bottom Sediment

The impact on bottom sediment during operation phase is negligible

Solid Waste and Wastewater

A substantial quantum of debris and solid wastes would be generated in the project. The solid wastes might create environmental hazard if not properly managed. Water logging could also occur due to faulty drainage networks as well as drainage congestion. There should be recycling and reusing arrangement for management of wastes, otherwise it would be difficult to handle wastes. Besides, any local incineration of solid wastes would also emit toxic gases that will pollute the atmosphere.

The industries and hospitals would also produce hazardous wastes. The types of the wastes will vary depending on the characters, shapes and production procedures of different industries. Food and textile color, toxic and sensitive chemicals used by pharmaceuticals and hospitals, scrap metals from the engineering production units and hospital wastes are the major examples of hazardous materials. Unplanned disposal of hazardous waste has

potential negative health impacts. Surface water as well as groundwater could be contaminated by these wastes if not properly managed. Aquatic ecosystem might get severely affected in case of toxic contamination in the discharge site of the Padma River which will eventually create negative impact on the overall water quality.

7.3.12 Biological Environment

Ecosystem

Wildlife habitat

The wildlife habitat would be impacted during operation phase of the project if appropriate measures would not be taken as per DoE standard. It is anticipated that some air borne particles (PM_{10}, $PM_{2.5}$) will be produced during industries' daily activities. Similarly, pollutants *e.g.* chemicals, oil, grease, etc. might get released through drains to the main river system and deteriorate water quality. It will also deteriorate healthy aquatic habitats. Feeding habitats to waterfowls might also decline due to industrial pollution in the nearby aquatic habitats.

Species composition

Various types of affluent would be released from different industries during construction and operation phase of the KEZ. The effluents if not properly treated might impact tiny organisms of both flora and fauna like minor phyla *e.g.* planktons, benthos, other sensitive species which might even disappear from existing ecosystem.

Fisheries

Impact on Fish Habitat Condition

Fish habitat of the study area would be degraded in the event of discharging untreated industrial effluent to nearby water bodies. In such events, water quality of nearby water bodies as well as fish habitats could be deteriorated.

Impact on Fish Species Diversity

Fish species diversity might be declined due to river water pollution if industrial wastewater would not be properly treated before discharging into the water bodies.

Impact on Stock Susceptibility

Since the area would be developed for the project, it would be no longer serve as spawning and grazing land for local beel fishes. Therefore, during monsoon, fishes would migrate to other water bodies for spawning and grazing.

Agriculture

Impacts on Land Use

After the completion of this project, land use in surrounding areas might be changed at present, major land use of study area is for agriculture. Development of EZ would attract more infrastructural development around the project site to facilitate industrial growth changing the land use area from agriculture to industrial land use. Some of the other developments including construction of roads, housing facility, commercial areas including hotels, hospital, restaurants, schools, ancillary industries, etc. might also take place in nearby areas. The induced economic development might also result change of typical rural

and agricultural area to urban or semi-urban area which might result in a major change in land use pattern.

Impacts on Crop Production

The infrastructural and industrial development might change the existing land use for agricultural purpose to industrial and infrastructural development which would ultimately cause loss of crop production. Generally light attracts pest. Therefore, lighting of the NEZ area might cause pest infestation to the adjacent agricultural areas which might also lead to crop damage.

7.3.13 Socio-economic Environment

Community Health and Safety

The development of the economic zone and setting up of industries would have some impacts on the Socio-economic conditions of the area. Industrial development would involve generation of emissions, effluents, waste and increased vehicular movements. These altogether might have overall negative impact on the health of the people and aesthetics of neighboring area.

Occupational Health and Safety

The use of machineries and other project's equipment would put the workers and employees at risks of fire, explosion and accident. As such, the occupational health and safety of the workers and employees would be a concern during operation phase of the project.

Employment Opportunity

After construction, the proposed economic zone would create huge employment opportunity. Besides, expansion of industrialization and other associated set up would also generate additional employment opportunities and associated facilities in future for the local people. The local market and business will also be expanded. Indirect employment would also be generated through other opportunity such as agriculture, food production, and retail business. Besides, the proposed EZ could create some job opportunity for the local educated young people and outsiders. This employment generation, through Kushtia EZ will have a tremendous impact on human development and poverty reduction in this area.

Urbanization and Economic Development

Urbanization is regarded as an engine of growth and development of the country. The area selected for the proposed KEZ is now rural. The establishment of economic zone in this area, and coming of various industries will lead to transform this area into an urban center. Many associated infrastructures will be developed; many facilities will be established. Eventually, regional economy will be developed leading to the contribution to the overall national economy. This urbanization and economic development process on the one hand, will improve the living standard of local people and increase the asset value; on the other hand, it will create pressure on local environment, transformation of agricultural land into industrial enterprises, and dispossession of poor/smallholders' people.

Impacts of Additional Traffics

During the operation phase of KEZ, movement of an additional traffic is expected. The newly established industries will have traffic for the transportation of their raw materials and

finished products. Also, as a consequence of the economic activities and urbanization, the number of existing traffics will be increased. If the road networks around the project area are not adopted accordingly, traffic congestion could be occurred. The roads might get damaged due to the additional load of traffics. Traffic congestions and damaged roads will cause delay in movement, which eventually will affect the community and hamper the swiftness of all kinds of businesses. At a broader scale, these impacts may hinder the success of KEZ. Additional traffics without proper road management and law enforcement may cause road accidents as well.

7.4 Impact Evaluation

In addition to the impact identification and further analysis, each impact was evaluated by the significance of each impact. The significance is defined by the magnitude and sensitivity. The result of the impact evaluation is provided in the following table.

Environmental Parameters	Relative Importance Value	Degree of Impact	Relative Impact		EIV
			Positive	Negative	
i. Physical					-10
Regional Hydrology/ Flooding	4	-1		-4	
Drainage Congestion/Water logging	4	-1		-4	
Erosion and Siltation	2	-1		-2	
Dust Pollution/Noise Pollution	2	0			
ii. Ecological					-15
Fisheries	8	-2		-16	
Forest	4	0			
Tree Plantation	2	+1	+2		
Wetland/ Wetland Habitat	4	0			
Nuisance Plant/Eutrophication	1	-1		-1	
iii. Human Interest					+4
Loss of Agricultural Lands					
Employment Opportunities	6	-3		-18	
Navigation and Boat	6	+3	+18		
Communication	2	-3		-6	
Industrial Activities	3	+2	+6		
Irrigation Facilities	2	+3	+6		
Landscape	2	-1		-2	
iv. Quality of Life Values					+15
Health and Nutrition	3	+2	+6		
Sanitation and Water Supply	3	0			
Education/ Literacy	3	+2	+6		
Road Safety	3	-1		-3	
Slum Improvement	3	+2	+6		
Total Environmental Impact Value (EIV)			**50**	**-56**	**-6**

Due to very high Environmental Impact Value, suggested mitigations measures must be taken into consideration. The detail of the matrix has been attached to the Appendix 14.

8 Cumulative Impact Assessment

For the projection of cumulative impact very sound and scientific modeling technique such as air dispersion model and noise model were used in this study. For this region, baseline environment monitoring of certain environmental attributes viz. Meteorology, Ambient Air Quality, Ambient Noise Quality were studied surrounding the project area. Therefore, USEPA recommended different air dispersion model and noise prediction model to assess the emission and magnitude of the contaminants to the adjacent areas of the Project site. The model AERMOD 8.9 and DhwaniPro have been used to predict and simulate the effects of criteria pollutants from major emission sources in the Project area and analyzed the effect on ambient air quality for NO2, SO2, PM2.5 and PM10 and Noise Quality respectively.

8.1 Air Quality

From the baseline condition, pollution load of project area was found under range of 51-100 AQI which indicates that air quality of the area is satisfactory with minor discomfort to the sensitive people. As per the proposed industry setup and power demand we found the loads of pollutions in GHG contributions are:

(1) Overall total traffic pollution load will be 90.29 tonnes/year including sum of PM10, PM2.5, SO2, NO2, CO and CO2 in the studied area.

(2) As per feasibility study, requirement of electricity is around 60.46 MW and its pollution will be 434.4 Tons e/Yr including sum of PM10, PM2.5, SO2, NO2, CO and CO2 in the studied area. The more details are given in appendix 6.

Further, the model was run to predict the maximum ground level concentration of PM10, NO2 and SO2 of proposed economic zone. The predicted maximum incremental GLC (24-hour average) of PM10, PM2.5, SO2 and NOx was found as 3.96 µg/m³, 3.96 µg/m³, 0.93 µg/m³, and 1.47 µg/m³ respectively. The main impacted area due to air pollution is under 2 km towards the W to SE and S side. Parabolic curves have been observed under 2 km which are reducing gradually leading to the reduction in impacts. Major source of pollution will be DG Sets and Operational activities based on the energy consumption and pollution load. Comparing the baseline data with incremental data; it has been observed that the increased Air Quality Index due to the incremental ground level concentration does not have impact on the prescribed color zone of the respective pollutants. More details have been given in the appendix of Air Modeling.

8.2 Noise Quality

For controlling measure, we have calculated the Day and Night average value based on the adjusted weighted Factor and found noise level varied from 47.89 dB(A) to 61.4 dB(A) in the study area. These data were simulated in the program and found predicted level 10.1 to 17.4 dB(A) for R_001 to R_008 respectively. The Mathematical equation is used for noise prediction is L2 = L1-20 Log D2/D1. Highest predicted value for receptor was observed at R_007, R_005 and R_0006 where point source contributes about 22.4 to 25.1 dB(A) respectively without any barrier. The sources include noise from receptor area and estimated point sources from industrial machineries, commercial buildings and construction

activities for the controlling noise level from the point source, this can be controlled by using general linear wall type sound barrier of 3 to 6m height or by proposed tree and shrub plantations. For this, model has been simulating with 3m barrier which indicate the significant reduction of noise from sources. The predicted value show that R_003 and 2 reduce drastically with barrier whereas R_003 is now 3.2 dB(A) from 10.1 dB(A), R_002 is now 4.8 dB(A) from 12.3 respectively. The more details of prediction results L_{Aeq} with project barrier is given in the appendix of Noise Modeling.

9 Public Consultation and Disclosure

Stakeholder consultation (a two-way flow of information and opinion exchange), or simply consultation, is a regulatory process of EIA by which the people's input on matters affecting them is sought. Its main goals are to improving the efficiency, transparency and community involvement in policies, programs and projects. Stakeholder Consultation is mandatory for any development project according to guidelines of DoE, which includes approaching people to engage them in the project and take their concerns about the impact and benefit of the project from their point of view.

During the consultation process, the proposed Kushtia EZ as well as its impacts was discussed with local people. In the consultation process, the stakeholders got involved with the study consultants in reforming/ developing the project interventions considering the local needs and aspirations in line with the problems and solutions suggested by them. The proposed interventions, findings of the EIA and the EMP were shared with the project stakeholders for obtaining their perceptions, views and feedbacks on the probable changes likely to happen within the project area.

9.1 Approach and Methodology

In this study, a participatory approach was followed during the consultation with both primary and secondary stakeholders of the project. A checklist was prepared regarding inventory of assets, entitlement issues, etc. During consultation the entitlement criteria and compensation packages as per government law and BEZA guideline were shared with the PAPs; their feedbacks were collected in response.

The techniques like: a) stakeholder consultation meeting, b) focus group discussion, C) informal discussion, and d) key informant interview were used to explore problems and possible suggested measures regarding the land acquisition, compensation and payment procedures. Grievance redress mechanism was designed considering the feedbacks of the stakeholders.

9.2 Stakeholders' Mapping

Stakeholder mapping, is a strategic process that has been used to identify and analyze the individuals, groups, organizations, or entities that have an interest, influence, or stake in the Kushtia EZ. The main aim of stakeholder mapping is to determine the various stakeholders' perspectives, concerns, expectations, and potential impacts on the Kushtia EZ project or situation. Most importantly, stakeholder's mapping involves identifying relevant Project stakeholders or groups of stakeholders, characterizing the key stakeholder issues and concerns, and mapping the Project stakeholders to determine the appropriate level of engagement for each stakeholder or stakeholder group.

As the executing authority, BEZA will develop and manage the Kushtia EZ in Mokarimpur Union of Bheramara Upazila under Kushtia district through engaging multiple stakeholders. For the purposes of this Social Engagement Plan (SEP), as defined in the World Bank Environmental and Social Framework, **"stakeholder" refers to individuals or groups who:**

(a) are affected or likely to be affected by the Project (project-affected parties); and (b) may have an interest in the Project (other interested parties). Stakeholder identification for the Kushtia EZ was initiated during the scoping meetings and was further developed during discussion with the community and relevant stakeholders of the proposed Kushtia EZ. The stakeholder mapping workshop was undertaken to:

- Confirm the stakeholders and groups who were identified in initial scoping exercises and further revise and update the stakeholder list with input from key stakeholders;
- Analyze the level of impact the Project have on each stakeholder group, their level of interest, influence and importance, to identify the level of engagement required for each group; and
- Identify engagement strategy with each stakeholder group and assign responsibility to team members.

9.2.1 Project-affected parties

Affected Parties include local communities, community members and other parties that may be subject to direct impacts from the project during development phase. Specifically, the following individuals and groups fall within this category:

- Affected Persons who are living in or beside the planned land of Kushita EZ;
- Communities in the vicinity of the project's planned activities;
- The local population and local communities including the vulnerable group that include the elderly, physically and mentally disabled persons, single mothers, adolescent girls, minority transgender community and the children;
- Local health, education and like services that would have to provide basic support to the Kushtia EZ staffs, workers and their families including school going children like basic healthcare, schooling etc.
- Residents, business entities, and individual entrepreneurs in the area of the project who are adversely affected owing to the project activities, and others that can benefit from the employment, training and business opportunities offered due to implementation of the project;
- During the operation phase, when the factories are in place and functioning, staffs and workers of the factories, buyers of the product, suppliers of raw material, vendors, utility service providers and local community who would be affected by the factory generated pollutants of all forms
- During operation phase the Entrepreneurs/Businessmen investing in the project could also be adversely affected by staffs/workers who may adopt illegitimate means like arson, workers agitation, destruction of machineries etc. to coerce the authority to meet their ends etc.
- At times unilaterally adopted BEZA policies may also go against the interest of the entrepreneurs investing in the Kushtia EZ.

Local NGOs and initiative/advocacy groups represent the considerable capacity that the project(s) may tap for disseminating the information and raising awareness of the planned activities among the potentially affected communities in the project area. NGOs typically have well established interaction with the local communities, are able to propose the most effective and culturally appropriate methods of liaising based on the local customary norms and prevailing means of communication, and possess the facilitation skills that may be utilized as part of the project's consultations. In addition, NGOs may lend assistance in disseminating information about the proposed project(s) to the local communities, including

in the remote areas (*e.g.* by placing information materials about the project in their offices, distributing the project information lists during events that they are organizing), and provide venues for the engagement activities such as focus-group discussions.

9.2.2 Other interested parties

The projects' stakeholders also include parties other than the directly affected communities, including:

- Civil society groups and NGOs on the regional, national and local levels, which pursue environmental and socio-economic interests and may become partners of the project. Organizations within this group are likely to be located outside the project's Direct Area of Influence;
- Community-based groups and non-governmental organizations (NGOs) working on Labor, or Gender issues including GBV and Human Rights in the locality that work for and represent local residents and other local interested groups, and act on their behalf;
- GoB officials, permitting and regulatory agencies at the national and regional levels, including environmental, technical, social protection and labour authorities.
- GoB officials at the District level and below including DoE: local Union Parisad, Upazila Parisad in the project area, village administrations; local MP etc.
- Business owners and providers of services, goods and materials that will be involved in the project's wider supply chain and transportation business or may be considered for the role of project's suppliers in the future;
- Residents of the other rural settlements within the project area that can benefit from employment and training opportunities stemming from the project;
- Mass media and associated interested groups including District and local Press Club, local, regional and national print and broadcasting media, digital/web-based entities, and their associations.
- Foreign investors and companies, Development Partners (at National and International levels) etc.

Table 9-1: A list of stakeholders identified with level of impacts and influence

Other interested parties	Interest in the project	Impacts	Influence
International Level			
Environmental and societal NGOs (including those working on Labor, Human rights, environment and Gender and GBV matters)	Understanding of the range of problems and opportunities associated with the project(s).	Low	low
Foreign Investors	The Kushtia EZ has all the potentials foreign direct investors as the most attractive destination for investment in Bangladesh.	high	Low
Multinational or foreign companies	Interested in operating or partnering with companies in the area.	High	low
Donor agency	This zone is environmentally and socially sustainable and the lesson and learned may share for international community	Low	Low

Other interested parties	Interest in the project	Impacts	Influence
Academics and researchers	They may involve with various research work at the project site to provide scientific knowledge of the impacts of the project.	Medium	Low
National Level			
Foreign and local investors	They will establish their industries and complying with required potential environmental and social issues	High	Low
Business and workers' organizations	Interest in procurement and supply chain, potential environmental and social as well as community health and safety, including occupational health and safety of the Labor force	Medium	Low
Academic institutions (*e.g.* universities, think tanks, schools)	There would be a large influx of migrant workers/Managers/staffs with family in the project area. Students from this group would need schooling and healthcare facilities in situ. This demands the establishment of educational institutions within and near the project area. In addition, academic institutions and think thanks would be interested in the project due to its large development impacts (economic growth, social impacts, etc.)	Low	Low

Other interested parties	Interest in the project	Impacts	Influence
Training service providers	They would be providing the training and skill development programs for workers	Medium	Low
Urban Development Department	They are working for preparing a comprehensive Master Plan for influence area of Kushtia EZ and would need help from the local government to implement the plan	Medium	Low
Roads and Highways Department	The approach road will play vital role to ensure efficient transportation links with Kushtia EZ, they may help BEZA and local community through ensuring its proper maintenance	High	Low
Environmental and societal NGOs	Understanding of the range or problems associated with the project(s)	Low	Low
Other NGOs (HR, Gender, Labor Issues)	Represents the interests of different interested parties and vulnerable groups	Medium	Low
Mass media	They are intermediaries for informing the general public about the planned activities of the project developer(s) and for information disclosure in connection with the proposed project(s)	Medium	Low
Business community	Economically interested business entities (conclusion of contracts, economic damage due to competition, etc.); they can be also be potential customers of the project developer	High	Low

Other interested parties	Interest in the project	Impacts	Influence
Project employees and Project's sub-contractors	Technical understanding of the range or problems associated with the proposed project(s) including Health and Safety issues	Medium	Low
District level			
Administration of Kushtia District and other government agencies	Legislative and executive authorities. Functions of supervision and monitoring, etc. Example: Deputy Commissioner (DC) and supporting Local Government Agencies (DoE, DoF, BWDB, DPHE, Department of Livestock and Fisheries, DDM, etc.)	High	Medium
Local NGOs (HR, Gender, Labor Issues)	Represents interests of different interested parties and vulnerable groups	Low	Low
Mass media	They are intermediaries for informing the general public about the planned activities of the project developer and for information disclosure in connection with the proposed project.	Medium	Low
Business community	Economically interested business entities (conclusion of contracts, economic damage due to competition, etc.);	Medium	Low
Local communities	Interested parties living in regions of Kushtia that could be indirectly affected by the realization of the projects	High	Low
Local small business man	Small scale businessmen in the project vicinity would benefit from the project related workers/staff and managers and the raised purchasing power of the local populace getting jobs in the project through selling daily necessities	High	Low
Union Level			
UP Chairman	Elected Union Porisad Chairman would be interested to have influence over resettlement, compensation and providing jobs to the needy local population around the project area thereby improving own influence for future local and national elections	High	Low
Ward Members	Represent interests of the affected communities (land users) and vulnerable groups	High	Low
Local land users and other local population	Potential vulnerable groups, affected communities and other interested parties living in the close proximity of the project area	Medium	Low

In the process of project implementation and operation phase when goods will be produced at the factories at Kushtia EZ and, whenever certain 'Interested Party/Parties' are identified, they should be included, and the SEP will be updated.

9.2.3 Disadvantaged/vulnerable individuals or groups

BEZA will take special measures to ensure that disadvantaged and vulnerable groups have equal opportunity to access of information, participate in the engagement activities, provide feedback, and submit grievances. The deployment of the Social Development Officers will help to ensure proactive outreach to all population groups, and they will make a special effort to engage with those identified as vulnerable or disadvantaged. If necessary, BEZA will provide transport to public meetings for vulnerable people, and will also deliver brochures and informational material to such households in the language appropriate. To reach the elderly and the disabled in the community and the single mothers and the transgender community, dedicated efforts should be undertaken to reach them at their convenience by the Social Development Officer. BEZA will take necessary supportive measures for the vulnerable groups within the overall process. The vulnerable groups may include and are not limited to the following:

- Elderly people, especially if they are living alone;
- Persons with physical and mental disabilities and their care givers;
- Low-income families dependent on state support;
- Women-headed households or single mothers with underage children, adolescent girls;
- Children and adolescent girls
- The unemployed persons (men and women).
- Squatters
- Poor farmer and fishermen
- Minority Transgender community within the area of influence of the project area

It is anticipated that, among the above vulnerable groups, working age group who will be getting jobs in construction activities and suppliers of goods and services will be benefitted. Preferential employment of vulnerable people from the zone of influence should be ensured. Equal remuneration for the male and female workers for similar types of assignment will encourage the female to do job. Social security and protection against gender-based violence can benefit the poor women particularly adolescent girls.

9.3 Public Consultation Meeting (PCM)

A public consultation meeting was held regarding proposed Kushtia EZ at Notunhat Mor, Mokarimpur, Bheramara, Kushtia on 17th March 2023. Goals and objectives of the project has disclosed with the affected people and their communities through open public consultation meeting. The main objective of the public consultation meeting is to get stakeholders input in project planning and implementation. Participants from both primary and secondary stakeholders' groups had attended the public consultation meeting. To ensure stakeholder's participation, a rigorous publicity has undertaken at the community. The project proponent (BEZA) has issued invitation letters to the concerned stakeholders to participate in public consultation meeting and request to have any comments, suggestion and recommendation on land acquisition and in preparation of ESIA. Alhaj Aktaruzzaman Mithu, Upazila Chairperson Bheramara, Md. Abdus Samad, Chairperson Mokarimpur Union, local school teacher, journalist and other people including project affected people has attended the consultation meeting.

Public consultation meeting was carried out with the local people in the project impact areas to disclose information about the proposed project and its various activities and discuss their views and concerns. The poor people illegally living in the khas land expressed their concern of losing their housing and requested to replace them properly. Because they don't have the

ability to buy land and build housing for them. Moreover, the land owners of the proposed private land also requested to leave the private land from the proposed Kushtia EZ. The overall opinion of the participants which has been expressed during public consultation is mostly positive. They are happy about this project. There are some positive as well as negative impacts of the project reported by the local people.

Participants of the consultation were expressed their opinion as follows, “Proper rehabilitation should be arranged”. “We need to do the development work without hampering our environment specially the Padma River”. “May our compensation be given to us without any discrimination and we give the responsibility to our honorable chairman”

Figure 9.1: Public Consultation Meeting Mokarimpur Union

UP Chairperson says that my village will be my city. The proposed Kushtia EZ will change and upgraded the roads and communication system, people of this area especially women will get work opportunity, this will change their lives.

Table 9-2: Summary of Focus Group Discussion

Date and Place	Target Group	Participants			Issues/ Topic discussed	Opinion of APs
		M	F	T		
20/06/22 Mokarimpur	Male	21	0	21	Project objective and goals, Opportunities that to be created by the project, land requirement, livelihood and income restoration, compensation, improvement of service facilities etc.	In all FGDs, the participants mostly affected person expressed their concern on losing their only shelter and livelihood as they do not possess any land. Their livelihood mostly depends on that small parcel of land too. As they aren’t educated or skilled enough to migrate their occupation other than agriculture and homestead vegetation and losing the shelter means losing everything to them. They requested the concern authority to arrange some
21/06/22 Mokarimpur	Women	0	17	17		
22/06/22 Char Mokarimpur	Mixed	5	6	11		
22/06/22 Mokarimpur	Mixed (Youth)	7	5	12		

Date and Place	Target Group	Participants M	F	T	Issues/ Topic discussed	Opinion of APs
						rehabilitation plan for shelter. They also demanded job placement priority in the Kushtia EZ according to their qualification.

Table 9-3: The institutional consultations with the Key Informants

Department	Designation and Contact Details	Discussion	Suggestions
Department of Agriculture 22-06-2022	Shahnaz Ferdousi, Agriculture Extension Officer 01726854874	The Officer state that, after the implementation of GK project, rice production of the study area has improved and along with grain productions vegetables grow adequately. A huge portion of the local people solely depends on vegetable production. Also, people depend on livestock so grass production in large scale is done throughout the whole year. Among the variety of rice Aush production is comparatively low within the study area.	People are solely dependent on agriculture within the study area. Implementation of Economic zone will cause them lose the land and lose their only way to earn. The Officer suggestion for mitigating this negative impact by arranging exclusive skin developing training season to the local people and give them priority for employments. Also, to cope up with the increasing food demand while more agricultural land is getting lost, new variety of crops need to be developed and crop intensity must be expanded.
Department of Livestock	Dr. Tayran Iqbal, Upazila Livestock Officer	During the discussion, it was found that almost 60% people of the area is dependent on livestock and there is an animal hospital. There are two large dairy farms (Feeda Agro) where the number of cows is more than 100 and lots of small household farms in that area. Almost every household has a small poultry or dairy farm. This project activity will have an important contribution to the economy of Bangladesh. If the project takes initiatives to make processing and fattening plants for milk processing it will strengthen the economic condition of the people. At the same time, livestock not only help with financial medium, but also provides us crucial animal protein. Also, there are enough grazing areas for the existing livestock but if these lands are taken for industrial purpose, it will affect the supply of food for the animals. Dairy and small-scale farms are increasing in the area. The department informed us; there will be small impact of the project on livestock resources because of lessening the grazing yard of the area. There are enough facilities for training of the “Khamari” and this project will enhance this if new technologies are introduced through this project.	As the area produce a large amount of grass for the animals so grazing yards need to be preserved or protected and proper disposal of industrial wastes needs to be ensured.
Department of Public	Md. Saidur Rahman,	Discussions with the Department of Public Health Engineering (DPHE)	The potential Groundwater source needs to be

Department	Designation and Contact Details	Discussion	Suggestions
Health Engineering (DPHE)	Assistant Engineer 01718627103	took place during the field survey. We discussed about the drinking water supply and waste management in the project area. The depth of groundwater in the project area is around 30 ft and most of the people collect their drinking water from shallow tube well but in recent time during dry season scarcity of water is arising since ground water goes lower than 100 ft. The amount of Arsenic in inland surface water of the project area had been found 0.2mg/l which is below the standard of DoE. But arsenic concentration in ground water varies and in some area is high causing sickness to local people. Waterborne diseases are rare within the study area. Also, discussions on sanitation and health facilities were discussed with the Department of Public Health and Engineering.	preserved and wise use of water should be ensured. To protect the health of the inhabitants of the area proper sanitation facilities should be established.
Department of Forest	G.M. Mohammad Kabir, Deputy Conservator of Forest, Kushtia 01712140210	Discussions with the forest department found that there is no reserve forest within the 10km radius of the project area. But there is a proposal of social forestry in Bheramara upazila which has not been implemented yet. The main tress found in the study area are Akashmoni (Earleaf acacia), Rain tree, native fruit trees, Banyan tree, Figs trees (Dumur), Horitoki (Myrobalan), Beechwood (Horitoki) tree etc. Forest officer said there is no endangered species in the area so there will be no impact of the project on wild animals and trees.	Wise specification of areas and no cutting of trees needs to be maintained. Trees suitable for the project area needs to be planted around the project site and wherever possible. He mostly suggested to plant ornamental trees like Bastard teak (Palash), Red silk-cotton (Shimul), Golden shower (Shonalu), Royal Poinciana (Krishnachura), Zarul etc.
Department of Social Services	Md. Abu Nasir, Upazila Social Service Officer	Most of the benefits of this project were discussed with the Department of Social welfare officer. He informed about many financial incentive schemes provided by the government in order to help the poor and disables. He also discussed with current allowances and how government doing such social works through this department. The current employment status, the allowances for the orphans are also discussed. Social safety and security of the local community based on violence and gender issue can be a crucial one to focus on.	While selecting potential industry for the EZ, non-polluting industry should get priorities. Local ingredient-based industry must be included and local people needs to be employed.
Department of Fishery	Shammi Shirin, Senior Upazila Fisheries	The fishery officer stated the fish resources update of the study area. There are 198 fishermen in total in that upazila. Nowadays almost 50%	In any condition, no waste water should be allowed to dump in the surface waterbody. High degree of

Department	Designation and Contact Details	Discussion	Suggestions
	Officer 01769459525	fishermen are engaged in the Ruppur nuclear power plant. The fishes catch from rivers are directly sent to the Ishwardi market. The common fish species in that area are Peuli, Bashpati, Chingri, Ritha, Bowal. There are some endangered fish species according to the fisheries officer. These are Meni or Veda fish. There is a temporary sanctuary in Hishna River, Chandgram Union. The reasons behind the decrease in fish production are excessive extraction, habitat contraction, sedimentation etc. But the overall fish production is increasing in the area and the rate is 4112metric ton.	treatment is required before dumping the waste water in the water to ensure the treated water will dilute at expected concentration with the existing water flow.
Bangladesh Water Development Board	Md. Rois Uddin, Executive Engineer, BWDB 01756967761	The Chief BWDB Engineer of the project zone stated that the zone is very effective for surface water connectivity. Reduction of fresh water from upstream, in dry season water level is decreasing and salinity level is increasing due to the flow of seawater. The canals are continuously excavating for maintaining drainage patterns. The soil characteristics is very favorable for agriculture but he is concerned with the lithological characteristics of the zone. The design of foundation is very challenging for heavy structures. The elevation of the zone is very high and it is not a flood prone zone. The drainage system through Ganges-Kobadak Irrigation Project or G-K Project of the area is up to the mark and there is no water logging in that area. He noted that almost 4000 cusec water is used in the G-K Project.	Excavation of canels and restoring the dead water bodies are required to build up a resourceful ecological zone. Proper communication with BWDB and Fishery department is required to restore the fish resources. ETP or any treatment unit which will be selected for EZ should be capable enough to provide continual operation of treating dangerous waste water.
Department of Environment (DoE)	Md. Atayur Rahman, Deputy Director, DoE 01914107611	The existing environmental condition along the proposed project site were discussed with the Department of Environment. The beneficial impacts of the project as well as the negative impacts and their mitigation procedures were discussed as well. Current environmental condition and no harm to the natural equilibrium from the project were discussed. In view of achieving sustainable development goals the project must be done in an environment friendly manner. The scope of improving the environmental condition of the project area through increasing greenery and decreasing GHGs emissions were discussed with DoE. The proposed project area contains various tree species and vegetation cover, so if these species are uprooted or cut	DoE suggested that the report must be done after the approval of ToR from DoE. All the rules and regulations given by DoE must be followed. Ponds and waterbodies available in the project area cannot be filled. Trees cannot be cut down, even if a tree is cut down, it has to be replanted. If the project includes lead (Pb) or dying industry, mitigation measures must be taken so that liquid or hazardous waste do not contaminate the water and soil. ETP, WTP, SWTP needs to be implemented.

Department	Designation and Contact Details	Discussion	Suggestions
		down, they must be replanted after the project done. Greenbelt must be developed.	
Department of LGED	Md. Abul Hashem, Upazila Engineer 01708161493	The existing socio-economic condition along the proposed project implementation were discussed with the Upazila LGED Officer. The beneficial impacts of the project as well as the negative impacts and their mitigation procedures were discussed as well. He mentioned Kushtia as an economically developed city while this project will improve its overall socio-economic condition of the city.	He suggested to implement proper drainage facility within the project site since overall drainage condition is bad in Kushtia District. Improving road network is also another necessity for the proposed EZ to operate smoothly.
Department of Roads and Highway	Shakirul Islam, Executive Engineer, RHD 01730782774	The executive engineer of roads and highway department, Kushtia said that the existing roads are 18 feet wide and 34 feet wide road is under construction. There is a proposal for six lane road construction for Kushtia highway. He noted that local vehicles and motor cycles cause most of the accidents in roads. He said that if the EZ is implemented heavy vehicles will travel which need the widening of roads and also the longevity needs to be ensured. In view of decreasing traffic jam, timing should be formulated for the movement of loaded vehicles/truck.	He suggested to propose different road network for the economic zone to avoid traffic jam in highway. He also suggested for the widening of existing and newly constructed roads.
Disaster Management Officials	Md. Abdur Rahman, District Relief and Rehabilitation Officer 01712040610	The existing condition and available facilities for fronting any natural disaster has been discussed with the District Relief and Rehabilitation officer. Thunderstorm, lighting, flood etc. are the common disaster in Kushtia district and district relief office is always ready to help the people. The proposed economic zone will improve the economic condition of the local people thus they will be more self-independent to face any disaster which makes him hope to early start of the project.	Skill development training should be arranged for local people so that they can be employed in the EZ. Shelter home for the people suffering from river bank erosion and flood needs to be ensure first.

10 Environmental Mitigation, Management and Monitoring Plan

The land use of the study area has been used for the assessment of the environmental impact of the proposed Kushtia EZ. The total study area has been considered as 10 km radius from the centre of the economic zone and area is about 77,576.14 acres. Land use of the study area has been prepared using high resolution *KOMPSAT-2,3 Satellite Image* dated 2019-20.

The images show that the major land use category is single crop is 27,146.96 acres (35.0% of the gross area) and rural settlement is 17,255.34 acres (22.24% of the gross area). Besides other land use area rivers and khals, herb dominated area, sand area and freshwater aquaculture. The detailed land use data is presented in Table 10-1.

Table 10-1: Land Use/Land Cover of the Project and Study Area[61]

Land Use	Project Area (acres)	% of gross project area	Study Area (acres)	% of gross study area
Single Crop	150	93	27,146.96	34.99
Multiple Crop	19	5	7,801.10	10.06
Orchards and Other Plantations (Trees)	20		4,045.11	5.21
Rural Settlement	6	1.4	17,255.34	22.24
Road	3	0.6	3,335.92	4.30
Brickfield	-		313.82	0.40
Air Port	-		370.66	0.48
Dump Sites/ Extraction Sites	-		56.83	0.07
Herb Dominated Area	50		896.99	1.16
Rivers and Khals	-		7,961.72	10.26
River Banks	-		14.83	0.02
Lake	-		24.71	0.03
Baor	-		130.97	0.17
Ponds	-		76.60	0.10
Fresh Water Aquaculture	-		328.65	0.42
Low land	67			
Fallow Land	105		7,810.99	10.07%
Grand Total	**420**	**100**	**77,576.14**	**100**

[61] Source: KOMPSAT 2,3 satellite image data

Environmental and Social Management Plan (ESMP) is a site-specific plan developed to ensure that all necessary measures including mitigation and monitoring activities are identified and implemented in order to preserve and protect the environment and to avoid and manage the negative impacts of the project and comply with environmental legislation. The primary objective of the ESMP is to provide a guideline for proper management and monitoring of the identified environmental and other impacts due to the project and to offer document to the implementers for accomplishing the institutional requirements of the authority. It will identify the residual impacts and unavoidable impact and its management. As GoB is committed to ensure sound environmental and social condition, preparation and execution of ESMP is mandatory for preparation, implementation and monitoring of environmental and social protection measures during and after commissioning of the project. ESMP indicates how various measures are proposed to be undertaken during different phases of the project including cost components. It consists of various steps including:

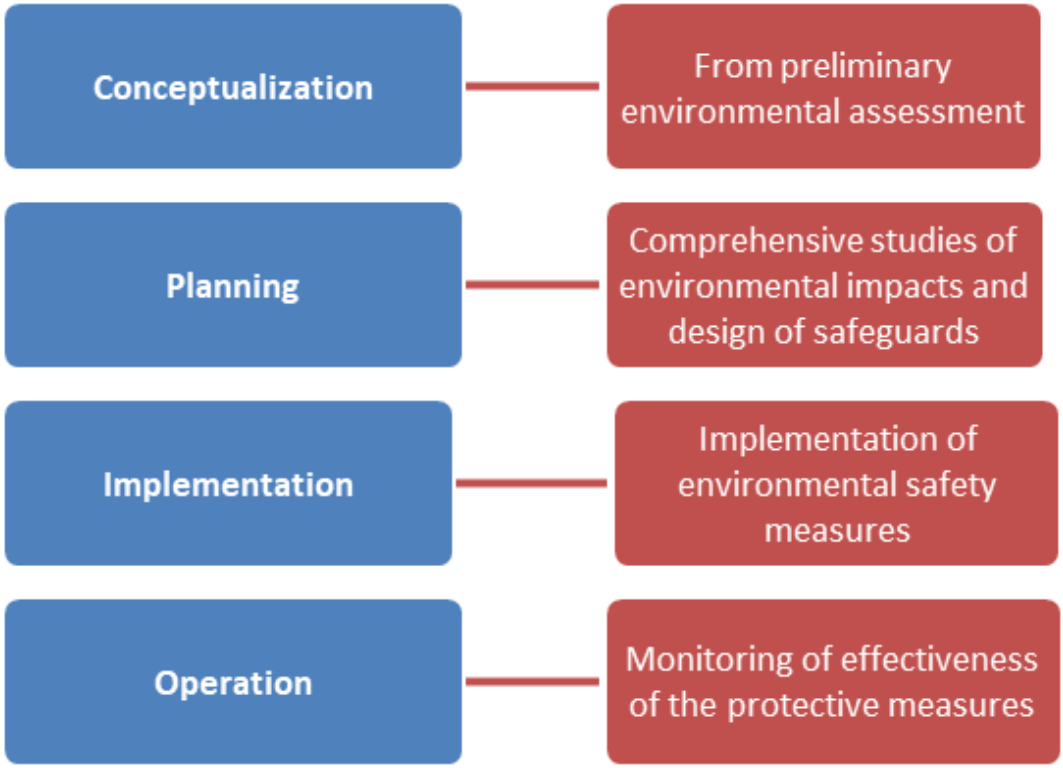


Figure 10.1: Different Steps of ESMP

The present study clarifies the following proposed ESMP measures:

(1) The mitigation measures that need to be taken during construction and operation phases of the project to eliminate or offset adverse environmental impacts, or reduce to acceptable limits;
(2) The actions needed to implement these measures; and
(3) A monitoring plan consists of concrete monitoring indicator required to assess the effectiveness of the mitigation measures employed.

Similarly, integrated ESMP is a necessary requirement for implementation of the BEZ, which will be a guide for the environmental protection activities. A comprehensive measure for mitigation and monitoring of possible environmental hazards has been enlisted for ensuring

safety measures and minimizing the risks and hazards due to implementation of the project in the study.

10.1 Mitigation Plan

The establishment and execution of proposed EZ is believed to have a positive impact for sustainable economic growth of the country as well as provision of employment to the local people. However, the project may also have some impacts on the existing local environment, eco-system and socio-cultural activities including land use, soil quality, pollution of water, air, noise, etc. Therefore, a mitigation mechanism has to be established to the affected communities regarding various harmful impacts including the effects on livelihoods, environment, agriculture, water bodies, and surrounding social infrastructures. A detail ESMP including health and safety measures has been described in the following tables (Table 10-2, Table 10-3 and Table 10-4). The Project proponent will be responsible for accomplishing the proposed safety measures mentioned in the proposed ESMP.

10.1.1 Environmental Mitigation Plan

Following are the main advantages of the environmental mitigation plan:

(1) Ensure plan for the fulfillment of basic environmental standards essentially required to meet during design, construction, and operation period of the project;

(2) Provide plan for the development of compensatory actions especially in the form of compensatory forestation, green zone development and landscaping for minimizing the negative ecological impacts due to the project;

(3) Reduce the potential environmental impacts, causing the biophysical environment in the area to deteriorate and indirectly slow down the economy of local communities by the project.

(4) The ESMP for the proposed EZ has been prepared based upon optimum and reasonable costs that are needed for mitigation measures on a “least-cost” basis. Activities that need to be carried out for the environmental and social management and monitoring of the proposed EZ could be divided into two phases: during construction phase, and during operation phase.

Table 10-2: Environmental Impacts and Mitigation Plan for Site Development works

Activity/Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Supervision and Monitoring
Removal of Vegetation	• The removal of vegetation during site clearance must be restricted to the confines of the project area.	Pre-construction phase	Contractor	BEZA/PMC
Setting up of construction camps/labour camps	• The construction camps should be at least 500m away from habitations from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. • Location for stockyards for construction materials will be located at least 1 km from water sources • The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer • All sites used for camps will be adequately drained. They will not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures • The camps will be located such that the drainage from and through the camps will not endanger any domestic or public water supply • All sites will be graded, ditched and rendered free from depressions such that • water may get stagnant and become a nuisance • Construction camps shall be provided with sanitary latrines (1 per 25 pax), bathing facility and urinals. • Sanitary latrines shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings • Adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labour employed therein. • Sewerage drains will be provided for the flow of used water outside the camp. • Drains and ditches will be treated with bleaching powder on a regular basis. • The sewage system for the camp will be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.	Pre-construction phase	Contractor	BEZA/PMC

Activity/Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Supervision and Monitoring
	• Clean potable drinking water facility should be provided at the site and the water quality should be monitored regularly • Crèche facility should be provided for children if female workers are employed First aid facilities should be made available at construction camp. First aid box should contain small, medium and large sized sterilized dressings, sterilized burns dressings, 2% alcoholic solution of iodine, bottle containing salvolatile, snakebite lancet, bottle of potassium permanganate crystals, scissors, Ointment for burns and surgical antiseptic solution • 1 first aid box should be available per 50 labours • A person trained in first-aid treatment shall be made in charge who shall always be readily available during the working hours at the work place • A suitable motor transport shall be kept readily available to carry injured or ill person to the nearest hospital.			
Identification of dumping sites for debris	• The dumping sites shall not be located within designated protected areas; • Residential facility or sensitive facilities like hospitals, schools etc. shall not be located in downwind direction of the identified dumping sites • Dumping shall not impact natural drainage courses • Dumping sites should be located at least 1 km from sensitive locations • Permission from concerned local body should be taken before finalizing the location • Agriculture lands should be avoided and waste lands should be preferred • Selected site should not support significant vegetation • The area should be sprinkled with water to suppress the dust emissions • Plant species suitable to grow in that condition should be planted at the time of closure	During construction	Contractor	BEZA/PMC
Soil Erosion and Sedimentation control	• To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation. • Sedimentation tanks should be provided in line with storm water drains to trap the sediments from run-off. Sand bags can be used to trap sediments more effectively	During construction	Contractor	BEZA/PMC
Disposal of	• Waste from construction camp should be segregated at site. Food/wet waste should be	During	Contractor	BEZA/PMC

Activity/Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Supervision and Monitoring
Debris and any generated waste	composted in pit at the site, recyclable should be sent to authorized recyclers and rejected waste should be disposed regularly through responsible agency in the area; • Dustbins should be provided at the site and construction camps to prevent littering of waste; • Storage area of minimum 2 days should be provided at construction camp for storage of the waste generated from labour camps; • Construction debris should also be segregated at the site. This debris should be used for filling to the extent possible. Recyclable waste should be sold through authorized dealers and reject waste should be sent to the identified debris disposal site; • All arrangement for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental. • Construction debris should be stored under covered sheds on paved surfaces to prevent leaching; • Any hazardous waste generated during construction activity shall be stored at suitable place and then disposed off in consultation with the guidelines. • Contaminated runoff from storage areas shall be captured in ditches with an oil trap at the outlet. • Utmost care shall be taken to ensure that the Municipal Corporation norms are met for the safe collection, transport and disposal of construction waste and debris.	construction		
Dust Generation	• Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. • Compaction of prepared site to re-strain the fugitive emissions. • Water should be sprayed in the cement and earth mixing sites as well as after compaction. • In high dust areas, workers should be provided and encouraged to use masks. • Regular maintenance, servicing of the vehicles and periodic emission check for equipment and machinery would be carried out in conformity with the Central Motor Vehicles Rules, 1989. • Water will be sprayed on the haul road. • All the vehicles entering the project site will be checked for Pollution-Under-Control	During construction	Contractor	BEZA/PMC

Activity/Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Supervision and Monitoring
	Certificates. • Air quality monitoring to be carried out during construction phase to check the pollutants level in the air			
Contamination of surface water and groundwater	• Material mixing, material storing, washing of equipment and vehicles and other activities close to water bodies shall be avoided; • Car washing / workshops near water bodies will be avoided; • Avoid excavation during monsoon season; • Loosened soil will be stabilized by Contractor through landscaping and developing vegetation, wherever possible, once construction activity is completed at any site. • Sanitation facility with septic tank followed by soak pit will be developed. Common toilets will be constructed on site during construction phase and the waste water would be channelized to the septic tanks and soak pits in order to prevent waste water to enter into the water bodies. • Provision of oil and grease traps upstream of storm water drains • Surface run off due to construction activity will not be discharged in open without treatment.	During construction	Contractor	BEZA/PMC
Noise from Vehicles, Plants and Equipment	• Construction activities would be carried out in the daytime only. • The construction equipment would be provided with adequate noise control measures and should comply with the noise standards as prescribed by DoE • Regular maintenance of vehicles and equipment would be carried out and corrective action taken in case of any deviation. • Ear muff/ear plug shall be given to the workers working around or operating plant and machinery emitting high noise levels. • DG sets if installed should be provided with acoustic enclosures • Labour working in noise prone area should be provided with ear plugs and job rotation should be practiced to prevent the prolonged exposure of any workers to high noise levels	During construction	Contractor	BEZA/PMC
Accidents	• Safety officer should be appointed at site to ensure all the safety guidelines are being	During	Contractor	BEZA/PMC

Activity/Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Supervision and Monitoring
	followed at site • Cautionary guidance should be provided at site to aware people about the associated risk with the area. Entry to the fuel storage room or machinery operation room should be restricted only to authorized trainer personnel • All Accidents shall be reported immediately and incident analysis, preventive measures shall be implemented.	construction		
Clearing of Construction of Camps and Restoration	• Contractors shall prepare site restoration plans. The plans shall be implemented prior to demobilization. • On completion of works, all temporary structures shall be cleared, all rubbish burnt, excreta or other disposal pits or trenches filled in and sealed and the site left clean and tidy.	Post construction	Contractor	BEZA/PMC
Occupational Health and Safety Plan	• All construction worker should wear a safety jacket and other protective equipment like helmet, gloves, gum boots, ear plugs, mask while working at the site. • Workers should be made aware about the health issues related with open defecation. • Training to workers should be provided for handling the construction equipment and machinery. • Training to the workers should be provided to handle the emergency situations like • fire, floods etc. • First aid facility and sufficient nos. of trained personnel should be available at all the time at construction camp. • Cautionary signage and notice should be displayed in local language and English at the required places like fuel storage area so that hazards can be avoided. • A security guard should be deputed in these areas and entry should be restricted.	During construction	Contractor	BEZA/PMC
Disaster Management	• All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.	During construction	Contractor	BEZA/PMC

Table 10-3: Mitigation Measures Suggested for Developer

Impact	Mitigation Measures During Construction Phase
Identification of Site for Disposal of Construction Debris, Construction Labour Camp and Plant Site	• Site identified should be 1.0 km away from settlement, sensitive locations, like school, hospital, religious structures, reserve forest and any other eco-sensitive zone etc. • Site identified should be approved by BEZA and PMC. • Site should be located in downwind direction from settlement area. • Fertile agricultural land and community land should be avoided for setting of these facilities.
Air Pollution	• Sprinkling of water during construction phase on all unpaved roads, site and haul roads. • Avoiding excess pilling of raw material and debris at site. • Storage and transportation of raw material and debris in covered conditions. • Cutting of only identified trees after obtaining permission of forest department. • Regular cleaning of site. • Provision of adequate parking space at site so as to prevent idling of vehicles during construction phase • Upkeeping and maintenance of all the construction vehicles, machinery and equipment used for construction purpose • Guiding signage should be provided at the site for vehicles entering the site to minimize the movement of vehicle within the site • Timings of the construction material vehicles should be fixed and should be during non-peak hours to prevent traffic congestion and traffic jams • Speed limits should be restricted within the site for all the construction vehicles • Usage of low energy intensive building material like fly ash mix cement and bricks • Usage of low Sulphur diesel for running DG sets, construction vehicles and equipment • Obtaining temporary electricity connection during construction phase and operating DG sets only during power failure • Provision of wheel washing facility at exit point of site • Adequate air pollution control measures like provision of bag filters, stacks of adequate height should be provided with WMM, hot mix plant, batching plant etc. • Open burning of wood or any other material should be prohibited at site and all the workers should be made aware about the same • Zonation of EZ should be carried out such that high polluting industries should be located in downwind direction

Impact	Mitigation Measures During Construction Phase
Water Pollution and Water Conservation	• Minimizing the run-off from the site by construction of sediment basins for collection of storm run-off and re-using that water for curing purpose and wheel washing • Curing of structures to be done by spraying and during early morning and evening hours only to minimize the water requirement • Maintaining the flow of water sprinklers so as to avoid wastage of water • No debris should be thrown or disposed off in any water body like river, pond, canal etc. or ground water source like functional or abandoned well • Excavation should not be carried out during monsoon • Provision of temporary storm water drainage system during construction phase to drain the storm water and should be connected to nearest surface water body. • Excavated pits should be provided with garland drains to prevent entrance of water inside the pit. • Provision of oil and grease traps with the storm water drains draining the parking and fuel storage area. • Provision of septic tanks and soak pits at the site and labour camps for disposal of sewage generated by construction labour. • Waste generated by construction camps should be disposed off regularly at the identified site for debris disposal. • Provision of cross drainage structures like balancing for maintaining the drainage pattern. • Stone and bricks should be purchased only from licensed vendors. • Keeping provision of land for development of CSTP and CETP in future. • Provision of rain water harvesting should be made at EZ site and rain water shall be used during operation phase to minimize fresh water requirement. • Rain water harvesting tank should be developed at the site so as that water can be used for meeting daily water demand • Tank alarms should be installed so as to prevent overflow of water. • Leakage detection should be carried out quarterly so as to detect any leakages in the water supply pipeline. • Provision of land for CSTP an CETP should be made at least 30m away from the water pipeline, water storage tank and rain water storage tank.

Impact	Mitigation Measures During Construction Phase
Soil Quality	• Top soil, if excavated from the project site should be stored in covered condition and should be used later for landscaping purpose • Storage of raw materials, debris and fuel on paved surfaces • Training the workers to handle the material so as to minimize spillage of material on soil • Provision of cross drainage structures to prevent water logging and soil erosion • Stone pitching with grass turfing should be done for the high embankment close to water body • Disposal of construction debris, municipal waste from labour camps and hazardous waste from site should be disposed off at the identified site • Keeping provision of land for development of solid waste management facility within the EZ site • No open area should be left without the vegetation to protect the soil. • Mulching of soil should be done regularly to prevent direct exposure of soil to wind and water
Noise Pollution	• Construction vehicles, machinery and equipment used for construction purpose should meet the standards prescribed by DoE; • Upkeeping and regular maintenance of all the construction vehicles, machinery and equipment used for construction purpose; • Speed limits should be restricted for all construction vehicles and equipment; • Honking should be prohibited at the site; • Provision of acoustic enclosures, noise mufflers, silencers, etc. with the DG sets and any noise generating machinery; • Provision of temporary noise shield/barrier in areas where more noise will be generated.
Ecology	• Development of 10 m (minimum) thick green buffer all along the periphery of EZ; • Boundary should be constructed around the EZ site to prevent trespassing of the animals; • Native plant species requiring should be considered for plantation; • Timber should be purchased only from authorized vendors; • No water body should be filled outside the EZ site.

Impact	Mitigation Measures During Construction Phase
Socio-economy and Aesthetics	• All proposed air, water, noise and soil pollution control measures should be taken; • Provision of employment opportunity during construction phase to local people; • Provision of personal protective equipment to all the workers; • Job rotation should be practiced for workers exposed to high noise levels; • Site should be covered from all the site during construction phase; • Drinking water facility, adequate nos. of toilet, septic tank/soak pit, bathing facility, lighting should be provided in labour camps; • Storm water drainage system should also be provided in labour camps to prevent water ponding and breeding of mosquitoes; • LPG should be provided as fuel in the labour camps; • Provision of facility like guest house, community building, commercial area, ATM, Bank, hospital and parking should be made within the EZ site.
Disaster and Risk Management	• Provision of first aid kit and first aid room and well trained first aid fractioned at the site all the time • Ambulance facility should be provided at the site • Tie-ups with local hospital should be made to handily emergency case, if any • Availability of safety officers and supervisors at all the time on the site • Workers should be given training for handling construction vehicles, equipment and handling emergency situations like fire, floods, earthquake and cyclone • Cautionary signage should be provided in the areas associated with risks like storage of explosives, fuels, heavy construction material etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safety measures • Emergency handling cell and room should be developed at the site and should be headed by project and safety manager • Contact no. of nearest fire-station and hospitals should be displayed within the emergency handling room

Table 10-4: Mitigation Measures Suggested for Individual Plot Owners

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Operation Phase
Air Pollution	• Sprinkling of water during construction phase on all unpaved roads, site and haul roads	• Installation of air pollution control devices like Electro-static precipitator, bag filters, separators, cyclones, multi-level

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Operation Phase
	• Avoiding excess pilling of raw material and debris at site • Storage and transportation of raw material and debris in covered conditions • No trees should be fell down without permission of BEZA and forest department • Regular cleaning of site • Provision of adequate parking space at site so as to prevent idling of vehicles during construction phase • Upkeeping and maintenance of all the construction vehicles, machinery and equipment used for construction purpose • Guiding signage should be provided at the site for vehicles entering the site to minimize the movement of vehicle within the site • Timings of the construction material vehicles should be fixed and should be during non-peak hours to prevent traffic congestion and traffic jams • Construction vehicles should follow the speed limits set up for EZ zone • Usage of low energy intensive building material like fly ash mix cement and bricks • Usage of low Sulphur diesel for running DG sets, construction vehicles and equipment. • Obtaining temporary electricity connection during construction phase from BEZA and operating DG sets only during power failure • Provision of wheel washing facility at exit point of site • Open burning of wood or any other material should be prohibited at site and all the workers should be made aware about the same	condensers and evaporators, scrubbers, quenchers, stacks of height as per DoE norms • Disposal of the waste material at the designated site for waste disposal in covered condition • All the roads within the plot should be paved and water sprinkling should be practiced to minimize dust generation. • Adequate stack height should be provided for dispersion of the emissions • Chemicals having potential to release VOCs should be stored, handled and used in closed system • Quarterly monitoring should be carried out for testing ambient air quality • Development of thick green belt of 10 m all along the industrial plot periphery

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Operation Phase
Water Pollution and water Conservation	• Minimizing the run-off from the site by construction of temporary storm water drainage, sediment basins for collection of storm run-off and reusing that water for curing purpose and wheel washing • Curing of structures to be done by spraying and during early morning and evening hours only to minimize the water requirement • Maintaining the flow of water sprinklers so as to avoid wastage of water and ponding of water • No debris should be thrown or disposed off in any water body like river, pond, canal etc. or ground water source like functional or abandoned well • Excavation should not be carried out during monsoon • Excavated pits should be provided with garland drains to prevent entrance of water inside the pit • Provision of septic tanks and soak pits at the site for disposal of sewage generated by construction labour • Waste generated during construction should be disposed off regularly at the identified site for debris disposal • Stone and bricks should be purchased only from licensed vendors	• Provision of ETP and STP for treatment of sewage and industrial effluent • Provision of dual plumbing system so as treated water from STP can be re-used for flushing, horticulture and cooling purpose • Separation of the effluent streams depending on the nature of pollutants • Monitoring the quality of sewage, treated water, drinking water quality and ground water quality regularly • Tank alarms should be installed so as to prevent idle running of pumps • Provision of storm water drainage system at site and it should be connected to rain water harvesting system. Storm water drains should also be connected to the nearest surface water body to drain excess flow, if any • Provision of rain water harvesting system so that water can be collected and used to meet daily water demand. • Provision of oil and grease traps with the storm water drains draining the parking and fuel storage area • Leakage detection system should be provided and the water supply system should be regularly inspected to detect leakages • Distance of STP/ETP and RWH pits should be minimum 30 m to prevent contamination of collected storm water • Untreated effluent should not be discharged into surface water body or any abandoned ground water source or to ground. • No hazardous waste, municipal waste, industrial waste should be disposed off in the water bodies or in ground • Leachates, if any or untreated sewage should be stored only in lined ponds to prevent contamination of ground water
Soil Quality	• Top soil, if excavated from the project site should be stored in	• All industries should use best technologies for optimal

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Operation Phase
	covered condition and should be used later for landscaping purpose • Storage of raw materials, debris and fuel on paved surfaces • Training the workers to handle the material so as to minimize spillage of material on soil • Disposal of construction debris, municipal waste and hazardous waste at designated sites	utilization of the raw material and re-use and recycling of waste material in the process to reduce waste generation as well as raw material demand for the project. • All industries should be responsible for management of the solid and hazardous waste generated from their plots. Industries should be liable to pay penalty in case of non-compliance of conditions laid down by DoE • It should be mandatory for all industries to provide storages for different category waste, its processing and safe disposal. • Options for composting of compostable waste, segregation and selling recyclable waste should be opted • Waste storage area should be paved surfaces and covered • No open area should be left without the vegetation to protect the soil.
Noise Pollution	• Construction vehicles, machinery and equipment used for • construction purpose should meet the standards prescribed by DoE • Upkeeping and regular maintenance of all the construction vehicles, machinery and equipment used for construction purpose • Speed limits should be restricted for all construction vehicles and equipment • Honking should be prohibited at the site • Provision of acoustic enclosures, noise mufflers, silencers etc. with the DG sets and any noise generating machinery • Provision of temporary noise shield/barrier in areas where more noise will be generated	• Usage of machineries of modern make and adoption of latest available technology which compiles to noise levels standards laid by DoE • Provision of personal protective equipment to workers exposed to noisy operations. Audiometric tests should be carried out for workers exposed to high noise levels. Job rotation should be practiced to prevent continual exposure. • Noise levels in industries should be monitored regularly using noise meters. • Minimal usage of horns within industrial plot. Specification of speed limits on roads made by BEZA should be followed. Provision of speed breakers at regular intervals to regulate speed of vehicles • Regular maintenance of vehicles and construction machinery involved in industrial operation • Noisy operation should be taken up in covered conditions so

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Operation Phase
		that no disturbance due to noise is caused • Thick green belt should be developed within each industrial plot that will act as noise barrier.
Ecology	• Only identified trees should be fell down after obtaining permission from forest department • Compensatory plantation should be carried out in ratio of min 1:2 under guidance of forest department • Native plant species requiring should be considered for plantation • Timber should be purchased only from authorized vendors	• Green belt of 10 m thickness should be developed all along the periphery of the industrial plot • Native plant species requiring should be considered for plantation
Socio-economy and aesthetics	• All proposed air, water, noise and soil pollution control measures should be taken • Provision of employment opportunity during construction phase to local people • Provision of personal protective equipment to all the workers • Job rotation should be practiced for workers exposed to high noise levels • Site should be covered from all the site during construction phase • Drinking water facility, adequate nos. of toilet, septic tank/soak pit, bathing facility, lighting should be provided for construction labour • Storm water drainage system should also be provided at site to prevent • water ponding and breeding of mosquitoes	• Social welfare activities shall be carried out by each industrial owners in nearby areas of EZ like development of cattle sheds, arranging trainings for villagers for best agriculture practices, providing skill generation training to locals so as they can be employed in industries • Providing employment to local people preferably • Adoption of all proposed air, noise, soil and water quality measures • Rain water harvesting should be carried out in EZ so as to minimize the water extraction from River.
Disaster and Risk Management	• Provision of first aid kit and first aid room and well trained first aid practitioner at the site all the time	• Provision of first aid kits at the site • Tie-ups with local hospital should be made to handling

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Operation Phase
	• Ambulance facility should be provided at the site • Tie-ups with local hospital should be made to handling emergency case, if any • Availability of safety officers and supervisors at all the time on the site • Workers should be given training for handling construction vehicles, equipment and handling emergency situations like fire, floods, earthquake and cyclone • Cautionary signage should be provided in the areas associated with risks like storage of explosives, fuels, heavy construction material etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safety measures • Emergency handling cell and room should be developed at the site and should be headed by project and safety manager • Contact no. of nearest fire-station and hospitals should be displayed within the emergency handling room	emergency case, if any • Regular medical check-ups of the employees • Training should be given to workers for handling the equipment and managing emergency situations • Material safety data sheets of chemicals to be used should be displayed on local languages at work station • Provision of personal protective equipment to the workers as per requirement • Cautionary signage should be provided in the areas associated with risks like storage of chemicals, explosives, fuels etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safety measures

10.1.2 Social Mitigation Plan

In order to minimize adverse impacts during different phases of project lifecycles, mitigation measures and responsibilities for its implementation during pre-construction, construction, operation phases are given below:

Table 10-5: Social Mitigation Plan

Item	Expected Social Impacts	Proposed Mitigation Measures and Management	Implementing Organization	Supervision Responsibility	Mitigation Cost Source
Involuntary Resettlement	▪ Total 37.93 acre of private land will be acquired for Economic Zone	▪ Proper compensation should be ensured to legal owner(s) according to the ARIPA, 2017 ▪ Affected people should get proper	Appointed Contactor	District Commissioner (DC) Office/ BEZA	DC Office

Item	Expected Social Impacts	Proposed Mitigation Measures and Management	Implementing Organization	Supervision Responsibility	Mitigation Cost Source
		compensation in terms of grants/allowances for structure and tress as per ARIPA, 2017 ▪ The authority should be careful and take necessary measures that every displaced people can be resettled as per ARIPA, 2017 in time			
Vulnerable Group	▪ Vulnerable project affected people who are handicapped, physically disabled, earns less than 10000 per month, female-headed families will be identified during conducting LRP.	▪ Additional allowance of 30% over and above the entitlements; ▪ Provide soft skill jobs (physically benign) and employment opportunities (such as cleaning, office assistant, computer operator) for vulnerable that may increase their participation and support them with income and livelihood. ▪ Organize women in self-help group to operate canteens in the EZ; ▪ Ensure non-exploitation of women in terms of equal wage, opportunity, participation in decision making etc.; ▪ Implementation of social welfare programs targeted at vulnerable groups including old aged, physically handicapped etc. under Corporate Social Responsibility (CSR) programs and activities; ▪ Create awareness among the workers, staff and women about the exploitation and sexual harassment at	Appointed Contactor	DC Office/BEZA	DC Office

Item	Expected Social Impacts	Proposed Mitigation Measures and Management	Implementing Organization	Supervision Responsibility	Mitigation Cost Source
		work place.			
Livelihood	▪ PAPs who earn working in the paddy fields might lose their income source. ▪ Sharecroppers in the project area also might lose their income source. ▪ Expansion of industrialization will generate additional employment opportunities and associated facilities in future for the local people. ▪ During the conduction of Livelihood Restoration Plan (LRP), the number of affected households, and others will be identified and detailed information will be provided.	▪ Income loss can be mitigated by providing alternative job opportunities for PAPs; ▪ Give proper compensation to farmers and sharecroppers as per ARIPA, 2017 ▪ All direct income loss must be adequately compensated within the LRP; ▪ Construction activity will provide employment to huge nos. of people including skilled, unskilled and non-skilled workers. This will improve the quality of life of people; ▪ Provision of proper training to all workers for handling the construction equipment; ▪ Affected ethnic community should get priority in recruitment. ▪ An appropriate Livelihood Restoration Plan (LRP) may be prepared to enumerate affected persons and improve their livelihood options.	Appointed Contactor	DC Office/BEZA	DC Office
Existing social infrastructures and services and social institutions	Impact to Relocated PAHs of the Project ▪ Accessibility of PAHs to social Infrastructure/service and social institutions would be affected more or less due to the relocation. Impact to Local People in the local	▪ The proposed relocation site will be arranged with basic social infrastructures and institutions as a part of the assistance by the project ▪ The traffic volume should be controlled by the construction contractor to avoid serious traffic	Appointed Contactor	DC Office/BEZA	Contractor Cost

Item	Expected Social Impacts	Proposed Mitigation Measures and Management	Implementing Organization	Supervision Responsibility	Mitigation Cost Source
	Community of the project area ▪ Accessibility of social infrastructure/service and social institutions will be affected due to the increase of construction vehicles.	congestion.			
Local Conflict of Interest	▪ Landholders do not have legal entitlements, and some have incomplete or no legal documents although they purchased or occupied land. Thus, people "without documents" are not eligible to get compensation (according to Law) but will be affected, which might lead to local agitation/conflict.	▪ Ensure the alternative livelihood for project affected people using/living in the khas land; ▪ Give priority to the affected people by engaging them in different project activities based on their skill; ▪ Arrange capacity building training program;	Appointed Contactor	DC Office/BEZA	DC Office
Landscape	▪ '420 acres of land will be cleared and altered to industrial area as the part of Economic Zone development. ▪ Although semi- urbanization of landscape in and around Kushtia EZ is inevitable.	▪ All construction activities for administration building, land filling and boundary wall will be carried out within economic zone site and will not cause any impact on landscape and scenic beauty. ▪ A green buffer of 3.5 m only one row of trees will be developed all around the project site, which will enhance the scenic beauty of the area. ▪ Green area will be established in each plot and public space; ▪ The landscape of the project area is	Appointed Contactor	BEZA	Contactor Cost

Item	Expected Social Impacts	Proposed Mitigation Measures and Management	Implementing Organization	Supervision Responsibility	Mitigation Cost Source
		expected to be well-maintained semi-urbanized area.			
Labor Influx	▪ Risk of Social conflict between labors and community people; ▪ Increased risk of illicit behavior and crime; ▪ Influx of additional population and burden on public services; ▪ Gender based violence, child labor and school dropout; ▪ Local inflation of price and increased pressure on accommodation and rent; ▪ Increased of traffic and related accident. ▪ Risks of infectious diseases due to influx of workers of the industries and the semi-urbanization of the project area and its surroundings area.	▪ Prepare and Implement Labor Influx Management Plan by Contractor– that shall be prepared prior to commencement of civil works. ▪ Behavioral change communication in labor management through Information, Education and Communication (IEC) process as part of Labor Management Plan.	Appointed Contactor	BEZA	Contactor Cost
Children's Right	▪ Impact on educational opportunity on school children in PAHs of the Project; ▪ Impact on educational opportunity of school children in local community; ▪ Impact of the Project on increase of child labor	▪ Support of sending children to school; ▪ Help the parents with hunting for a job, including the one at the construction site; ▪ Mediation for micro credit loan; ▪ Introduce them to assistance organizations such as NGO and so forth.	Appointed Contactor	BEZA	Contactor Cost

10.1.3 Green Belt Development

Development of a greenbelt/tree plantation along the boundary and internal roads will be beneficial. The tree plantation will have the following objectives:

(1) Restoration of green cover lost due to tree felling and shrub cutting during land clearance activities;
(2) Restoration/preservation of genetic diversity;
(3) Attenuation of noise pollution from EZ to surroundings;
(4) Creation of aesthetic environment.

New trees can be planted to make up the gaps devoid of trees. Greenbelts have to be made across the periphery, vertical and horizontal stretches. The selection of trees and plants for greenbelt/tree plantation should be those which could grow in the existing agro climatic conditions. They should be able to survive in the local soil conditions.

Based on the above considerations and also due to loss of trees on the site, the plant species should be native (especially those which are cut from the site and for road widening) in nature. The selected plant species would need minimum level of maintenance including fertilization and other soil amelioration.

Apart from trees, the shrubs removed from the site, and other herbaceous species may also be planted in between the trees along the boundary wall. This will act as green cover, prevent soil erosion by increasing the binding capacity of the soil, and importantly act as noise barrier together with trees.

Tree plantation also need to be taken up along the roads such as approach road to the EZ, internal road reaching administration building, on the vacant land of administration building, etc.

10.1.4 Corporate Social and Environmental Responsibility

The concept of corporate social responsibility is based on the idea that not only public policy but companies, too, should take responsibility for social issues. In more recent approaches, CSER is seen as a concept in which companies voluntarily integrate social and environmental concerns into their business operations and into the interaction with their stakeholders. The idea of being a socially responsible company means doing more than comply with the law when investing in human resources and the environment.

Under the CSER framework, BEZA has proposed action plans for the benefit and welfare of the society as well as environmental sustainability of the project which is given below:

Proposed Action Plans

At policy level, the CSER trust needs to allocate a considerable resource on alternative livelihoods. The CSER trust guidelines of BEZA if any shall clearly define project role and participation in the alternative livelihood implementation plan. The project may contribute to the alternate livelihoods plan under their CSER networks.

The CSER trust shall engage an external agency to conduct a market study to identify livelihood options. A phased alternative livelihood plan along with financial feasibility shall be developed for all the affected villages. If required, an external agency shall be contacted to implement the livelihood plan.

(1) A monitoring committee shall be formulated to ensure proper implementation and documentation of the alternative livelihood plan.
(2) A sustainable environment friendly green belt may be proposed under the CSER fund throughout the periphery of the project area and all the unpaved open spaces if present.

Environmental and Social Management Plans to be Prepared

This Section of the ESIA report provides recommendations for environmental and social management measures based on the available information at this stage of the project. However, it is planned that at a later stage, namely detailed design phase, KEZ will prepare detailed management plans and procedures to address potential social and environmental impacts identified within this ESIA and ensure implementation of the measures contained therein. Recommended management plans and/or procedures are presented in the following Table 10-6. These individual plans or procedures may be stand-alone documents or combined into a larger environmental management plan addressing a range of environmental aspects, according to project needs. They may be prepared by or in collaboration with project contractors. Each management plan will document applicable legal requirements (if existing), criteria, standards, and mitigation and management commitments for the project. Monitoring and reporting requirements will be included to (1) increase baseline information, (2) confirm predicted impacts and (3) identify unforeseen impacts, thus enabling continuous improvement and adaptive management where required.

Table 10-6: Recommended management plan

Plan	Content/Objectives
Emergency Response Plan	Includes safe working procedures for staff, designation of safety zones and measures to protect sensitive receptors.
Waste Management Plan	Provides detailed descriptions and quantities of wastes expected to be produced by the project, direct waste flows and outline project waste collection and disposal frequencies.
Traffic Management Plan	Includes a baseline transport study and impact assessment, expected traffic movements throughout construction and operations, assessment of optimum traffic routing, recommendations for upgrading local infrastructure, recommendations for road safety education, and other procedures to mitigate and manage traffic impacts.
Noise, Dust and Light Management Plan	Includes an inventory of all noise, dust, particulate matter and light generating activities, and details control methods to be used during construction and operations.
Chemicals and Hazardous Materials Handling Plan	Outlines procedures for storage and use of chemicals and hazardous materials, including access and security, provision of PPE and distribution of MSDS information.
Decommissioning Plan	Outlines procedures for decommissioning project facilities.

10.2 Enhancement Plan

A major emergency in any situation is one, which has the potential to cause serious injury or loss of life, which may cause extensive damage to the structure in vicinity and environment

and could result in serious disruption to normal operation both inside and outside the industry premises. Depending on the magnitude the emergency, service of the outside agencies may also be damaged.

The management plan will be circulated to all concerned member of emergency team. It is essential that all concerned personnel familiar themselves with the overall on- site emergency plan and their respective roles and responsibilities during emergency. Mock drill is an essential tool in a state of perpetual preparedness at all times to meet any emergency. The plan covers information regarding the properties of the industry, type of disasters and disaster/accident prone zones. Structure of the Emergency Management plan is following below:

(1) Mock drills
(2) Noticing the accidents
(3) Informing declarer of emergency
(4) Declaration of emergency (Public information and warning)
(5) Evacuation of Personnel
(6) Functions of declarer
(7) Interaction with outside agencies
(8) All Clear Signal
(9) Mutual aid

The primary purpose of this emergency plan is to control and contain the incident and so to prevent it from spreading. To cover eventuality in the plan and the successful handling of the emergency will depend on appropriate action and decision being taken on the spot.

10.3 Contingency Plan

A contingency plan is an essential guideline for undertaking the immediate need-based response in a well-designed, organized and coordinated manner for facing any adverse incident during an emergency. Contingency plan will guide to identify the victims at risk (who, what extent, when), responsible authority and the materialistic and natural disruptions (what extent). Nature of emergency and hazardous situations may be of any or all of the following categories:

a. Emergency

   (1) Fire, burn injury
   (2) Accidental injury
   (3) Electric shock
   (4) Explosion
   (5) Any Medical emergency

b. Natural Disasters

   (1) Flood
   (2) Earthquake
   (3) Storm/tornados/cyclone

c. Other External Factors: manmade disaster, sabotage, war etc.

The objectives of having an Emergency Response Plan (ERP) are to:

(1) Guide the authority/emergency response team (ERT) in determining the appropriate response to emergencies;
(2) Provide respondents/ERT with planned strategy and recognized measures;
(3) Guide to notify the appropriate ERT personnel and regulatory authorities;
(4) Manage public and media relations;
(5) Notify the next-to-kin of accident victims;
(6) Promote inter-section communications to ensure an "EZ-wide" coordinated emergency response to minimize the effects of troublesome events;
(7) Reducing recovery time and costs;
(8) Respond to immediate requirements to safeguard the environment and the community.

Generally following steps of responses can be followed to combat any emergency:

Step-1: Risk determination and immediate measures

(1) Identification of potential hazards associated with the emergency episode due to the natural events or regular activities.
(2) Taking appropriate measures by the ERT/authority for determining the type, quality, extent of involvement.

Step-2: Local investigation:

Determination of the source/reason of the event resulting to the emergency and prevent further losses.

Step-3: Detail assessment:

Conduct an assessment of the incident site for any further information on hazards and taking necessary actions for remedies.

Step-4: Rehabilitation:

Initiate restoration/ rehabilitation measures.

Step-5: Reporting:

Reporting of the occurrence of the incidence with all the details including the measures undertaken to the appropriate authority is taking initiative for further steps including financial assistance etc. to the appropriate authority.

Step-6: Risk Communication:

Taking steps for mass communication with addressing public and media regarding concerns and issues including human lives, property and the environment and responses to resolute the stress of the community and the country. Functioning of following units can be helpful to combat any emergency in the industrial area. Emergency Response Cell with an:

(1) Well trained emergency response team (ERT)
(2) Emergency preparedness plan
(3) Provision of periodic drill of emergency rescue operations; *e.g.* Firefighting services;
(4) Emergency medical services
(5) Provision of emergency transfer of patients

Health, Safety and Safe Work Environment

In accordance with the requirement of DoE, BEZ must have a plan to take adequate measures against accidents and to meet the emergency. A contingency plan should be in place to deal with any emergency or natural calamities. There should be trained emergency response teams, specific contingency plans and incidence specific equipment packages in place to deal with these types of emergencies. In case of an emergency incident occur, immediate action must be taken to mitigate the impacts. In order to minimize the possibility of injury to the responders and others it is important that emergency responders follow the steps of emergency response plan to avoid missing any events.

Work plays a central role in people's lives, since most workers spend at least eight hours a day in the workplace, whether it is on a plantation, in an office, factory, etc. Therefore, work environments should be safe and healthy. Yet this is not the case for many workers. Every day workers all over the world are faced with a multitude of health hazards, such as:

(1) Dusts
(2) Gases
(3) Noise
(4) Vibration
(5) Extreme temperatures.

Unfortunately, some employers assume little responsibility for the protection of workers' health and safety. In fact, some employers do not even know that they have the moral and often legal responsibility to protect workers. As a result of the hazards and a lack of attention given to health and safety, work-related accidents and diseases are common in all parts of the world.

Costs of Occupational Injury/Disease

Work-related accidents or diseases are very costly and can have many serious direct and indirect effects on the lives of workers and their families. For workers some of the direct costs of an injury or illness are:

(1) The pain and suffering of the injury or illness
(2) The loss of income
(3) The possible loss of a job
(4) Health-care costs.

It has been estimated that the indirect costs of an accident or illness can be four to ten times greater than the direct costs, or even more. An occupational illness or accident can have so many indirect costs to workers that it is often difficult to measure them. One of the most obvious indirect costs is the human suffering caused to workers' families, which cannot be compensated with money.

The costs to employers of occupational accidents or illnesses are also estimated to be enormous. For a small business, the cost of even one accident can be a financial disaster. For employers, some of the direct costs are:

(1) Payment for work not performed;
(2) Medical and compensation payments;
(3) Repair or replacement of damaged machinery and equipment;
(4) Reduction or a temporary halt in production;
(5) Increased training expenses and administration costs;

(6) Possible reduction in the quality of work;
(7) Negative effect on other workers.

Some of the indirect costs for employers are:

(8) The injured/ill worker has to be replaced;
(9) A new worker has to be trained and given time to adjust;
(10) It takes time before the new worker is producing at the rate of the original worker;
(11) Time must be devoted to obligatory investigations, to the writing of reports and filling out of forms;
(12) Accidents often arouse the concern of fellow workers and influence labor relations in a negative way;
(13) Poor health and safety conditions in the workplace can also result in poor public relations.

Overall, the costs of most work-related accidents or illnesses are very high to the workers and their families and to the employers as well. On a national scale, the estimated costs of occupational accidents and illnesses can be as high as three to four per cent of a country's gross national product. In reality, no one really knows the total costs of work-related accidents or diseases because there are a multitude of indirect costs which are difficult to measure beside the more obvious direct costs. BEZ will ensure health, safety and safe work environment for the officials and workers.

10.4 Compensation Plan

A standard compensation plan has to be developed for securing the legal demand of the individuals or households. It essentially needs to provide necessary compensation as per the law of land. There will be households/individuals who are to be resettled from Category A: 382.07 acres of land (as per Table 4-3 under Section 4.5) which is already under custody of BEZA from Bangladesh Railway and Category B: private land 47.54 acres (37.93 acres as part of the EZ and 9.61 acres for off-site utility networks and approach roads as per Table 10-7).

For Category A, having no compensation provisions as per ARIPA, BEZA has decided to pay resettlement allowance of BDT 50,000 each household. There are 200 HHs to be resettled under Category A.

For Category B, ARIPA shall apply and the compensation and other additional benefits will be provided to the households/individuals, who are to be resettled. The rates are estimated as following:

Table 10-7: Compensations for Land

			Items	Width	Length	Area		Unit Rate (2022) Tk/unit
1			**Category A or land from BR**					
1	.	1	Compensation for Resettlement from Land under BEZA's Custody				200 HH	t 50,000 each
2			**Category B or private land**			41.96 acre		119,427 t/dec.
2	.	1	Land (private) acquisition for the zone (at Char Mokarimpur mouza)			37.93		120,000

				Items	Width	Length	Area		Unit Rate (2022) Tk/unit
							acre		t/dec.
2	.	2		Land of Bangladesh Railway Transferred for the Zone					
				(at token price/nil)			382.07 acre		-
2	.	3		Land acquisition for gas pipeline					
				(not required as it will follow existing road network)			Nil		
2	.	4		Land acquisition for surface water intake pipeline					
				(Plots 37, 46, 48, 49, 50, 51, 55, 61, 62, 194 of Char Ruppur mouza from river bank upto EZ boundary)	21.75 m	407 m	2.19 acre		10,020 t/dec.
2	.	5		Land acquisition for Drainage Discharge Canal					
				(Plots 32, 33, 35, 38, 39, 40, 47 of Arizishara mouza from EZ boundary upto the river)	22 m	339 m	1.84 acre		9,150 t/dec.
2	.	6		Land Acquisition for EZ Approach Road 1	45 m	315 m	3.50 acre		14,841 t/dec.
				(Plot no 320 of Char Mokarimpur)					
2	.	7		Land Acquisition for EZ Approach Road 2			2.08 acre		9,150 t/dec.
				EZ Approach Road 2	30 m	438 m			
				Plot no 12, 16, 17, 20, 31 of Charrupur. (1.17 acres of plot 21 is already acquired 3.25 - 1.17 = 2.08 Acres)					
2	.	8		Stamp duty and registration cost (@7.5% of land rate)					
3				**Resettlement (Category B Land)**					
3	.	1		Compensation for Structures (private land)					
3	.	1	. 1	Katcha			0 sft		
3	.	1	. 2	Semi Pucca			12,224 sft		1254 t/sft
3	.	1	. 3	Pucca			3,768 sft		2611 t/sft
3	.	1	. 4	Toilet (Water sealed sanitary)				4	t 85,675 each
3	.	1	. 5	Toilet (non water sealed sanitary)				10	t 44,850 each
3	.	1	. 6	Toilet (Non sanitary)					
3	.	1	. 7	Tubewell				12	t 34,500 each
3	.	3		Compensation for crops (on private land to be acquired)			24.66 dcl		6,400 t/dcl
3	.	4		Compensation for tree (on private land to be acquired)				1,026	t 5,618 each

Workers who develop any disease/injury during construction or operational phase of the proposed project should be treated accordingly with ensuring necessary compensation by the responsible authority.

10.5 Monitoring Plan

The main purpose of a monitoring plan for the potential environmental parameters during the construction and operation phases in this project is:

(1) To provide a standard guideline for comparing the baseline environmental conditions (data observed/collected during the study period) and other factors with that of the construction and operational phases.
(2) To evaluate the effectiveness of the mitigation measures for preservation of the natural environment.
(3) To detect any disruption of environment according to national standards.

Several environmental components can be affected during the construction and operation of the project. Following plan has been formulated for monitoring and evaluation of environmental components with potential risk of disruption.

Table 10-8: Monitoring plan for economic zone

Category	Issues	Location	Frequency	Executing Agency	Enforcement Agency
Pre-construction and construction phase					
Air Quality	NOx, SOx, CO, CO_2, $PM_{2.5}$, PM_{10} etc.	8 points in the construction site	Quarterly	Contractor	KEZ
Water Quality	Water, temperature, pH, SS, TDS, EC, DO, BOD_5, COD, Total coliforms, Total nitrogen, Total Phosphorus, Chromium, As, Fe, other metals etc.	Outflow of construction (at least 3 sampling points/mixing point. Well near the construction site (1 point)	Quarterly	Contractor	KEZ
Wastes	Amount and kind of solid wastes.	Construction site	Quarterly	Contractor	KEZ
Noise and Vibration	Noise and vibration level, Traffic count	Preservation area such as residence around the proposed construction site (at least 1 point)	Once (24 hours)/3 months	Contractor	KEZ
Ecosystem	Species number	1 point in the construction area	Twice a year in dry and rainy seasons	Contractor	KEZ
Hydrology	Groundwater level, Ground elevation level, consumption of groundwater amount	Well near the construction site	Quarterly	Contractor	KEZ

Category	Issues	Location	Frequency	Executing Agency	Enforcement Agency
Socio-economic Condition	The implementation status for CSR activities such as community support program	Around project Site	Annually	Contractor	KEZ
Risk of Infectious Disease such as AIDS/HIV	Awareness of infectious diseases	Construction site	Monthly	Contractor	KEZ
Occupational Health and Safety	Record of accidents and infectious diseases	Construction site	Monthly	Contractor	KEZ
Community Health and Safety	Record of accidents and infectious diseases related to the community	Around construction site	Monthly	Contractor	KEZ
Operation phase					
Air Quality	NO_X, SO_X, CO, $PM_{2.5}$, PM_{10}, VOCs, HAPs etc.	Representative location inside the project area	1 week each in the dry and rainy seasons (first 3 years after starting of the operation stage)	Individual industries	KEZ /BEZA
Water Quality	Water temperature, pH, SS, DO, BOD_5, COD, color, odor, Total Nitrogen, Total Phosphorus, Sulphide, Chromium, Arsenic, Copper, Mercury, Cadmium, Lead, and Nickel etc.	At least 3 sampling points/mixing point: discharge water, upstream water, and downstream water)	Every month: Water temperature, pH, SS, DO, BOD_5, COD, color and odor, Every 3 months: all parameters	Individual industries	KEZ /BEZA
Waste	Amount of hazardous and non-hazardous wastes in the project site.	Project site	Bi-annually (Submission of the environmental report by the tenants)	Individual industries	KEZ /BEZA
Soil Contamination	Status of control of solid and liquid waste which causes	Project site	Bi-annually (Submission of the environmental	Individual industries	KEZ /BEZA

Category	Issues	Location	Frequency	Executing Agency	Enforcement Agency
	soil contamination.		report by the tenants)		
Noise and Vibration	Source noise emissions (Noise level monitoring in db (A) near noise generating equipment, *e.g.* Pumps, flare etc.	Project site	Quarterly	Individual industries	KEZ /BEZA
Odor	Offensive odor control by the proponent	Project site	Bi-annually (Submission of the environmental report by tenants)	Individual industries	KEZ /BEZA
Ecosystem	Species number	1 point in the Construction area	Bi-annually in dry and rainy seasons	Individual industries	KEZ /BEZA
Socio-economic Condition	The implementation status for CSER activities such as community support program.	Around Project Site	Annually	Individual industries	KEZ /BEZA
Risks for Infectious Disease such as AIDS/HIV	Status of measures against infectious diseases	Project Site	Twice/year (Submission of the environmental report by the tenants)	Individual industries	KEZ /BEZA
Occupational Health and Safety	Record of accidents and infectious diseases	Work sites and offices	Bi-annually (Submission of the environmental report by the tenants)	Individual industries	KEZ /BEZA
Community Health and Safety	Record of accidents and infectious diseases related to the community	Around the Project site	Biannually (Submission of the environmental report by the tenants)	Individual industries	KEZ /BEZA
Usage of Chemicals	Record of the type and quantity of chemicals and implementation status of control measures through self-	Project Site	Biannually	Individual industries	KEZ /BEZA

Category	Issues	Location	Frequency	Executing Agency	Enforcement Agency
	inspection				

Note: *Air quality monitoring site in the construction area should be selected in consideration of keeping the same location during construction phase.

Water quality monitoring location should be selected at least eight points for one discharge point to confirm the impact of the effluent water from the project site to the existing canals/Rivers/water bodies

10.6 Monitoring Indicators

Due to establishment of the proposed project several environmental components have potential risk of disruption either during construction or operational phases that needs to be monitored for detection and management of any damage of the environment. Following are the plausible indicators with major significance that should be monitored and evaluated for the potential risks that could be beneficial for carrying out proper mitigation measures:

(1) Health and safety issues of workers
(2) Air quality
(3) Water quality (ground water and surface water)
(4) Noise level
(5) River water level
(6) Soil erosion
(7) Waste management

Existence of terrestrial and marine flora and fauna (compare to the baseline scenario).

10.7 Budget Plan for Environmental Management and Monitoring

This section describes the budget plans for the environmental management and environmental monitoring by the project proponent. Proponent will take necessary environmental mitigation measures and its expenses for the environmental management not only at the construction and operation phases but also at the closing, termination, and after termination phases in accordance with the ESIA study. The costs are approximate and need calibration at the time of detailed design and estimation stage.

Most of the mitigation measures such as, construction of CETP, waste management system, and implementation plan and trainings are already included in the project cost. Summary costs of monitoring including investments costs are presented in the Table below:

Table 10-9: Environmental Compliance Monitoring Cost

	Activities	Estimated Cost (million BDT)
During pre-construction and Construction (borne by EPC/Land Development Contractor) for three years		
(1)	Environmental quality (air, water, noise, soil) monitoring	8.5
(2)	Occupational health, safety, and sanitation	5.0
(3)	Ecosystem, Biodiversity, Fisheries Resources and Agricultural	5.0

	Activities	Estimated Cost (million BDT)
	Resources Monitoring.	
Subtotal		18.5
During 3 years of operation (to be included in O/M cost) for three years		
(1)	Environmental quality (air, water, effluent, noise, soil) monitoring	8.0
(2)	Waste Generation and Management	5.0
(3)	Ecosystem and biodiversity	5.0
(4)	Land and agriculture resources	5.0
(5)	Health, safety, and sanitation	5.0
(6)	Monitoring beyond compliance	5.0
Subtotal		33.0
Total Monitoring		**51.5**

Table 10-10: Investment Cost of Environmental Monitoring

	Activities	Estimated Cost (Million BDT)
(1)	Continuous Ambient Air Quality Monitoring Stations	22
(2)	Continuous Effluent Quality Monitoring Instrument	13
(3)	Micro Weather Station	3.5
(4)	Environmental Laboratory	35
	Estimated Total Cost	**73.5**

Table 10-11: Cost of Independent Monitor

	Activities	Estimated Cost (Million BDT)
	Independent Monitor for a six (6) years period including 3 years of operation (only fees and cost)	50

Note: Each individual industry inside the economic zone should carry out their environmental quality monitoring as per DoE regulations.

Table 10-12: Estimated annual cost for manpower EMMP

	Designation	Number	Cost BDT/mon	Cost BDT/yr
(1)	Environmental Specialist	1	1,00,000	13,00,000
(2)	Social Analyst	1	50,000	6,50,000
(3)	Occupational health specialist and a safety specialist	1	50,000	6,50,000
(4)	ETP In charge	1	50,000	6,50,000
(5)	ETP Operator	6	120,000	1,440,000
(6)	ETP Waste water assessment Lab Operator	2	40,000	910,000
(7)	Field-Surveyor	1	25,000	3,25,000
(8)	Cleaner for waste management	5	10,000	650,000
(9)	Support staff	2	10,000	2,60,000
Total				**61,85,000**

10.8 Institutional Arrangement

For ensuring effective implementation of ESMP and environmental and social monitoring the KEZ construction project and the KEZ management (during operation) must have special unit/department focusing on environmental management and compliance. Figure 10.2 and Figure 10.3 illustrates organogram for the proposed environmental management and compliance unit.

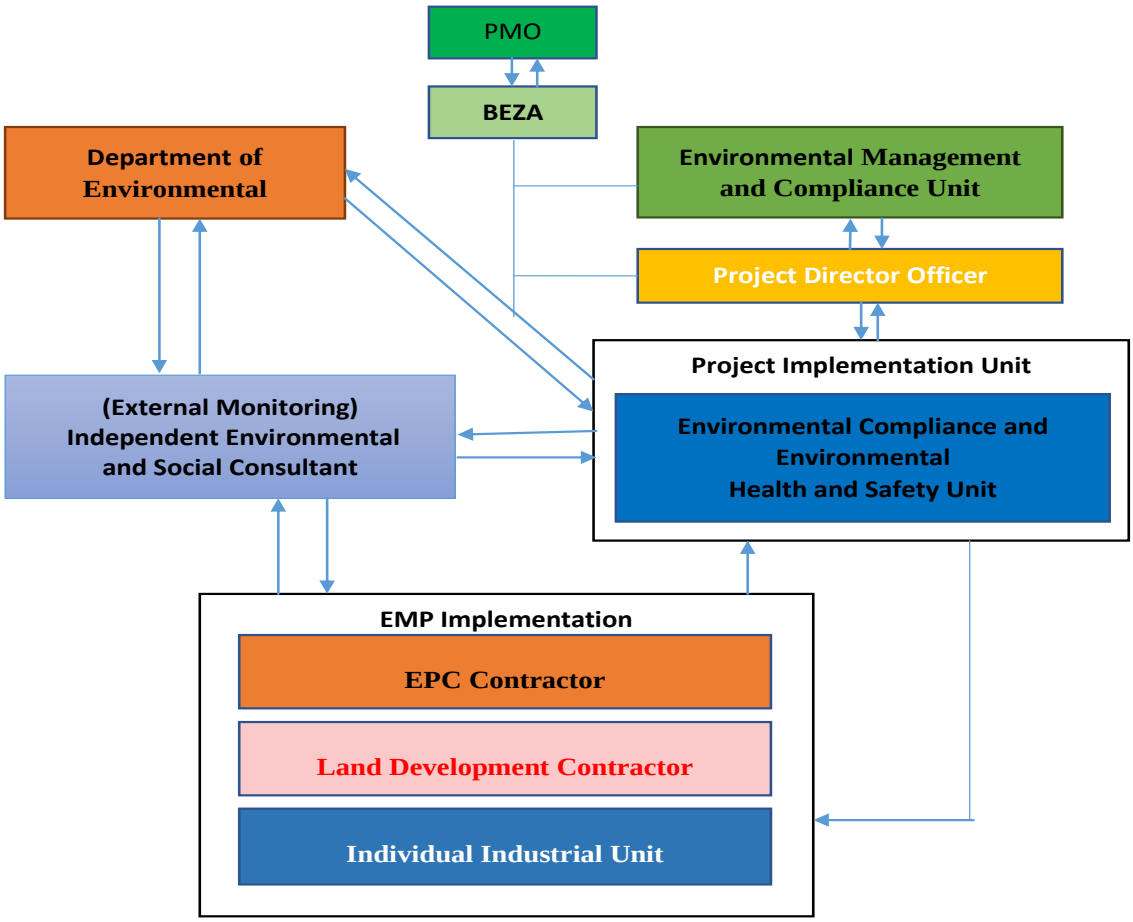


Figure 10.2: Institutional Setting for Environmental Compliance and EHS Unit

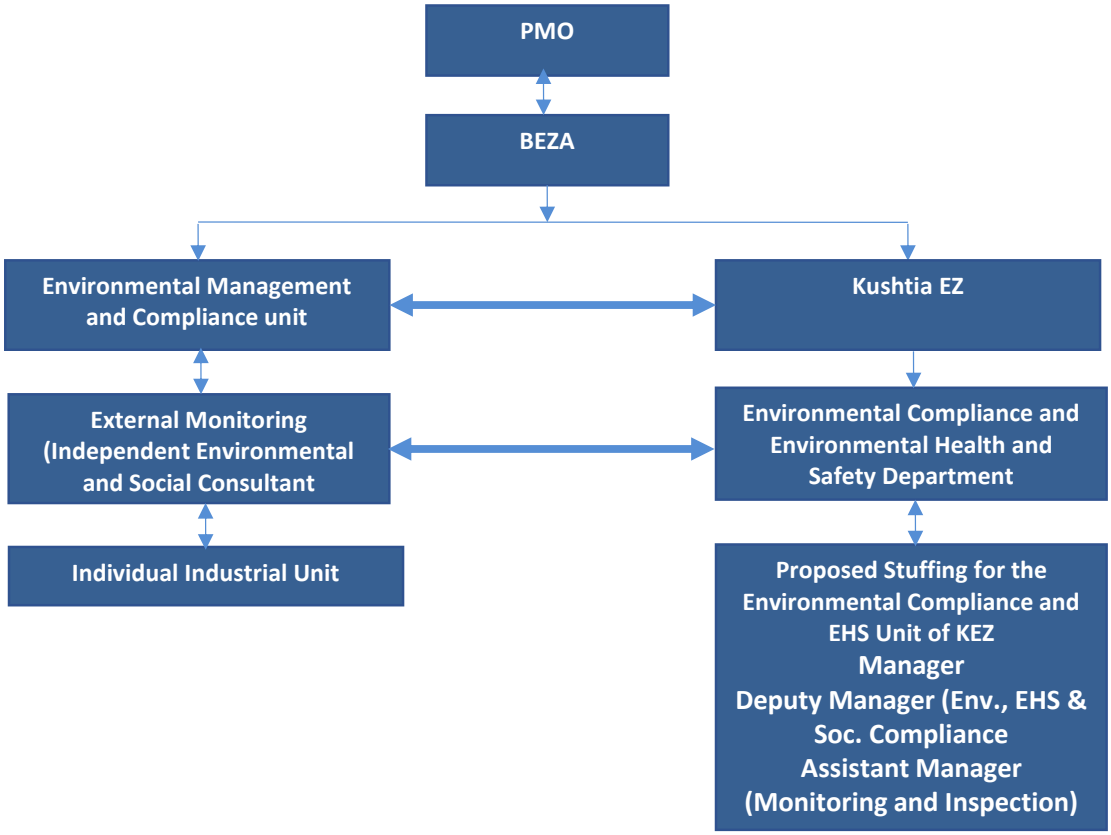


Figure 10.3: Institutional Setting for Environmental Compliance and EHS Unit

10.7.1 Guidelines on Environmental and Social Conditions in BOQ/ Contract Documents

The majority of environmental and social impacts arising from sub-projects, which stem from activities directly managed by contractors, will be addressed through direct mitigation efforts by those contractors. Hence, the central focus of the Project's strategy lies in ensuring that contractors effectively manage and mitigate impacts associated with their project activities. BEZA will incorporate standardized environmental and social clauses in the tender documentation and contract documents of Kushtia EZ, in order for potential bidders to be aware of environmental and social performance requirements that shall be expected from them, should be able to reflect that in their bids, and are required to implement the clauses for the duration of the contract. BEZA will enforce compliance by contractors with these clauses.

The health and safety procedure illustrated in the Labour Acts, WB Environmental and Health Safety Guidelines (EHSG) (General including Construction and Decommissioning) and IFC PS 2 will be referenced all activities under the Project implementation. BEZA is expected to carry out field visits and inspections of the construction of Kushtia EZ from time to time. However, the WBG's EHSG (General Guidelines and for Construction and Decommissioning) may not have sufficient details and specific requirements to deal with various occupational health and safety issues posed by the project, thus the BEZA/IA should put in place specific standards meeting.

Good International and Industry Practices (GIIP) in the bidding documents and contracts reflecting appropriate level of risk.

As a core contractual requirement, the contractor is required to ensure all documentation related to environmental and social management to be available for inspection at any time by the BEZA or BEZA appointed agents. The contractual arrangements with each project worker must be clearly defined in accordance with Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019. A full set of contractual requirements related to environmental and social risk and impact management will be provided in the Projects' Environmental and Social Impact Assessment. All environmental and social requirements shall be included in the bidding documents and contracts in addition to any additional clauses, which are contained, in the Projects environmental and social instruments.

Under no circumstances will BEZA, the Ministry, Contractors, suppliers or sub-contractors engage forced labour. Forced labour includes bonded labour (working against an impossible debt), excessive limitations of freedom of movement, excessive notice periods, retaining the worker's identity or other government-issued documents or personal belonging, imposition of recruitment or employment fees payable at the commencement of employment, loss or delay of wages that impede the workers' right to end employment within their legal rights, substantial or inappropriate fines, physical punishment, use of security or other personnel to force or extract work from project workers, or other restrictions that compel a project worker to work in a non-voluntary basis.

In accordance to the Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019, Bangladesh Labour Act, 2006 and IFC Performance Standard 2, BEZA shall:

(1) Comply with legislation and other applicable requirements which relate to the zone's occupational health and safety hazards.
(2) Enable active participation in OH&S risks elimination through promotion of appropriate skills, knowledge and attitudes towards hazards.
(3) Continually improve the occupational health and safety management system and performance.
(4) Communicate this policy statement to all persons working under the control of BEZA with emphasis on individual OH&S responsibilities.
(5) Avail this policy statement to all interested parties at all BEZA facilities and sites.

In accordance to the Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019, correspondence from BEZA should:

(1) Identify potential hazards;
(2) In collaboration with the employer, investigate the cause of accidents at the workplace;
(3) Inspect the workplace including plant, machinery, substances, with a view to ascertaining the safety and health of employees provided that the employer is informed about the purpose of the inspection;
(4) Accompany an inspector whilst that inspector is carrying out the inspector's duties in the workplace;
(5) Attend meetings of the safety and health committee to which that safety and health representative is a member;
(6) Make recommendations to the employer in respect of safety and health matters affecting employees, through a safety and health committee; and
(7) Where there is no safety and health committee, the safety and health representatives shall make recommendations directly to the employer in respect of any safety and health matters affecting the employees.

In accordance to the Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019, Bangladesh labour act, 2006, and World Bank EHSG/ IFC Performance Standard 2, first aid provisions are required. These provisions, and to avoid work related accidents and injuries, the contractor will:

(1) Provide occupational health and safety training to all employees involved in works.
(2) Provide protective masks, helmet, overall and safety shoes, and safety goggles, asappropriate.
(3) Provide workers in high noise areas with earplugs or earmuffs.
(4) Ensure availability of first aid box.
(5) Provide employees with access to toilets and potable drinking water.
(6) Provide safety and occupational safety measures to workers with Personal Protection Equipment (PPE) when installing pumps to prevent accidents during replacement and installation and follow safety measures in installing submersible pump and cleaning the raiser pipes.
(7) Properly dispose of solid waste at designated permitted sites landfill allocated by the local authorities and cleaning funds; and attach the receipt of waste from the relevant landfill authority.
(8) Carry out all procedures to prevent leakage of generator oil into the site.
(9) Provide secondary tank for oil and grease to avoid spills.

Further to enforce the compliance of environmental management, contractors are responsible and liable of safety of site equipment, labours and daily workers attending to the construction site and safety of citizens for each sub-project site, as mandatory measures.

Labour Influx and Gender Based Violence

Contractors will need to maintain labour relations with local communities through a code of conduct (CoC). The CoC commits all persons engaged by the contractor, including sub-contractors and suppliers, to acceptable standards of behavior. The CoC must include sanctions for non-compliance, including non-compliance with specific policies related to gender-based violence, sexual exploitation and sexual harassment (*e.g.* termination). The CoC should be written in plain language and signed by each worker to indicate that they have:

(1) received a copy of the CoC as part of their contract;
(2) had the CoC explained to them as part of induction process;
(3) acknowledged that adherence to this CoC is a mandatory condition of employment;
(4) understood that violations of the CoC can result in serious consequences, up to and including dismissal, or referral to legal authorities.
(5) A copy of the CoC shall be displayed in a location easily accessible to the community and project affected people. It shall be provided in English and Bangla.
(6) Contractors must address the risk of gender-based violence, through:
(7) Mandatory training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women. Training may be repeated;
(8) Informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;
(9) Adopting a policy to cooperate with law enforcement agencies in investigating

complaints about gender-based violence;

Developing a system to capture gender-based violence, sexual exploitation and workplace sexual harassment related complaints/issues.

This process will be under the portfolio of the Social Standards Officer who shall identify and engage the relevant stakeholders on GBV and HIV and Aids issues. In the Bangladesh labour act, 2006, Section 34, it is mentioned that no child shall be employed to work in any occupation. Section 44 mentions that anyone under age 14 is considered as child and under 18 but over 14 is considered as adolescent. World Bank strictly prohibits child labour and clearly mentioned that the minimum age of 18 years is required for anyone to get employment in such works. Section 37 of the act suggests a fitness certificate required for adolescents to get employed and they can be appointed to do the light works.

According to the World Bank guidelines, the minimum age of employment for this project shall be 18 years and to ensure compliance, all employees will be required to produce National Identification Cards as proof of their identity and age which is the national identification document required for employment. If any contractor employs a person under the age of 18 years, that contractor's will not only be terminated by BEZA but also be reported to the authorities.

The terms and conditions of employment in Bangladesh are governed by the provisions of Bangladesh Labour Act, 2006 in connection with The Control of Employment Ordinance, 1965 and the employment in industrial sectors and economic zones are governed by Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019. Section 6 of the Ordinance makes it mandatory for employers to give its employees an appointment letter along with an identity card containing photograph. Section 7 makes it obligatory for employers to provide service book containing written particulars of employment, signed by both parties upon employment. This requirement however is not applicable to badli (substitute worker) or casual workers. For this project, contractors will be required to provide all its employees with written particular of employment, including those excluded by the provision of S.5, 6 and casual employees.

Contractors will also be required to comply with the most current decision of Wages Board assigned by the government, as of December 2018, the amendment of the labour act was implemented. Regarding the labour wage and the minimum wage declared by the government in the amendment it was prescribed BDT 8,000 specifically for garments workers. The Wages Order specifies the minimum wages, hours of work, overtime pay, leave entitlements, travelling and Subsistence Allowances and the issue of protective clothing.

Upon receiving a public contract, the contractor shall certify in writing that the wages, hour and conditions of work or persons to be employed by him on the contract are not less favorable than those contained in the most current wages regulation issued by the government recommended by the Wages Board Chairman. The employer shall maintain worker's register which will be available for inspection during working hours for the Inspector appointed by BEZA.

In ensuring full compliance with the law in this regard, contractors will be required to furnish BEZA with copies of the Service Book or copies of contract of all its workforce. Contractors

will not be allowed to deploy any employee to work in the project if such copy of employment of that employee has not been handed to BEZA.

As a monitoring mechanism, a contractor shall not be entitled to any payment unless he has filed, together with his claim for payment, a certificate: - a) stating whether any wages due to employees are in arrears; b) stating that all employment conditions of the contract are being complied with. It will be a material term of the contract to allow BEZA to withhold payment from contractor should the contractor not fulfil their payment obligation to their workers.

The Bangladesh Labour Act, 2006 (Section 176) ratifies the Rights of Workers, guarantees all workers of their right to freely form, join or not join a trade union for the promotion and protection of the economic interest of that worker; and collective bargaining and representation and in The Bangladesh Labour Act, 2006, Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019, a worker's welfare society holds the right to negotiate the terms and conditions of employment and other related matters and any worker has the right to join the welfare society. Section-119 of this ordinance suggest collective bargaining agent to negotiate representing the welfare society of workers.

The workers should have the rights to join registered worker's welfare society but must face penalty upon joining any unregistered welfare societies. The 2019 Ordinance has made a direct provision that if a single welfare society remains then that shall be treated as the Collective Bargaining Agent. BEZA provides employees with the right to join and form an organization for purpose of labour representation. The societies shall have the right to represent its members during hearings and to negotiate favorable terms and conditions for their members (annually) amongst other rights.

In any working environment it is essential for both employers and employees to be fully conversant with all aspects of disciplinary processes, the grievance handling procedures and the legal requirements and rights involved. In implementing an effective dispute management system consideration must be given to the disputes resulting from the following:

(1) Disciplinary action
(2) Individual grievances
(3) Collective grievances and negotiation of collective grievances
(4) Gender-based violence, sexual exploitation and workplace sexual harassment

The starting point for all disciplinary action is rules. These rules may be implied or explicit and of course will vary from workplace to workplace. Some rules are implied in the contract of employment (*e.g.* rule against stealing from the employer), however it is advisable that even implied rules be included in the disciplinary code or schedule of offences. In an organized workplace these rules ideally are negotiated with the worker's welfare societies and are often included in the Recognition Agreements signed by the employer and worker's welfare society.

Advance notice regarding termination, retrenchment, discharge should be given to workers. In Bangladesh, labour courts are there to settle the disputes. In handling any kinds of disputes, there is a whole chapter of settlement of disputes in Bangladesh Labour Act, 2006. The Bangladesh EPZ/EZ Labour Law Ordinance No 01, 2019 also ensures EPZ labour court for different zones to act and take necessary steps in case of any dispute. In accordance to the acts, in case of any dispute the following procedures are to be followed:

Conduct an investigation to determine whether there are grounds for a hearing to be held;

(1) If a hearing is to be held, the employer is to notify the employee of the allegations using a form and language that the employee can understand;
(2) The employee is to be given reasonable time to prepare for the hearing and to be represented by a fellow employee or a union representative;
(3) The employee must be given an opportunity to respond to the allegations, question the witnesses of the employer and to lead witnesses;
(4) If an employee fails to attend the hearing the employer may proceed with the hearing in the absence of the employee;
(5) The hearing must be held and concluded within a reasonable time and is to be chaired by an impartial representative;
(6) If an employee is dismissed, it must be given the reasons for dismissal and the right to refer the dispute concerning the fairness of the dismissal.

Therefore, it is incumbent upon the Contractors to ensure that they have a disciplinary procedure and Code and standards which the employees are aware of. Each contractor will be required to produce this procedure to ensure that employees are not treated unfairly.

Gender based discrimination to be strictly prohibited and monitored by BEZA. BEZA will, with support from consultants, identify and employ GBV service providers who are actively engaged in prevention of gender-based violence, sexual exploitation and workplace sexual harassment. They will also create an operational manual for future reference of the IA. BEZA, the project unit and the contractor are not equipped to handle complaints or provide relevant services to survivors, but will refer them to GBV service providers who will in turn use health facilities, law enforcement's gender unit or others, and other services for management of the issue. Grievances related to gender-based violence should also be channeled through the GBV service provider. The identification and appointment of GBV service provider will be done before project implementation.

BEZA shall make sure that contractors monitor, keep records and report on terms and conditions related to labour management. The contractor must provide workers with evidence of all payments made, including social security benefits, pension contributions or other entitlements regardless of the worker being engaged on a fixed term contract, full-time, part-time or temporarily. The application of this requirement will be proportionate to the activities and to the size of the contract, in a manner acceptable to BEZA and the IFC/World Bank EHS Guidelines:

(1) Labour conditions: records of workers engaged under the Project, including contracts, service book, registry of induction of workers including CoC (see section 7.2), hours worked, remuneration and deductions (including overtime), collective bargaining agreements;
(2) Safety: recordable incidents and corresponding Root Cause Analysis (lost time incidents, medical treatment cases), first aid cases, high potential near misses, and remedial and preventive activities required (for example, revised job safety analysis, new or different equipment, skills training, and so forth).
(3) Workers: number of workers, indication of origin (expatriate, local, nonlocal nationals), gender, age with evidence that no child labour is involved, and skill level (unskilled, skilled, supervisory, professional, management).
(4) Training/induction: dates, number of trainees, and topics.

(5) Details of any security risks: details of risks the contractor may be exposed to while performing its work—the threats may come from third parties external to the project.
(6) Worker grievances: details including occurrence date, grievance, and date submitted; actions taken and dates; resolution (if any) and date; and follow-up yet to be taken—grievances listed should include those received since the preceding report and those that were unresolved at the time of that report.
(7) If the accident is severe, then call emergency vehicle and immediately rush the injured person to local hospital or company recommended nursing home. Phone numbers are available in bellow.
(8) Fill in the accident report form with the help of witness and deposit the same to the Emergency Response Team.

Utilities Failure

Examples of utility failure that may occur are electrical outage, plumbing failure/flooding, natural gas leak, steam line break, ventilation problems and/or elevator failure. In the event of a failure, immediately notify Emergency Response Team.

(1) For emergencies and potential danger or after hours call to Control room
(2) In a situation where a building needs to be evacuated, please proceed to the building specific evacuation area.
(3) Turn off equipment, machines and computers.
(4) Assist disabled persons as needed.
(5) Do not use elevators.
(6) Stay at the designated evacuation area until the fire department or designated representative has given the —all clear to re-enter the building.

Guidelines on environmental conditions in the BOQ/contract documents

The environmental and social management program should be carried out as an integral part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. For this purpose, it is recommended that the Project Director (PD) for this specific project takes the overall responsibility of environmental and social management and monitoring.

The PD will form a team with required manpower and expertise to ensure proper environmental monitoring, and to take appropriate measures to mitigate any adverse impact and to enhance beneficial impacts resulting from the project activities. The PD through its team will ensure that the contractor shall undertake and implement appropriate measures as stipulated in the contract document. It should be emphasized that local communities should be involved in the management of activities that have potential impacts on them. They should be properly consulted before taking any management decision that may affect them. Environmental and social management is likely to be most successful if such decisions are taken in consultation with the local community.

The environmental and social management during the construction phase should primarily be focused on addressing the possible negative impacts arising from:

(1) Cutting/ clearing of crops/ trees/ vegetation along RoW of trunk mains, and associated impact on terrestrial fauna
(2) Air pollution

(3) Traffic/ communication problems
(4) Noise pollution
(5) Drainage congestion
(6) Water and soil pollution
(7) Destruction of aquatic habitat and reduction of fisheries, aquatic fauna

Guidelines on Environmental safeguards are generally incorporated in the Schedule of Works/ BOQ. In case of DB/ DBO contractors are engaged, the following guidelines need to be followed. The Schedule of Works for a DBO Project is as follows:

(1) General items
(2) Design
(3) Civil works
(4) Procurement of pipes and appurtenances for trunk sewer and collection network
(5) Sewer works for the treatment plant
(6) Sewer installation for trunk main and collection network
(7) Mechanical equipment
(8) Electrical equipment
(9) Internal roads and landscaping
(10) Operation and maintenance works for 3 years

Environmental and social safeguard guidelines to be included in the General items of Schedule of Works and comprise the following points. Insurances for contractor's equipment, insurances for injury to persons and damage to properties and other insurances.

(1) Quality assurance and control plan
(2) Environmental and social management plan
(3) Traffic management plan
(4) Erection and removal of signboards
(5) Health and safety plan
(6) GBV plan
(7) Labour management plan

A detailed write-up on the above issues is generally included in the employer's requirement which is a part of the bidding document. Some but not limited to the following conditions should be included in the employer's requirement with the contract document for the DB/DBO contractor. The DB/DBO contractor shall:

(1) design the works to minimize adverse environmental impacts;
(2) meet all the obligations under the prevailing environmental regulations and the Environmental Management Plan;
(3) The Contractor shall at all times operate and maintain the Works in accordance with the approved Environmental Social Management Plan and approved Contractor's Documents including:
    a. the operating and maintenance manuals
    b. the Emergency Response Plan
    c. Traffic Management Plan
    d. the water quality testing plan
    e. the health and safety manual
    f. the quality assurance manual
    g. providing training on OHS and waste management plan

The Contractor shall undertake all monitoring, sampling and testing in accordance with:

a. The minimum frequencies and sampling methods specified in these Employer's
b. Requirements;
c. The approved water quality testing plan;
d. The Environmental Social Management Plan;
e. Any additional requirements specified by the applicable regulatory authorities

For a DB/DBO contract The Employer should specify the scope of the contractor's responsibilities for preparing and implementing the ESMF and the ESMP. The proposals related to environmental social safeguards of the Contractor needs to be submitted to DoE for environmental verification.

Under the general requirement for planning, design, approvals and documents of the Bid document the following requirements are mandatory:

(1) design the works to minimize adverse environmental impacts;
(2) meet all the obligations under the prevailing environmental regulations and the Environmental Management Plan;
(3) Under the general requirement for Operation Management in the Bid Document the following requirements are mandatory:
(4) maintain the site in tidy condition and take measures to control potential environmental nuisance, including but not limited to, odours, litter, pests, insects, rodents and birds;
(5) Under the general requirement for Performance during the Operation Service Period in the Bid Document the following requirements are mandatory:
(6) The Contractor shall at all times operate and maintain the Works in accordance with the approved Environmental Social Management Plan and approved Contractor's Documents including:

i. the operating and maintenance manuals
ii. the Emergency Response Plan which includes managing emergencies in the event of chemical spills; contamination of the water source; pollution of the environment;
iii. the water quality testing plan
iv. traffic management plan
v. the health and safety manual
vi. the quality assurance manual

(7) Under the general requirement for Water Quality Testing Plan in the Bid Document the following requirements are mandatory:
(8) The Contractor shall develop a water quality testing plan (the "Water Quality Testing Plan")
(9) including methods, procedures, schedules and frequencies of sampling and analysis
(10) a plan to monitor noise and other local environmental impacts
(11) a program to monitor whether the work is complying with the Environmental Social Management Plan

Under the general requirement for Overall description of the Operation Service in the Bid Document the following requirements are mandatory:

The Contractor shall treat wastewater including septic waste to meet the specified standards and shall discharge the treated wastewater into the environment safely (or at the specified discharge point)

Third Party Monitoring and Reporting

For effective implementation and an independent environment evaluation, a third-party consulting firm will be hired by the contractor/PIU. This consulting firm will be given the responsibility to monitor and regularly report the overall performance of the contractor independently in complying with the provisions of the ESMP for satisfactory environmental management of the proposed project including compliance with the DoE conditions.

10.10 '3R' Strategies for Waste Management

The 3R initiative aims to promote reduce, reuse and recycle to build a sound-material-cycle society through the effective use of resources and materials. The principle of reducing waste, reusing and recycling resources and products is often called the "3Rs. In the economic zone 3R policy should be introduced to ensure sustainable management of waste.

The popular and well-known concept of "3R" refers to reduce, reuse and recycle, particularly in the context of production and consumption. It calls for an increase in the ratio of recyclable materials, further reusing of raw materials and manufacturing wastes, and overall reduction in resources and energy used. These ideas can be applied to the entire lifecycles of products and services from design and extraction of raw materials to transport, manufacture, use, dismantling/reuse and disposal.

Under 3R policy, the standard waste management can be done which is depicted in the following Figure 10.5.

Figure 10.4: 3R policy

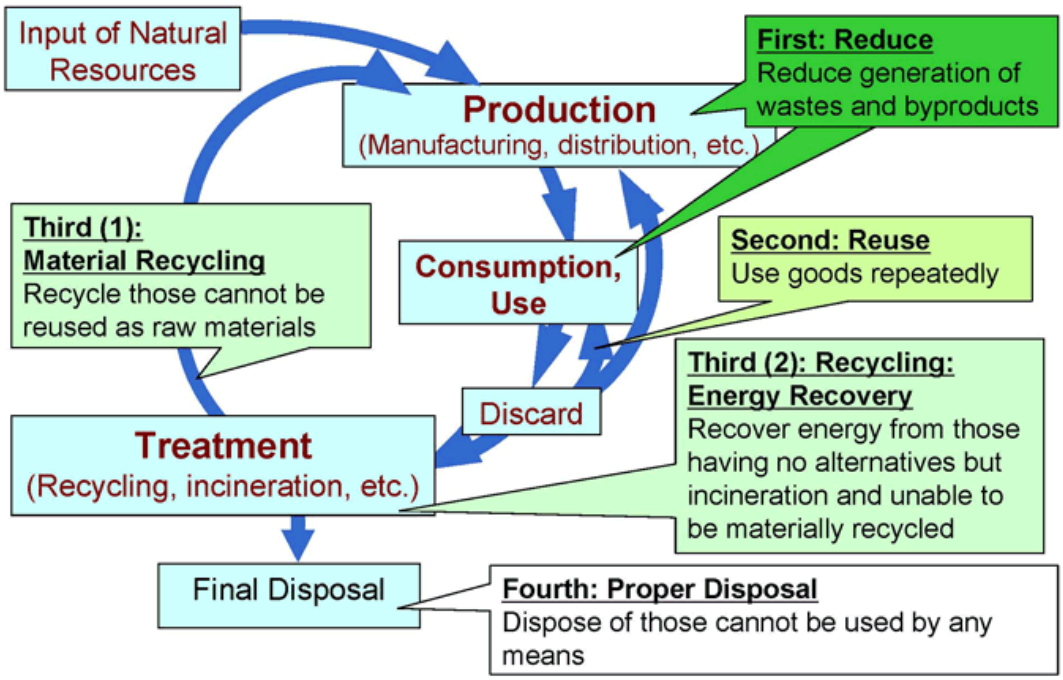


Figure 10.5: Standard Waste Management with 3r Policy

10.11 Waste Management Resource and Energy Efficiency

Resource and Energy Efficiency offers a powerful and cost-effective tool for achieving a sustainable future. It will save money and cut emissions faster than any other climate change mitigation option. Efficiently using resources and energy consequentially bring about both economic and ecological advantages. By enacting efficiency measures, the EZ simultaneously can save costs and reduce environmental impacts and risks. The resource and energy efficiency can be achieved in the EZ through the following ways:

(1) Reduce energy demand and judge alternative solutions
(2) Benchmark processes to 'Best Available Technology' and to 'Average in Line of Business'. Benchmark within process chain, *e.g.* with regard to different suppliers.
(3) Assessing material production through an environmental lens by using a life cycle perspective.
(4) Getting knowledge regarding the significance of the indirect effects of resource and energy supplies.
(5) Generating understanding of Life Cycle Thinking and integrate it into day-to-day business on all levels.
(6) Obtain solid information regarding the environmental impacts of processes and products for the use of external communications.

10.12 Optimum Use of water

Water is most important for domestic, agriculture and industrial purposes. But due to over exploitation, water resources are shrinking day by day. In this regard, water efficiency as well as optimum use of water should be prioritized in KEZ. Optimum use of water can be ensured by the following ways:

(1) Water efficient building design;

(2) Collection of spilled water;
(3) Installation of water efficient sanitary ware, *e.g.* low-flush water closets and percussion taps;
(4) Collection of roof water for irrigation purposes and support of freshwater water features;
(5) Grey water recycles;
(6) Educational initiatives;
(7) Minimize water used in swimming pools;
(8) Reuse of mains water for washing wet suits;

Table 10-13: Ways of ensuring optimum uses of water

Water efficiency measure	Typical cost	Typical payback period	Example of initiatives
Good industrial keeping	No – Low cost	Immediate	• Appropriate storage and containment of potentially contaminating solids and/or liquids to minimize risk of spills and the need for wash down • A system to identify accidental discharges or spills and to quickly remedy problems should they arise • Routine inspection of water transport and storage systems to identify and repair leaks • Flow rate controls on equipment that requires regular or continuous supplies of water • Optimal wash down facilities with equipment fitted with automatic shutoff valves and high pressure or low volume controls, as necessary • Regular planned maintenance of systems and calibration of monitoring equipment
Management	Low – minimal cost	Immediate	• A detailed understanding of the water system on site • Availability of a water mass balance • A monitoring programme, that considers both quality and quantity and is not restricted to the inlet and outlet to the site (in other words that monitoring within the process also occurs) • A system to set targets for water consumption, use and discharge • Regular assessment of monitoring data to determine progress against targets as well as to assess compliance with legal limits

Water efficiency measure	Typical cost	Typical payback period	Example of initiatives
			• A review of process scheduling to ensure optimal water use and production • Regular staff training and awareness campaigns focused on water issues
Reuse	Low – medium cost	Less than 1year	• Reuse of wash-down water • Rain water harvesting
Recycle	Medium cost	1- 2 years	• Recycle water after treatment
Redesign	High cost	> 3 years	• Closed loop systems • Effluent treatment

10.13 Optimum Use of Energy

Providing a comfortable and healthy interior environment is one of the core functions of building energy systems and accounts for about a third of total building energy use. New technologies for heating, cooling, and ventilation not only can achieve large gains in efficiency, but they can improve the way building systems meet occupant needs and preferences by providing greater control, reducing unwanted temperature variations, and improving indoor air quality. Opportunities for improvements fall into the following basic categories:

(1) Good building design, including passive systems and landscaping
(2) Improved building envelope, including roofs, walls, and windows
(3) Improved equipment for heating and cooling air and removing humidity
(4) Solar energy storage that can be a part of the building structure or separate equipment
(5) Improved sensors, control systems, and control algorithms for optimizing system performance

There are many ways to reduce the energy lost in ventilation systems, which include the following:

Reduce leaks in building shells and ducts: While minimizing uncontrolled infiltration is a critical part of building design and construction, locating and fixing leaks in existing buildings presents a greater challenge, especially in commercial buildings where pressurization tests cannot be easily used to measure and locate leaks. BUET/House building research led to the development of material that can be sprayed into existing ducts to seal leaks from the inside.

Use natural ventilation where possible: In some climates and at certain times of the year, natural ventilation can be used to introduce fresh air using natural circulation or fans. Good building design, carefully chosen orientation, windows that open, and ridge vents are some of the many strategies that can be used. Economizers are devices that bring in fresh air when appropriate and can reduce cooling loads by 30% when operated by a well-designed control system. Economizer designs that minimize or eliminate failures can be important for efficiency, but a significant fraction of installed economizers may not be operative because of poor maintenance. The next generation of sensors and controls can automate detection

and maintenance notification to help address this issue, and economizer designs can be improved to minimize maintenance.

Advanced sensor and control systems provide ventilation only where and when it's needed: Most installed systems implement fixed air-exchange rates as specified by code, but ventilation needs depend upon occupancy, building purpose and internal activities, and other factors (*e.g.* a hospital). Significant efficiencies could be gained if ventilation systems provided only the fresh air needed to maintain required levels of carbon dioxide (CO_2) and other compounds. Such systems are known as demand-controlled ventilation. Modern systems can use sensors to detect concentrations of CO_2 and other contaminants, and this information can be used to make appropriate adjustments to ventilation rates. However, keeping them in calibration has proven difficult. Good control systems may be able to reduce ventilation-related energy use in residences by as much as 40%.

Use efficient, variable speed motors: Most ventilation systems adjust flow rates only by turning motors off and on or by using dampers. Significant energy savings can be achieved using efficient, variable air volume systems with variable-speed fans along with properly designed and sealed ducts. There are also major opportunities for improving the efficiency and lowering the cost of variable speed motors and motor controls.

Use heat and moisture exchange devices: Even greater energy savings can be achieved by using heat exchangers that allow incoming cool air to be heated by warm building air being exhausted (or the reverse if the building is cooled). Advanced systems can also exchange moisture (*i.e.* enthalpy exchangers). These systems are discussed in the section on heat pumps.

11 Conclusion and Recommendation

The aim of the proposed Kushtia EZ is to promote local as well as regional and national economic development by establishing appropriate industries in an enabling environment. The economic benefits of the project as envisaged in the master plan includes contribution to increasing GDP, value addition by creating employments opportunities, increase of national foreign reserve through inflow of direct foreign investment. However, these benefits may also incur some environmental cost.

(1) The proposed development land may result permanent loss of seasonal waterbodies including agricultural lands (mostly single crops), fish habitats and livelihood of some people. However, the people owning the land would get compensation as per the rules of the country. Unfortunately, people who do not have appropriate paper to produce their land right would not get any compensation. As most of the total area is khas land so the inhabitants will not get any compensation for the land which might cause a social tension among the people.

(2) The proposed land development for establishing KEZ by converting low land area to highland area would have impacts on surrounding drainage and flooding situation. The surrounding water management infrastructures *e.g.* River flow, canals, embankment which will be under further stress due permanent alteration because of the development of the area and groundwater recharge potential areas.

(3) The construction activities might increase SPM in the local air. Construction activities might also generate noise. The EIA proposes appropriate mitigation measures to control such impacts.

(4) The EIA proposes automated monitoring system for CETP/ETP/STP/pollution mitigation measures. However, during operation, pollution (air pollution, water pollution) might take place due to non-functioning of CETP/ETP/STP/pollution mitigation measures.

(5) Surface water as well as ground water has been considered as a major source of water supply. Considering the large demand of water for operating KEZ, the impact on groundwater availability is inevitable unless the KEZ apply water saving technology and make arrangement for groundwater recharge. The Master plan includes several green areas which might enhance groundwater recharge.

(6) The proposed KEZ and allied infrastructural development would induce local and national economic development which would directly benefit the local community. Living standard of local people would be improved.

An important objective of establishing EZ is to promote planned industrial development by creating enabling environment and facilities at a place equipped with environmental management rules and regulations and pollution abatement measures, which would prevent unplanned and isolated growth of industries and thereby would prevent diffusive environmental pollution. It is quite common that unplanned and isolated growth of industries do not always comply environmental regulation and it often stay out of the reach of environmental regulating agencies. Therefore, an EZ looks better in the context of implementing environmental regulation and environmental monitoring. Such benefit of EZ is also foreseeable in case of KEZ. However, to ensure minimum environmental and social

impacts during land acquisition, construction and operation, the EIA recommends the following:

(1) An automated and online monitoring system should be established to operate and monitor CETPs. The KEZ authority should establish a strict environmental compliance policy and practice with strict penalty for any non-compliance.

(2) An integrated approach of infrastructural development is needed to ensure attractiveness of the KEZ to investors

(3) National 3R Strategy for Waste Management (Reduce, Reuse and Recycle) should be followed for the management of solid waste.

(4) Integrated and Smart (monitor and control, GIS interface) Utility (Gas, Water, Power, Firefighting, etc.) Design would further ensure interest of investors.

(5) Industries should adopt water saving technology

(6) Development of a green belt surrounding the area should be considered with due importance.

(7) The mitigation measures proposed in EIA should be strictly implemented.

(8) All infrastructures should be built based on the seismic design consideration to avoid potential hazard risk.

(9) This EIA should be a part of all the tender documents and contracts related to the establishment of the KEZ.

(10) The monitoring plan proposed in the EIA should be strictly followed.

(11) Safety Management guidelines for workers should be strictly followed to minimize occupational health hazards.

(12) Eligible local people should be considered on priority basis that will be helpful for minimizing the socio-economic disruption.

(13) Since the local people have a high hope of local, regional and national economic benefit from the project, long delay of the construction and operation may cause public disappointment. Therefore, the project schedule should be strictly followed.

12 Appendices

Appendix 1: DoE Approved ToR

শেখ হাসিনার বাংলাদেশ
পরিচ্ছন্ন পরিবেশ

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, E-16 Agargaon
Sher-e-Bangla Nagar, Dhaka-1207
www.doe.gov.bd

Memo No: 22.02.0000.018.72.041.22. 60 Date: 28.04.2022

Subject: **Exemption from IEE and Approval of Terms of Reference (TOR) for Environmental Impact Assessment (EIA) of the Kushtia Economic Zone at Bheramara, Kushtia.**

Ref: Your letter dated: 30.03.2022

With reference to your application received on 30.03.2022 for the subject mentioned above, the Department of Environment hereby gives Exemption from IEE and Approval of Terms of Reference (TOR) for Environmental Impact Assessment (EIA) of the proposed Kushtia Economic Zone subject to fulfilling the following terms and conditions:

I. The project authority shall submit a comprehensive Environmental Impact Assessment (EIA) considering the overall activity of the said project in accordance with the TOR submitted to the Department of Environment (DOE) and additional suggestions provided herein.

II. The EIA report should be prepared in accordance with following indicative outlines:

1. **Executive summary**

The Executive summary of the EIA/EMP report in about 8-10 pages should be prepared incorporating the information on following points:

a. Project name and location (Village, District).
b. Products and capacities.
c. Requirement of land, raw material, water, power, fuel, with source of supply (Quantitative)
d. Process description in brief, specifically indicating the gaseous emission, liquid effluent and solid and hazardous wastes.
e. Measures for mitigating the impact on the environment and mode of discharge or disposal.
f. Capital cost of the project, estimated time of completion.
g. Site selected for the project - Nature of land - Agricultural, barren, Government/ private land, status of is acquisition, nearby (in 2-3 km.) water body, population, with in 10km other industries, forest , eco-sensitive zones, accessibility.
h. Baseline environmental data - air quality, surface and ground water quality, soil characteristic, flora and fauna, socio-economic condition of the nearby population
i. Identification of hazards in handling, processing and storage of hazardous material and safety system provided to mitigate the risk.
j. Likely impact of the project on air, water, land, flora-fauna and nearby population
k. Emergency preparedness plan in case of natural or in plant emergencies
l. Issues raised during public hearing (if applicable) and response given
m. Occupational Health Measures
n. Post project monitoring plan

2. **Introduction:** (Background, brief description, scope of study, methodology, limitation, EIA team, references)

3. **Legislative, regulation and policy consideration** (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)

শেখ হাসিনার বাংলাদেশ
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4. Project Description:

4.1 Introduction
4.2 Project Objective
4.3 Project Option
4.4 Land Acquisition Plan
4.5 Details regarding R& R involved in the project
4.6 Project activities: A list of main project activities to be undertaken during site clearance, construction as well as operation.
4.7 Details of the trees to be fell for the project.
4.8 Details of the infrastructure to be developed for the project
4.9 Project schedule: The phase and timing for development of the project
4.10 Resources and utility demand: Resource required to develop the project
- 4.10.1 Soil and construction materials
- 4.10.2 Demand for utilities
  - 4.10.2.1 Water Supply System (Resources and distribution system)
  - 4.10.2.2 Sewage System
  - 4.10.2.3 Effluent Treatment Plant
  - 4.10.2.4 Power Supply Plan
  - 4.10.2.5 Solid waste management
- 4.10.3 Demand for Infrastructure
  - 4.10.3.1 Road System
  - 4.10.3.2 Drainage Plan

4.11 Land use details of the study area
- 4.11.1 Submit the details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river;
- 4.11.2 Details regarding project boundary passing through any eco- sensitive area and within 10 km from eco- sensitive area.

4.12 Tentative Implementation Schedule
4.13 Map and survey information: Location map, cadastral map showing, land plots, (project and adjacent area), geological map showing, geological units, and other natural resources.

5. Site Details:

Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damage, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.

5.1 Location of the project site
5.2 A top sheet of the study area of radius of 10 Km and site location on 1:50,000/ 1:25000 scale on an A3/A2 sheet
5.3 Layout maps indicating existing units within the industrial estate as well as proposed units within industrial units
5.4 Land use break-up of total land of the project site
5.5 Zoning of the area in terms of 'type of industries' coming-up in the industrial area based on the resource requirement along with likely pollutants with quantity from the various industries.
5.6 Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any

6. Environmental and Social Baseline

Examine baseline environmental quality along with projected incremental load due to the project taking into account of the existing developments nearby. The project boundary area and study area for which the base line data is generated should be indicated through a suitable map. Justification of the parameters, frequency and locations shall be discussed in the EIA.

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6.1 Meteorology
- 6.1.1 Temperature
- 6.1.2 Humidity
- 6.1.3 Rainfall

6.2 Environmental Quality

6.2.1 Air Quality:
Ambient air quality data at minimum 8(eight) locations for SPM, PM_{10}, $PM_{2.5}$, SO_2 and CO for 12 weeks. The monitoring station should be based by taken into account the pre-dominant wind direction population zone and sensitive receptors.

6.2.2 Water Quality:
(a) Surface water: Surface water quality of nearby river (100m upstream and downstream of discharge point) at minimum 8(eight) locations
(b) Ground water: Ground water monitoring at minimum 8(eight) locations

6.2.3 Noise level
Noise level monitoring at minimum 8(eight) locations within the study area

6.2.4 Traffic volume:
Traffic study of the area, types of vehicles, frequency of vehicles or transport of materials, additional traffic due to proposed project.

6.2.5 Flora and Fauna:
Detailed description of flora and fauna (terrestrial & aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species.

6.2.6 Soil Characteristics

6.3 Natural Environment
- 6.3.1 Topography
- 6.3.2 Hydrological situation
- 6.3.3 Soil erosion
- 6.3.4 Drainage congestion and water logging
- 6.3.5 Flora, Fauna and Biodiversity
- 6.3.6 Environmental Critical Area/Protected/Reserved Area

6.4 Socio economic Status
- 6.4.1 Socio economic condition
- 6.4.2 Quality of life indication
- 6.4.3 Income and poverty
- 6.4.4 Gender and women
- 6.4.5 Common property resources
- 6.4.6 Conflict of interest and Law & Order situation
- 6.4.7 Historical, Cultural and archaeological sites

7. Environmental and Social Impact Assessment

Summary of the Environmental and Social Impact Assessment
- 7.1 Air Quality
- 7.2 Water Quality
- 7.3 Waste
- 7.4 Soil Contamination
- 7.5 Noise and Vibration
- 7.6 Offensive Odor
- 7.7 Bottom Sediment
- 7.8 Flora/ Fauna and Biodiversity
- 7.9 Hydrology
- 7.10 Soil Erosion
- 7.11 Framework of Resettlement Works

3

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7.12 Involuntary Resettlement
7.13 Living and Livelihood
7.14 Vulnerable People
7.15 Local Conflict of Interest
7.16 Misdistribution of Benefit and Damage

8. **Cumulative Impact Assessment**

9. **Public Consultation and Disclosure**
   9.1 Introduction
   9.2 Public Consultation Meeting

10. **Environmental Mitigation, Management and Monitoring Plan**
   10.1 Environmental Mitigation and Management Plan
   10.2 Environmental Monitoring Plan
   10.3 Action plan for green belt development: Green buffer in the form of green belt to a width of 15 meters should be provided all along the periphery of the industrial area. The individual units should keep 33% of the allotted area as a green area.
   10.4 Budget Plan for Environmental Management including total capital cost and recurring cost for environmental pollution control measures
   10.5 Details of solid waste including hazardous waste generation and their storage, utilization and management. EMP shall include 3R Strategies for waste management and natural resource conservation.
   10.6 A note on treatment of waste water from different units and characteristics of waste water. Complete scheme of effluent treatment system.
   10.7 Implementation Schedule
   10.8 Institutional Arrangement

11. **Conclusion and Recommendation**

III. The project authority shall submit the EIA report along with an application for Environmental Clearance in prescribed form, the applicable fee in a treasury Chalan, the applicable VAT on clearance fee in a separate treasury Chalan, the No Objection Certificates (NOC) from local authority, NOC from Forest Department (in case of cutting any forested plant, private or public) and NOCs from other relevant agencies for operational activity etc. to the Kushtia District Office of DOE at Kushtia with a copy to the Head Office of DOE in Dhaka.

IV. Without approval of EIA report by the Department of Environment, the project authority shall not undertake land and infrastructural development and open L/C in favor of importable machineries.

V. Without obtaining Environmental Clearance, the project authority shall not start operation of the project.

28.04.2022

(Masud Iqbal Md. Shameem)
Director (Environment Clearance)
Phone: 88-02-8181673

Deputy Manager (Monitoring)
Bangladesh Economic Zone Authority
Prime Minister's Office
Level 7,8,9 Biniyog Bhaban
Plot#E-6/B, 1207 W Agargaon, Dhaka .

Copy Forwarded to:
1. Director, Department of Environment, Khulna Divisional Office, Khulna.
2. Deputy Director, Department of Environment, Kushtia District Office, Kushtia.
3. Assistant Director, Office of the Director General, Department of Environment, Dhaka.

4

Appendix 2: Detailed Air Quality Test Report

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0001
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 22.06.2022
	Location Name	: Project Site
	Location Code	: AQ1 at 24°4'42.60"N; 89° 0'39.41"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	140	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	85.2	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	49.6	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.8	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	32.2	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.79	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	382	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

Mitra S. K. Bangladesh (Pvt.) Ltd.

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Authorized Signatory

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Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
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T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0002
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 22.06.2022
	Location Name	: Shahpara Jame Mosque
	Location Code	: AQ2 at 24° 5'8.39"N; 88°59'46.85"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	148.6	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	88.6	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	46.2	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.8	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	34.6	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.78	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	378	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

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House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0003
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 23.06.2022
	Location Name	: Lalon Sah Bridge
	Location Code	: AQ3 at 24°3'46.04"N; 89°1'8.97"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	135	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	78	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	39.7	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.5	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	31.5	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.74	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	392	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

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Mitra S. K. Bangladesh (Pvt.) Ltd.
House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.
T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0004
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 23.06.2022
	Location Name	: Munsi Para Mosque
	Location Code	: AQ4 at 24° 3'36.32"N; 89° 0'21.72"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	142	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	82	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	41.5	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.3	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	28.5	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.79	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	402	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

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Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0005
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 23.06.2022
	Location Name	: Bangladesh_India Power Transmission Centre
	Location Code	: AQ5 at 24° 3'59.80"N; 88°59'53.51"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	155	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	86	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	42.6	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.8	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	36.2	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.86	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	412	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

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House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0006
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 23.06.2022
	Location Name	: Gopal Nagar Jame Mosque
	Location Code	: AQ6 at 24° 4'30.40"N; 88°59'39.52"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	130	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	71	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	35.9	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.3	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	28.8	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.77	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	396	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

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Authorized Signatory

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0007
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 23.06.2022
	Location Name	: Solamain Sah Chisti Majar
	Location Code	: AQ7 at 24° 5'14.03"N; 89° 0'35.69"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	125	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	69	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	34.5	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.2	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	26.9	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.72	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	388	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

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Authorized Signatory

Registered Office: 19 Green Road, Kalabagan, Dhaka-1205, Bangladesh.

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0008
	Date	: 05.07.2022
	Commodity	: **Ambient Air**
	Date of sampling	: 23.06.2022
	Location Name	: Paksy Babupara
	Location Code	: AQ8 at 24° 4'52.08"N; 89° 2'9.84"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameter	Unit	Results	Value exposures	Bangladesh Standards	IFC Standard	Method of Estimation
SPM	µg/m³	139	8hrs	200	-	IS 5182: Part4:1999 (Reaff.2014)
PM_{10}	µg/m³	80	24hrs (average)	150	150 (ITM1)	IS: 5182 (Part 23)
$PM_{2.5}$	µg/m³	41.6	24hrs (average)	65	75 (ITM1)	IS 5182 (PT-24),2019
SO_2	µg/m³	6.6	24hrs(average)	80	20 (guideline)	IS: 5182 (Part 2)
NO_2	µg/m³	33.2	24hrs (average)	100 (annual)	40 (annual)	IS: 5182 (Part 6)
CO	mg/m³	0.82	1hr (Max)	40	-	IS: 5182 (Part 10)
CO_2	PPM	396	1hr (Max)	-	-	IS: 5182 (Part 10)
O_3	µg/m³	<20.0	1hr (Max)	235	-	TPM/MSK/ENV(AP)/01/07

National Standard: *Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.*
International Standard: *World Health Organization (WHO). Air Quality Guidelines Global Update, 2005 adopted by IFC*

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Appendix 3: Detailed Water Quality Test Report

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:	Report No.	: MSK-BD/2022-23/07/0025
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Upstream Padma River
	Location Code	: SWQ-1 at 24° 5'7.93"N; 89°0'50.31"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-1	Standard	Method of Estimation
pH	-	7.78	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	40	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	4.8	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	105	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	138	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	2.8	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	12	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0026
	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Down Stream Padma River
	Location Code	: SWQ-2 at 24° 3'52.61"N;89° 1'29.16"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-2	Standard	Method of Estimation
pH	-	7.89	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	22	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.2	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	35	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	198	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	2.2	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	6	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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Bangladesh.

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E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0027
	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Kuchiamora Rd Pond
	Location Code	: SWQ-3 at 24° 4'35.69"N;88°59'55.68"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-3	Standard	Method of Estimation
pH	-	7.72	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	36	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	4.9	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	55	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	275	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	4	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	18	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0028
	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Midstream Padma River
	Location Code	: SWQ-4 at 24° 4'33.04"N; 89° 1'31.64"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-4	Standard	Method of Estimation
pH	-	7.77	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	38	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.0	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	95	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	145	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	3	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	10	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0029
	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Pond Near Project Site
	Location Code	: SWQ-5 at 24° 4'43.07"N;89° 0'36.97"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-5	Standard	Method of Estimation
pH	-	8.3	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	86	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	3.8	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	145	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	302	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	12	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	48	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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W : www.mitrask.com

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Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0030
	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Pond Near BIPTC center
	Location Code	: SWQ-6 at 24° 4'3.39"N; 88°59'48.19"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-6	Standard	Method of Estimation
pH	-	7.86	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	78	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	4.1	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	116	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	296	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	12	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	35	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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T : +88 02 5815 3195, +88 01973 167 777
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W : www.mitrask.com

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Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0031
	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Pond Near Nehrullsalm
	Location Code	: SWQ-7 at 24° 4'49.88"N; 89° 0'6.19"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-7	Standard	Method of Estimation
pH	-	8.2	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	65	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	4.2	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	96	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	286	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	6	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	28	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:	Report No.	: MSK-BD/2022-23/07/0032
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Date	: 05.07.2022
	Commodity	: Surface Water
	Date of sampling	: 23.06.2022
	Location Name	: Padama River Oxbow Water
	Location Code	: SWQ-8 at 24° 5'30.98"N; 89° 0'34.59"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SW-8	Standard	Method of Estimation
pH	-	7.75	6.5-8.5	APHA(23rd Edition)4500-H-B
Turbidity	NTU	70	-	PHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	4.6	6	APHA 23rd Ed. 2017-4500-O-C/G
Total Suspended Solids (as TSS)	mg/l	125	-	APHA(23rd Edition)2540D
Total Dissolved Solid (as TDS)	mg/l	146	-	APHA(23rd Edition) 2540C
Chromium (as Cr)	mg/l	<0.01	-	APHA 23rd Edtn-2017, 3500 Cr B
Mercury (as Hg)	mg/l	<0.001	-	IS 3025(Part 48)-1994; Rffm:2014
Biochemical Oxygen Demand (as	mg/l	4	2	APHA (23rd Edition) 5210B 201
Chemical Oxygen Demand (as COD)	mg/l	15	-	APHA (23rd Edition) 5220B, 2017

National Standard: Environment Conservation Rules 1997, GoB, Standards for inland surface water, schedule 3 (A).

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E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0017
	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: Moni Park
	Location Code	: GWQ-1 at 24° 4'33.81"N; 89° 1'4.52"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-1	Standard	Method of Estimation
pH	-	7.65	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/cm	402	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.6	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.21	1	APHA (23rd Edition)4500 - F C/D,
Chloride (as Cl)	mg/l	20	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	0.15	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	0.35	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	1.6	10	APHA (23rd Edition) 4500- NO3-E,
Nitrite (as NO2)	mg/l	0.6	<1.0	APHA (23rd Edition) 4500- NO3-E,
Iron (as Fe)	mg/l	0.58	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.005	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100	0.0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:	Report No.	: MSK-BD/2022-23/07/0018
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: BIPTC office
	Location Code	: GWQ-2 at 24° 4'7.11"N; 88°59'53.05"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-2	Standard	Method of Estimation
pH	-	7.65	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/c	409	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.4	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.44	1	APHA (23rd Edition)4500 - F C/D, 2017
Chloride (as Cl)	mg/l	35	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	0.17	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	0.31	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	1.8	10	APHA (23rd Edition) 4500- NO3-E, 2017
Nitrite (as NO2)	mg/l	0.88	<1.0	APHA (23rd Edition) 4500- NO3-E, 2017
Iron (as Fe)	mg/l	0.3	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.005	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100	0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:	Report No.	: MSK-BD/2022-23/07/0019
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: Damukdia
	Location Code	: GWQ-3 at 24° 4'57.49"N; 88°59'43.07"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-3	Standard	Method of Estimation
pH	-	7.72	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/cm	469	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.2	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.18	1	APHA (23rd Edition)4500 - F C/D, 2017
Chloride (as Cl)	mg/l	21.2	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	0.08	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	0.12	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	2.3	10	APHA (23rd Edition) 4500- NO3-E, 2017
Nitrite (as NO2)	mg/l	0.06	<1.0	APHA (23rd Edition) 4500- NO3-E, 2017
Iron (as Fe)	mg/l	0.28	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.05	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100ml	0.0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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Registered Office: 19 Green Road, Kalabagan, Dhaka-1205, Bangladesh.

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0020
	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: Shahpara Jame Mosque
	Location Code	: GWQ-4 at 24° 5'8.39"N; 88°59'46.85"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-4	Standard	Method of Estimation
pH	-	7.65	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/cm	455	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.4	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.12	1	APHA (23rd Edition)4500 - F C/D, 2017
Chloride (as Cl)	mg/l	19.5	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	0.06	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	0.09	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	<0.01	10	APHA (23rd Edition) 4500- NO3-E, 2017
Nitrite (as NO2)	mg/l	<0.01	<1.0	APHA (23rd Edition) 4500- NO3-E, 2017
Iron (as Fe)	mg/l	0.18	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.05	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100ml	0.0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0021
	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: Munsi Para Mosque
	Location Code	: GWQ-5 at 24° 3'36.32"N; 89° 0'21.72"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-5	Standard	Method of Estimation
pH	-	7.62	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/cm	475	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	4.8	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.13	1	APHA (23rd Edition)4500 - F C/D, 2017
Chloride (as Cl)	mg/l	27.5	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	0.05	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	0.08	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	1.6	10	APHA (23rd Edition) 4500- NO3-E, 2017
Nitrite (as NO2)	mg/l	<0.01	<1.0	APHA (23rd Edition) 4500- NO3-E, 2017
Iron (as Fe)	mg/l	0.22	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.05	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100ml	0.0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0022
	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: Gopal Nagar Jame Mosque
	Location Code	: GWQ-6 at 24° 4'30.40"N; 88°59'39.52"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-6	Standard	Method of Estimation
pH	-	7.69	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/cm	504	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.1	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.21	1	APHA (23rd Edition)4500 - F C/D, 2017
Chloride (as Cl)	mg/l	23.6	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	0.09	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	0.13	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	1.6	10	APHA (23rd Edition) 4500- NO3-E, 2017
Nitrite (as NO2)	mg/l	0.05	<1.0	APHA (23rd Edition) 4500- NO3-E, 2017
Iron (as Fe)	mg/l	0.29	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.05	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100ml	0.0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0023
	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: Solamain Sah Chisti Majar
	Location Code	: GWQ-7 at 24° 5'14.03"N; 89° 0'35.69"E
	Project	: Kushtia EZ
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-7	Standard	Method of Estimation
pH	-	7.77	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/cm	495	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.3	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.33	1	APHA (23rd Edition)4500 - F C/D, 2017
Chloride (as Cl)	mg/l	18.2	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	<0.05	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	<0.05	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	<0.01	10	APHA (23rd Edition) 4500- NO3-E, 2017
Nitrite (as NO2)	mg/l	<0.01	<1.0	APHA (23rd Edition) 4500- NO3-E, 2017
Iron (as Fe)	mg/l	0.26	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.05	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100ml	0.0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0024
	Date	: 05.07.2022
	Commodity	: Groundwater
	Date of sampling	: 22.06.2022
	Location Name	: Paksy Babupara
	Location Code	: GWQ-8 at 24° 4'52.08"N; 89° 2'9.84"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	GW-8	Standard	Method of Estimation
pH	-	7.79	6.5-8.5	APHA(23rd Edition)4500-H-B
Temperature	°C	25	20-30	APHA 23rd EDITION,2550 B
Electrical Conductivity (as EC)	Us/cm	509	-	APHA (23rd Edition) 2510B
Dissolved Oxygen (as DO)	mg/l	5.0	6	APHA 23rd Ed. 2017-4500-O-C/G
Fluoride (as F)	mg/l	0.35	1	APHA (23rd Edition)4500 - F C/D, 2017
Chloride (as Cl)	mg/l	33.6	150-600	APHA (23rd Edition)4500-Cl B 2017
Phosphorous (as PO4)	mg/l	0.11	0	APHA (23rd Edition) 4500- P D, 2017
Total Phosphorous (as PO4)	mg/l	0.25	0	APHA (23rd Edition) 4500- P D, 2017
Nitrate (as NO3),	mg/l	4.6	10	APHA (23rd Edition) 4500- NO3-E, 2017
Nitrite (as NO2)	mg/l	1.2	<1.0	APHA (23rd Edition) 4500- NO3-E, 2017
Iron (as Fe)	mg/l	0.34	0.3-1.0	APHA (23rd Edition)3500 Fe B 2017
Manganese (as Mn)	mg/l	<0.02	0.1	APHA (23rd Edition)3120B 2017 (ICP)
Arsenic (as As)	mg/l	<0.05	0.05	APHA (23rd Edition)3120B 2017 (ICP)
Zinc (as Zn)	mg/l	<0.02	5	APHA (23rd Edition)3120B 2017
Chemical Oxygen Demand (as COD)	mg/l	<4.0	4	APHA (23rd Edition) 5220B, 2017
E-coli,	/100ml	0.0	0	IS 1622 : 1981 (RA 2014

National Standard: *Environment Conservation Rules 1997, GoB, Standards for Drinking Water, schedule 2.*

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Appendix 4: Detailed Noise Quality Test Report

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Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0009
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 22.06.2022
	Location Name	: Project Site
	Location Code	: NQ-1 at 24°4'42.60"N; 89° 0'39.41"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	40.8	20.00 pm	59.0
7.00 am	41.7	21.00 pm	57.3
8.00 am	45.0	22.00 pm	54.1
9.00 am	48.0	23.00 am	48.7
10.00 am	47.4	24.00 am	38.9
11.00 am	52.0	1.00 am	43.9
12.00 pm	53.7	2.00 am	33.2
13.00 pm	55.3	3.00 am	32.4
14.00 pm	56.5	4.00 am	33.6
15.00 pm	52.8	5.00 am	36.2
16.00 pm	57.3	**Leq-day**	**54.9**
17.00 pm	59.5	**Leq-night**	46.70
18.00 pm	52.8	**Leq-max**	**59.5**
19.00 pm	56.6	**Leq-min**	**32.4**

Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.		
Monitoring Schedule	**Day**	**Night**
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2005		
Residential; Institutional; Educational	55	45
Industrial	70	70

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MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0010
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 23.06.2022
	Location Name	: Shahpara Jame Mosque
	Location Code	: NQ-2 at 24° 5'8.39"N; 88°59'46.85"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	38.7	20.00 pm	44.0
7.00 am	40.6	21.00 pm	39.2
8.00 am	40.6	22.00 pm	40.0
9.00 am	42.6	23.00 am	36.1
10.00 am	43.5	24.00 am	35.5
11.00 am	45.7	1.00 am	33.7
12.00 pm	46.4	2.00 am	33.8
13.00 pm	46.8	3.00 am	33.2
14.00 pm	47.7	4.00 am	35.2
15.00 pm	53.2	5.00 am	36.9
16.00 pm	54.5	**Leq-day**	48.7
17.00 pm	53.4	**Leq-night**	36.1
18.00 pm	49.6	**Leq-max**	**54.5**
19.00 pm	50.1	**Leq-min**	**33.2**

Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.		
Monitoring Schedule	**Day**	**Night**
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2005		
Residential; Institutional; Educational	55	45
Industrial	70	70

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0011
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 23.06.2022
	Location Name	: Lalon Sah Bridge
	Location Code	: NQ-3 at 24°3'46.04"N; 89°1'8.97"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	45.7	20.00 pm	49.3
7.00 am	51.1	21.00 pm	48.9
8.00 am	53.8	22.00 pm	48.4
9.00 am	56.2	23.00 am	47.1
10.00 am	58.8	24.00 am	46.3
11.00 am	61.9	1.00 am	45.9
12.00 pm	63.5	2.00 am	43.8
13.00 pm	62.7	3.00 am	42.8
14.00 pm	64.8	4.00 am	43.6
15.00 pm	63.4	5.00 am	45.0
16.00 pm	61.9	**Leq-day**	59.8
17.00 pm	59.0	**Leq-night**	45.8
18.00 pm	52.9	**Leq-max**	**64.8**
19.00 pm	50.9	**Leq-min**	**45.7**

Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.		
Monitoring Schedule	**Day**	**Night**
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2005		
Residential; Institutional; Educational	55	45
Industrial	70	70

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0012
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 24.06.2022
	Location Name	: Munsi Para Mosque
	Location Code	: NQ-4 at 24° 3'36.32"N; 89° 0'21.72"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	**40.3**	20.00 pm	**53.7**
7.00 am	**42.2**	21.00 pm	**53.4**
8.00 am	**45.1**	22.00 pm	**52.3**
9.00 am	**47.9**	23.00 am	**50.2**
10.00 am	**49.7**	24.00 am	**46.2**
11.00 am	**53.6**	1.00 am	**44.6**
12.00 pm	**56.0**	2.00 am	**43.3**
13.00 pm	**58.7**	3.00 am	**42.0**
14.00 pm	**63.5**	4.00 am	**39.2**
15.00 pm	**60.7**	5.00 am	**39.9**
16.00 pm	**59.3**	**Leq-day**	**56.8**
17.00 pm	**57.9**	**Leq-night**	**47.0**
18.00 pm	**56.4**	**Leq-max**	**63.5**
19.00 pm	**54.9**	**Leq-min**	**39.2**
Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.			
Monitoring Schedule		**Day**	**Night**
Silent area		50	40
Residential area		55	45
Mixed area		60	50
Commercial Area		70	60
Industrial area		75	70
World Bank/IFC Standard, 2005			
Residential; Institutional; Educational		55	45
Industrial		70	70

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0013
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 24.06.2022
	Location Name	: Bangladesh_India Power Transmission Centre
	Location Code	: NQ-5 at 24° 3'59.80"N; 88°59'53.51"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	**46.2**	20.00 pm	**58.7**
7.00 am	**47.3**	21.00 pm	**54.2**
8.00 am	**49.8**	22.00 pm	**48.1**
9.00 am	**57.1**	23.00 am	**47.4**
10.00 am	**59.3**	24.00 am	**45.2**
11.00 am	**58.9**	1.00 am	**41.0**
12.00 pm	**61.4**	2.00 am	**38.9**
13.00 pm	**62.3**	3.00 am	**37.3**
14.00 pm	**64.5**	4.00 am	**36.5**
15.00 pm	**66.2**	5.00 am	**38.2**
16.00 pm	**68.1**	**Leq-day**	**63.2**
17.00 pm	**69.7**	**Leq-night**	**43.7**
18.00 pm	**64.4**	**Leq-max**	**69.7**
19.00 pm	**62.1**	**Leq-min**	**36.5**

Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.

Monitoring Schedule	**Day**	**Night**
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2005		
Residential; Institutional; Educational	55	45
Industrial	70	70

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MITRA S. K. BANGLADESH (PVT.) LTD. DHAKA

Authorized Signatory

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0014
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 25.06.2022
	Location Name	: Gopal Nagar Jame Mosque
	Location Code	: NQ-6 at 24° 4'30.40"N; 88°59'39.52"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	**37.4**	20.00 pm	**51.6**
7.00 am	**41.3**	21.00 pm	**50.4**
8.00 am	**45.6**	22.00 pm	**48.3**
9.00 am	**47.2**	23.00 am	**45.1**
10.00 am	**51.7**	24.00 am	**41.5**
11.00 am	**54.2**	1.00 am	**42.9**
12.00 pm	**57.7**	2.00 am	**40.3**
13.00 pm	**59.5**	3.00 am	**37.5**
14.00 pm	**58.3**	4.00 am	**36.2**
15.00 pm	**59.1**	5.00 am	**39.4**
16.00 pm	**57.2**	**Leq-day**	**55.0**
17.00 pm	**55.2**	**Leq-night**	**43.1**
18.00 pm	**53.7**	**Leq-max**	**59.5**
19.00 pm	**52.9**	**Leq-min**	**36.2**

Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.

Monitoring Schedule	**Day**	**Night**
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2005		
Residential; Institutional; Educational	55	45
Industrial	70	70

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Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0015
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 26.06.2022
	Location Name	: Solamain Sah Chisti Majar
	Location Code	: NQ-7 at 24° 5'14.03"N; 89° 0'35.69"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	**42.1**	20.00 pm	**52.7**
7.00 am	**47.7**	21.00 pm	**50.4**
8.00 am	**48.2**	22.00 pm	**49.7**
9.00 am	**50.4**	23.00 am	**48.1**
10.00 am	**53.3**	24.00 am	**44.2**
11.00 am	**56.4**	1.00 am	**40.4**
12.00 pm	**58.2**	2.00 am	**39.3**
13.00 pm	**60.4**	3.00 am	**36.1**
14.00 pm	**64.2**	4.00 am	**37.5**
15.00 pm	**66.5**	5.00 am	**34.0**
16.00 pm	**68.3**	**Leq-day**	**60.6**
17.00 pm	**60.3**	**Leq-night**	**44.3**
18.00 pm	**56.4**	**Leq-max**	**68.3**
19.00 pm	**53.2**	**Leq-min**	**34.0**

Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.		
Monitoring Schedule	**Day**	**Night**
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2005		
Residential; Institutional; Educational	55	45
Industrial	70	70

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House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSK-BD/2022-23/07/0016
	Date	: 05.07.2022
	Commodity	: **Ambient Noise**
	Date of sampling	: 26.06.2022
	Location Name	: Paksy Babupara
	Location Code	: NQ-8 at 24° 4'52.08"N; 89° 2'9.84"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Time	Leq (dBA)	Time	Leq (dBA)
6.00 am	**36.4**	20.00 pm	**55.3**
7.00 am	**39.4**	21.00 pm	**46.3**
8.00 am	**52.3**	22.00 pm	**44.4**
9.00 am	**49.2**	23.00 am	**42.8**
10.00 am	**52.3**	24.00 am	**39.2**
11.00 am	**56.7**	1.00 am	**36.6**
12.00 pm	**49.4**	2.00 am	**35.3**
13.00 pm	**52.8**	3.00 am	**33.1**
14.00 pm	**45.3**	4.00 am	**32.0**
15.00 pm	**43.2**	5.00 am	**35.7**
16.00 pm	**38.9**	**Leq-day**	**52.2**
17.00 pm	**55.7**	**Leq-night**	**39.4**
18.00 pm	**49.3**	**Leq-max**	**57.5**
19.00 pm	**57.5**	**Leq-min**	**36.4**

Amended Schedule 2, 2005 of Environment Conservation Rules 1997, GoB.

Monitoring Schedule	Day	Night
Silent area	50	40
Residential area	55	45
Mixed area	60	50
Commercial Area	70	60
Industrial area	75	70
World Bank/IFC Standard, 2005		
Residential; Institutional; Educational	55	45
Industrial	70	70

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Appendix 5: Detailed Soil Quality Test Report

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSKGL/ED/2021-22/003961-58
	Date	: 05.07.2022
	Commodity	: Soil Quality
	Date of sampling	: 22.06.2022
	Location Name	: Project Site
	Location Code	: SQ-1 at 24°4'42.72"N; 89° 0'46.54"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SQ-1	Standard	Method of Estimation
pH	-	8.22 (1:2.5)	-	IS 2720 (Part 26)-1987;Rffm:2011
Electrical Conductivity (as	Us/c	198 (1:2)	-	IS 14767:2000,RA 2016
Organic Matter (as OM)	%	0.35	-	IS 2720 (Part 22)-1972; Rffm:2015
Total Nitrogen (as TN)	mg/	382	-	TPM/MSK/P&E/1/35
Lead (as Pb)	mg/	6	85	EPA 6010D
Zinc (as Zn)	mg/	44	140	EPA 6010D
Chromium (as Cr)	mg/	18	100	EPA 6010D
Copper (as Cu)	mg/	21	36	EPA 6010D
Nickel (as Ni)	mg/	13	35	EPA 6010D
Cadmium (as Cd)	mg/	<2.0	0.8	EPA 6010D
Potassium (as K)	mg/	65	-	TPM/MSK/P&E/1/5
Phosphorous (as PO4)	mg/	<3.0	-	TPM/MSK/P&E/1/12
Sand	%	43	-	TPM/MSK/P&E/1/36A
Silt	%	20	-	TPM/MSK/P&E/1/36A
Clay	%	37	-	TPM/MSK/P&E/1/36A
Texture	-	Clay Loam	-	TPM/MSK/P&E/1/36A

Dutch Standard: Dutch Target and Intervention Values, 2000, for soil and sediment and National Environment

Mitra S. K. Bangladesh (Pvt.) Ltd.

MITRA S.K. BANGLADESH (PVT.) LTD. DHAKA

Managing Director

Registered Office: 19 Green Road, Kalabagan, Dhaka-1205, Bangladesh.

Mitra S. K. Bangladesh (Pvt.) Ltd.

House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.

T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSKGL/ED/2021-22/003961-60
	Date	: 05.07.2022
	Commodity	: Soil Quality
	Date of sampling	: 23.06.2022
	Location Name	: Bheramara-Kuchiamora road
	Location Code	: SQ-3 at 24° 4'38.42"N; 88°59'53.29"E
	Project	: **Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SQ-3	Standard	Method of Estimation
pH	-	7.66 (1:2.5)	-	IS 2720 (Part 26)-1987;Rffm:2011
Electrical Conductivity (as	Us/c	434(1:2)	-	IS 14767:2000,RA 2016
Organic Matter (as OM)	%	0.78	-	IS 2720 (Part 22)-1972; Rffm:2015
Total Nitrogen (as TN)	mg/	502	-	TPM/MSK/P&E/1/35
Lead (as Pb)	mg/	17	85	EPA 6010D
Zinc (as Zn)	mg/	44	140	EPA 6010D
Chromium (as Cr)	mg/	31	100	EPA 6010D
Copper (as Cu)	mg/	35	36	EPA 6010D
Nickel (as Ni)	mg/	29	35	EPA 6010D
Cadmium (as Cd)	mg/	<2.0	0.8	EPA 6010D
Potassium (as K)	mg/	112	-	TPM/MSK/P&E/1/5
Phosphorous (as PO4)	mg/	<3.0	-	TPM/MSK/P&E/1/12
Sand	%	45	-	TPM/MSK/P&E/1/36A
Silt	%	23	-	TPM/MSK/P&E/1/36A
Clay	%	32	-	TPM/MSK/P&E/1/36A
Texture	-	Loam	-	TPM/MSK/P&E/1/36A

Dutch Standard: Dutch Target and Intervention Values, 2000, for soil and sediment and National Environment

Mitra S. K. Bangladesh (Pvt.) Ltd.

MITRA S.K. BANGLADESH (PVT.) LTD. DHAKA

Managing Director

Mitra S. K. Bangladesh (Pvt.) Ltd.
House # 02, 5th Floor, Road # 32,
Dhanmondi, Dhaka-1209
Bangladesh.
T : +88 02 5815 3195, +88 01973 167 777
E : mskdhaka@mitrask.com
W : www.mitrask.com

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TEST REPORT

Name & Address of the Customer:		
SHAHIDUL CONSULTANT LTD 44/8-F, Indira Road, Panthapath, Dhaka- 1215	Report No.	: MSKGL/ED/2021-22/003961-59
	Date	: 05.07.2022
	Commodity	: Soil Quality
	Date of sampling	: 22.06.2022
	Location Name	: Lalon Sah Bridge
	Location Code	: SQ-2 at 24° 3'36.66"N; 89° 0'52.88"E
	Project	**: Kushtia EZ**
Ref. No. & Date: SCL/4_EZ/Tests/Kushtia/MSK/25-2022 Dated 02.03.2022		

ANALYSIS RESULTS

Parameters	Unit	SQ-2	Standard	Method of Estimation
pH	-	7.79(1:2.5)	-	IS 2720 (Part 26)-1987;Rffm:2011
Electrical Conductivity (as	Us/c	284 (1:2)	-	IS 14767:2000,RA 2016
Organic Matter (as OM)	%	0.87	-	IS 2720 (Part 22)-1972; Rffm:2015
Total Nitrogen (as TN)	mg/	446	-	TPM/MSK/P&E/1/35
Lead (as Pb)	mg/	14	85	EPA 6010D
Zinc (as Zn)	mg/	39	140	EPA 6010D
Chromium (as Cr)	mg/	28	100	EPA 6010D
Copper (as Cu)	mg/	26	36	EPA 6010D
Nickel (as Ni)	mg/	34	35	EPA 6010D
Cadmium (as Cd)	mg/	<2.0	0.8	EPA 6010D
Potassium (as K)	mg/	77	-	TPM/MSK/P&E/1/5
Phosphorous (as PO4)	mg/	<3.0	-	TPM/MSK/P&E/1/12
Sand	%	42	-	TPM/MSK/P&E/1/36A
Silt	%	19	-	TPM/MSK/P&E/1/36A
Clay	%	39	-	TPM/MSK/P&E/1/36A
Texture	-	Clay Loam	-	TPM/MSK/P&E/1/36A

Dutch Standard: Dutch Target and Intervention Values, 2000, for soil and sediment and National Environment

Mitra S. K. Bangladesh (Pvt.) Ltd.
DHAKA
Managing Director

Registered Office: 19 Green Road, Kalabagan, Dhaka-1205, Bangladesh.

Appendix 6: Air Modeling Report

AIR QUALITY MODELING

Background

Modern technological man's craze for more and more material wealth and physical comforts has unknowingly pushed him into the world of unsustainable trade, commerce, and industry, for the carrying of which, a number of developmental activities like hazardous and non-hazardous involving excessive use of science and technology necessarily take place. In this regard, environmental degradation like air pollution has been observed in each industrial development. Therefore, it is necessary to decrease such environmental pollution and degradation through environmental management procedure. In Bangladesh, Environment Conservation Act 1995 (Amended 2010) is currently the main act governing environmental protection in Bangladesh, which replaced the earlier environment pollution control ordinance of 1992 and provides the legal basis for Environment Conservation Rules, 1997 (ECR1997).

An issue that is becoming ever more important is identifying and mitigating potential environmental and social impacts related to the development. Therefore, a baseline study is essential in order to be able to determine the level of impact expected and to enable the monitoring of impacts after the development has occurred. To facilitate further preparation of Environment Clearance Report cognizant to the need to mitigate the negative environmental impacts of projects in its portfolio and has developed systems to safeguard the environmental concerns. To comply with the environmental safeguard requirement a baseline environmental status of project sites has to be established before activity initiates in the field. It will be done through primary monitoring and surveys for relevant parameters and secondary data collection to provide a database against which short- or long-term environmental impacts of the project can be determined, the existing baseline environmental data are to be collected.

To predict pollution level and its management through very sound and scientific modeling technique such as air dispersion model and noise model are used widely in the present scenario. For this this region, bbaseline eenvironment monitoring of certain environmental attributes viz. Meteorology, Ambient Air Quality, Ambient Noise Quality need to be studied surrounding projected area. Similarly, rregulatory agencies rely on dispersion models as part of environment management plan and their approval processes

Therefore, USEPA recommended different air dispersion model and noise prediction model to assess the emission and magnitude of the contaminants to the adjacent areas of the Project site. The model AERMOD 8.9 has been used to predict and simulate the effects of criteria pollutants from major emission sources in the Project area and analysed the effect on ambient air quality for NO2, SO2, PM2.5 and PM10.

Introduction

The Gaussian Dispersion Modeling (GDM) is used for prediction of dispersion of air emission and the computation of Ground Level Concentration (GLC) up to a specified distance from source. The fundamental model is given below:

Where c is a concentration at a given position, Q is the source term, x is the downwind, y is the crosswind and z is the vertical direction and u is the wind speed at the h height of the

release. The σy, σz deviations describe the crosswind and vertical mixing of the pollutant. The above equation describes a mixing process that results in a Gaussian concentration distribution both in crosswind and in vertical direction, centered at the line downwind from the source. Gravitational settling and chemical or radioactive decays are neglected.

Model Setup

To ensure compliance with the air emission criteria the following model setup has been taken into consideration in this study with integration of monitored baseline data of the project Table 1.1.

Table 1.1: General layout of the Model

Parameter	Details
Model name	AERMOD 9.5.0
Model type	Steady state Gaussian plume air dispersion model
Averaging time	24 Hour
Source type	Point source
Surface meteorological data	Site specific data processed by AERMET

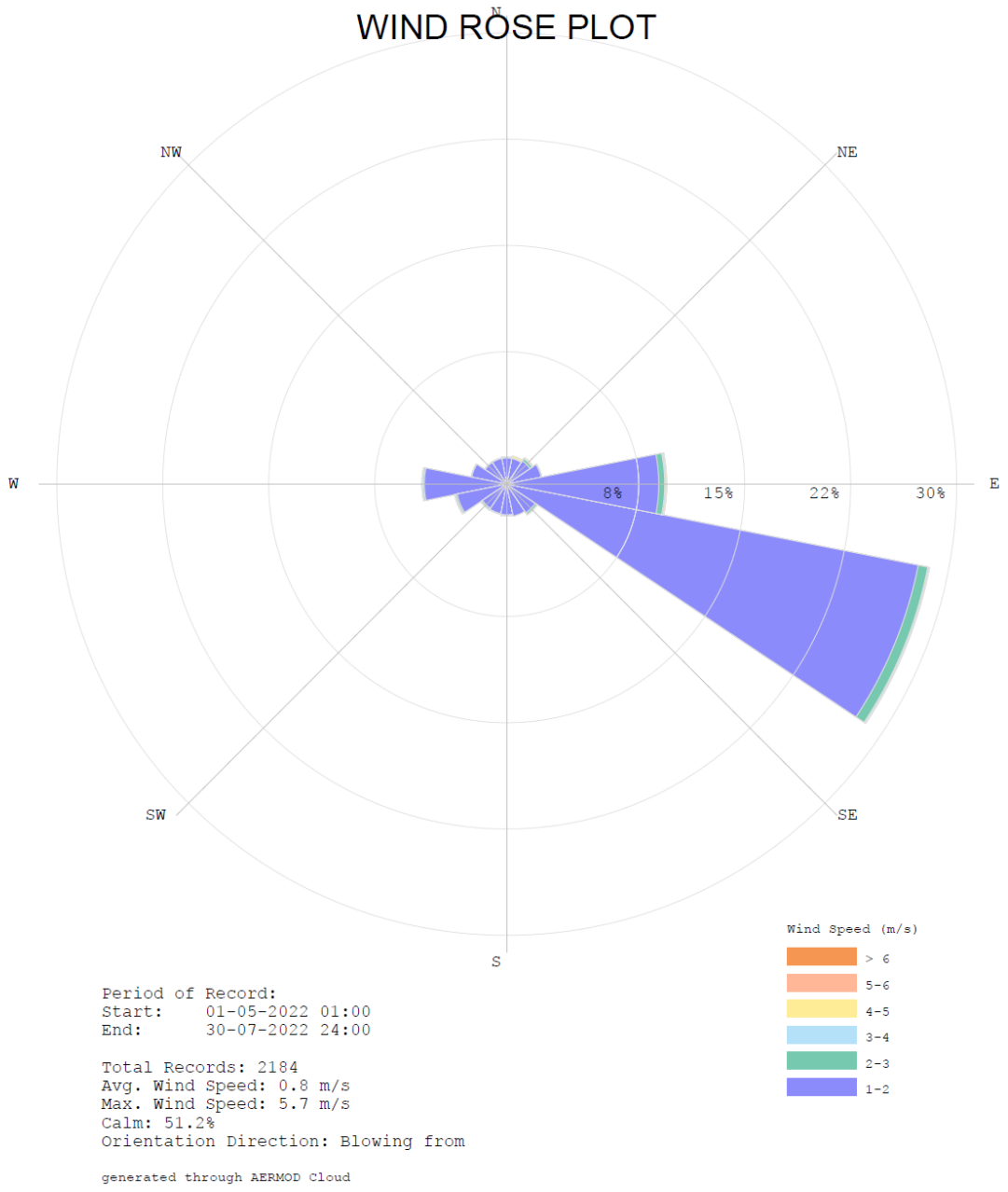
Meteorological Data

Monitoring period has been considered for June to July 2021. Meteorological file has been prepared by taking the hourly data for one month and consist of wind direction, wind speed, temperature (in K), mixing height, stability class (urban and rural) and cloud cover. AERMET View version 9.5.0 has been used to create the SURFACE file (.SFC) and PROFILE file (.PFL).

Wind rose:

The Windrose was plotted with the aid of software WRPLOT which is shown in Fig 1 and following results have been obtained.

Predominant wind direction is ESE.
Average Wind Speed recorded as 0.8 m/s
Maximum Wind Speed recorded 5.7 m/s
Second and third predominant wind direction are E and W respectively.
Calm conditions were recorded as 51.2 %



Model details and Frame work of Computation:

Methodology

There are two input data processors that are regulatory components of the AERMOD modeling system: AERMET, a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data preprocessor that incorporates complex terrain using USGS Digital Elevation Data.

Considerations / Control and model Input:

There are following considerations for this project

a. Emission during the operation phase is mainly from the DG sets which are operational during the power failure only.

b. Stacks are proposed to be installed above the terrace level of the building as per DoE, ECR, 1997 norms.
c. Reference point has been taken as the center of the project site.
d. Only surface air data has been considered for running the model for upper air, upper air estimator has been used.
e. Model is run through the whole period and 24 Hours. Results have been prepared accordingly

Results and Discussion

After filling all the details, software was run and following output have been generated by Aermod View. It is evident from the following table that the maximum ground level concentration in the study area will be well within the applicable national as well as international standards (WHO) for air quality in both the scenarios. The concentration isopleths of PM10, PM2.5, SOx and NOx for different averaging periods without baseline concentrations have been presented. As stated in the General EHS Guidelines of the World Bank/ IFC, emissions from a single project should not contribute more than 25% of the applicable ambient air quality standards to allow additional, future sustainable development in the same. Considering both the guidelines, the predicted incremental ground level concentrations due to the Project will be well within these guidelines.

The model was run to predict the maximum ground level concentration of PM10, NO2 and SO2 due to operation of proposed economic zone. Point sources at location of proposed DG stack will be fixed. Receptors were fixed at baseline monitoring stations as well as in uniform polar grid up to 10km radius from project site. The model was run assuming for 24-hour activities. The predicted maximum incremental GLC (24-hour average) of PM10, PM2.5, SO2 and NOx was found as 3.96 µg/m³, 3.96 µg/m³, 0.93 µg/m³, and 1.47 µg/m³ respectively. The predicted maximum incremental GLC (24-hour average) and predicted cumulative GLC at baseline air quality monitoring locations are presented in Table 1.2. The spatial distribution of PM10, PM2.5, SO2 and NO2 GLC in 10 km study area are presented in Figure 1.2, 1.3, 1.4, and 1.5 for PM10, PM2.5, SO2 and NOx respectively

Table 1.2: Predicted GLC of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 at Ambient Air Quality Monitoring Stations

Code	Village/Coordinate		Baseline Conc. (µg/m^3)				Predicted GLC (µg/m^3)				Total GLC (µg/m^3) (Existing + Proposed Scenario)			
		PM10	PM2.5	SOx	NOx	PM10	PM2.5	SOx	NOx	PM10	PM2.5	SOx	NOx
A1	24°4'42.60"N, 89° 0'39.41"E	85.2	49.6	6.8	32.2	0.16	0.16	0.01	0.06	85.36	49.76	6.81	32.26
A2	24°5'8.39"N, 88°59'46.85"E	88.6	46.2	6.8	34.6	0.12	0.12	0.03	0.05	88.72	46.32	6.83	34.65
A3	24°3'46.04"N, 89°1'8.97"E	78	39.7	6.5	31.5	0.02	0.02	0.0	0.01	78.02	39.72	6.5	31.51
A4	24° 3'36.32"N, 89° 0'21.72"E	82	41.5	6.3	28.5	0.01	0.01	0.0	0.01	82.01	41.51	6.3	28.51
A5	24°3'59.80"N, 88°59'53.51"E	86	42.6	6.8	36.2	0.02	0.02	0.0	0.01	86.02	42.62	6.8	36.21
A6	24°4'30.40"N, 88°59'39.52"E	71	35.9	6.3	28.8	0.53	0.53	0.11	0.2	71.53	36.43	6.41	29
A7	24°5'14.03"N, 89° 0'35.69"E	69	34.5	6.2	26.9	0.07	0.07	0.01	0.03	69.07	34.57	6.21	26.93
A8	24° 4'52.08"N, 89° 2'9.84"E	80	41.6	6.6	33.2	0.03	0.03	0.01	0.01	80.03	41.63	6.61	33.21
ECR 2023 standards		150	65	80	100	150	65	80	100	150	65	80	100

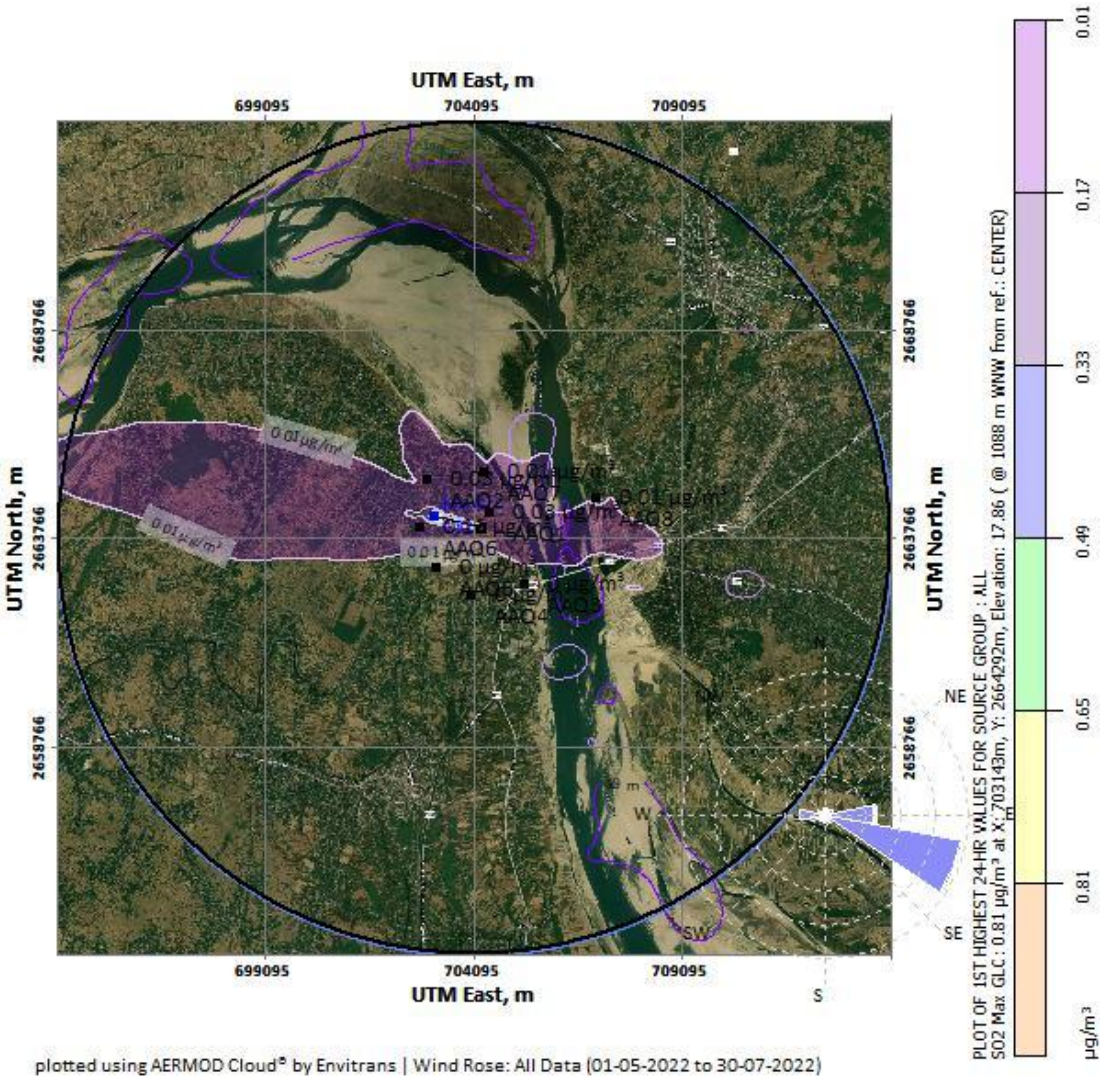


Figure 1.4: Isopleths of 24-hourly Average Maximum SO2 Ground Level Concentrations

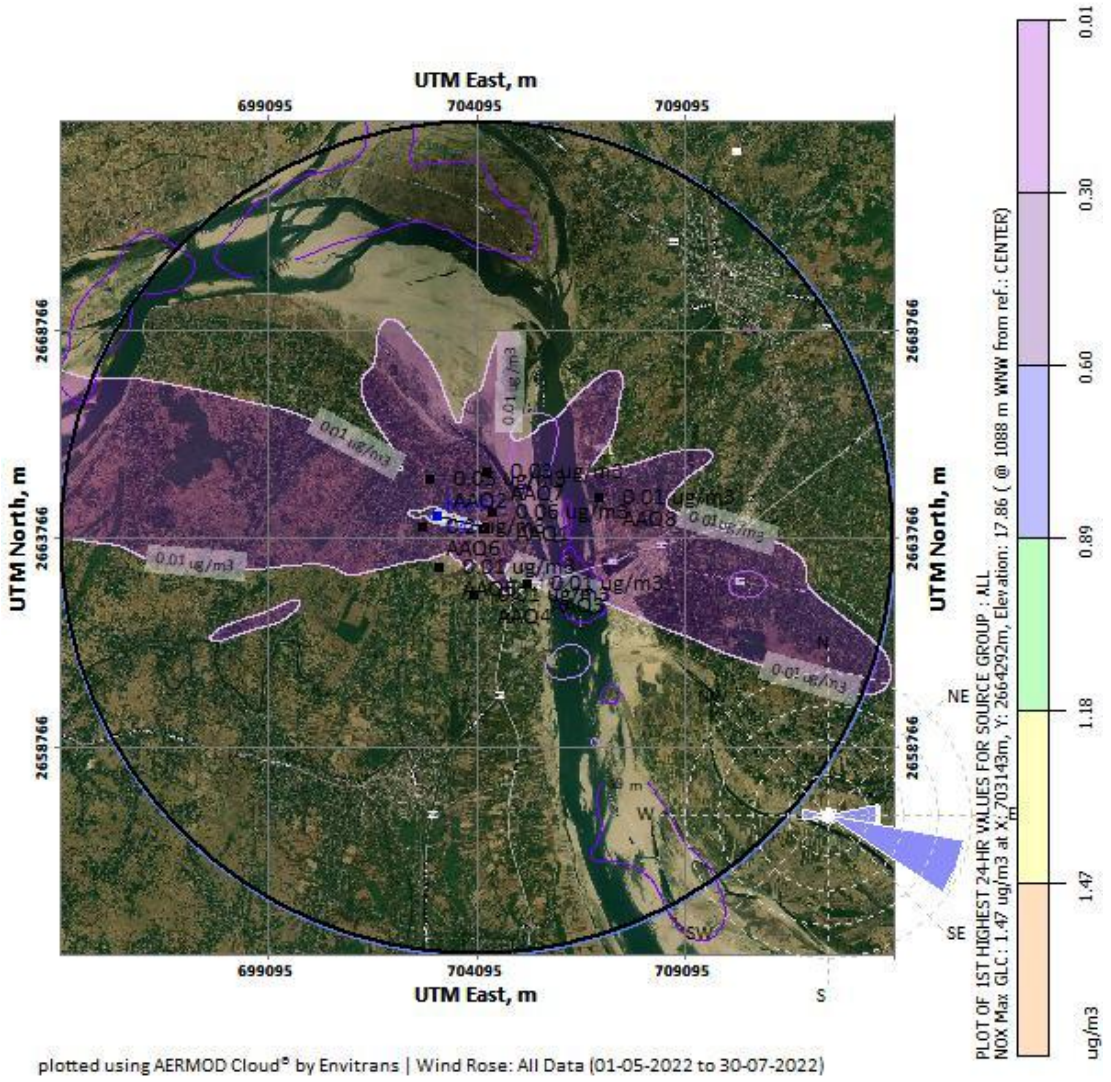


Figure 1.5: Isopleths of 24-hourly Average Maximum NO2 Ground Level Concentrations

Inference and observation

The main impacted area due to air pollution is under 2 km towards the W to SE and S side. Parabolic curves have been observed under 2 km which are reducing gradually leading to the reduction in impacts. Major source of pollution will be DG Sets and Operational activities based on the energy consummation and pollution load. Comparing the baseline data with incremental data; it has been observed that the increased Air Quality Index due to the incremental ground level concentration does not have impact on the prescribed color zone of the respective pollutants.

The incremental value of PM_{10} for the ambient air has been found to be 'Moderate' category during the baseline studies as well as after the incremental ground level concentration. Therefore, there is no significant impact on existing air quality owing to the project. It is however to be noted that the air pollution quality in the study area is already Moderate category.

Proposed Air Pollution Control Measure

MITIGATION MEASURES DURING OPERATION PHASE:

- ✓ DG Stack height shall be maintained as per the guidelines.
- ✓ Suppression of dust by sprinkling of water twice or thrice a day depending upon weather conditions.
- ✓ Two tier green belt shall be made along the boundary wall to reduce the impact of air pollution from air coming from outside boundary and inside air shall be restricted inside only.
- ✓ Landscaping shall be done properly so that no dust emission shall be there. All the pavers shall be surrounded with grass.
- ✓ Wheel washing bay shall be provided during construction phase. Extended area RCC shall be provided to prevent mud sticking to tyres.
- ✓ Barricading of boundary wall shall be done 1/3rd of building height. As the building height increases, the height of wall shall also be increased up to mass of 10m.
- ✓ All the DG sets on site shall be centralized and shall be closed acoustic type.
- ✓ Stack height of DG sets shall be maintained above the roof top of highest building.
- ✓ All the construction material shall be covered with the tarpaulin sheets to avoid fugitive emissions.
- ✓ All the trucks/dumpers shall be covered while entering and going out from the site.
- ✓ All the buildings shall be covered with suitable envelope to prevent dust emission due to cutting of bricks and tiles during plumbing and other works.

Appendix 7: Noise Modeling Report

1. Introduction

Kushtia EZ to complete a noise modeling assessment to predict the Sound Pressure Levels (SPLs) expected during the operational phase of the project and to estimate the noise contribution from the facility to the current baseline conditions. The SPLs that would be generated during facility operation were predicted using the DhwaniPro software tool, which is an industry standard. The baseline noise conditions (background noise) were determined in the project area based on the results of eight (08) monitoring campaigns that were conducted in 2022. The SPLs that are predicted to be generated by the proposed complex and the cumulative noise levels with the background SPLs were discussed and compared with the Maximum Permissible Limits for Noise Intensity defined by Bangladesh regulation (ECR, 1997) and the IFC Guidelines. This assessment focused on evaluating the compliance of the noise contributions from the project in the sensitive receptors and industrial areas with national and international ambient noise standards. Based on the Noise Model results, the proposed Kushtia EZ is complying with the national and International limits presented in the report with applying the required mitigation.

However, a cumulative effect of surface excavation activities generates enormous noise in the project area and its surrounding areas. Prolonged exposure to high noise levels over a period of years invariably causes permanent damage to the auditory nerve and/or its sensory components (Banerjee and Chakraborty, 2006). The irreversible damage, commonly referred as noise-induced hearing loss (NIHL), is the commonest occupational diseases among-st the construction workers especially at such sites which have multiple noise sources. Besides this the fauna of surrounding area is also affected by noise as the wildlife is more sensitive to noise than the human beings (Mathur, 2005).

A. Noise due to crushing, Screening and Loading Plan: The average noise levels generated due to proposed crushing activities will be about 88.5 dB(A) which is within the exposure limit of 90 dB(A). The crusher shall be housed in a shed to contain noise. Screening activities shall generate average noise level of about 96.5 dB (A). Workers in the noise generating zone will be provided with earmuffs/earplugs besides dust mask.

B. Noise due to excavation and transportation: In order to predict ambient noise levels due to the construction activities from various sources at different location within the barrage complex the noise dispersion modeling has been done on the assumption that all noise sources are acting as a single source generating approximately 91 dB(A). Noise generated due to deployment of rock breaker, excavators, loaders and dump trucks are shown in Table 1.1.

Table 1.1. Standard Values of Noise Level

	Machinery/ Activity	Noise Produced in dB(A) at 50 ft fromV source*
1	Excavator/Shovel	85
2	Front end loader	85
3	Dump Truck/ Tippers (at full throttle)	92
4	Near Haul road (while dumpers are moving)	88
5	Dozer (when dozing)	102
6	Drill machine (drilling with Jack hammer)	88

7	Aggregate processing unit / Stone Crusher (outside crushercabin)	100
8	Aggregate processing unit / Stone Crusher (inside crusher cabin)	86

Source: U.S. Department of Transportation (Federal Highway Administration) – Construction Noise Handbook

Environmental noise particularly industry/commercial/traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of machinery/work/vehicles. The impacts of noise due to the proposed project will be of temporary significance locally in the construction phase and slight increase may occur during the operation stages. Table 1.2 presents the source of noise pollution and the impact categorization.

Table 1.2: Source of the Noise pollution and its impact

	Phase	Source of Noise pollution	Impact categorization
1	Pre-Construction	Man, material and machinery movements Establishment of labor camps, onsite offices, stock yards and construction plants	All activities will last for a short duration and also shall be localized in nature
2	Construction Phase	Plant Site: Stone crushing, asphalt production plant and batching plants, diesel generators etc. Work zones: Community residing near to the work zones	Plant Site: Impact will be significant within 500m. Work zones: Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.
3	Operation Phase	Due to increase in traffic (due to improved facility)	Will be compensated with the uninterrupted movement of heavy and light vehicles.

1.1 Objective and Scope of Work

Kushtia EZ to complete a noise modeling assessment to predict the Sound Pressure Levels (SPLs) expected during the construction phase of the project and to estimate the noise contribution from the facility to the current baseline conditions.

- The SPLs that would be generated during construction were predicted using the DhwaniPro software tool, which is an industry standard. This software incorporates the modelling of point, line and area noise sources with screening effects of barriers and buildings and ground absorption effects to construct an acoustic model. The results are presented in the form of an acoustic map with contour lines of equal noise levels (isophones) at 5 decibel dB(A) intervals.
- The baseline noise conditions (background noise) were determined in the project area based on the results of Eight (n=08) monitoring campaigns that were conducted in two seasons in year of 2022.
- The SPLs that are predicted to be generated by the proposed area and the cumulative noise levels with the background SPLs were discussed and compared

with the Maximum Permissible Limits for Noise Intensity defined by Bangladesh regulation (ECR 2023) and the IFC Guidelines.

- This assessment focused on evaluating the compliance of the noise contributions from the project in the sensitive receptors and commercial and residential areas with national and international standards.
- This Noise Model report is intended to be used as input to the Environmental and Social Impact Assessment (ESIA) of the project. This noise model is considered a screening approach to evaluate potential environmental noise impacts from the proposed economic zone.
- This model was run based on data, which is a common practice at such early stage of the project. In a later stage after construction and before operation, it is highly recommended to rerun the model should there are any deviations in the current model inputs.

1.2. REGULATIONS

The following applicable national and international standards have been considered to evaluate the compliance of the project with ambient noise standards. This section presents both the Bangladesh limits and IFC Guidelines for ambient noise. As for the European Union relevant guidelines, Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise, establishes that the concrete figures of any limit values are to be determined by the Member States. Consequently, there are no reference values on ambient noise set by European legislation to be presented in this section.

1.2.1 Bangladesh Legislation

The Department of Environment (DoE) has the power to set criteria and conditions, monitor compliance and take action against violators of these criteria and conditions. Maximum noise levels generated by an industrial facility are authorized to mark off the areas under their jurisdiction as silent, residential, mixed, and commercial or industrial zones according to the Noise Pollution (Control) Rules, 2006. The allowable noise limits, listed in Table 1.3, are determined by zone types and vary with the time of day. They should also put signs to mark those areas. The act also describes the approved standard limit of sound in the added schedule 1 and 2.

Table 1.3: Noise Standard as per Classification given by Noise Pollution Rule, 2006

Type of area	Acceptable limit of noise level (dB)	
	Day time	Night time
Silent	45	40
Residential	50	45
Mixed	60	50
Commercial	70	60
Industrial	75	70

In the schedule 1, silent area means area up-to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/ to be identified by the government. In the silent area it is prohibited to use any kind of horns of vehicles, audio signals and loudspeakers. According to this act, daytime is counted from 6am to 9pm whereas night-time is counted from 9pm to 6am.

1.2.2 International Finance Corporation (IFC) Ambient Noise Guidelines

The International Finance Corporation (IFC) has established guidelines for maximum permissible noise levels generated by a facility. The IFC Environmental, Health, and Safety (EHS) Guidelines for Noise Management (April 2007) refer to guidelines for industrial sectors. Noise impacts should not exceed the levels listed in Table 1.4.

Table 1.4 IFC Maximum Allowable Noise Levels dB(A)

Guideline	Zone	Day, dB	Night, dB
IFC EHS Guidelines	Residential, institutional, educational	55	45
	Industrial, commercial	70	70

Prior to construction activities, subproject contractors has been conduct noise level measurements as baseline. During construction, contractors will be required to conduct noise level measurements and ensure that the subproject does not cause deterioration of noise level beyond the standards. This is included in the environmental management plan hereof. The principal sources of noise are recognized in the study area which details are given in the Table 1.5.

Table 1.5: Principal sources of noise in the Study Area

Source	Particulars
General community noise:	Noise from the market area, advertising via rickshaw mounted loud speakers, prayer calls, church bells, etc.
Road traffic:	Noise from the main roads and some secondary roads released from engines and originated from the frequent use of signal-horn
Commercial operations	Noise from minor industries and handicraft business surrounding project area.
Pumps:	Most pumps are housed but often operate during night time, what may result in increased noise levels during the night time.
Noise arising from natural sources:	Insects (in particular various types of crickets) and birds (as observed near forest area), wind and heavy rain may contribute to elevated noise levels.

Noise levels are measured in Decibel (dB). The Decibel scale is presented in Table 1.6.

Table 1.6: Noise characterization

Noise level, dB	Characterisation / examples for sources of noise
0	Threshold of hearing
20	Background noise in quite countryside or silent study room
40	Noise level in a living room
60	Conversational speech
80	Busy road traffic or freight train
100	Pneumatic hammer, construction site
110	Rock music concert
120	Threshold of discomfort

Noise level, dB	Characterisation / examples for sources of noise
140	Threshold of pain

Source: compiled from www.osha.gov/SLTC/noisehearingconservation/loud.html, retrieved May 30, 2022 and other sources

Noise levels standards are set by the Environment Conservation Rules 1997 for different types of land use;

Silent Area: The category "silent area" relates to 100 m zones around hospitals and other sensitive land uses as established by the government. In the absence of any regional planning documents describing the spatial distribution of commercial, residential, and other land uses based on the field observation.

- Residential Area: "Residential" zones are assigned to the sampling points located in rural, urban household areas with no business activities.
- Commercial Area: The area represents the business complex area.
- Industrial Area: The area represents the industrial complex including manufacturing, processing packaging units establish in area like economic zones etc.
- Mixed area: the area represents combined residential, commercial as well as industrial area.

Both, GoB and IFC guidelines (see provide noise limits for day and night time. While night time in Bangladesh is defined as the time interval between 9 PM and 6 AM, ICF considers night time from 10 PM to 7 AM.

In the absence of national standards describing the noise measurement methodology, the IFC guidelines were used as a minimum: "*Noise monitoring programs should be designed and conducted by trained specialists. Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently, as appropriate (or else cover differing time periods within several days, including weekday and weekend workdays). The type of acoustic indices recorded depends on the type of noise being monitored, as established by a noise expert. Monitors should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface (e.g. wall). In general, the noise level limit is represented by the background or ambient noise levels that would be present in the absence of the facility or noise source(s) under investigation."* According to IFC Guidelines noise impacts shall not exceed the levels below or not increase the (background) noise levels more than 3 dB at the nearest receptors.

1.3. BASELINE NOISE CONDITIONS

The background noise levels measured in the project area were used to determine the baseline noise conditions. These noise levels were used in combination with the predicted noise levels to be contributed from the proposed project based on the model to determine the expected cumulative noise levels. For the purpose of this assessment, two sources of data were available:

- Results of two monitoring campaigns: A monitoring survey was conducted in two seasons in the year of 2022 at Eight locations (n=08) along the project boundary Figure 1.1 and

- An additional measurement was calculated based the proposed activities during construction and taken as a reference value for noise prediction.

Figure 1.1 Location of Noise Monitoring Measurements

Measurements were continuously recorded at all six locations during a 24-hour period that covered two intervals, 'Day' and 'Night', as per ECR 2023. Measurement locations were chosen to be as relevant as possible to the project design and the locations of predicted noise sources. The 24-hour ambient noise measurements were conducted using a Type I (precision grade) sound level meter, and 1/3 octave band logging was employed. The parameters measured at each location included, equivalent continuous sound pressure level (Leq) Table 1.7.

Table 1.7: Measured background data from the receptor of the project area

Noise Level	NQ-1	NQ-2	NQ-3	NQ-4	NQ-5	NQ-6	NQ-7	NQ-8
Day	54.9	48.7	59.8	56.8	63.2	55	60.6	52.2
Night	46.7	36.1	45.8	47	43.7	43.1	44.3	39.4
DAY and Night Average (weighted Factor adjusted	55.66	47.89	58.68	56.81	61.4	54.38	59.01	51.34

As sound waves travel through the air a small portion of the energy is converted into heat depending upon the atmospheric temperature and humidity, however the amount is only significant with high frequencies and long distances. There are no affecting weather conditions, such as wind or temperature inversion, as these will affect the propagation path of a noise source and diffraction around the barrier. Wind Rose Plot of the study area for last ten-year, wind is blowing from South direction in most of time with 1 to 2 m/s speed Figure 1.2.

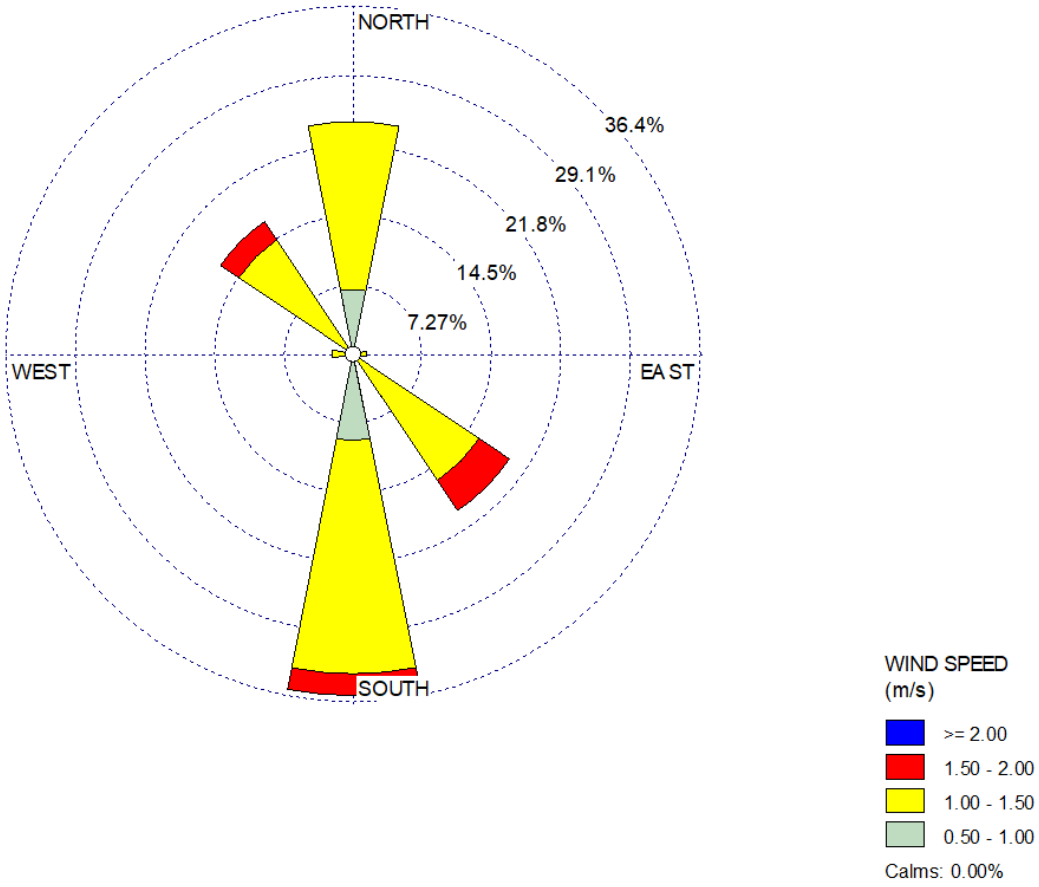


Figure 1.2: Wind Rose Plot of Kushtia EZ Area

Appendix 8: Noise Modeling Report

1.4. METHODOLOGY

1.4.1 Modelling Software

The DhwaniPro software was used to predict noise levels that will result from the proposed facility. DhwaniPro is a modeling and presentation tool that helps optimizing the noise control measures and visualizing the effects of noise propagation throughout complex systems, such as the proposed facilities. DhwaniPro is industry-standard noise prediction software used to calculate sound pressure levels and generate noise maps. The maps are a graphical representation of the calculated sound pressure levels, considering reflections and diffractions of sound, and taking into account the geometry of buildings at the site and topography. The pressure level calculated or interpolated for each point within the modelling domain are shown as a grid of sound pressure, from which a contour map is generated showing isophones (lines of equal sound pressure). DhwaniPro generates industrial noise maps using the calculation methods given by standards ISO 8913 for noise emissions and ISO 9613 for noise propagation.

1.4.2 Modelling Approach

The program includes a database module that prompts for all input data required for the calculations made by the noise model, including geometrical data of all objects relevant to the investigation. All data entered into the database can be further edited by adding attributes, such as x, y, z coordinates, noise emission levels, noise absorption and reflective properties. The calculation area is also defined. The noise sources can be of four different types: point sources, line sources, area sources and industrial buildings. The two latter sources can be defined by their total acoustic power or by the acoustic power density of the source. Every source is described in terms of its acoustic power, which allows the noise propagation calculation to be based on any of the standards that are included in the software. The calculation module generates a grid of receptors over the calculation area defined in the database. The main calculation module provides the necessary data to calculate or interpolate the noise pressure in the middle of each grid cell from the receptors around it. Grid spacing is chosen to accommodate the model resolution requirements. Additional corrections, such as reflection and absorption coefficients of walls and ground material, can be made. Impulse and tonal sources can be defined; and the sources can be associated with a radiation pattern. The library module of the software program is used to provide industrial standard noise for each source in the absence of vendor data. The library defines each noise source in terms of central frequency or in terms of frequency spectrum. If spectral data are unknown and the project has an industrial nature, as in this case, the noise pressure in each cell can be calculated using a default central frequency of 500 Hz (typical industrial standard) or a different value, if the choice is supported.

1.4.3 Cumulative Effects

Accumulated levels of sound pressure are calculated combining the sound contribution generated during the operation phase and the conditions of existing

background noise. The decibels have a logarithmic value. In order to calculate the contribution of several sound sources, it is necessary to use the following formula:

$$L_{pt} = 10log\left(\sum_{i=1}^{n} 10^{Lpi/10}\right)$$

Where,

Lpt = Total sound pressure

Lpi = Partial sound pressure

n = Number of sources of sound

An example that illustrates the cumulative effect of adding one sound source B to another sound source A. Based on the calculation above, the effective contribution of a second sound source is dependent on its value relative to the original sound source Figure 1.3.

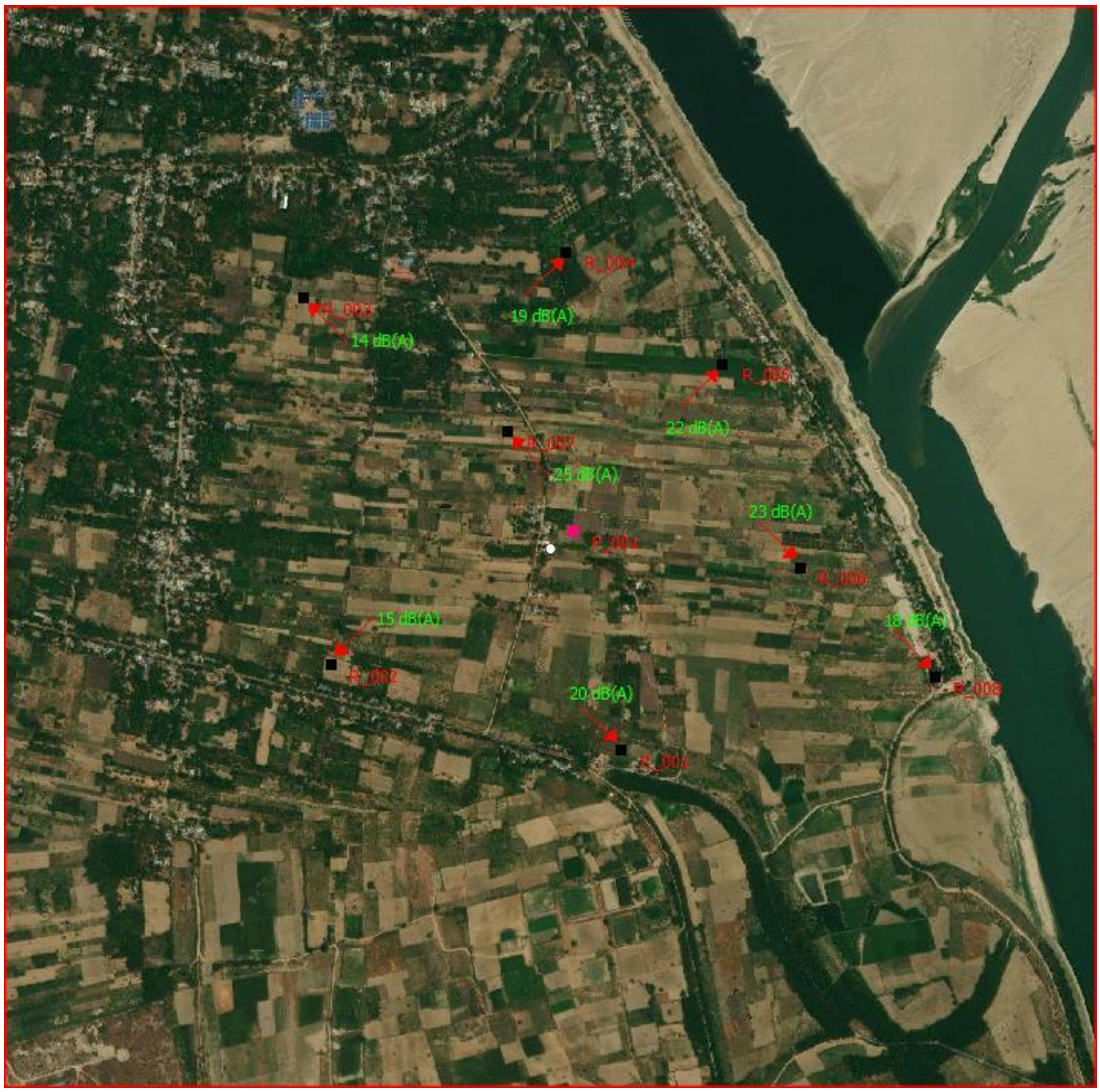


Figure 1.3: Accumulated levels of sound pressure at receptors

In the study area, we have identified the following receptor point which might be affected by proposed project activities. This receptor point is having Pridicted level at every receptor points which details are given below;

SUMMARY REPORT FOR CAERESIAN RECEPTOR POINTS

Title: Sound Propagation Model Run
Unit: dB(A)

Receptor ID Name	X-Coordinate m	Y-Coordinate m	Predicted Level dB(A)
Grid	705435	2665382	8.9
Grid	704935	2665382	10.6
Grid	704435	2665382	10.6
Grid	703935	2665382	8.1
Grid	703435	2665382	4.5
Grid	705435	2664882	11.3
Grid	704935	2664882	15.3
Grid	704435	2664882	16.8
Grid	703935	2664882	10.3
Grid	703435	2664882	4
Grid	705435	2664382	12.3
Grid	704935	2664382	18.8
Grid	704435	2664382	32.9
Grid	703935	2664382	1.5
Grid	703435	2664382	0
Grid	705435	2663882	11
Grid	704935	2663882	14.7
Grid	704435	2663882	15.8
Grid	703935	2663882	10.2
Grid	703435	2663882	4.2
Grid	705435	2663382	8.5
Grid	704935	2663382	10.1
Grid	704435	2663382	10.1
Grid	703935	2663382	7.7
Grid	703435	2663382	4.3

Remarks:

1. Summaries of highest values by receptor

1.5. Modeling output

1.5.1. Noise Predictions with Project during Day Time

In this section, noise model was simulating with noise levels during day time (with project) and shown in Figure 1.4. The sources include noise from receptor area and estimated point sources from industrial machineries, commercial buildings and construction activities. Although the baseline day and night time noise levels monitored at eight major locations along the proposed project.

Noise level at R_003 to R_005 and R_007 exceeds 55dB (daytime standard of noise for residential zone) in day time and below the commercial and industrial zone. The highest Leq noise levels were recorded at R_005 which is 60.6 dB(A) during daytime. The Mathematical equation is used for noise prediction is L2 = L1-20 Log D2/D1. Highest predicted value for receptor was observed at R_007, R_005 and R_0006 where point source contributes about 22.4 to 25.1 dB(A) respectively without any barrier. The more details of prediction results L_{Aeq} with project in Day Time is given below;

SUMMARY REPORT FOR DISCRETE RECEPTOR POINTS

Title: Sound Propagation Model Run
Unit: dB(A)

Receptor ID Name	X-Coordinate m	Y-Coordinate m	Predicted Level dB(A)	Baseline dB(A)	Resultant^ dB(A)
R_001	704564	2664005	20.4	54.9	54.9
R_002	704033	2664164	15	48.7	48.7
R_003	703984	2664840	14.2	59.8	59.8
R_004	704465	2664925	19.3	56.8	56.8
R_005	704750	2664718	22.4	63.2	63.2
R_006	704892	2664343	22.6	55	55.0
R_007	704357	2664594	25.1	60.6	60.6
R_008	705139	2664141	17.9	52.2	52.2

Remarks:
1. Summaries of highest values by receptor
2. ^Predicted plus background level

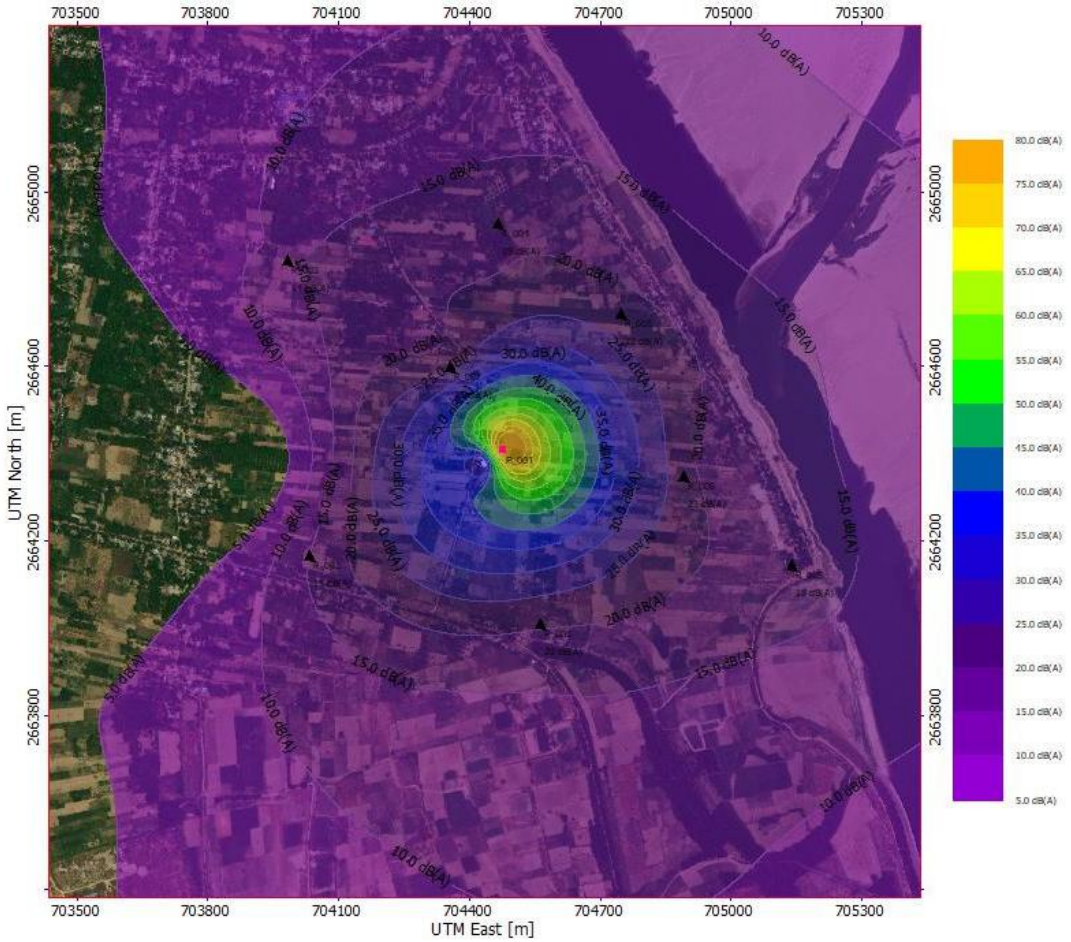


Figure 1.4: Contour map showing noise levels during day time

1.5.2. Noise Predictions with Project during Night Time

In this section, noise model was simulating with noise levels during night time (with project) and shown in Figure 1.5. The map shows, new economic zone will create an about 1000m radius with 48 dB noise zone around the surrounding areas in night time. The noise level in the receptor points were not exceeds 50 dB(A) in most cases around the newly established areas in the night. However, the predicted value shows that the point source (construction phase) may deviate the noise level from 0.6 to 4.9 dB(A) in the baseline data that exceed the exceeds 50 dB(A) in most cases around the newly established areas in the night. The highest predicted value for receptor was observed at R_007 and R_0006 where point source contributes about 5.9 dB(A) without any barrier. The more details of prediction results L_{Aeq} with project in Day Time is given below;

SUMMARY REPORT FOR DISCRETE RECEPTOR POINTS

Title: Sound Propagation Model Run
Unit: dB(A)

Receptor ID	X-Coordinate Name	Y-Coordinate m	Predicted Level dB(A)	Baseline dB(A)	Resultant^ dB(A)
R_001	704564	2664005	0.6	46.7	46.7
R_002	704033	2664164	0	36.1	36.1
R_003	703984	2664840	0	45.1	45.1
R_004	704465	2664925	0	47	47.0
R_005	704750	2664718	2.3	43.7	43.7
R_006	704892	2664343	2.6	43.1	43.1
R_007	704357	2664594	4.9	44.3	44.3
R_008	705139	2664141	0	39.4	39.4

Remarks:

1. Summaries of highest values by receptor
2. ^Predicted plus background level

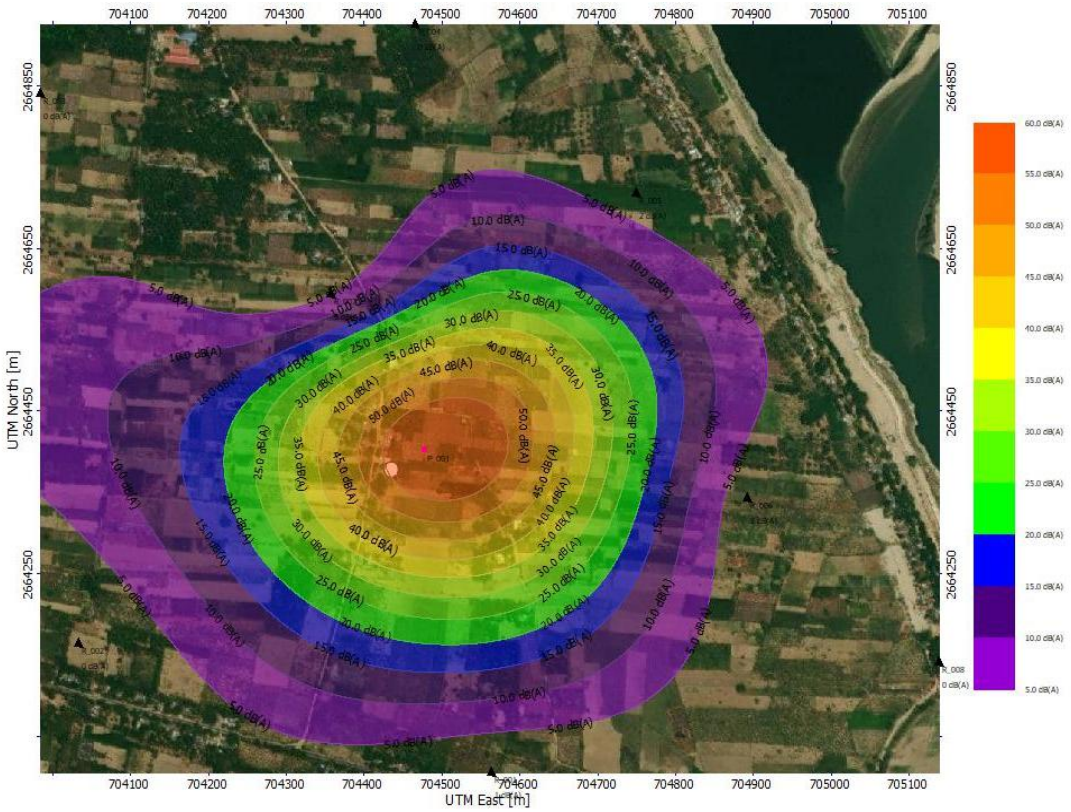


Figure 1.5: Contour map showing noise levels during day time

1.5.3. Measuring Control through Barrier

For controlling measure we have calculated the Day and Night average value based on the adjusted weighted Factor (Figure 1.6) and found noise level varied from 47.89 dB(A) to 61.4 dB(A) in the study area. These data were simulated in the program (Figure 1.6) and found predicted level 10.1 to 17.4 dB(A) for R_001 to R_008 which details given below;

SUMMARY REPORT FOR DISCRETE RECEPTOR POINTS

Title: Sound Propagation Model Run
Unit: dB(A)

Receptor Name	ID	X-Coordinate m	Y-Coordinate m	Predicted Level dB(A)	Baseline dB(A)	Resultant^ dB(A)
R_001		703822	2663000	11	55.6	55.6
R_002		703933	2662548	12.3	47.89	47.9
R_003		703612	2663843	10.1	58.68	58.7
R_004		703936	2664225	12.8	56.81	56.8
R_005		704513	2664083	17.4	61.4	61.4
R_006		704995	2663966	16.5	54.38	54.4
R_007		705214	2663631	16.4	59.1	59.1
R_008		705325	2663041	14.8	51.34	51.3

Remarks:
1. Summaries of highest values by receptor
2. ^Predicted plus background level

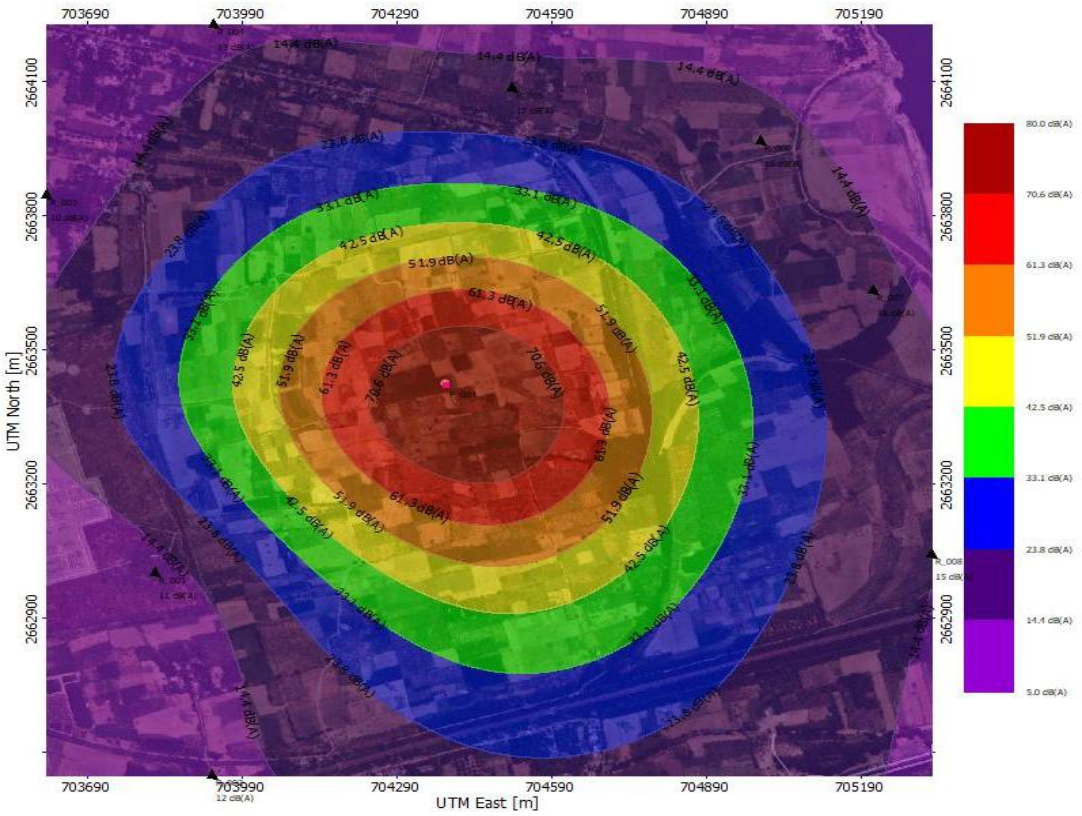


Figure 1.6: Noise Predictions with Project during Day and Night

For the controlling noise level from the point source, this can be controlled by using general linear wall type sound barrier of 3 to 6m height or by proposed tree and shrub plantations. Initial we have simulated the data with 5 m barrier at four points which details are given below;

SUMMARY REPORT FOR BARRIER

Title: Sound Propagation Model Run
Unit: dB(A)

Source ID Name	X1-Coordinate m	Y1-Coordinate m	X2-Coordinate m	Y2-Coordinate m	Height m
B_001	703766	2663862	703429	2663874	3
B_002	703429	2663874	703568	2664237	3
B_003	703568	2664237	704516	2663997	3
B_004	704516	2663997	705060	2663852	3
B_005	705060	2663852	705140	2663511	3
B_006	705140	2663511	705267	2662943	3
B_007	705267	2662943	703939	2662611	3
B_008	703939	2662611	703896	2663123	3
B_009	703896	2663123	703806	2663852	3
B_010	703806	2663852	703750	2663871	3
B_011	703750	2663871	703429	2663878	3
B_012	703429	2663878	703429	2663878	3
B_013	703429	2663878	703766	2663862	3

TOTAL BARRIER: 13

For this, model has been simulating with 3m barrier which indicate the significant reduction of noise from sources Figure 1.7. The predicted value show that R_003 and 2 reduce drastically with barrier whereas R_003 is now 3.2 dB(A) from 10.1 dB(A), R_002 is now 4.8 dB(A) from 12.3 Respectively. The more details of prediction results L_{Aeq} with project with barrier is given below;

SUMMARY REPORT FOR DISCRETE RECEPTOR POINTS

Title: Sound Propagation Model Run
Unit: dB(A)

Receptor ID Name	X-Coordinate m	Y-Coordinate m	Predicted Level dB(A)	Baseline dB(A)	Resultant^ dB(A)
R_001	703822	2663000	5.8	55.6	55.6
R_002	703933	2662548	4.8	47.89	47.9
R_003	703612	2663843	3.2	58.68	58.7
R_004	703936	2664225	5.5	56.81	56.8
R_005	704513	2664083	9.9	61.4	61.4
R_006	704995	2663966	9.3	54.38	54.4
R_007	705214	2663631	9	59.1	59.1
R_008	705325	2663041	7.4	51.34	51.3

Remarks:
1. Summaries of highest values by receptor
2. ^Predicted plus background level

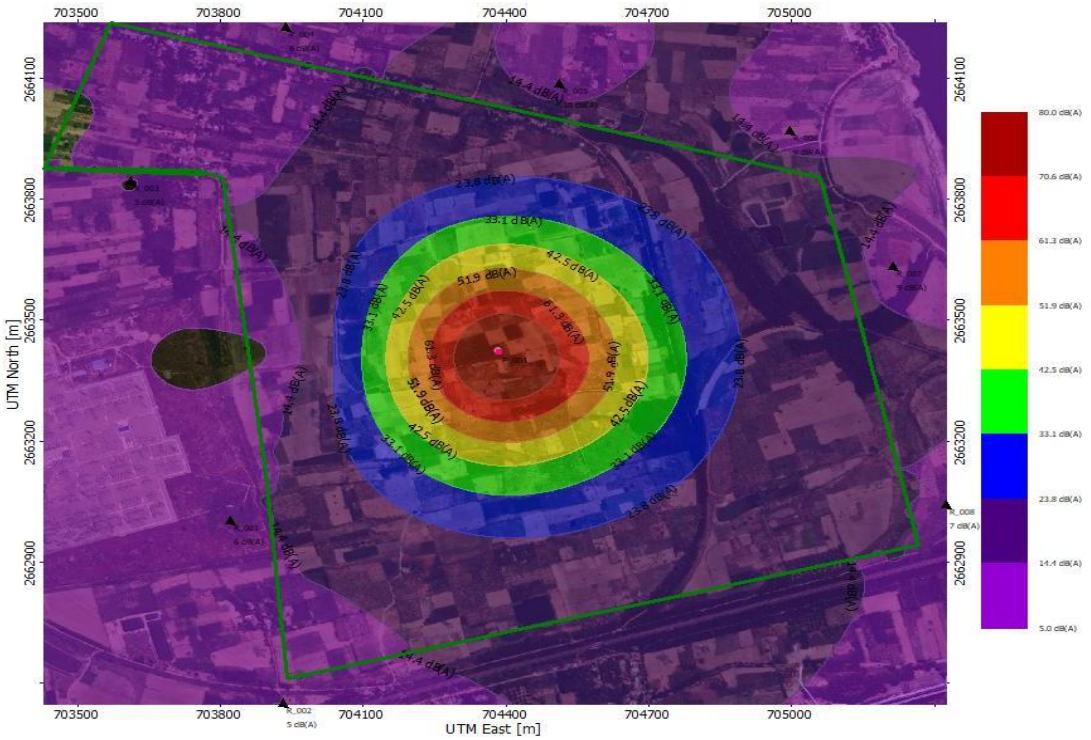


Figure 1.7: Contour map showing noise levels with 5m barrier

1.6. Mitigation measures to reduce Noise levels

The following are the mitigation measures to reduce noise pollution:

A. Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90 dB(A).
B. If required, high noise producing generators such as concrete mixers, generators, graders, etc. must be provided with noise shields.
C. Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum.
D. Workers in the vicinity of high noise levels will be provided earplugs, helmets and will be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8 hour shift.
E. During construction vibratory compactors will be used sparingly within the urban areas. In case of complaints from roadside residents, the engineer will ask the site engineer to take suitable steps of restricting the work hours even further or use an alternative roller.
F. Proposed tree and shrub plantations planned for avenue plantation especially close to settlements, may form an effective sound buffer during the operation stage.

1. Estimation of Pollution Load

An emission inventory (EI) is a comprehensive listing by source of air pollutant and /or GHG emissions in a geographic area during a specific time period. Emission inventories are one of the fundamental components of Air Quality Management

Plans to measure progress/changes overtime to achieve cleaner air and to determine compliance with environmental regulations. Emission inventories are also very useful in air quality model applications and for understanding long-range transport of pollutants. The variability of emissions over short periods can be described using temporal resolution. Depending on the purpose of an inventory of key ABC pollutants will focus on primary gaseous and particulates pollutants, such as PM_{10}, $PM_{2.5}$, gaseous pollutants (SO_2, CO_2, NOx, NH_3, CO) and other greenhouse gases (GHGs). The pollutants listed above should be included in any inventory in order to obtain an overall picture of atmospheric processes that allow for evaluation of the effects of secondary air pollutants, such as ozone, and secondary aerosols through photochemical reactions. EI, the resolution can be annual, seasonal, monthly, daily, hourly, or for a shorter period.

1.1. Emissions Inventory Analysis

1.1.1. Estimating Non-Point Source Emissions

1.1.1.1. Air Quality Index (AQI)

EPA establishes an AQI for five major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health:

- ✓Ground-level ozone
- ✓Particle pollution (also known as particulate matter, including PM2.5 and PM10)
- ✓Carbon monoxide
- ✓Sulfur dioxide
- ✓Nitrogen dioxide

An air quality index is a scale used to show how polluted the air is, along with the risks associated with each rating. An AQI is calculated using established standards based on medical research for the acceptable levels of major air pollutants. Air quality indexes serve two main purposes:

- ✓ To inform the public about air quality in a comprehensible manner so that they may take action to protect their health
- ✓ To help countries develop and assess policies for better air quality

The air quality index is a piecewise linear function of the pollutant concentration. At the boundary between AQI categories, there is a discontinuous jump of one AQI unit. To convert from concentration to AQI this equation is used:(If multiple pollutants are measured, the calculated AQI is the highest value calculated from the above equation applied for each pollutant.)

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}} (C - C_{low}) + I_{low}$$

Where,

I = The (Air Quality) index

C = The pollutant concentration

C_{low}= the concentration breakpoint that is<C
C_{high} = the concentration breakpoint that is>C
I_{low}= the concentration breakpoint that is Clow
I_{high}= the index breakpoint corresponding to C high

There are six AQI categories with colour denotes, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe Table 1.1. Each of these categories is decided based on ambient concentration values of air pollutants and their likely health impacts (known as health breakpoints).

Table: 1.1. Sub category of Air Quality Index as per rating scale

AQI-Rating Scale	Impacts
Good (0–50)	Minimal Impact
Satisfactory (51–100)	Minor breathing discomfort to sensitive people
Moderate (101–200)	Breathing discomfort to the people with lung,
Poor (201–300)	Breathing discomfort to people on prolonged exposure
Very Poor (301–400)	Respiratory illness to the people on prolonged exposure
Severe (>401)	Respiratory effects even on healthy people

Pollution load of project area were found under range of 51-100 AQI which indicates that air quality of the area is satisfactory with minor discomfort to the sensitive people Table 1.2. Overall the pollution load is minimal and suitable for human settlement.

Table 1.2. AQI Value of the Study Area

Location	Parameters	AQI Value	Quality
AAQ-1	SPM PM_{10} $PM_{2.5}$ SO_2 NO_2 CO CO2 O3	85	Satisfactory
AAQ-2		89	Satisfactory
AAQ-3		78	Satisfactory
AAQ-4		82	Satisfactory
AAQ-5		86	Satisfactory
AAQ-6		71	Satisfactory
AAQ-7		69	Satisfactory
AAQ-8		80	Satisfactory

1.1.1.2. Estimated pollution load from vehicles

With air pollution being the top environmental cause of premature death (EEA, 2014), there is an increased concern about human population. Although transport sector has considerably reduced its emissions of air pollutants in 2000 (EEA, 2016a), this sector still remains the largest contributor to emissions such as NOx. Emission inventories are used as inputs to air quality models, to study the dispersion of pollutants, in conjunction with local meteorology, topography, and composition of pollutants.

Among many features that a good emissions inventory depends on, one is better understanding of the sources and their strengths. Sources of air pollution are many. In an urban environment, most common are fuel combustion and non-combustion (volatile) sources from industries; vehicular activity –direct vehicular exhaust and indirect fugitive dust from roads; combustion of conventional (coal and kerosene) and non-conventional (wood and cow dung) fuels in the domestic sector; wind-blown dust in the dry areas; construction activities; seasonal forest fires and dust storms.

Table 1.3. Traffic Survey Data of the Study Area

LOCATION: T-1-Bheramora-Kuchiamara road					Date: 26.08.2022	
	TIME (Hours)	MOTORIZED VEHICLES			NON-MOTORIZED VEHICLES	TOTAL
		Heavy Motor Vehicles	Light Motor Vehicles	Two/Three Wheelers		
1	9.00-10.00	36	56	35	56	183
2	10.00-11.00	55	50	30	45	180
3	11.00-12.00	75	53	45	42	215
4	12.00-13.00	85	51	25	49	210
5	13.00-14.00	80	54	35	51	220
6	14.00-15.00	45	62	38	22	167
7	15.00-16.00	55	74	31	29	189
8	16.00-17.00	65	52	36	31	184
9	17.00-18.00	68	50	32	37	187
10	18.00-19.00	45	56	31	29	161
11	19.00-20.00	34	55	41	30	160
12	20.00-21.00	30	54	36	10	130
13	21.00-22.00	29	30	32	4	95
14	22.00-23.00	30	15	28	1	74
15	23.00-00.00	1	12	18	1	32
16	00.00-01.00	1	0	8	0	9
17	01.00-02.00	0	0	2	0	2

	TIME (Hours)	MOTORIZED VEHICLES			NON-MOTORIZED VEHICLES	TOTAL
		Heavy Motor Vehicles	Light Motor Vehicles	Two/Three Wheelers		
18	02.00-03.00	0	0	0	0	0
19	03.00-04.00	0	0	0	0	0
20	04.00-05.00	0	6	0	0	6
21	05.00-06.00	0	6	22	7	35
22	06.00-07.00	8	10	18	12	48
23	07.00-08.00	10	45	25	15	95
24	08.00-09.00	30	54	35	25	144
Total Number		782	845	603	496	2726

Beyond the obvious (emission factors), largest uncertainty in this equation lies with the "Number of Vehicles" for each category. It is assumed that most of the cities have access to the registered number of vehicles, but an ideal emissions inventory would include the in-use fleet, which could be different from what is registered. While estimating the in-use fleet, it is often hard to estimate how many of the registered are in-use in the city limits or outside and vice versa (vehicles registered outside and in-use in the city). First order approximation is to use the registered numbers; as and when further details arise and if there is a provision for full scale survey, adjust the calculations. In this study we have done the manual continuous 24 Hr traffic survey for estimation of traffic pollution load around the study area Table 1.3.

Vehicle kilometres travelled (VKT), is a survey data, most commonly evaluated in the units of "kilometres travelled per day". There is no single established method to obtain this data, but to survey. Possible approximations are.

- Public transport buses, operating on fixed or non-fixed routes, operate at an average speed is 30 km/hr for 8 hours a day, which accounts for 240 km per day.
- Public transport buses operating on long distance routes, travel in and out of the city, which means distance travelled in the city limits is the distance between the depots to the city limits.
- Passenger vehicles, on average operating at 30-40 km/hr for 1-2 hours on the road. A quick survey among the colleagues, work places, or on road for a day or two will provide an approximate VKT for this category.
- Another possibility for passenger vehicles is the information from the vehicle registrations, the distance travelled over a year(s) will give an idea of average VKT's per day.

- Commercial small trucks in the city, again operating at 30-40 km/hr for 8 hours a day, will provide an estimate.
- Motorcycles (2Ws) are expected to travel at speeds higher than the other modes and for short time periods; unless you are in the cities like Bangkok, Hanoi, or HCMC, where 2 Ws are extensively used for commercial purposes and as small distance taxis.
- Please note that these approximate numbers (theories) are for conditions observed in the developing countries, where the congestion levels are on the rise and doesn't allow the vehicles to operate at speeds observed in the developed countries.
- Emission Factors (EF), by definition, represent the release of a pollutant due to combustion of fuel, with common units of gm/veh-km, under a variety of conditions, *e.g.* loaded and unloaded; idling; cold starts; and cruising. An emission factor is typically established based on testing a number of vehicles (with varying age and mix) under conditions listed above, to arrive at an average number. Table below presents an average set of emission factors for major vehicular categories for three fuel types (LDV = light duty commercial vehicles).

Equation is emissions estimator of all parameters as per traffic volume count. equations and parameters included are explained below;

$$Emission\ (Tons/Year) = \frac{No.of\ Vehicle \times VKT \times EF}{CF\ is\ 1000000}$$

Where,

No. of Vehicle = Monitored data

VKT = Vehicle kilometres travelled (Survey Data)

EF= Emission Factor (obtained from published Data)

CF = Conversion Factor for Tonnes/Year

Monitored data were characterized by three segment viz. Heavy Motor Vehicle, Light Motor Vehicle and Two and Three Wheelers for calculation Table 1.4. Result show that emission by Heavy Motor Vehicle is largest contributor for CO2 in the traffic emission load which is about 263.5 tonnes/year. Overall total traffic pollution load is 321.45 tonnes/year including sum of PM10, PM2.5, SO2, NO2, CO and CO2 in the studied area.

Table 1.4. Emission Calculated value as per monitored and survey data

Vehicular Mode	Parameters	Number of Vehicles	Vehicle KM travel (km/Day)	EF (gm/km)	Vehicular KM Traveled (km/Year)	Emission (Tonnes/Year)
Heavy Motor Vehicle	PM10	782	100	2	31000	0.156
	PM2.5	782	100	1	31000	0.078
	SO2	782	100	1	31000	0.078
	NO2	782	100	10	31000	0.782
	CO	782	100	3.5	31000	0.274
	CO2	782	100	850	31000	66.470
Light Motor Vehicle	PM10	845	40	1.25	12400	0.042
	PM2.5	845	40	0.5	12400	0.017
	SO2	845	40	0.3	12400	0.010

Vehicular Mode	Parameters	Number of Vehicles	Vehicle KM travel (km/Day)	EF (gm/km)	Vehicular KM Traveled (km/Year)	Emission (Tonnes/Year)
	NO2	845	40	2	12400	0.068
	CO	845	40	2.5	12400	0.085
	CO2	845	40	500	12400	16.900
Two-Three Wheelers	PM10	603	100	0.2	31000	0.012
	PM2.5	603	100	0.08	31000	0.005
	SO2	603	100	0.02	31000	0.001
	NO2	603	100	0.1	31000	0.006
	CO	603	100	8	31000	0.482
	CO2	603	100	80	31000	4.824
Total Emission Tonnes/Year						90.290

1.1.2. Identify emission sources within the facility;

The industrial units are required to monitor ambient air quality and stack emission within industrial premises. The project area under feasibility condition and planning for environmental clearance. The area is existing under natural condition as no man made activities has started. Therefore, we have made emission calculation based on the feasibility study data and similar published work.

1.1.2.1. Emissions for electrical appliances

All electrical appliances use energy and create greenhouse gases (GHG). By counting the number of appliances such as running of heavy machine, light fittings, computers, heaters, fridges, Smartboards etc., and estimating the amount of greenhouse gases created per item (kg CO2). For the estimation of emission load, following equation has been taken into consideration which details are given below;

STEP-I: Calculate the kilowatt hours (kWh) of your appliances

$$\text{kWh} = \frac{Hrs \times Day \times Watts}{1000}$$

Step-II: Next multiply the kilowatt hours (kWh)by the Emissions Factor (EF) for your appliance

$$\text{GHG (kg CO2)} = \text{kWh} \times \text{EF}$$

Step-III: Annual emission of CO2 tonnes/year for your appliance

$$\text{GHG (Tonnes CO2/Year)} = \text{MW} \times \text{EF} \times \text{Day}$$

As per feasibility study, require electricity around 60.46 MW in different sector which details are given in the Table 1.5.

Table 1.5. Projection of Estimated Emission Load Sector Wise

Sector	Load Capacity (MW)	Operation Time (Hr)	Operation Day	Emission Factor	GHG (Ton/Year)
Electrical and Electronic Goods	2.27	8	260	0.64	378
Textile	1.20	8	260	0.64	200
Pharmaceutical/Chemical/C	9.63	8	260	0.64	1,605

Sector	Load Capacity (MW)	Operation Time (Hr)	Operation Day	Emission Factor	GHG (Ton/Year)
osmetics					
Leather Product/Footwear	0.16	8	260	0.64	27
Agro and Food Processing	0.83	8	260	0.64	138
Jute Goods	0.16	8	260	0.64	27
RMG	2.44	8	260	0.64	407
Misc. Industrial Use*	4.27	8	260	0.64	712
Provision for Uncertainty of Peak Load Demand	5.24	8	260	0.64	873
Other than Industrial Use	6.61	8	260	0.64	1,102

2.2 Emissions for Gas Consumption

For industries, around 60.46 MW electricity will be required. Gas is required with respect Burner capacity =CFH (Approx. 11000 CFH for 1000KW Electricity Generation). Equation is emissions estimator of all parameters as per traffic volume count. equations and parameters included are explained below;

$$Emission\left(\frac{Tons}{Year}\right) = \frac{Natural\ Gas\ Consuption \times Heating\ Value \times EF}{CF\ is\ 100000000}$$

Where,

Natural Gas Consumption Rate = Monitored data (Approx. 11000 CFH for 1000KW Electricity Generation)

Heating Value = Obtained from Published data

EF= Emission Factor (obtained from published Data)

CF = Conversion Factor for Tonnes/Year

Table 1.6: GHG emission rate as per gas consumption of proposed industries

Land Use Pattern	GHG	GHG Emissions/Yr (Tons e/Yr)	
Electrical and Electronics good	CO2	91,60,03,942	9.1600
	CH4	65,312.22	0.0007
	N2O	16,328.06	0.0002
Textile and RMG	CO2	4,15,65,24,735	41.5652
	CH4	2,96,365.40	0.0030
	N2O	74,091.35	0.0007
Pharmaceutical/Chemical/Cosmetics	CO2	12,31,27,24,215	123.127
	CH4	8,77,912.60	0.0088
	N2O	2,19,478.15	0.0022
Leather Product/Footwear	CO2	3,92,12,498	0.3921
	CH4	2,795.90	0.0000
	N2O	698.98	0.0000

Land Use Pattern	GHG	GHG Emissions/Yr (Tons e/Yr)	
Agro and Food processing	CO2	12,52,83,92,951	125.284
	CH4	8,93,290.05	0.0089
	N2O	2,23,322.51	0.0022
Total emission of Economic Zone (Tons e/Yr)	299.555		

Appendix 9: Pollution Load Report

An emission inventory (EI) is a comprehensive listing by source of air pollutant and /or GHG emissions in a geographic area during a specific time period. Emission inventories are one of the fundamental components of Air Quality Management Plans to measure progress/changes overtime to achieve cleaner air and to determine compliance with environmental regulations. Emission inventories are also very useful in air quality model applications and for understanding long-range transport of pollutants. The variability of emissions over short periods can be described using temporal resolution. Depending on the purpose of an inventory of key ABC pollutants will focus on primary gaseous and particulates pollutants, such as PM_{10}, $PM_{2.5}$, gaseous pollutants (SO_2, CO_2, NOx, NH_3, CO) and other greenhouse gases (GHGs). The pollutants listed above should be included in any inventory in order to obtain an overall picture of atmospheric processes that allow for evaluation of the effects of secondary air pollutants, such as ozone, and secondary aerosols through photochemical reactions. EI, the resolution can be annual, seasonal, monthly, daily, hourly, or for a shorter period.

1.2. Emissions Inventory Analysis

1.1.1. Estimating Non-Point Source Emissions

1.1.1.1. Air Quality Index (AQI)

EPA establishes an AQI for five major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health:

- ✓ Ground-level ozone
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An air quality index is a scale used to show how polluted the air is, along with the risks associated with each rating. An AQI is calculated using established standards based on medical research for the acceptable levels of major air pollutants. Air quality indexes serve two main purposes:

- ✓ To inform the public about air quality in a comprehensible manner so that they may take action to protect their health
- ✓ To help countries develop and assess policies for better air quality

The air quality index is a piecewise linear function of the pollutant concentration. At the boundary between AQI categories, there is a discontinuous jump of one AQI unit. To convert from concentration to AQI this equation is used:(If multiple pollutants are measured, the calculated AQI is the highest value calculated from the above equation applied for each pollutant.)

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}}(C - C_{low}) + I_{low}$$

Where,

I = The (Air Quality) index

C = The pollutant concentration

C_{low}= the concentration breakpoint that is<C
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I_{low}= the concentration breakpoint that is Clow
I_{high}= the index breakpoint corresponding to C high

There are six AQI categories with colour denotes, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe Table 1.1. Each of these categories is decided based on ambient concentration values of air pollutants and their likely health impacts (known as health breakpoints).

Table: 1.1. Sub category of Air Quality Index as per rating scale

AQI-Rating Scale	Impacts
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Very Poor (301–400)	Respiratory illness to the people on prolonged exposure
Severe (>401)	Respiratory effects even on healthy people

Pollution load of project area were found under range of 51-100 AQI which indicates that air quality of the area is satisfactory with minor discomfort to the sensitive people Table 1.2. Overall the pollution load is minimal and suitable for human settlement.

Table 1.2. AQI Value of the Study Area

Location	Parameters	AQI Value	Quality
AAQ-1	SPM	85	Satisfactory
AAQ-2	PM_{10}	89	Satisfactory
AAQ-3	$PM_{2.5}$	78	Satisfactory
AAQ-4	SO_2	82	Satisfactory
AAQ-5	NO_2	86	Satisfactory
AAQ-6	CO	71	Satisfactory
AAQ-7	CO2	69	Satisfactory
AAQ-8	O3	80	Satisfactory

Estimated pollution load from vehicles

With air pollution being the top environmental cause of premature death (EEA, 2014), there is an increased concern about human population. Although transport sector has considerably reduced its emissions of air pollutants in 2000 (EEA, 2016a), this sector still remains the largest contributor to emissions such as NOx. Emission inventories are used as inputs to air quality models, to study the dispersion of pollutants, in conjunction with local meteorology, topography, and composition of pollutants.

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and cow dung) fuels in the domestic sector; wind-blown dust in the dry areas; construction activities; seasonal forest fires and dust storms.

Beyond the obvious (emission factors), largest uncertainty in this equation lies with the "Number of Vehicles" for each category. It is assumed that most of the cities have access to the registered number of vehicles, but an ideal emissions inventory would include the in-use fleet, which could be different from what is registered. While estimating the in-use fleet, it is often hard to estimate how many of the registered are in-use in the city limits or outside and vice versa (vehicles registered outside and in-use in the city). First order approximation is to use the registered numbers; as and when further details arise and if there is a provision for full scale survey, adjust the calculations. In this study we have done the manual continuous 24 Hr traffic survey for estimation of traffic pollution load around the study area Table 1.3.

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LOCATION: T-1-Bheramora-Kuchiamara road						Date: 26.08.2022
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4	12.00-13.00	85	51	25	49	210
5	13.00-14.00	80	54	35	51	220
6	14.00-15.00	45	62	38	22	167
7	15.00-16.00	55	74	31	29	189
8	16.00-17.00	65	52	36	31	184
9	17.00-18.00	68	50	32	37	187
10	18.00-19.00	45	56	31	29	161
11	19.00-20.00	34	55	41	30	160
12	20.00-21.00	30	54	36	10	130
13	21.00-22.00	29	30	32	4	95
14	22.00-23.00	30	15	28	1	74
15	23.00-00.00	1	12	18	1	32

Sl	TIME (Hours)	MOTORIZED VEHICLES			NON-MOTORIZED VEHICLES	TOTAL
		Heavy Motor Vehicles	Light Motor Vehicles	Two/Three Wheelers		
16	00.00-01.00	1	0	8	0	9
17	01.00-02.00	0	0	2	0	2
18	02.00-03.00	0	0	0	0	0
19	03.00-04.00	0	0	0	0	0
20	04.00-05.00	0	6	0	0	6
21	05.00-06.00	0	6	22	7	35
22	06.00-07.00	8	10	18	12	48
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24	08.00-09.00	30	54	35	25	144
Total Number		782	845	603	496	2726

Vehicle kilometres travelled (VKT), is a survey data, most commonly evaluated in the units of "kilometres travelled per day". There is no single established method to obtain this data, but to survey. Possible approximations are.:

- Public transport buses, operating on fixed or non-fixed routes, operate at an average speed is 30 km/hr for 8 hours a day, which accounts for 240 km per day.
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- Passenger vehicles, on average operating at 30-40 km/hr for 1-2 hours on the road. A quick survey among the colleagues, work places, or on road for a day or two will provide an approximate VKT for this category.
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- Commercial small trucks in the city, again operating at 30-40 km/hr for 8 hours a day, will provide an estimate.
- Motorcycles (2Ws) are expected to travel at speeds higher than the other modes and for short time periods; unless you are in the cities like Bangkok, Hanoi, or HCMC, where 2 Ws are extensively used for commercial purposes and as small distance taxis.
- Please note that these approximate numbers (theories) are for conditions observed in the developing countries, where the congestion levels are on the rise and doesn't allow the vehicles to operate at speeds observed in the developed countries.
- Emission Factors (EF), by definition, represent the release of a pollutant due to combustion of fuel, with common units of gm/veh-km, under a variety of conditions, *e.g.* loaded and unloaded; idling; cold starts; and cruising. An emission factor is typically established based on testing a number of vehicles (with varying age and mix) under

conditions listed above, to arrive at an average number. Table below presents an average set of emission factors for major vehicular categories for three fuel types (LDV = light duty commercial vehicles).

Equation is emissions estimator of all parameters as per traffic volume count. equations and parameters included are explained below:

$$Emission\ (Tons/Year) = \frac{No.of\ Vehicle \times VKT \times EF}{CF\ is\ 1000000}$$

Where,
No. of Vehicle = Monitored data
VKT = Vehicle kilometres travelled (Survey Data)
EF= Emission Factor (obtained from published Data)
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Monitored data were characterized by three segment viz. Heavy Motor Vehicle, Light Motor Vehicle and Two and Three Wheelers for calculation Table 1.4. Result show that emission by Heavy Motor Vehicle is largest contributor for CO2 in the traffic emission load which is about 263.5 tonnes/year. Overall total traffic pollution load is 321.45 tonnes/year including sum of PM10, PM2.5, SO2, NO2, CO and CO2 in the studied area.

Table 1.4. Emission Calculated value as per monitored and survey data

Vehicular Mode	Parameters	Number of Vehicles	Vehicle KM travel (km/Day)	EF (gm/km)	Vehicular KM Traveled (km/Year)	Emission (Tonnes/Year)
Heavy Motor Vehicle	PM10	782	100	2	31000	0.156
	PM2.5	782	100	1	31000	0.078
	SO2	782	100	1	31000	0.078
	NO2	782	100	10	31000	0.782
	CO	782	100	3.5	31000	0.274
	CO2	782	100	850	31000	66.470
Light Motor Vehicle	PM10	845	40	1.25	12400	0.042
	PM2.5	845	40	0.5	12400	0.017
	SO2	845	40	0.3	12400	0.010
	NO2	845	40	2	12400	0.068
	CO	845	40	2.5	12400	0.085
	CO2	845	40	500	12400	16.900
Two-Three Wheelers	PM10	603	100	0.2	31000	0.012
	PM2.5	603	100	0.08	31000	0.005
	SO2	603	100	0.02	31000	0.001
	NO2	603	100	0.1	31000	0.006
	CO	603	100	8	31000	0.482
	CO2	603	100	80	31000	4.824
Total Emission Tonnes/Year						90.290

1.1.2. Identify emission sources within the facility;

The industrial units are required to monitor ambient air quality and stack emission within industrial premises. The project area under feasibility condition and planning for environmental clearance. The area is existing under natural condition as no man made

activities has started. Therefore, we have made emission calculation based on the feasibility study data and similar published work.

1.1.2.1. Emissions for electrical appliances

All electrical appliances use energy and create greenhouse gases (GHG). By counting the number of appliances such as running of heavy machine, light fittings, computers, heaters, fridges, Smartboards etc., and estimating the amount of greenhouse gases created per item (kg CO2). For the estimation of emission load, following equation has been taken into consideration which details are given below;

STEP-I: Calculate the kilowatt hours (kWh) of your appliances

$$\text{kWh} = \frac{Hrs \times Day \times Watts}{1000}$$

Step-II: Next multiply the kilowatt hours (kWh)by the Emissions Factor (EF) for your appliance

$$\text{GHG (kg CO2)} = \text{kWh} \times \text{EF}$$

Step-III: Annual emission of CO2 tonnes/year for your appliance

$$\text{GHG (Tonnes CO2/Year)} = \text{MW} \times \text{EF} \times \text{Day}$$

As per feasibility study, require electricity around 60.46 MW in different sector which details are given in the Table 1.5.

Table 1.5. Projection of Estimated Emission Load Sector Wise

Sector	Load Capacity (MW)	Operation Time (Hr)	Operation Day	Emission Factor	GHG (Ton/Year)
Electrical and Electronic Goods	2.27	8	260	0.64	378
Textile	1.20	8	260	0.64	200
Pharmaceutical/Chemical/Cosmetics	9.63	8	260	0.64	1,605
Leather Product/Footwear	0.16	8	260	0.64	27
Agro and Food Processing	0.83	8	260	0.64	138
Jute Goods	0.16	8	260	0.64	27
RMG	2.44	8	260	0.64	407
Misc. Industrial Use*	4.27	8	260	0.64	712
Provision for Uncertainty of Peak Load Demand	5.24	8	260	0.64	873
Other than Industrial Use	6.61	8	260	0.64	1,102

2.2 Emissions for Gas Consumption

Around 32.8 MW electricity will be required. Gas is required with respect Burner capacity =CFH (Approx. 11000 CFH for 1000KW Electricity Generation). Equation is emissions estimator of all parameters as per traffic volume count. equations and parameters included are explained below;

$$Emission\left(\frac{Tons}{Year}\right) = \frac{Natural\ Gas\ Consuption \times Heating\ Value \times EF}{CF\ is\ 100000000}$$

Where,

Natural Gas Consumption Rate = Monitored data (Approx. 11000 CFH for 1000KW Electricity Generation)
Heating Value = Obtained from Published data
EF= Emission Factor (obtained from published Data)
CF = Conversion Factor for Tonnes/Year

Land Use Pattern	GHG	GHG Emissions/Yr (Tons e/Yr)	
Electrical and Electronics good	CO2	91,60,03,942	9.1600
	CH4	65,312.22	0.0007
	N2O	16,328.06	0.0002
Textile and RMG	CO2	4,15,65,24,735	41.5652
	CH4	2,96,365.40	0.0030
	N2O	74,091.35	0.0007
Pharmaceutical/Chemical/Cosmetics	CO2	12,31,27,24,215	123.127
	CH4	8,77,912.60	0.0088
	N2O	2,19,478.15	0.0022
Leather Product/Footwear	CO2	3,92,12,498	0.3921
	CH4	2,795.90	0.0000
	N2O	698.98	0.0000
Agro and Food processing	CO2	12,52,83,92,951	125.284
	CH4	8,93,290.05	0.0089
	N2O	2,23,322.51	0.0022
Total emission of Economic Zone (Tons e/Yr)	299.555		

Appendix 10: FGD Attendance Sheets

BANGLADESH ECONOMIC ZONES AUTHORITY

Environmental and Social Impact Assessment (EIA) of Kushtia Economic Zone

FGD Attendance Sheet

Date:

Location:

SL	Name	Profession	Mobile No.	Signature
১	মো: সাইদুর রহমান	ব্যবসা	০১৭২৭৭৭৭৭৫	[illegible] 22/5/22
২	মো: ওসমান	কৃষি	০১৭১৫৫৪৭৮২	ওসমান
৩	তরিকুল		০১৭৬২২৭৭৭৬৮	তরিকুল
৪	হাসেম	কৃষি	০১৭৫৪৫৩০৬৮৩০	হাসেম
৫	আনোয়ার	কৃষি	০১৭১৩০৫৭৭৭০	[illegible] ২০/৫/22
৬	রাকিব	কৃষি	01992990722	[illegible]
৭	মো: রাসেল	কৃষি	01790288236	[illegible]
৮	ভুইয়া [illegible]	"	01316041235	[illegible]
৯	রহমান	"	0178188934	[illegible]
১০	তুহিন	"	015250162	[illegible]
১১	মো: খোকন আলী	চাকুরি	01719161103	[illegible]

Environmental and Social Impact Assessment (EIA) of Kushtia Economic Zone

FGD Attendance Sheet

Date:

Location:

SL	Name	Profession	Mobile No.	Signature
01	[illegible]		[illegible]	[illegible]
02	মো: [illegible]		[illegible]	[illegible]
03	মোঃ [illegible]		01779368983	[illegible]
04	মো: [illegible]		[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]
6	মো: [illegible] হোসেন		01306923924	[illegible]
7	সম্রাট		01745807100	Samr[illegible]
8.	মো: [illegible] আলম	[illegible]	01740-968387	[illegible]
9.	মোঃ হান্নান		01992790712	হান্নান
10	আরিফ [illegible]		01793369189	[illegible]
11	সজীব [illegible]		01773911929	সজীব
12	বাবু		01718248387	বাবু
13	[illegible]		01316483837	[illegible]
14	ওয়াসিম		01319764887	ওয়াসিম
15	[illegible] ভূঁইয়া		[illegible]	[illegible] ভূঁইয়া
16	[illegible]		0171180045	[illegible]
17	M.N. Islam		[illegible]	[illegible]
18	মো: [illegible]		[illegible]	[illegible]
19	আমিনুল		আমিনুল [illegible]	
20	[illegible]		0176048231	[illegible]
21	রবিউল		0173265592	রবিউল

Male

Environmental and Social Impact Assessment (EIA) of Kushtia Economic Zone

FGD Attendance Sheet

Date: Location:

SL	Name	Profession	Mobile No.	Signature
01	[illegible]	গৃহিনী	01724725780	[illegible]
02	[illegible]	গৃহিনী	01300519116	[illegible]
03	জরিনা	গৃহিনী	01317901894	[illegible]
04	[illegible]	গৃহিনী	01742471025	[illegible]
05	রানা	গৃহিনী	01311062979	[illegible]
06	সাবিনা	গৃহিনী	01724	[illegible]
07	[illegible]	[illegible]	[illegible]	[illegible]
08	রিমা খাতুন	গৃহিনী		রিমা
09	শাবনিন	গৃহিনী	01719770[illegible]	[illegible]
10	[illegible]	গৃহিনী	01723500325	[illegible]
11	তাসলিমা	গৃহিনী	01752437037	তাসলিমা
12	[illegible]	গৃহিনী	01768465847	[illegible]
13	[illegible]	গৃহিনী		[illegible]
14	[illegible]	গৃহিনী		[illegible]
15	তাসলিমা খাতুন	গৃহিনী		[illegible]
16	[illegible]	গৃহিনী		[illegible]
17	জরিন	গৃহিনী	01722324435	[illegible]

Female

Environmental and Social Impact Assessment (EIA) of Kushtia Economic Zone

FGD Attendance Sheet

Date: Location:

SL	Name	Profession	Mobile No.	Signature
01	Rebeka	গৃহিনী	01768465847	রেবেকা
02	Md. Rajib Hossain	ব্যবসায়ী	01706749999	রাজিব
03	Md. Shirajul Sheikh	"	01799031880	সিরাজুল
04.	আব্দুর সাত্তার	দোকানদার	01757480647	সাত্তার
05.	কহিনুর বেগম	গৃহিনী	01731938598	কহিনুর
06.	মোছা. সাকিনা খাতুন	গৃহিনী	01777206211	সাকিনা
07.	মোছাঃ রহিমা খাতুন	গৃহিনী	01740636728	মোছাঃ রহিমা
08.	মো: আবিদুর রহমান	ছাত্র	01701357587	মো: আবিদ
09.	মো: আলমগীর হোসেন	ছাত্র	০৭ —	আলমগীর
10.	মোছা. দুলু খাতুন	গৃহিনী	—	দুলু
11	মোছা আমেনা খাতুন	গৃহিনী	01763567927	আমেনা

Mixed (Male and Female

Environmental and Social Impact Assessment (EIA) of Kushtia Economic Zone

FGD Attendance Sheet

Date: Location:

SL	Name	Profession	Mobile No.	Signature
01	[illegible]	গৃহিনী	01724725780	[illegible]
02	[illegible]	গৃহিনী	01300519116	[illegible]
03	জরিনা	গৃহিনী	01317901894	জরিনা
04	[illegible]	গৃহিনী	01742471025	[illegible]
05	রানা	গৃহিনী	01311062979	[illegible]
06	সাবিনা	গৃহিনী	01724	সাবিনা
07	[illegible]	[illegible]	[illegible]	[illegible]
08	রিমা খাতুন	গৃহিনী		রিমা
09	শাবনিন	গৃহিনী	01719770[illegible]	শারমীন
10	[illegible]	গৃহিনী	01723500325	[illegible]
11	তাসলিমা	গৃহিনী	01752437037	তাসলিমা
12	[illegible]	গৃহিনী	01768465847	[illegible]
13	[illegible]	গৃহিনী		[illegible]
14	[illegible]	গৃহিনী		[illegible]
15	তাসলিমা খাতুন	গৃহিনী		[illegible]
16	[illegible]	গৃহিনী		[illegible]
17	জরিন	গৃহিনী	01722324435	[illegible]

Female

Environmental and Social Impact Assessment (EIA) of Kushtia Economic Zone

FGD Attendance Sheet

Date: Location:

SL	Name	Profession	Mobile No.	Signature
1	মো: সাইদুর রহমান	ব্যবসা	[illegible]	[signature] 22/04/22
2	মো: ওয়াহেদ	কৃষি	[illegible]	ওয়াহেদ
3	আঁখি	গৃহিনী	[illegible]	আঁখি
4	তরিকুল	কৃষি	[illegible]	তরিকুল
5	শিল্পী	গৃহিনী	[illegible]	শিল্পী
6	তাসলিমা	গৃহিনী	01752437037	তাসলিমা
7	মাসুম	কৃষি	01754536823	মাসুম
8	রিমা খাতুন	গৃহিনী		রিমা
9	বিথী	গৃহিনী	[illegible]	বিথী
10	মো: রাজন	কৃষি	–	রাজন
11	রবিন	কৃষি	[illegible]	রবিন
12	আতিয়ার	কৃষি	[illegible]	[signature]

Mixed (Youth)

Appendix 11: Ecological Checklist

কুষ্টিয়া অর্থনৈতিক অঞ্চলের পরিবেশগত এবং সামাজিক প্রভাব মূল্যায়ন

ইকোলজিরতথ্য সংগ্রহের জন্য চেকলিস্ট

ক. মৌলিক তথ্য

প্রকল্পের নাম					
জেলা		উপজেলা		মৌজা	

খ. প্রধান আবাসস্থলের তথ্য/১০ কিলোমিটার ব্যাসার্ধের মধ্যে বাস্তুতন্ত্রের প্রকারভেদ (যেখানে প্রয়োজন দয়া করে সেখানে টিক দিন)

কৃষিজমি		সংরক্ষিত বন	
বসতি/ভিটেবাড়ি		ম্যানগ্রোভ	
ফলের বাগান		খাল এবং পুকুর	
পতিত জমি		নদী	
শৈলশ্রেণী বা পর্বত		উপকূল / সমুদ্রের তীর	
সামাজিক বন এর অন্তর্ভুক্ত জমি			

গ. বন সম্পর্কিত তথ্য (যদি থাকে)

বন	প্রকার*	অবস্থান	প্রকল্প থেকে দূরত্ব

*১= জলাভূমির বন, ২=সংরক্ষিত বন, ৩= নিবিড় বন, ৪=নলখাগড়ার বন, ৫= অন্যান্য (নির্দিষ্ট করুন)

ঘ. প্রস্তাবিত প্রকল্পের নিকটবর্তী নদী ব্যবস্থা/ নৌপথ / জলাভূমি সম্পর্কিত তথ্য

নাম	প্রকল্প থেকে দূরত্ব	মাছের অভয়ারণ্য	প্রাপ্ত মাছ চাষ/ ঘের	সংযোগ ব্যবস্থা

ঙ. প্রকল্প দ্বারা প্রভাবিত হতে পারে এমন এলাকার (পিআইএ) মধ্যে প্রাপ্ত স্থলজ উদ্ভিদের জন্য চেকলিস্ট

ক্রম	স্থানীয় নাম	বৈজ্ঞানিক নাম	বাসস্থানের প্রকার	স্থানীয় প্রাচুর্যতা	আইইউসিএন অনুযায়ী প্রাচুর্যতা**র অবস্থা**

স্থানীয় প্রাচুর্যতা: H= High (সর্বোচ্চ); M= Medium (মাঝামাঝি); L= Low (সর্বনিম্ন); NA= Not available (প্রযোজ্য নয়)

আইইউসিএন অনুযায়ী প্রাচুর্যতা**র অবস্থা**: Extinct (বিলুপ্ত)=EX; Extinct in the Wild (বন্য পরিবেশে বিলুপ্ত) = EW; Critically Endangered (মহাবিপন্ন) = CR; Endangered (বিপন্ন)=EN; Vulnerable (সংকটাপন্ন)=VU; Near Threatened (প্রায়-বিপদগ্রস্ত) =NT; Least Concern (ন্যূনতম বিপদগ্রস্থ) =LC; Data Deficient (অপ্রতুল-তথ্য) =DD; Not Evaluated (মূল্যায়িত নয়) =NE

চ.প্রকল্প দ্বারা প্রভাবিত হতে পারে এমন এলাকার (পিআইএ) মধ্যে প্রাপ্ত জলজ উদ্ভিদের জন্য চেকলিস্ট

ক্রম	স্থানীয় নাম	বৈজ্ঞানিক নাম	বাসস্থানের প্রকার	স্থানীয় প্রাচুর্যতা	আইইউসিএন অনুযায়ী প্রাচুর্যতা**র অবস্থা**

স্থানীয় প্রাচুর্যতা: H= High (সর্বোচ্চ); M= Medium (মাঝামাঝি); L= Low (সর্বনিম্ন); NA= Not available (প্রযোজ্য নয়)

আইইউসিএন অনুযায়ী প্রাচুর্যতার অবস্থা: Extinct (বিলুপ্ত)=EX; Extinct in the Wild (বন্য পরিবেশে বিলুপ্ত) = EW; Critically Endangered (মহাবিপন্ন) = CR; Endangered (বিপন্ন)=EN; Vulnerable (সংকটাপন্ন)=VU; Near Threatened (প্রায়-বিপদগ্রস্ত) =NT; Least Concern (ন্যূনতম বিপদগ্রস্থ) =LC; Data Deficient (অপ্রতুল-তথ্য) =DD; Not Evaluated (মূল্যায়িত নয়) =NE

ছ. প্রকল্প দ্বারা প্রভাবিত হতে পারে এমন এলাকার (পিআইএ) মধ্যে প্রাপ্ত স্থলজ প্রাণীর জন্য চেকলিস্ট

ক্রম	স্থানীয় নাম	বৈজ্ঞানিক নাম	বাসস্থানের প্রকার	স্থানীয় প্রাচুর্যতা	আইইউসিএন অনুযায়ী প্রাচুর্যতা**র অবস্থা**
স্তন্যপায়ী					
পক্ষীকূল					
সরীসৃপ					

ক্রম	স্থানীয় নাম	বৈজ্ঞানিক নাম	বাসস্থানের প্রকার	স্থানীয় প্রাচুর্যতা	আইইউসিএন অনুযায়ী প্রাচুর্যতা**র অবস্থা**
উভচর					

স্থানীয় প্রাচুর্যতা: H= High (সর্বোচ্চ); M= Medium (মাঝামাঝি); L= Low (সর্বনিম্ন); NA= Not available (প্রযোজ্য নয়)

আইইউসিএন অনুযায়ী প্রাচুর্যতার অবস্থা: Extinct (বিলুপ্ত)=EX; Extinct in the Wild (বন্য পরিবেশে বিলুপ্ত) =EW; Critically Endangered (মহাবিপন্ন) = CR; Endangered (বিপন্ন)=EN; Vulnerable (সংকটাপন্ন)=VU; Near Threatened (প্রায়-বিপদগ্রস্ত) =NT; Least Concern (ন্যূনতম বিপদগ্রস্থ)=LC; Data Deficient (অপ্রতুল-তথ্য) =DD; Not Evaluated (মূল্যায়িত

জ. প্রকল্প দ্বারা প্রভাবিত হতে পারে এমন এলাকার (পিআইএ) মধ্যে প্রাপ্ত মৎস্য সম্পদের জন্য চেকলিস্ট

ক্রম	স্থানীয় নাম	বৈজ্ঞানিক নাম	বাসস্থানের প্রকার	স্থানীয় প্রাচুর্যতা	আইইউসিএন অনুযায়ী প্রাচুর্যতা**র অবস্থা**

স্থানীয় প্রাচুর্যতা: H= High (সর্বোচ্চ); M= Medium(মাঝামাঝি); L= Low; NA= Not available (অনুপস্থিত)

আইইউসিএন অনুযায়ী প্রাচুর্যতার অবস্থা: (বিলুপ্ত)=EX; Extinct in the Wild (বন্য পরিবেশে বিলুপ্ত) =EW; Critically Endangered (মহাবিপন্ন)= CR; Endangered (বিপন্ন)=EN; Vulnerable (সংকটাপন্ন)=VU; Near Threatened (প্রায়-বিপদগ্রস্ত)=NT; Least Concern (ন্যূনতম বিপদগ্রস্থ)=LC; Data Deficient (অপ্রতুল-তথ্য) =DD; Not Evaluated (মূল্যায়িত নয়)=NE

ঞ. নির্দিষ্ট বাস্তুতন্ত্রের উপর প্রস্তাবিত প্রকল্পের কারণে প্রত্যাশিত প্রভাবসমূহ (পরিবর্তিত ভূমির ব্যবহার, শব্দ, মানুষের উপস্থিতি ইত্যাদির কারনে সৃষ্ট প্রভাব)

কার্যক্রম	প্রভাব

ট. মন্তব্য (যদি থাকে):

তথ্য সংগ্রাহকের নাম:	

স্বাক্ষর:	
তারিখ:	

Appendix 12: Key Informant Interview Checklist

কুষ্টিয়া অর্থনৈতিক অঞ্চলের পরিবেশগত এবং সামাজিক প্রভাব মূল্যায়নের

জন্য দলীয় আলোচনার গাইডলাইন

অংশগ্রহনকারীঃ প্রকল্প এলাকার স্থানীয় জনগণ (পুরুষ এবং মহিলা প্রধান, আদিবাসি ইত্যাদি)

ক্রম	অংশগ্রহণকারীর নাম	লিঙ্গ		বয়স	পেশা	জাতীয় পরিচয়পত্রের নং	মোবাইল	স্বাক্ষর
		পুরুষ	মহিলা					
১								
২								
৩								
৪								
৫								
৬								
৭								
৮								
৯								
১০								

অবস্থান/ মৌজাঃ..... গ্রামঃ..... ইউনিয়নঃ.....

উপজেলাঃ..... জেলাঃ.....

মডারেটরের নামঃ.....

নোট সংগ্রাহকের নামঃ.....

সাক্ষাৎকারের সময়ঃ.....

তারিখঃ..... শুরুঃ..... শেষঃ .....

সুপারভাইজারের স্বাক্ষরঃ .....

দলীয় আলোচনার গাইডলাইনঃ

১. কত বছর ধরে আপনি এখানে বসবাস করছেন? .....

২. এই এলাকার মানুষের প্রধান পেশা কি? .....

৩. এই এলাকায় প্রধানত কি ধরনের জমির ব্যবহার দেখা যায়? (কৃষি, বসতবাড়ি, জলাশয়, পতিত জমি ইত্যাদি)

.....

৪. এই এলাকায় কি ধরনের বাড়িঘর দেখা যায়? (পাকা, আধাপাকা, কাচা, ছনের তৈরী ইত্যাদি)

.....

৫. এই অঞ্চলে পানীয় জলের মূল উৎসগুলো কি কি? (পাইপলাইন, নলকূপ, পাহাড়ী ঝর্ণা, বৃষ্টির পানি, কূপ, পুকুর, নদী ইত্যাদি)

. .....

৬. এই অঞ্চলের প্রধান স্যানিটেশন ব্যাবস্থাগুলি কি কি? (খোলা টয়লেট, আবদ্ধ টয়লেট, ভাসমান টয়লেট, পিট/রিং-স্লাব নন স্যানিটারি, টয়লেট নাই)

.....

৭. বিদ্যুৎ সরবরাহের উৎস গুলো কি কি? (জাতীয় গ্রিড, জেনারেটর, সৌর শক্তি ইত্যাদি)

.....

৮. এই এলাকা য় ডিজিটাল যোগাযোগ ব্যবস্থা এবং এর ব্যবহারের ধরণ কী ? (সেল ফোন , ইন্টারনেট ইত্যাদি)
.....

৯. এই এলাকায় স্বাস্থ্যেসেবার অবস্থা কি? (রোগের ধরন, আক্রান্ত ব্যক্তি, চিকিৎসার ধরণ, স্বাস্থ্যসেবা সুবিধাসমূহ এবং আক্রান্ত থাকার সময়কাল ইত্যাদি)

.....

১০. এই অঞ্চলে বসবাসরত মানুষের আয়ের প্রধান উৎসগুলো কি কি? (কৃষি, ব্যবসা, সেবা, দিন মজুরী, পশুপালন, ভাড়া পরিষেবা, উদ্যান / ফলের বাগান, জমা অর্থ, পেনশন, অর্থের বিদেশী উৎস ইত্যাদি)

.....

১১. আপনি কি মনে করেন যে প্রকল্পের কারণে কোনও সামাজিক এবং সাংস্কৃতিক সম্পদ বা প্রতিষ্ঠান ক্ষতিগ্রস্ত হবে?

.....

১২. আপনার অঞ্চলে কোন ধরণের কলকারখানাগুলি বেশী দেখা যায় ? আপনি কি মনে করেন যে এই প্রকল্পের কারণে কারখানা গুলি ক্ষতিগ্রস্থ হবে?

.....

১৩. এই অঞ্চলে চাষাবাদের ধরনগুলি কি কি এবং আপনি প্রতি বছর আপনার জমিতে কতবার চাষ করতে পারেন ?

.....

১৪. এই এলাকার ঋণ ব্যবস্থা এবং উৎসগুলোর অবস্থা কি? (সরকারী ব্যাংক , বেসরকারী ব্যাংক , গ্রামীণ ব্যাংক , এনজিও, পিকেএসএফ, বিআরডিবি সমবায়, সমবায় সমিতি, আনসার / ভিডিপি, অন্যান্য)

.....

১৫. এই এলাকায় পারিবারিকভাবে সিদ্ধান্ত গ্রহণের প্রক্রিয়াটির পদ্ধতি সমূহ (লিঙ্গপ্রধান) কি কি? (শুধুমাত্র পুরুষ, শুধুমাত্র মহিলা, পুরুষ এবং মহিলা উভয়)

শুধুমাত্র

১৬. কুষ্টিয়া অর্থনৈতিক অঞ্চল প্রতিষ্ঠার সুবিধা / ইতিবাচক প্রভাবগুলি কি কি?

.....

১৭. কুষ্টিয়া অর্থনৈতিক অঞ্চল সম্প্রসারণের নেতিবাচক প্রভাবগুলো কি কি?

.....

১৮. প্রস্তাবিত প্রকল্পের কারণে পরিবেশ সম্পর্কিত কি কি ধরণের প্রভাব পরিলক্ষিত হতে পারে বলে আপনি মনে করেন?

.....

১৯. আপনার কি মনে হয় যে এই প্রকল্পটি স্থানীয় মানুষের স্বাস্থ্যের উপর প্রভাব ফেলবে?

.....

২০. আপনি কি মনে করেন প্রকল্পটি এই এলাকার মানুষের জীবনযাত্রার মান উন্নয়নে সহায়তা করবে?

.....

২১. আপনি কি মনে করেন যে স্থানীয় জনগণকে এই উন্নয়ন প্রকল্পের বিভিন্ন পর্যায়ে সম্পৃক্ত করা উচিত?

.....

২২. এই প্রকল্প থেকে আপনার প্রত্যাশা কি?

.....

২৩. আপনার কি মনে হয় এই প্রকল্পটির দ্বারা সরকার উপকৃত হবে?

.....

২৪. যেহেতু এই উন্নয়ন প্রকল্পটি এই অঞ্চলের পক্ষে উপকারী , তাই এই সম্প্রদায়ের একজন হিসেবে সিদ্ধান্ত গ্রহণের ক্ষেত্রে আপনার ভূমিকা রয়েছে। আপনি কি প্রকল্প সংশ্লিষ্ট কিছু পরামর্শ দিতে পারেন?

.....
.....
.....
.....

ধন্যবাদ

Appendix 13: Checklist for household survey

পাবনা অর্থনৈতিক অঞ্চলের অঞ্চলের পরিবেশগত এবং সামাজিক প্রভাব মূল্যায়ন
খানা সমীক্ষার প্রশ্নপত্র

জনাব/জনাবা,

আসসালামু আলাইকুম/আদাব। আমি শহীদুল কনসালটেন্ট লিমিটেড থেকে অর্থনৈতিক অঞ্চলের পরিবেশগত ও সামাজিক প্রভাব মূল্যায়ন সমীক্ষার কাজে এসেছি। প্রকল্পটি বাস্তবায়নের দায়িত্বে রয়েছে বাংলাদেশ অর্থনৈতিক অঞ্চল কর্তৃপক্ষ। এই কাজের সামগ্রিক উদ্দেশ্য হল আইনি কাঠামো অনুসরণ করে প্রস্তাবিত অর্থনৈতিক অঞ্চলের জন্য যথাযথ কর্তৃপক্ষের কাছ থেকে প্রয়োজনীয় পরিবেশগত ও সামাজিক সমীক্ষার মাধ্যমে প্রয়োজনীয় ছাড়পত্র সংগ্রহ করা।

উক্ত প্রকল্পের পরিবেশগত এবং সামাজিক প্রভাব মূল্যায়নের জন্য বাংলাদশে অর্থনৈতিক অঞ্চল র্কতৃপক্ষ পরার্মশক প্রতিষ্ঠান হিসেবে আইআইএফসি'কে নিয়োজিত করেছে এবং আইআইএফসি, সাব কনসালটেন্ট হিসেবে শহীদুল কনসালটেন্ট লিমিটেডকে নিয়োজিত করেছে। এ লক্ষ্যে আমরা নিম্নলিখিত তথ্যাবলী আপনার সাক্ষাৎকারের মাধ্যমে জানতে চাই। আপনি অনুমতি দিলে আমি সাক্ষাৎকার শুরু করতে পারি।

অংশগ্রহণকারীঃ প্রকল্প এলাকার স্থানীয় বাসিন্দা

													২	০	২	২
সাক্ষাৎকার গ্রহণকারীর নাম		সাক্ষাৎকার গ্রহণকারীর স্বাক্ষর		কোড নং					তারিখ							
													২	০	২	২
তত্ত্বাবধায়কের নাম		তত্ত্বাবধায়কের স্বাক্ষর		কোড নং					তারিখ							

সমীক্ষক
শহীদুল কনসালটেন্ট লিমিটেড

আগস্ট, ২০২২

সেকশন ১ উত্তরদাতার সাধারণ তথ্যাবলী

১.১	উত্তরদাতার নাম	-	
১.২	উত্তরদাতার বয়স (বছর)	-	……বছর
১.৩	ধর্ম	-	
১.৪	লিঙ্গ	-	
১.৫	বৈবাহিক অবস্থা	-	
১.৬	শিক্ষাগত যোগ্যতা	-	
১.৭	উত্তরদাতার প্রধান পেশা	-	
১.৮	উত্তরদাতার অপ্রধান পেশা	-	
১.৯	আপনার পরিবারের সদস্য সংখ্যা কত জন?	-	পুরুষ……, মহিলা……, বালক……, এবং বালিকা……
১.১০	আপনার পরিবারের উপার্জনক্ষম সদস্য সংখ্যা কত জন?	-	পুরুষ……, মহিলা……,
১.১১	ক্ষুদ্র নৃগোষ্ঠী	-	
১.১২	প্রান্তিক জনগোষ্ঠী	-	
১.১৩	আপনার পরিবারের মাসিক মোট আয়	-	
১.১৪	আপনার পরিবারের মাসিক মোট ব্যয়	-	
১.১৫	সরকারী সামাজিক সহায়তা (বিগত তিন বছরে)	-	
১.১৬	মৌজা	-	
১.১৭	ইউনিয়ন/ওয়ার্ড	-	
১.১৮	উপজেলা	-	
১.১৯	জেলা	-	
১.২০	জাতীয় পরিচয়পত্রের নম্বর (যদি থাকে)	-	
১.২১	উত্তরদাতার মোবাইল নম্বর	-	

ধর্ম - মুসলিম-১, হিন্দু-২, বৌদ্ধ-৩, খ্রিষ্টান-৪, অন্যান্য (উল্লেখ করুন)..... ৯৯

লিঙ্গ - পুরুষ-১, মহিলা -২, তৃতীয় লিঙ্গ -৩

বৈবাহিক অবস্থা - অবিবাহিত -১, বিবাহিত -২, তালাক প্রাপ্ত -৩, বিপত্নীক/বিধবা -৪, বিচ্ছিন্ন -৫, অন্যান্য -৯৯

শিক্ষাগত যোগ্যতা - ১ম থেকে চতুর্থ শ্রেণি/এবতেদায়ি মাদ্রাসা-১ , প্রাথমিক স্কুল সার্টিফিকেট-২ , ষষ্ঠ হতে সপ্তম শ্রেণি-৩ , জুনিয়র স্কুল সার্টিফিকেট-৪ , নবম হতে দশম শ্রেণি-৫ , এসএসসি বা সমমান/আলিম- ৬, বিএ বা সমমান/ফাজিল-৭, এমএ বা সমমানের/কামিল-৮, উচ্চতর শিক্ষা-৯, হাফেজ-১০, সাক্ষর-১১, নিরক্ষর-১২, অন্যান্য (উল্লেখ করুন)……৯৯

পেশার কোড - কৃষি-১, শিক্ষক-২, প্রবাসী-৩, চাকুরী-৪, গৃহিণী-৫, জেলে-৬, ব্যবসা-৭, দিনমজুর-৮, চালক-৯, রাজমিস্ত্রী-১০, কাঠমিস্ত্রী-১১, বেকার-১২, দর্জি-১৩, ডাক্তার-১৪, কবিরাজ-১৫, মাঝি-১৬, ছাত্র/ছাত্রী-১৭, রিক্সা/ভ্যান চালক-১৮, বৃদ্ধ/বৃদ্ধা-১৯, বুয়া -২০, নাপিত-২১, মুচি- ২২, মেকানিক/টেকনিশিয়ান-২৩, প্রযোজ্য নয়-২৪, অন্যান্য (উল্লেখ করুন)……৯৯

ক্ষুদ্র নৃগোষ্ঠী - সাঁওতাল-১, মাহাতো-২, রাজবংশী-৩, সিং-৪, অন্যান্য (উল্লেখ করুন)----------৯৯

প্রান্তিক জনগোষ্ঠী - স্বামী পরিত্যাক্তা মহিলা-১, বিধবা-২, প্রতিবন্ধী-৩, অন্যান্য (উল্লেখ করুন)----------৯৯

সরকারী সামাজিক সহায়তা - ভিজিডি-১, ভিজিএফ-২, বয়স্ক ভাতা -৩, মাতৃত্ব ভাতা -৪, প্রতিবন্ধী ভাতা -৫, মুক্তিযোদ্ধা ভাতা -৬, অন্যান্য (উল্লেখ করুন)----------৯৯

সেকশন ২ বসবাসের সময়কাল

২.১। আপনি এখানে কত মাস/বছর যাবত বসবাস করছেন? ……মাস/বছর

২.২। আপনার এই এলাকায় বসবাসের কারণ কি? পৈত্রিকসুত্রে.... ১, চাকরি.....২, ব্যবসা.....৩, যোগাযোগের সুবিধা..... ৪, অন্যান্য (উল্লেখ করুন).....৯৯

সেকশন ৩-জমির মালিকানা এবং ব্যবহারের ধরণ সংক্রান্ত তথ্যাবলী

৩.১। জমির মালিকদের ক্ষেত্রে প্রযোজ্য

ক্রঃ নঃ	জমির ধরণ	জমির পরিমাণ (শতক)	ব্যবহার নিজ/ শতক	কর্মচারী আছে কিনা (নিজ ব্যবহারের ক্ষেত্রে)	আয় (নিজ ব্যবহারের মূল্য ধরে) (বাৎসরিক/টাকা)	ইজারা/ভাড়া / বর্গাচাষশত ক	ভাড়া হতে আয় (টাকা/বাৎসরিক)
১.	ভিটা						
২.	চাষাবাদ (উৎপাদন সামগ্রীর খরচ বাদে)						
৩.	ব্যবসা						
৪.	পুকুর/জলাশয়						
৫.	অন্যান্য						
	মোট						

৩.২। ভাড়াটিয়াদের ক্ষেত্রে প্রযোজ্য

ক্রঃ নঃ	জমির ধরণ	জমির পরিমাণ(শতক)	ভাড়া (টাকা/বৎসর)	আয়-ব্যয় (টাকা/বৎসর)	কর্মচারী
১.	ভিটা				
২.	চাষাবাদ (উৎপাদন সামগ্রীর খরচ বাদে)				
৩.	ব্যবসায়িক				
৪.	পুকুর/জলাশয়				
৫.	অন্যান্য				
	মোট				

সেকশন ৪-ঘর-বাড়ির ধরণ

৪.১। আপনার বসবাসকৃত বাড়ির ধরণ কেমন?
পাকা.....১; সেমি পাকা.....২; কাঁচা (টিন-শেড এবং টিন/বাঁশ/মাটির বেড়া .....৩; কুঁড়ে ঘর.....৪

সেকশন ৫- বিদ্যুৎসরবরাহ সম্পর্কিত তথ্যাবলী

৫.১। আপনার বাড়িতে কি বিদ্যুতের সংযোগ আছে?
হ্যাঁ.....১, না.....২
৫.৫.১। উত্তর হ্যাঁ হলে উক্ত সংযোগের উৎস কি? (একাধিক উত্তর)
জাতীয় গ্রিড..... ১, জেনারেটর.....২; সৌরবিদ্যুত.....৩; অন্যান্য (উল্লেখ করুন) 99

সেকশন ৬- মুঠোফোন ও ইন্টারনেটসম্পর্কিত তথ্যাবলী

ক্রঃ নঃ	উৎস	সক্রিয় সিমের সংখ্যা(পরিবার)	ব্যবহারকারীর সংখ্যা(পরিবার)
৬.১।	মুঠোফোন		
৬.২।	ইন্টারনেটের ধরণ		
৬.৩।	ইন্টারনেটের ব্যবহার (একাধিক উত্তর)		

ইন্টারনেট (ধরণ)	-	ব্রডব্যান্ড সংযোগ.....১, মোডেম....২, অন্যান্য....৯৯

ইন্টারনেট (ব্যবহার)	-	ইমেইল করতে-১, সামাজিক যোগাযোগে মাধ্যমের জন্য-২, ইমেইল +সামাজিক যোগাযোগ মাধ্যম-৩, অফিসিয়াল কাজে-৪, শিক্ষার ক্ষেত্রে-৫, ব্যবসায়িক কাজে-৬, অন্যান্য (নির্দিষ্ট করুন)....৯৯

সেকশন ৭-স্বাস্থ্য সুবিধা ও পুষ্টি সংক্রান্ত তথ্যাবলী

৭.১। বিগত ১২ মাসে আক্রান্ত হওয়া প্রধান রোগব্যাধি

ক্রঃ নঃ	ব্যাধি	আক্রান্ত ব্যক্তি	সময়কাল	সর্বশেষ চিকিৎসা
১.				
২.				
৩.				
৪.				

ব্যাধি - জ্বর/কাশি/সর্দি/ইনফ্লুয়েঞ্জা-১, আমাশয়/ডায়রিয়া-২, আঘাত-৩, হাঁপানি/শ্বাসযন্ত্র-৪, গ্যাস্ট্রিক আলসার -৫, রক্তচাপ-৬, রিউম্যাটিক জ্বর-৭, চর্মরোগ -৮, ক্যান্সার-৯, কিডনি রোগ-১০, যকৃতব্যাধি-১১, মানসিক রোগ-১২, পক্ষাঘাত-১৩, ইএনটি (নাক/কান/গলা)-১৪, ডেঙ্গু-১৫, চোখের রোগ-১৬, অন্যান্য-৯৯

আক্রান্ত ব্যক্তি - ৫ বছরের কম বয়সী শিশু -১, শিশুদের বয়স ৫ থেকে ১৪ -২, কিশোর বয়স ১৫ থেকে ১৯ -৩, প্রাপ্তবয়স্ক ২০ থেকে ৪৯-৪, প্রবীণ বয়স ৫০ থেকে ৬৪-৫, বার্ধক্য ৬৫++-৬

সময়কাল - এক সপ্তাহ পর্যন্ত-১, এক সপ্তাহ থেকে এক মাস পর্যন্ত-২, এক মাসেরও বেশি-৩

সর্বশেষ চিকিৎসা - কমিউনিটি ক্লিনিক-১, ইউনিয়ন স্বাস্থ্য কেন্দ্র -২, উপজেলা স্বাস্থ্য কমপ্লেক্স-৩, বেসরকারী হাসপাতাল ক্লিনিক-৪, মেডিসিনের দোকান-৫, জেলা হাসপাতাল-৬, গ্রামীণ ডাক্তার-৭, কবিরাজ-৮, হোমিওপ্যাথিক-৯, ইউনানী আয়ুর্বেদিক-১০, অন্যান্য (নির্দিষ্ট করুন)..... ।৯৯

৭.২। পরিবারে গত ১২ মাসে কেউ কি মারা গেছে? হ্যাঁ..... ১
না ২

৭.২.১। হ্যাঁ হলে আপনার সাথে তার সম্পর্ক কি? স্বামী -১, স্ত্রী-২, ছেলে-৩, মেয়ে-৪, ভাই-৫, বোন -৬, মা-৭, বাবা-৮, শ্যালক-৯, শালিকা/ ননদ /ভাবী -১০, শ্বশুর-১১,শ্বাশুড়ি-১২, অন্যান্য (নির্দিষ্ট করুন)-৯৯

৭.৩। পুষ্টি সংক্রান্ত তথ্য (সবসময়-১, প্রায়ই-২, মাঝে মাঝে-৩, খুব কমই-৪, কখনই না -৫)

ক) ভাত.....
খ) ডাল .....
গ) মাছ .....
ঘ) মাংস .....
ঙ) ফল .....
চ) শাকসবজি .....
ছ) ডিম .....
জ) দুধ .....
ঝ) অন্যান্য .....

৭.৪। আপনার পরিবারের সদস্যের স্বাস্থ্যসেবার জন্য আপনি কোথায় যান?
হাতুড়ে ডাক্তার..... ১, কমিউনিটি ক্লিনিক..... ২, উপজেলা স্বাস্থ্যকেন্দ্র..... ৩, সরকারী হাঁসপাতাল.....৪, বেসরকারী হাঁসপাতাল..... ৫, অন্যান্য..... ৯৯

৭.৫। আপনার পরিবারের সদস্যের স্বাস্থ্যসেবার জন্য আপনি সর্বশেষ কবে ডাক্তারের শরণাপন্ন হয়েছেন?
এক সপ্তাহ আগে...১, এক মাস আগে... ২, তিন মাস আগে... ৩, ছয় মাস আগে... ৪, এক বছর আগে...৫

৭.৫। আপনি কি মনে করেন এই প্রকল্পের জনস্বাস্থ্যে কোন প্রভাব আছে?
হ্যাঁ……১, না……২
৭.৬। এই প্রকল্পের ফলে জনস্বাস্থ্যে প্রভাবগুলো কি ধরনের হতে পারে বলে আপনি মনে করেন?
খুব বেশী…..১; বেশী…..২; মাঝামাঝি …..৩; কম,…..৪; খুব কম…… ৫

সেকশন ৮- পরিবারের আয়ের খাতসমূহ

৮.১। আপনার পরিবারে মোট কতজন সদস্য আয় বৃদ্ধিমূলক কাজের সাথে জড়িত? .....
৮.২। আপনার পরিবারে কে কে আয় বৃদ্ধিমূলক কাজের সাথে জড়িত?
বাবা..... ১ মা..... ২ ছেলে..... ৩ মেয়ে..... ৪ দাদা ..... ৫ দাদি.....
৬

৮.৩। অনুগ্রহপূর্বক আপনার পরিবারের সম্ভাব্য মাসিক আয়ের খাতসমূহ উল্লেখ করুন-

ক্রমিক নং	খাতসমূহ	মাসিক গড় আয়(টাকা)
১	ব্যবসা	
২	চাকুরী	
৩	দিন মজুর	
৪	কৃষি হয়ে প্রাপ্ত আয় (যেমন-ধান, আলু, সবজি ইত্যাদি বিক্রয়)	
৫	গবাদি পশু বিক্রয়	
৬	হাঁস-মুরগী বিক্রয়	
৭	ভাড়া	
৮	গাছ/বাগানের ফল বিক্রয় থেকে আয়	
৯	পোষ্ট অফিস/ব্যাংকে সঞ্চিত অর্থ	
১০	পেনশন স্কিমের মাধ্যমে সঞ্চিত অর্থ	
১১	বিদেশ থেকে পাঠানো অর্থ (রেমিটেন্স)	
১২	অন্যান্য (নির্দিষ্ট করুন)	
	মোট	

***উৎপাদন খরচ বাদে আয় উল্লেখ করতে হবে**

সেকশন ৯- পরিবারিক ঋণ বিষয়ক তথ্যাবলী

৯.১। আপনি বিগত ৩ বছরে কোন ঋণ গ্রহণ করেছেন কিনা? হ্যাঁ ১
না ২

৯.১.১। হ্যাঁ হলে ঋণের উৎস কি?

ক্রঃ নঃ	ঋণের উৎস	ঋণ গ্রহণের সময় (কত মাস পূর্বে)	ঋণের পরিমাণ (টাকা)	কিস্তির সংখ্যা	প্রতি কিস্তির পরিমাণ (টাকা)	পরিশোধিত কিস্তির সংখ্যা	পরিশোধের পরিমাণ
১.	সরকারী বাণিজ্যিক ব্যাংক						
২.	বেসরকারী বাণিজ্যিক ব্যাংক						
৩.	গ্রামীণ ব্যাংক						
৪.	জাতীয় এনজিও/পিকেএসএফ						
৫.	স্থানীয় এনজিও						
৬.	বিআরডিবি সমিতি						
৭.	সমবায় সমিতি						
৮.	আনসার/ভিডিপি						
৯.	অন্যান্য						
	মোট						

সেকশন১০ - জেন্ডার বিষয়ক তথ্যাবলী

১০.১। আপনার পরিবারে যেকোনো পারিবারিক সিদ্ধান্ত গ্রহণের ক্ষেত্রে কার মতামতকে প্রাধান্য দেয়া হয়?	শুধুমাত্র পুরুষদের.....	১
	শুধুমাত্র নারীদের.....	২
	নারী এবং পুরুষ উভয়েরই মতামত	৩

সেকশন ১১ - সম্প্রদায়ের সামাজিক এবং সাংস্কৃতিক সম্পদ **বিষয়ক তথ্যাবলী**

১১.১। আপনাদের এলাকায় কি কি ধরণের সামাজিক ও সাংস্কৃতিক সম্পদ বা প্রতিষ্ঠান আছে?

স্কুল/কলেজ/মাদ্রাসা.....১, মসজিদ/মন্দির/গির্জা.....২, শহীদ মিনার.....৩, পাঠাগার.....৪, কবরস্থান/শ্মশান.....৫, ক্রীড়া/সাংস্কৃতিক সংঘ.....৬, ব্যাংক.....৭, পোস্ট অফিস.....৮, সরকারি গভীর নলকূপ.....৯, প্রত্নতাত্ত্বিক নিদর্শন.....১০

১১.২। আপনি কি মনে করেন প্রকল্পের কারনে এলাকার সামাজিক ও সাংস্কৃতিক সম্পদের কোনো ক্ষতি হবে? হ্যাঁ.... ১, না.....২

১১.২.১। হ্যাঁ হলে কি ধরণের ক্ষতি হতে পারে? (এক/একাধিক উত্তর দিন)

স্কুল/কলেজ/মাদ্রাসা.....১, মসজিদ/মন্দির/গির্জা.....২, শহীদ মিনার.....৩, পাঠাগার.....৪, কবরস্থান/শ্মশান.....৫, ক্রীড়া/সাংস্কৃতিক সংঘ.....৬, ব্যাংক.....৭, পোস্ট অফিস.....৮, সরকারি গভীর নলকূপ.....৯ প্রত্নতাত্ত্বিক নিদর্শন ১০

সেকশন ১২ – যোগাযোগ ব্যবস্থা **বিষয়ক তথ্যাবলী**

১২.১। এই এলাকার প্রধান যোগাযোগের বাবস্থা কি কি?

রাস্তা (পাকা)...১, রাস্তা (কাঁচা)...২, রেলপথ...৩, নদীপথ...৩, আকাশপথ...৪,

১২.২। স্থলপথে আপনারা মূলত কি কি ধরণের যানবাহন ব্যবহার করেন?

বাস...১, ভ্যান/রিক্সা...২, ইজিবাইক/সিএনজি...৩, অন্যান্য (নির্দিষ্ট)... ..... ৯৯

১২.৩। জলপথে আপনারা মূলত কি কি ধরণের যানবাহন ব্যবহার করেন?

নৌকা...১, লঞ্চ...২, ট্রলার.....৩; পন্যবাহী বড় নৌযান .....৪ ; অন্যান্য (নির্দিষ্ট)... ..... ৯৯

১২.৪। আপনি কি মনে করেন প্রকল্পের কারনে যাতায়াত/যোগাযোগ ব্যবস্থার কোন ক্ষতি হবে? হ্যাঁ..... ১, না.....২

১২.৫। উত্তর হ্যাঁ হলে, কি কি ধরনের ক্ষতি হতে পারে?

ভারী বোঝার কারণে রাস্তাগুলি ক্ষতিগ্রস্থ হতে পারে... ১, ট্রাফিক জ্যাম.....২, দুর্ঘটনা বেড়ে যাবে.....৩

সেকশন ১৩ – কল-কারখানা **বিষয়ক তথ্যাবলী**

১৩.১। আপনাদের এলাকায় কোন কল-কারখানা আছে কিনা? হ্যাঁ..... ১, না.....২

১৩.২। উত্তর হ্যাঁ হলে, কি কি ধরণের কল-কারখানা আছে?

পাট কল... ১, টেক্সটাইল শিল্প.....২, তাঁত শিল্প.....৩, ছোট স্কেল এবং কুটির শিল্প.....৪, বাঁশ এবং বেতের শিল্প....৫, অটো রাইস

মিলস...৬, প্লাস্টিক শিল্প .....৭ ফ্লাওয়ার মিলস.....৮

১৩.৩। আপনি কি কোন কারখানায় চাকরি করেন? হ্যাঁ..... ১, না.....২

১৩.৪। প্রকল্পের কারনে কল-কারখানার কি কি ক্ষতি হবে বলে আপনি মনে করেন?

কারখানা বন্ধ হবে...১, উৎপাদন বন্ধ হবে...২, কর্মীরা চাকরি হারাবে...৩, কর্মীর সংখ্যা বৃদ্ধি পাবে...৪,

১৩.৫। প্রকল্পের কারনে কল-কারখানার কি কি উন্নতি হবে বলে আপনি মনে করেন?

উৎপাদন বৃদ্ধি পাবে...১, কর্মীদের বেতন বৃদ্ধি পাবে...২, যোগাযোগ ব্যবস্থার উন্নতি হবে...৩, এলাকার মানুষের কর্মসংস্থান হবে...৪,

সেকশন ১৪– জলবায়ু সম্পর্কিত **তথ্যাবলী**

১৪.১। এখানে প্রতিবছর কেমন বৃষ্টিপাত হয়?

কম.....১, মাঝারি.....২, বেশি.....৩

১৪.২। এখানকার তাপমাত্রার অবস্থা সারা বছর কেমন থাকে?

কম.....১, মাঝারি.....২, বেশি.....৩

১৪.৩। আপনি কি মনে করেন গত ১০ বছরে এখানকার জলবায়ুর পরিবর্তন হয়েছে?

হ্যাঁ..... ১, না.....২

১৪.৪। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে বর্তমান বায়ুর গুণগত মান কেমন?

খুব ভালো..... ১, ভালো..... ২, মাঝারী..... ৩, খারাপ.....৪, খুব খারাপ..... ৫,

১৪.৫। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কি বায়ু দূষণের কোনও উৎস বিদ্যমান রয়েছে?

হ্যাঁ..... ১, না.....২
১৪.৫.১। হ্যাঁ হলে কি ধরণের উৎস রয়েছে? (এক/একাধিক উত্তর দিন)
ইট ভাটা.....১, বিদ্যুৎ কেন্দ্র..... ২, যান চলাচল..... ৩, কৃষি প্রক্রিয়াকরণ খামার..... ৪, ছোট উদ্যোগ.....৫, কারখানা..... ৬, বর্জ্য নিষ্পত্তির স্থান.....৭, অন্যান্য (নির্দিষ্ট করুন).....৯৯

১৪.৬। আপনি কি মনে করেন গত ১০ বছরে এখানকার বায়ুর মান খারাপ হয়েছে?
হ্যাঁ..... ১, না.....২
১৪.৭। আপনার কি ধারণা, প্রস্তাবিত প্রকল্পের কারণে বায়ু দূষণের পরিমাণ কেমন হবে?

খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, খারাপ.....৪, খুব খারাপ..... ৫

সেকশন ১৫– শব্দের স্তর সম্পর্কিত **তথ্যাবলী**

১৫.১। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কি শব্দের কোনও উৎস বিদ্যমান রয়েছে?
হ্যাঁ..... ১, না.....২
১৫.১.১। হ্যাঁ হলে কি ধরণের উৎস রয়েছে? (এক/একাধিক উত্তর দিন)
যান চলাচল.....১, শিল্প ও কারখানা.....২, অন্যান্য (নির্দিষ্ট করুন).....৯৯
১৫.২। আপনি কি মনে করেন গত ১০ বছরে এখানকার শব্দের পরিমাণ বেড়েছে?
হ্যাঁ..... ১, না.....২
১৫.৩। আপনার কি ধারণা, প্রস্তাবিত প্রকল্পের কারণে শব্দ দূষণের পরিমাণ কেমন হবে?
খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, কম.....৪, খুব কম..... ৫,

সেকশন ১৬– পানি সম্পদ সম্পর্কিত **তথ্যাবলী**

১৬.১। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কি কোনও জলাশয় রয়েছে?
হ্যাঁ..... ১, না.....২
১৬.১.১। হ্যাঁ হলে কি ধরণের জলাশয় রয়েছে? (এক/একাধিক উত্তর দিন)
পুকুর.....১, খাল.....২, নদী.....৩, অন্যান্য (নির্দিষ্ট করুন).....৯৯
১৬.২। আপনার বাড়িতে কি খাবার পানির উৎস রয়েছে?
হ্যাঁ..... ১, না.....২
১৬.২.১। হ্যাঁ হলে কি ধরণের খাবার পানির উৎস রয়েছে? (এক/একাধিক উত্তর দিন)
নলকূপ.....১, মোটরযুক্ত নলকূপ..... ২, বালি দ্বারা পরিশোধিত পুকুরের পানি..... ৩, বৃষ্টির পানি ধরে রাখা..... ৪,

পাইপলাইনের মাধ্যমে জল সরবরাহ.....৫, পাহাড়ি ঝর্ণা..... ৬, হ্রদ / নদী.....৭, অন্যান্য (নির্দিষ্ট করুন).....৯৯

১৬.৩। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে ভূপৃষ্ঠের পানির মান কেমন?

খুব ভালো..... ১, ভালো ..... ২, মাঝারী..... ৩, খারাপ.....৪, খুব খারাপ..... ৫,

১৬.৪। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে ভূগর্ভস্থের পানির মান কেমন?

খুব ভালো..... ১, ভালো ..... ২, মাঝারী..... ৩, খারাপ.....৪, খুব খারাপ..... ৫
১৬.৫। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে ভূগর্ভস্থ পানিতে কি ধরনের দূষকের উপস্থিতি রয়েছে?
আর্সেনিক.....১, আয়রন.....২, অন্যান্য (নির্দিষ্ট করুন).....৯৯
১৬.৬। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কি পানি দূষণের কোনও উৎস রয়েছে?
হ্যাঁ..... ১, না.....২
১৬.৬.১। হ্যাঁ হলে কি ধরণের পানি দূষণের উৎস রয়েছে? (এক/একাধিক উত্তর দিন)
সার ব্যবহার.....১ পয়ঃনিষ্কাশন..... ২, গৃহস্থালি আবর্জনা..... ৩, শিল্প কারখানা থেকে ময়লা আবর্জনা..... ৪, তরল বর্জ্য

নির্গমন ..... ৫, অন্যান্য (নির্দিষ্ট করুন).....৯৯

১৬.৭ আপনি কি মনে করেন গত ১০ বছরে এখানকার পানির মান আরও খারাপ হয়েছে?
হ্যাঁ..... ১, না.....২
১৬.৮। আপনার কি ধারণা, প্রস্তাবিত প্রকল্পের কারণে পানি দূষণের পরিমাণ কেমন হবে?

খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, কম.....৪, খুব কম..... ৫,

১৬.৯। আপনার বাড়িতে কি স্বাস্থ্যসম্মত পয়ঃনিষ্কাশন ব্যবস্থা রয়েছে?
হ্যাঁ..... ১, না.....২
১৬.৯.১। হ্যাঁ হলে কি ধরণের পয়ঃনিষ্কাশন ব্যবস্থা রয়েছে? (এক/একাধিক উত্তর দিন)
নন স্যানিটারি ল্যাট্রিন..... ১, খোলা স্যানিটারি ল্যাট্রিন ..... ২, আবদ্ধ স্যানিটারি ল্যাট্রিন ..... ৩, টয়লেট সুবিধা নেই.....৪

সেকশন ১৭– কৃষি সম্পদ / চাষাবাদ সম্পর্কিত তথ্য

১৭.১। চাষের ধরণ

ধরণ	হ্যাঁ..... ১, না.....২
ফসল উৎপাদন	
হাঁস-মুরগি পালন	
মাছ চাষ	
শস্য উৎপাদন এবং হাঁস-মুরগি পালন	
হাঁস-মুরগি পালন ও মাছ চাষ	
শস্য উৎপাদন ও মাছ চাষ	
শস্য উৎপাদন, হাঁস-মুরগি ও মাছ চাষ	
অন্যান্য (নির্দিষ্ট করুন)	

১৭.২। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কোন ধরণের ফসলের চাষ হয়? (এক/একাধিক উত্তর দিন)
ধান.....১ গম..... ২, পাট..... ৩, ডাল..... ৪, শাকসবজি ..... ৫, ফল..... ৬ ,অন্যান্য (নির্দিষ্ট করুন).....৯৯
১৭.৩। আপনার জমিতে বছরে কতবার চাষ করা যায়?

বর্ণনা	পরিমাণ (শতাংশ)
এক-ফসলি জমি	
দ্বি-ফসলি জমি	
ত্রি-ফসলি জমি	

১৭.৪। কোন ধরণের সার বেশিরভাগ চাষের জন্য ব্যবহৃত হয়? (এক/একাধিক উত্তর দিন)
জৈব সার... ..১; রাসায়নিক সার... ..২
১৭.৫। কৃষিকাজের জন্য কোন ধরণের প্রযুক্তি ব্যবহৃত হয়?
গতানুগতিক.....১ আধুনিক.....২
১৭.৬ আপনি কি মনে করেন গত ১০ বছরে এখানকার কৃষিজমি কি হ্রাস পেয়েছে?
হ্যাঁ..... ১, না.....২ অপরিবর্তিত.....৩
১৭.৬.১। হ্যাঁ হলে কি কারনে জমি কমে যাচ্ছে? (এক/একাধিক উত্তর দিন)
ভুমি ক্ষয়... .১ জমির উর্বরতা হ্রাস ... .. ২ নগরায়ন... ..৩ শিল্পায়ন... ..৪ ছোট পরিবার গঠন... .. ৫ অন্যান্য (নির্দিষ্ট করুন).....৬
১৭.৭। এখানে গত ১০ বছরে কি উৎপাদনের হারের কোনও পরিবর্তন হয়েছে?
বেড়েছে..... ১ কমেছে.....২ অপরিবর্তিত.....৩
১৭.৮। আপনার কি ধারণা, প্রস্তাবিত প্রকল্পের কারণে এই এলাকার কৃষি উৎপাদনের প্রভাব কেমন হবে?

খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, কম.....৪, খুব কম..... ৫,

সেকশন ১৮– **ভূমি** সম্পদ সম্পর্কিত তথ্য

১৮.১। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কোন ধরণের জমি দেখা যায়? (এক/একাধিক উত্তর দিন)

অনুর্বর জমি.....১ কৃষি.....২ জলজ চাষ .....৩ বসতঘর.....৪ বন ..... ৫ আবাসিক..... ৬ ব্যবসায়িক..... ৭

১৮.২। প্রকল্পের এলাকার মধ্যে কৃষির জন্য জমির গুণমান কেমন?

খুব ভালো..... ১, ভালো ..... ২, মাঝারী..... ৩, খারাপ.....৪, খুব খারাপ..... ৫

১৮.৩। প্রকল্পের এলাকার মধ্যে অবকাঠামো উন্নয়নের জন্য জমির গুণমান কেমন?

খুব ভালো..... ১, ভালো ..... ২, মাঝারী..... ৩, খারাপ.....৪, খুব খারাপ..... ৫

১৮.৪। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কি জমি দূষণের কোনও উৎস রয়েছে?

হ্যাঁ..... ১, না.....২

১৮.৪.১। হ্যাঁ হলে কি ধরণের দূষণের উৎস রয়েছে? (এক/একাধিক উত্তর দিন)

অবকাঠামোর উন্নয়নের জন্য .....১, পাথর ভাঙা ..... ২, গৃহস্থালি আবর্জনা ..... ৩, রাইস মিল / চাতাল থেকে সৃষ্ট ছাই..... ৪,

কলকারখানার ময়লা স্তুপ .....৫, তরল বর্জ্য নিঃসরণ..... ৬, অন্যান্য (নির্দিষ্ট করুন).....৭

১৮.৫। আপনি কি মনে করেন গত ১০ বছরে এখানকার মাটির গুণাগুণের কোনও পরিবর্তন হয়েছে?

হ্যাঁ..... ১, না.....২

১৮.৬। আপনার কি ধারণা, প্রস্তাবিত প্রকল্পের কারণে এই এলাকার মাটি দূষণের প্রভাব কেমন হবে?

খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, কম.....৪, খুব কম..... ৫,

সেকশন ১৯– **মৎস্য** সম্পর্কিত তথ্য

১৯.১। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে মাছ কেমন পাওয়া যায়?

কম.....১, মাঝারি.....২, বেশি.....৩

১৯.২। প্রকল্প অঞ্চলটির ১০ কিলোমিটারের মধ্যে মাছের প্রধান উৎস কোনটি? (এক/একাধিক উত্তর দিন)

নদী..... ১, পুকুর ..... ২, খাল..... ৩, বিল.....৪, অন্যান্য (নির্দিষ্ট করুন)..... ৯৯

১৯.৩। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে কি ধরনের মাছ কেমন পাওয়া যায়?

প্রাকৃতিক ..... ১, চাষকৃত ..... ২, খাল..... ৩, বিল.....৪, অন্যান্য (নির্দিষ্ট করুন)..... ৯৯

১৯.৪। কোন ফিশিং গিয়ার মাছ ধরার জন্য ব্যবহৃত হয়? (এক/একাধিক উত্তর দিন)

গিল নেট (কারেন্ট জাল) .....১, সিন নেট (বের জাল) ..... ২, সেট ব্যাগ নেট (ধুর জাল) ..... ৩, ড্রাগ নেট (কুচি জাল) ৪,

লিফট নেট (বেহালা/ ভেসেল জাল) .....৫, ফিশ ট্যাপ (ছই) ..... ৬, বরশি.....৭, অন্যান্য (নির্দিষ্ট করুন).....৮

১৯.৫। গত ১০ বছরে স্থানীয় মৎস্য চাষের কোনও পরিবর্তন হয়েছে?

পরিবর্তন হয়েছে..... ১ পরিবর্তন হয়নি.....২ অপরিবর্তিত.....৩

১৯.৬। আপনার কি ধারণা, প্রস্তাবিত প্রকল্পের কারণে স্থানীয় মৎস্য চাষে প্রভাব কেমন হবে?

খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, কম.....৪, খুব কম..... ৫,

সেকশন **২০– প্রাণিসম্পদ সম্পর্কিত তথ্য**

২০.১। প্রকল্প এলাকার ১০ কিলোমিটারের মধ্যে প্রাণিসম্পদ কেমন পাওয়া যায়?

কম.....১, মাঝারি.....২, বেশি.....৩

২০.২। কোন ধরনের প্রানী এই এলাকায় বেশী পাওয়া যায়?

গরু, মহিষ... .১; ছাগল, ভেড়া... .২; মুরগি... .৩; অন্যান্য (নির্দিষ্ট করুন)..... ৯৯

২০.৩। গবাদি পশু খাবারের কি কোনও ঘাটতি আছে?

হ্যাঁ..... ১, না.....২

২০.৪। প্রস্তাবিত প্রকল্পের কারণে প্রাণীদের জন্য খাবার প্রাপ্য, তাতে প্রভাবের মাত্রা কী হবে বলে আপনি মনে করেন?
খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, কম.....৪, খুব কম..... ৫

সেকশন ২১– পরিবেশগত সম্পদ সম্পর্কিত তথ্য

২১.১। প্রকল্পের ১০ কিলোমিটারের মধ্যে কি কোনও বিলুপ্তপ্রায় প্রজাতি রয়েছে?
হ্যাঁ..... ১, না.....২
২১.১.১। হ্যাঁ হলে সেটি কোনটি? (এক/একাধিক উত্তর দিন)
স্থলজ উদ্ভিদ... ..১; স্থলজ প্রাণী... .. ২; জলজ উদ্ভিদ... ..৩; জলজ প্রাণী... ..৪; কোনটিই নয়... .. ৫
২১.২। এখানে এমন কোন প্রজাতি রয়েছে যা বিলুপ্ত হয়ে গিয়েছে?
হ্যাঁ..... ১, না.....২
২১.২.১। হ্যাঁ হলে তার নাম লিখুন
.....
২১.৩। গত ১০ বছরে স্থানীয় জীববৈচিত্র্যের কোনও পরিবর্তন হয়েছে?
বেড়েছে..... ১ কমেছে.....২ অপরিবর্তিত.....৩
২১.৪। প্রস্তাবিত প্রকল্পের কারণে স্থানীয় জীববৈচিত্র্যের উপর প্রভাবের মাত্রা কী হবে বলে আপনি মনে করেন?
খুব বেশি..... ১, বেশি..... ২, মাঝারী..... ৩, কম.....৪, খুব কম..... ৫,

সেকশন ২২– প্রাকৃতিক দুর্যোগ সম্পর্কিত তথ্য

২২.১। কোন ধরণের প্রাকৃতিক দুর্যোগ এই অঞ্চলে বেশী দেখা যায়? (এক/একাধিক উত্তর দিন)
বন্যা... ..১; ঝড়... ..২, নদীর ভাঙন... ..৩; খরা... ..৪; ঘূর্ণিঝড়... ..৫; ভূমিকম্প... ..৬
২২.২। কোন ধরণের প্রাকৃতিক দুর্যোগ সবচেয়ে বেশি হুমকিস্বরূপ ?
বন্যা... ..১; ঝড়... ..২, নদীর ভাঙন... ..৩; খরা... ..৪; ঘূর্ণিঝড়... ..৫; ভূমিকম্প... ..৬
২২.৩। এই এলাকায় সম্ভাব্য কত দিন পর পর প্রাকৃতিক দুর্যোগ হয়ে থাকে?

	প্রতি বছর	২-৫ বছর	৫-১০ বছর	কখনোই না
বন্যা				
ঝড়				
নদী ভাঙ্গন				
খরা				
ঘূর্ণিঝড়				
ভূমিকম্প				

২২.৪। প্রকল্প এলাকায় কি কোনো ধরনের জলাবদ্ধতা আছে?
হ্যাঁ..... ১, না.....২
২২.৫। সাধারনত জলাবদ্ধতা সৃষ্টি হলে পানি সরে যেতে কত সময় লাগে?
১ দিন... ..১; ২-৫ দিন... .২; ৫-৭ দিন... ..৩; ৭ দিনের বেশি... ..৪
২২.৬। গত ১০ বছরে এ এলাকার প্রাকিতিক দুর্যোগ হওয়ার প্রবনতা কেমন ছিল?
বেড়েছে..... ১ কমেছে.....২ অপরিবর্তিত.....৩
২২.৭। আপনি কি মনে করেন প্রস্তাবিত প্রকল্পটি প্রাকৃতিক দুর্যোগের কারণে প্রভাবিত হতে পারে?
হ্যাঁ..... ১, না.....২

সেকশন ২৩– অর্থনৈতিক অঞ্চল সম্পর্কিত তথ্য

২৩.১। । আপনি কি মনে করেন অর্থনৈতিক অঞ্চলের ফলে এই অঞ্চলের মানুষের উপকার হবে?
হ্যাঁ..... ১, না.....২
২৩.১.১। যদি হ্যাঁ হয়, কি ধরনের উপকার হবে? (এক/একাধিক উত্তর দিন)
জমির দাম বাড়বে... ১; বাড়ির ভাড়ার পরিমাণ বাড়বে... ২; ব্যবসা-বাণিজ্য সহ কর্মসংস্থানের হার বাড়বে... ৩; পরিবহন ব্যবস্থার
উন্নতি হবে... ৪; অন্যান্য (নির্দিষ্ট করুন)..... .. ৯৯
২৩.২। আপনি কি মনে করেন অর্থনৈতিক অঞ্চল প্রতিষ্ঠার ফলে এই এলাকায় কোনও নেতিবাচক প্রভাব পড়বে?
হ্যাঁ..... ১, না.....২
২৩.২.১। যদি হ্যাঁ হয়, কি ধরনের নেতিবাচক প্রভাব পড়বে? (এক/একাধিক উত্তর দিন)

যানবহনের পরিমাণ বৃদ্ধি পাবে... ১; সড়ক দুর্ঘটনার সংখ্যা বাড়বে... ২; বায়ু এবং শব্দদূষণের পরিমাণ বাড়বে... ৩; শিশু নির্যাতন,
ইভটিজিং, মহিলাদের পাচার বৃদ্ধি পাবে... ৪; মাদকাসক্তদের পরিমাণ বাড়বে... ৫; এইচআইভি / এইডস সংখ্যা বৃদ্ধি পাবে... ৬; উপরের সবগুলো... ৯৯

সেকশন ২৪– প্রস্তাবিত প্রকল্প এলাকায় ভূমি অধিগ্রহণ **সম্পর্কিত তথ্য**

২৪.১। প্রস্তাবিত প্রকল্পের জন্য আপনার কোন জমি অধিগ্রহণ করা হবে কি?
হ্যাঁ ... ১; না, ... ২; জানা নাই...৩
২২.১.১। যদি হ্যাঁ হয়, জমির মালিকানার ধরণ কেমন? (এক/একাধিক উত্তর দিন)
পৈতৃকসূত্রে প্রাপ্ত জমি -১ ক্রয়কৃত জমি-২ লিজ / ভাড়া জমি-৩ বন্ধকী জমি -৪ ভাড়াকৃত জমি -৫ খাস/সরকারী জমি-৬ অন্যান্য (নির্দিষ্ট করুন) -৯৯
২৪.১.২। কি ধরনের জমি ক্ষতিপ্রস্ত হবে?

নং	জমির ধরন	মৌজা ও প্লট নং	ক্ষতিগ্রস্ত জমির পরিমাণ (শতাংশ)	জমি ব্যবহারের সময়কাল	আনুমানিক ক্ষতি (বছর)
১	ভিটা				
২	কৃষি জমি				
৩	গাছ				
৪	বাঁশের ঝোপ				
৫	পুকুর				
৬	জলাধার				
৭	অনুর্বর জমি				
৮	বাণিজ্যিক জমি				
৯	খাস জমি				
১০	অন্যান্য (নির্দিষ্ট করুন) ৯৯				

২৪.১.৩। ভাড়ার জন্য প্রযোজ্য

নং	জমির ধরন	জমির পরিমাণ(শতাংশ)	ভাড়া (টাকা/বছর)	আয়/ব্যয় (টাকা/বছর)
১	হোমস্টেড			
২	চাষাবাদ (উৎপাদন খরচ বাদে)			
৩	ব্যবসা			
৪	পুকুর / জলাশয়			
৫	অন্যান্য			
	মোট			

২৪.২। ক্ষতিগ্রস্ত জমির উপর আপনার কি কোনো গাছ আছে?
হ্যাঁ..... ১, না.....২
২৪.২.১। যদি হ্যাঁ হয়, তবে

নং	গাছের নাম	গাছের ধরন (কোড)	বর্ণনা ও সংখ্যা				মোট
			বড়	মাঝারি	ছোট	চারা	
১							
২							
৩							
৪							
৫							
৬							
৭							

আমের -১, পেয়ারা -২, জাম বা কালো বেরি -৩, কাস্টার্ড অ্যাপল -৪, তেতুল -৫, খেজুর বা তাল-৬, কাঁঠাল-৭, পেঁপে -৮, আনারস -৯, কলা
-১০, নারকেল -১১, লিচু -১২, ডালিম - ১৩, খেজুর - ১৪, ডুমুর -১৫
ধরণের কোড- ফল -১, কাঠ ও ফল -২, ওষধি -৩, জ্বালানী -৪, সৌন্দর্য বর্ধক -৫, বাঁশ--, অন্যান্য (নির্দিষ্ট করুন) -৯৯
২৪.৩। প্রকল্পের অঞ্চলে কি কোনও সাংস্কৃতিক স্থাপনা/ সম্পদ রয়েছে?
হ্যাঁ..... ১, না.....২
২২.৪.১। যদি হ্যাঁ হয়, তবে কি সেটা?
ঐতিহাসিক মসজিদ = ১, মন্দির = ২, গির্জা = ৩, বৌদ্ধ মন্দির = ৪, শ্মশান/কবরস্থান = ৫, একাত্তরের স্বাধীনতা যুদ্ধের স্থান = ৬, অন্যান্য (নির্দিষ্ট করুন) -৯৯
২৪.৩। প্রকল্প ক্ষতিগ্রস্থ পরিবারের মধ্যে কি উপজাতি সম্প্রদায়ের উপস্থিতি রয়েছে?
হ্যাঁ..... ১, না.....২
২৪.৩.১। যদি হ্যাঁ হয়, তবে

ইউনিয়ন	মৌজা	প্রকল্পের ক্ষতিগ্রস্থ লোকজন

Appendix 14: Environmental Code of Practices

Environmental Code of Practices

Introduction

The objective of the Environmental Code of Practices (ECPs) is to address all potential and general construction related impacts during the land development and construction phase of Purbagaon Economic Zone. The ECPs will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. These ECPs shall be annexed to the general conditions of all the contracts, including subcontracts, carried out under the Project.

The list of ECPs prepared for the Project is given below.

ECP 1: Waste Management
ECP 2: Fuels and Hazardous Goods Management ECP 3: Water Resources Management
ECP 4: Drainage Management ECP 5: Soil Quality Management
ECP 6: Erosion and Sediment Control ECP 7: Top Soil Management
ECP 8: Topography and Landscaping
ECP 9: Quarry Areas Development and Operation ECP 10: Air Quality Management
ECP 11: Noise and Vibration Management ECP 12: Protection of Flora
ECP 13: Protection of Fauna ECP 14: Protection of Fish
ECP 15: Road Transport and Road Traffic Management ECP 16: Construction Camp Management
ECP 17: Cultural and Religious Issues ECP 18: Worker Health and Safety
ECP 19: Construction and Operation Phase Security

Contractors will prepare site specific management plans, namely Construction Environmental Management Plan (CEMP), in compliance with the World Bank and Environmental Conservation Rules, 1997 of Bangladesh and based on the guidance given in the ECPs. The CEMP will form the part of the contract documents and will be used as monitoring tool for compliance. It is mandatory for the main contractors procured directly by the project to include these ECPs in their subcontracts. Violation of this requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractors.

ECP 1: Waste Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		The Contractor shall • Develop site specific waste management plan for various waste streams (*e.g.* reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to supervision consultant for approval. • Organize disposal of all wastes generated during construction in the designated disposal sites approved by the Project authority.

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	• Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate all wastes, wherever practical. • Vehicles transporting solid waste shall be totally confined within an enclosed vehicle or is fully covered with a tarp to prevent spilling waste along the route. • Tarp must be undamaged (not torn or frayed) properly secured to the body of the vehicle or trailer with ropes, chains, straps, or cords so that no waste is exposed. The edges of the tarps shall extend 12 inches over the permanent sides and back of the open top vehicle or trailer and must be secured to the permanent vehicle. All loads must be tapped from the point of origin of the waste to the tipping area of the final disposal/landfill. • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites clean, tidy and safe and provide and maintain appropriate facilities as temporary storage of all wastes before transporting to final disposal. • Potable water should be supplied in bulk containers to reduce the quantity of plastic waste (plastic bins). Plastic bag use should be avoided.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall • Collect chemical wastes in 200-liter drums (or similarsealed container), appropriately labeled for safe transport to an approved chemical waste depot. • Store, transport and handle all chemicals avoiding potential environmental pollution. • Store all hazardous wastes appropriately in bounded

ECP 2: Fuels and Hazardous Goods Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals, hazardous goods/materials on-site, wash down of equipment, and potential spills may harm the environment or health of construction workers.	The Contractor shall • Prepare spill control procedures and submit them for supervision consultant for approval. • Train the relevant construction personnel in handling of fuels and spill control procedures. • Refueling shall occur only within bounded areas. • Store dangerous goods in bounded areas on top of a sealed plastic sheet away from watercourses. Store all liquid fuels in fully bounded storage containers, with appropriate volumes, a roof, a collection point and appropriate filling/decanting point. • Store and use fuels in accordance with material safety data sheets (MSDS). Make available MSDS for chemicals and dangerous goods on-site. • Store hazardous materials at above flood level, determined for construction. • Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Sit containers and drums in temporary storages in clearly marked areas, where they will not be run- over by vehicles or heavy machinery. The area shall preferably drain to a safe collection area in the event of a spill. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • All machinery is to be stored and away from any water body, drainage inlets or natural drainage

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		area, where practical. Environmental control measures such as appropriate barriers (*i.e.* bounding, sediment fence, etc.) will be considered and/or implemented to control runoff away from the machinery and prevent any washout in to adjacent water body, drainage inlets or natural drainage area. • Transport waste of dangerous goods, which cannot be recycled, to an approved waste disposal facility. Safe transport of fuel or other hazardous liquids to and from the storage container will be facilitated through the provision detailed within the Material Safety Data Sheets (MSDS). • Wash down of equipment and vehicle servicing will be performed only in isolated impervious areas away from drainage inlets, connecting the drainage with an oil interceptor. Pits/bunds located away from waterways will be provided for concrete wash near construction areas. The contractor's environmental officer with assistance from supervisors is to ensure that pits/bunds are available, maintained at capacity and drivers instructed regarding the location and required procedures • Keep stock of absorbent and containment material (*e.g.* absorbent matting, dirt, sawdust, etc.) where hazardous materials are used and stored; and ensure staffs are trained in their correct use. • Oil and chemical spills and washouts shall be cleaned up and collected immediately, where safety permits. Disposal of remediated / cleanup/ washout materials shall be to an approved waste disposal facility. Materials shall be transported by an approved / licensed transporter. Contaminated Material to be removed from site as soon as reasonably practical after the incident. • Provide appropriate personal protective equipment (protective clothing, safety boots,

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		helmets, masks, gloves, goggles, etc.) to the construction personnel, depending on the materials handled. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.

ECP 3: Water Resources Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall • Follow the management guidelines proposed in ECP 1: Waste Management and ECP 2: Fuels and Hazardous Goods Management. • Minimize the generation of spoils, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems.
Discharge from construction sites	Construction activities, sewerages from construction sites and work camps may affect the surface water quality. The construction works will modify groundcover and topography, changing the surface water drainage patterns of the area. These changes in hydrological regime lead to increased rate of runoff, increase in sediment and	The Contractor shall • Install temporary drainage works (channels and check dams) in areas required for sediment and erosion control and around storage areas for construction materials. • Install temporary sediment lagoons, where appropriate, to capture sediment-laden run-off from work site. • Divert runoff from undisturbed areas around the construction site. • Stockpile materials away from drainage lines. • Prevent all solid and liquid wastes entering waterways by collecting spoils, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	contaminant loading, increased flooding, and effect habitat of fish and other aquatic biology.	disposal site or recycling depot. • Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This should be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil erosion and siltation	At the land development stage, soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. • Ensure that roads used by construction vehicles are swept regularly to remove dust and sediment. • Water the loose material stockpiles, access roads and bare soils on an as needed basis to minimize dust. Increase the watering frequency during periods of high risk (*e.g.* high winds).
Drinking water	Untreated surface water is not suitable for drinking purposes due to presence of suspended solids and E. coli.	The Contractor Shall • Provide drinking water that meets National and WHO Drinking Water standards. Drinking water to be chlorinated at source, and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time.

ECP 4: Drainage Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earth works, and construction	Lack of proper drainage for rainwater/liquid wasteor wastewater owing to the	The Contractor shall • Prepare drainage management procedures and submit them for supervision consultant for approval. • Prepare a program to prevent/avoid

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
yards	construction activities harms environment in terms of water and soil contamination, and mosquito growth.	standing waters, which supervision consultant will verify in advance and confirm during implementation. • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line. • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there. • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to National Standards, before it is being discharged into the recipient water bodies. • Ensure that there will be no water stagnation at the construction sites and camps. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion. • Protect natural slopes of drainage channels to ensure adequate storm water drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem.
Ponding of water	Health hazards due tomosquito breeding	• Do not allow ponding of water especially near the waste storage areas and constructioncamps. • Discard all the storage containers that are capable of storing of water, after use or store them in inverted position.

ECP 5: Soil Quality Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines

Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall • Strictly manage the wastes management plans proposed in ECP 1: Waste Management andstorage of materials and ECP 2: Fuels and Hazardous Goods Management. • Construct appropriate spill containment facilitiesfor all fuel storage areas. • Establish and maintain a hazardous material register detailing the location and quantities of hazardous substances including the storage, and their disposals. • Train personnel and implement safe work practices for minimizing the risk of spillage. • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site. • Remediate the contaminated land using the most appropriate available method.
Dumping of polluted soil for the development of land	Polluted soil may contaminate surface water as well as ground water in the long run	The Contractor shall • Test the quality of soil arranged for the land development before dumping and ensure the toxicity level is within the permissible standards.
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds.

ECP 6: Erosion and Sediment Control

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Clearing of construction sites	Cleared areas and slopes are susceptible for erosion of top soils, which affects the growth of vegetation and causes ecological imbalance.	The Contractor shall • Prepare site specific erosion and sediment control measures and submit them for supervision consultant for approval. • Reinstate and protect cleared areas as soon as possible. • Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turf/treeplantations.
		The Contractor shall • Locate stockpiles away from drainage lines.

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities and material stockpiles	Destruction of aquatic environment by erosion and/or deposition of sediment damaging the spawning grounds of fish	• Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds. • Remove debris from drainage paths and sediment control structures. • Cover the loose sediments of construction material and water them if required. • Divert natural runoff around construction areas prior to any site disturbance. • Install protective measures on site prior to construction, for example, sediment traps. • Install 'cut off drains' on large cut/fill batter slopes to control water runoff speed and hence erosion. • Observe the performance of drainage structures and erosion controls during rain and modify as required. • Restrict construction during December-February when appropriate to avoid temporary impacts to habitat during critical life history stages (*e.g.* spawning, egg and embryo development, and juvenile growth).
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. • Ensure that roads used by construction vehicles are swept regularly to remove sediment. • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (*e.g.* high winds).

ECP 7: Top Soil Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	Earthworks will impact the fertile	The Contractor shall • Strip the top soil to a depth of 35 cm and store in stock piles of height not exceeding 2m.

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	top soils that are enriched with nutrients required for plant growth or agricultural development.	• Remove unwanted materials from top soil like grass, roots of trees and others. • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantationsites. • Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bounding of the soil layers, water penetration and revegetation
Transport	Vehicular movementoutside NEZ or temporary access roads will affect the soil fertility of the agricultural lands	• Limit equipment and vehicular movements towithin the approved construction zone. • Plan construction access to make use, ifpossible, of the final road alignment.

ECP 8: Topography and Landscaping

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Construction activities especially earthworks will change topography and disturb the natural rainwater/flood water drainage as well as change the local landscape.	The Contractor shall • Prepare landscaping and plantation plan and submit the plan to supervision consultant for approval. • Ensure the topography of the final surface of all raised lands (construction yards, approach roads and rails, access roads, etc.) are conducive to enhance natural draining of rainwater/flood water. • Keep the final or finished surface of all the raised lands free from any kind of depression that causes water logging. • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and better landscaping. • Reinstate the natural landscape of the ancillary construction sites after completion of works.

ECP 9: Quarry Areas Development and Operation

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of borrow areas	Borrow areas will have impacts on local topography, landscaping and natural drainage.	The Contractor shall • Prepare borrow/quarry area management plan and submit the plan for supervision consultant approval. • Use only approved quarry and borrow sites. • Identify new borrow and quarry areas in consultation with the client, if required. • Reuse excavated or disposed material available in the project to the maximum extent possible. • Store top soil for reinstatement and landscaping. • Develop surface water collection and drainage systems, anti-erosion measures (berms, revegetation etc.) and retaining walls and gabions where required. Implement mitigation measures in ECP 3: Water Resources Management, ECP 6: Erosion and Sediment Control • The use of explosive should be used as low as possible to reduce noise, vibration, and dust. • Control dust and air pollution by application of watering and implementing mitigation measures proposed in • ECP 10: Air Quality Management • Noise and vibration control by ECP 11: Noise and Vibration Management.

ECP 10: Air Quality Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall • Prepare air quality management plan (under the Pollution Prevention Plan) and submit the plan for supervision consultant approval. • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel-efficient manner. • Cover hauling vehicles carrying dusty materials moving outside the construction site. • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions. • Control the movement of construction traffic. • Water construction materials prior to loading and transport. • Service all vehicles regularly to minimize emissions. • Limit the idling time of vehicles not more than 2 minutes.
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	The Contractor shall • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof of maintenance register shall be required by the equipment suppliers and contractors/subcontractors. • Pay special attention to control emissions from fuel generators. • Machinery causing excessive pollution (*e.g.* visible smoke) will be banned from construction sites. • Service all equipment regularly to minimize emissions. • Provide filtering systems, dust collectors or humidification or other techniques (as applicable) to the concrete batching and

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		mixing plant to control the particle emissions in all stages, including unloading, collection, aggregate handling, cement application, circulation of trucks and machinery inside the installations.
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard, and also can affect the local crops	The Contractor shall • Water the material stockpiles, access roads and bare soils on an as needed basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (*e.g.* high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted. • Minimize the extent and period of exposure of the bare surfaces. • Restore disturbed areas as soon as practicable by vegetation/grass-turfing. • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust generation is minimized during such operations. • Not use water as dust suppression on potentially contaminated areas, to prevent generation of liquid waste stream. • Crushing of rock and aggregate materials shall be wet-crushed, or performed with particle emission control systems. • Not permit the burning of solid waste.

ECP 11: Noise and Vibration Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	• The Contractor shall • Prepare a noise and vibration management plan (under the Pollution Prevention Plan) and submit the plan for supervision consultant approval. • Maintain all vehicles in order to keep it in good working condition in accordance with manufactures maintenance procedures.

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. • Perform the loading and unloading of trucks, and handling operations minimizing construction noise on the work site.
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	• The Contractor shall • Appropriately organize all noise generating activities to avoid noise pollution to local residents. • Use the quietest available machineries and equipment in construction work. • Maintain all equipment in order to keep them in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment. • Avoid unnecessary use of alarms, horns and sirens.
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	• The Contractor shall • Notify adjacent landholders prior to typical noise events outside of daylight hours. • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions. • Employ best available work practices on-site to minimize occupational noise levels. • Install temporary noise control barriers where appropriate. • Notify affected people if major noisy activities will be undertaken, *e.g.* blasting. • Plan activities on site and deliveries to and from site to minimize impact. • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.

ECP 12: Protection of Flora

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora are important habitats for birds, provide fruit harvest, timber/fire wood, protect soil from erosion and overall keep the natural balance for human- living. As such damage to flora has wide range of adverse environmental impacts.	The Contractor shall • Prepare a plan to protect flora and submit the plan for supervision consultant approval. • Minimize disturbance to surrounding vegetation. • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from supervision consultant for clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce need of tree removal. • Control noxious weeds by disposing of at designated dump site or burn on site. • Clear only the vegetation that needs to be cleared in accordance with the engineering plans and designs. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill, etc. • Not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary water main and valve access or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re- growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same location from where it came from. • Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. • Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest. • Provide adequate knowledge to the workers regarding nature protection and the need of

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		avoid felling trees during construction • Supply appropriate fuel in the work camps to prevent fuel wood collection.

ECP 13: Protection of Fauna

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities	The location of construction activities can result in the loss of wild life habitat and habitat quality,	The Contractor shall • Prepare a plan for protection of fauna and submit the plan for supervision consultant approval. • Limit the construction works within the designated sites allocated to the contractors. • Check the site (especially trenches) for trapped animals, and rescue them by the help of a qualified person. • Provide temporary access to the animals to cross the trenches.
	Impact on local and migratory birds, their habitats and active nests	• If bird nests are located/ detected within the right-of- way and roadside embankments, then those areas should be avoided. • Petroleum products should not come in contact with the natural and sensitive ecosystems. Contractor must minimize the release of oil, oil wastes or any other substances harmful to migratory birds' habitats, to any waters, wetlands or any areas frequented by migratory birds.
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	The Contractor shall • Restrict the tree removal to the minimum numbers required. • Relocate hollows, where appropriate. • Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition. Care should be taken to make sure bird habitats are not destroyed. If there is no option available, rehabilitate them in other neighboring trees. Also protect and

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		rehabilitate injured or orphaned birds.
Night time lighting	Lighting from construction sites and construction camps may affect the visibility of night time migratory birds that use the moon and stars for navigation during their migrations.	The Contractor shall • Use lower wattage flat lens fixtures that direct light down and reduce glare, thus reducing light pollution, • Avoid flood lights unless they are absolutely required. • Use motion sensitive lighting to minimize unneeded lighting. • Use, if possible, green lights that are considered as bird's friendly lighting instead of white or red colored lights. • Install light shades or plan the direction of lights to reduce light spilling outside the construction area.
Construction camps	Illegal poaching	The Contractor shall • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching. • Ensure that staff and Subcontractors are trained and empowered to identify, address and report potential environmental problems. • Provide sufficient food allowance to the workers so that they don't engage in illegal poaching or hunting.

ECP 14: Protection of Fish

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities around the wetlands (beel areas) and existing drainage canals	The main potential impacts to fisheries are hydrocarbon spills and disposal of wastes into the beel.	The Contractor shall • Prepare procedures for protection of fish and submit them for supervision consultant approval. • Ensure the construction equipment used in the river are well maintained and do not have oil leakage to contaminate river water. • Contain oil immediately on river in case of accidental spillage from equipment; make an emergency oil spill containment plan (under the Fuels and Hazardous Substances Management Plan) to be

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		supported with enough equipment, materials and human resources. • Do not dump wastes, be it hazardous or non- hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts on river are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • follow mitigation measures proposed in ECP 3: Water Resources Management and • ECP 4: Drainage Management.

ECP 15: Road Transport and Road Traffic Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	The Contractor shall • Prepare a traffic management plan and submit the plan for supervision consultant approval. • Strictly follow the Project's 'Traffic Management Plan' and work with close coordination with the Traffic Management Unit. • Prepare and submit additional traffic plan, if any of this traffic route is not covered in the Project's Traffic Management Plan, and requires traffic diversion and management. • Include in the traffic plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges, temporary diversions, necessary barricades, warning signs/lights, road signs, construction schedule etc. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the National Traffic Regulations
		The Contractor shall • Restrict truck deliveries, where practicable, to day time working hours.

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	Accidents and spillage of fuels and chemicals	• Restrict the transport of oversize loads. • Operate vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit, especially close to the sensitive receptors, schools, health centers, etc.

ECP 16: Construction Camp Management

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities	The Contractor shall • Prepare a construction camp management plan and submit the plan to supervision consultant for approval. • Locate the construction camps within the designated sites or at areas which are acceptable from environmental, cultural or social point of view and approved by the supervision consultant or the Client. • Conduct consultation with communities including local government institutes (Local member of Union Parishad) prior to set-up the camp. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the supervision consultant for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of • access roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		maintain effective surveillance over public health, social, and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water supply, and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	Contractor shall provide the following facilities in the campsites • Adequate housing for all workers. • Safe and reliable water supply, which should meet national/WHO standards. Drinking water to be chlorinated at source, and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time (WHO guideline). • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Treatment facilities for sewerage of toilet and domestic wastes. • Storm water drainage facilities. • Paved internal roads. • Provide child crèches for women working at construction site. The crèche should have facilities for dormitory, kitchen, indoor and outdoor play area. Schools should be attached to these crèches so that children are not deprived of education whose mothers are construction workers. • Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Disposal of waste	Management of	The Contractor shall • Ensure proper collection and disposal of solid wastes within the construction camps. • Insist waste separation by source; organic wastes in one container and inorganic wastes in another container at household level. • Store inorganic wastes in a safe place within

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	wastes is crucial to minimize impacts on the environment	the household and clear organic wastes on daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved waste disposal sites.
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	The Contractor shall • Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protection of biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.	The Contractor shall • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas. • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work. • Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and • communication for all workers on regular

ECP 17: Cultural and Religious Issues

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	The Contractor shall • Communicate to the public through community consultation regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Not block access to cultural and religious sites, wherever possible. • Restrict all construction activities within the foot prints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) should there be any church/mosque/religious/educational institutions and health center close to the construction sites and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious center. • Stop work immediately and notify the site manager, if during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until 'approval to continue' is obtained by the archaeological authority. • Provide independent prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and elderly people. • Allow the workers to participate in praying during construction time, if there is a request. • Resolve cultural issues in consultation with local leaders and supervision consultants. • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		works so as to maintain effective surveillance over public health, social, and security matters.

ECP 18: Worker Health and Safety

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (*e.g.* noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases, etc.), (ii) risk factors resulting from human behavior (*e.g.* STD, HIV/AIDS, etc.) and (iii) road accidents from construction traffic.	The Contractor shall • Prepare an Occupational Health and Safety plan and submit the plan for supervision consultant's approval. • Implement suitable safety standards for all workers and site visitors, with sufficient provisions to comply with international standards (*e.g.* International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own safety standards, in addition to complying with national standards. • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas. • Provide personal protective equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing the damaged ones. • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job. • Appoint an environment, health and safety manager to look after the health and safety of the workers. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		health, social and security matters.
	Child and pregnant labor	The Contractor shall • Not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks.
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	The Contractor shall • Ensure health care facilities and first aid facilities are readily available. Appropriately equipped first- aid stations should be easily accessible throughout the place of work. • Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards, in a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules. • Provide adequate lighting in the construction area, inside the tunnels, inside the powerhouse cavern and along the roads.
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in • ECP 16: Construction Camp Management: • Adequate ventilation facilities • Safe and reliable water supply. • Hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECP 2 • Solid waste collection and disposal system in accordance with ECP1. • Arrangement for trainings • Paved internal roads.

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Security fence at least 2 m height and security guards at entrances and every corner of the facility.

ECP 19: Construction Phase Security

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction Phase	Inadequate construction site security poses a significant risk to assets, construction materials and property. Theft/vandalism of assets, materials and property would increase construction costs and cause delays in project completion.	The Contractor shall: • Provide appropriate security personnel (*i.e.* security guards) to prevent unauthorized entry into the camp area. • Employ night watchman for periods of significant on-site storage or when the area necessitates. • Ensure all assets (*i.e.* tools, equipment, etc.) and construction materials at construction site are identified, inventoried and tracked as closely as possible. All assets should be clearly labeled and marked. Keep records of tool serial numbers • and check inventory on a regular basis. • All tools and equipment should have a check out/in system, if not in use should be secured and stored in a proper place to prevent theft or loss. Provide storage sheds for the secure storage of equipment and tools when not in use. • Ensure there is proper fencing around construction site perimeter. Fencing should be chain-link at least 2.4 m high and secured with a steel chain and lock. If possible the entire site should be fenced; if this is not possible, make sure construction trailer and any equipment storage areas are fenced. • Ensure construction site has controlled access points (one or two entry points at most), allowing for close monitoring of comings and goings from • the site.
	Improper security measures may pose security risk for construction workers and	The Contractor shall: • Prepare site specific security plan. • Maintain register to keep track of number of persons present in the camp at any given time.

Project Activity /Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	especially foreign staff on construction sites.	• Provide appropriate security personnel at job sites as mentioned above. • Ensure proper fencing as mentioned above. • Ensure controlled access points to job site as mentioned above. • Ensure works have easily identified credentials as mentioned above. • Ensure job sites are properly lighted at night, as mentioned above.

Appendix 15: Environmental Impact Valuation Method

Evaluation of impacts: Impact assessed on different parameters will be evaluated for both positive (+) and negative (-) impacts considering magnitude, immediacy, reversibility and sustainability. Phase I ESIA studies will be used to understand the impact assessment for subsequent phases. Impacts can also be quantified for the infrastructure projects, a typical project can evaluate the impact using the formula described below:

Impact Assessment of Infrastructure Project

The Method of Assessment. A simple methodology has been developed for Environmental Evaluation System (EES) developed by Battelle Columbus Laboratories in the United States. In Bangladesh, in absence of a database it is only possible to estimate the potential environmental changes from the existing situation. In this method, the existing environmental conditions will be the reference level and the positive and negative changes in environmental conditions resulting from the proposed project will be evaluated. The environmental impact will be assessed by Environmental Impact Values (EIVs), which may be defined mathematically as follows:

$$EIV = \sum_{i=1}^{n} (Vi)\,(Wi)$$

Where Vi is the relative change in the value of environmental quality of parameter i with respect to existing situation, Wi is the relative importance or weight of parameter i, and n is the total number of environmental parameters related to the project.

The computation of Environmental Impact Value (EIV) of a project needs determination of Vi, the value representing the magnitude of alteration of the environmental parameters, and Wi the value representing relative weight or importance of the respective parameters.

Magnitude of Environmental Alterations

Change of environmental parameters should not be measured with respect to existing condition. The standard practice is to compare the future-with-project condition against the future-without-project condition, difference between these two are taken as the change in environmental parameters. The future-without-project condition should be generated through trend analysis using historical data collected during the establishment of baseline condition.

The beneficial and adverse changes in environmental parameters resulting from a project, usually expressed in qualitative terms have been plotted in a scale to quantify the

environmental alterations. Figure 6.2 shows the correlation between qualitative statement and proposed quantitative values of environmental changes resulting from a project.

Very High (-)	-5
High (-)	-4
Medium (-)	-3
Low (-)	-2
Very Low (-)	-1
No Change	0
Very Low (+)	+1
Low (+)	+2
Medium (+)	+3
High (+)	+4
Very High (+)	+5

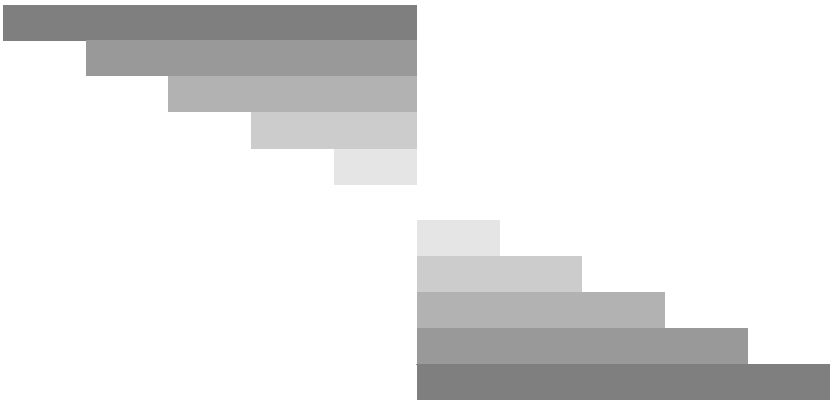


Figure Quantification of Environmental Impact

Since the changes of environmental parameters are measured with respect to existing condition, no change has 0 values. Benefits or positive impacts are here graded from +1 to +5, and negative impacts scored from -1 to - 5. Impacts are assessed quantitatively wherever possible. For example, if a project will have a positive impact on agricultural productivity and the production will be increased by 50%, then a scoring of +3 is applied to agricultural productivity. Similarly if assessed that the fish production will be decreased by 30%, a negative scoring of –2 is applied for the respective fishery component. A value from the scale representing effect of the project on each parameter will be taken to compute the EIV of the project.

Where it is not possible to directly quantify the impact in terms of increase or decrease in production, or deterioration of water quality or degradation of environment, the impact has to be estimated. For the purpose of estimation, positive and negative impacts are divided into three different groups, as Low, Medium and High. A low numerical value ranges from 1 to 2, Medium 3 and High with a numerical value ranging from 4 to 5.

Relative Importance of Environmental Parameters

All environmental parameters influenced by the project are not of equal importance or weight. The importance of a parameter varies from country to country depending on the environmental concerns of the country. Generally, in Bangladesh flood, employment, agriculture, fisheries etc. carry more importance than many others. The importance may also vary in different regions within the country. So the same parameter may have different values for subprojects located in different regions.

The parameters related to infrastructure projects have been given different values based on prevailing environmental concerns in Bangladesh and presented in Figure 6.3. These values have been arrived at after consideration of all probable impacts due to the project during its pre-construction, construction and post-construction stages. These are average values only based on normal conditions, which should be modified in case the projects are located in special locations having significant environmental concerns. The values representing importance or weight of the parameters can be used to compute the relative impacts of the parameters which are then summed up to obtain the total EIV of the project. In Table 6.2 a sample calculation for

determination of EIV has been shown. Relative Importance Values of Environmental Parameters shown in Figure 6.3 has been assigned considering the infrastructure development projects. As in LGED, the major projects are related to infrastructure development only; the values shown in this Fig. can be utilized for all of them.

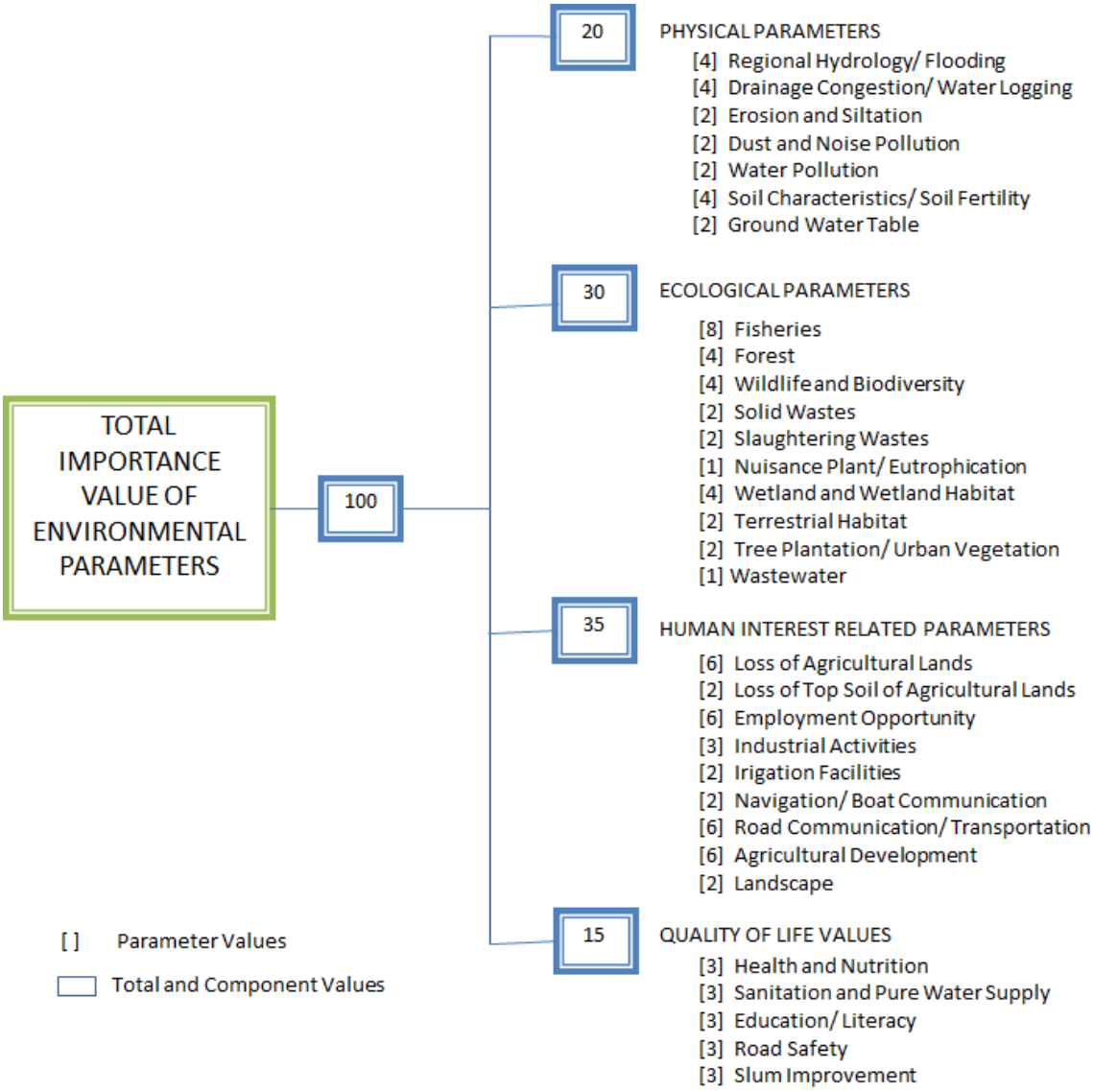


Figure 12.1: Relative Imp Values of Env Parameters Related to Infrastructure Projects

Appendix 16: Explanations of Drainage Technical Terminologies

Code	Class	Description
VR	Very rapidly drained	Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious.
R	Rapidly drained	Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may

		occur on steep gradients during heavy rainfall. Soils have low available water storage capacity (2.5-4 cm) within the control section, and are usually coarse textured, or shallow, or both.
W	Well drained	Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Soils have intermediate available water storage capacity (4-5 cm) within the control section, and are generally intermediate in texture and depth. Water source is precipitation. On slopes subsurface flow may occur for short durations, but additions are equaled by losses.
MW	Moderately well drained	Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity (5-6 cm) within the control section and are usually medium to fined textured. Precipitation is the dominant water source in medium to fine textured soils; precipitation and significant additions by subsurface flow are necessary in coarse textured soils.
I	Imperfectly drained	Water is removed from the soil sufficiently slowly in relation to supply, to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is the major supply. If subsurface water or groundwater, or both, is the main source, the flow rate may vary but the soil remains wet for a significant part of the growing season.
P	Poorly drained	Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow, or both, in addition to precipitation are the main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Soils have a wide range in available water storage capacity, texture, and depth, and are gleied subgroups, Gleisoil's, and Organic soils.
VP	Very poorly drained	Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen.

Appendix 17: Meeting minutes with decisions of the consultations (KII, Institutionals)

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (Department of Agriculture)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with the Upazila Agriculture Extension Officer of Bheramara Upazila, Kushtia District on 22nd June, 2022, at 11:00 AM.

The meeting commenced with introductions, and the consultants elucidated the purpose of their visit. They posed queries that delved into the local agricultural practices and the officer's perspective on the proposed project. In response, the officer provided an overview of the current agricultural practices, crop production, and intensity in the area. Additionally, she shared her apprehensions concerning the possible environmental and social repercussions of the project. Alongside these concerns, she also proposed potential measures for mitigating the project's impacts. The key verdicts of that discussion is following:

Discussion	Suggestions/Key concerns
The officer noted that following the implementation of the GK project, rice production in the study area has witnessed improvements, and both grain and vegetable productions have grown significantly. A substantial portion of the local population relies heavily on vegetable cultivation. Additionally, the community places a significant emphasis on livestock, leading to large-scale grass production throughout the year. Among the various types of rice, Aush production is relatively low within the study area.	The local population in the study area relies mostly on agriculture for their livelihood. The introduction of an Economic zone has the potential to disrupt their lives by leading to land loss, thereby jeopardizing their primary source of income. The officer proposed a solution to mitigate this negative impact: conducting dedicated skill development training sessions exclusively for the local residents, prioritizing their employment opportunities within the Economic zone. Moreover, considering the escalating food demand despite the loss of agricultural land, the officer recommended the development of new crop varieties and an expansion of crop intensity to address this challenge.

The officer expressed her readiness to provide assistance if required in the future.

Shahnaz Ferdousi
Agriculture Extension Officer
Bheramara Upazila, Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (Department of Livestock)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with the Upazila Livestock Officer of Bheramara Upazila, Kushtia District on 22nd June, 2022, at 01.00 PM.

The consultants began by introducing themselves and clarifying the purpose of their visit. The Upazila Livestock Officer warmly welcomed the consultants. After a brief conversation about the project, the consultants raised their questions. In response, the officer shared insights into the local community's engagement with livestock and about the large scale grass cultivation within the study area. Discussion on the potential environmental and social consequences of the project were done and the officer put forward recommendations for mitigation measures. The main conclusions drawn from this discussion are as follows:

Discussion	Suggestions/Key concerns
During the discussion, it was found that almost 60% people of the area is dependent on livestock and there is an animal hospital. There are two large dairy farms (Feeda Agro) where the number of cows is more than 100 and lots of small household farms in that area. Almost every household has a small poultry or dairy farm. This project activity will have an important contribution to the economy of Bangladesh. If the project takes initiatives to make processing and fattening plants for milk processing it will strengthen the economic condition of the people. At the same time, livestock not only help with financial medium, but also provides us crucial animal protein. Also, there are enough grazing areas for the existing livestock but if these lands are taken for industrial purpose, it will affect the supply of food for the animals. Dairy and small-scale farms are increasing in the area.	The department informed us; there will be small impact of the project on livestock resources because of lessening the grazing yard of the area. There are enough facilities for training of the “Khamari” and this project will enhance this if new technologies are introduced through this project. Given the substantial grass production for animals in the area, it's important to safeguard grazing yards. Additionally, it's crucial to guarantee the proper disposal of industrial wastes to prevent any negative impact on the environment and the livelihood of the local community.

The officer expressed his readiness to provide assistance if required in the future.

Dr. Tayran Iqbal
Upazila Livestock Officer
Bheramara Upazila, Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (DPHE)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with Assistant Engineer, Department of Public Health and Engineering of Bheramara Upazila, Kushtia District on 22nd June, 2022, at 10.00 AM.

The consultants initiated the interaction by introducing themselves and offering clarity on the purpose of their visit. The Assistant Engineer extended a warm welcome to the consultants. Following a brief discussion about the project, the consultants proceeded to pose questions regarding several pertinent matters related to the upazila. The officer provided valuable insights based on his experience in the study area. The discussion also revolved around the potential environmental and social implications of the project. In addition to raising concerns, the officer put forward recommendations for addressing and mitigating the impacts of the project. The primary notes from this discussion are as follows:

Discussion	Suggestions/Key concerns
During the discussion, the topics of drinking water supply and waste management in the study area were explored. The groundwater depth in the area is approximately 30 feet, and residents rely on shallow tube wells for their drinking water. However, during dry seasons, water scarcity has become an issue as groundwater levels drop below 100 feet. The concentration of arsenic in inland surface water was found to be 0.2mg/l, which falls below the Department of Environment's (DoE) standard. However, the level of arsenic in groundwater varies, and in some areas, it is high, leading to health issues among local residents. Waterborne diseases are infrequent within the study area. Also, discussions on sanitation and health facilities were discussed with the Department of Public Health and Engineering.	Preserving the potential groundwater sources and promoting responsible water usage are imperative. Ensuring the well-being of the area's residents requires the establishment of proper sanitation facilities. These measures are crucial to safeguarding both the environment and the health of the local population.

The officer expressed his readiness to provide assistance if required in the future.

Md. Saidur Rahman
Department of Public Health and Engineering
Bheramara Upazila, Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (Department of Forest)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with Deputy Conservator of Forest, Department of Forest, Kushtia District on 21st June, 2022, at 3.00 PM.

In the beginning, the consultants introduced themselves and offered an overview of the purpose of their visit. The Officer welcomed the consultants and sought clarification on the study's goals. After a brief conversation about the project, the consultants presented their inquiries. The discussion with the officer revolved around several key topics, including the existing forested areas, the prevalent tree species within the proposed project area, and the potential impacts of the project on the environment. The Deputy Conservator of Forest officer suggested several mitigation measures. The primary conclusions drawn from the discussion are as follows:

Discussion	Suggestions/Key concerns
Discussions with the forest department revealed that there are no reserved forests within a 10km radius of the project area. However, there is a pending proposal for social forestry in the Bheramara upazila that has yet to be implemented. The predominant tree species found in the study area include Akashmoni (Earleaf acacia), Rain tree, native fruit trees, Banyan tree, Figs trees (Dumur), Horitoki (Myrobalan), and Beechwood (Horitoki) tree, among others. According to the forest officer, there are no endangered species present in the area. Therefore, the project is not expected to have any significant impact on the local wildlife and tree population.	It is crucial to exercise careful site selection and refrain from tree cutting. Trees that are well-suited to the project area should be planted around the project site and in suitable locations. The forest officer primarily recommended the planting of ornamental trees such as Bastard teak (Palash), Red silk-cotton (Shimul), Golden shower (Shonalu), Royal Poinciana (Krishnachura), and Zarul, among others. This strategic approach to tree planting would contribute to the environmental aesthetics of the project area.

In conclusion, the officer expressed his willingness to provide assistance if required in the future.

G.M. Mohammad Kabir
Deputy Conservator of Forest, Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (Department of Social Services)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with Upazila Social Service Officer of Bheramara, Kushtia District on 22nd June, 2022, at 9.00 AM.

The consultants started by introducing themselves and explaining the purpose of their visit. Following a brief discussion about the project, the consultants proceeded to pose questions regarding several pertinent matters related to the upazila. After a concise conversation about the project, the consultants delved into their inquiries, which encompassed various significant aspects concerning the upazila. Matters related to social concerns, government-provided financial incentive schemes for the disadvantaged and disabled, local disasters, and more were discussed. The potential social implications of the proposed project were also discussed, and recommendations were proposed to manage and alleviate any potential impacts the project might have on the community. The primary notes from this discussion are as follows:

Discussion	Suggestions/Key concerns
The potential benefits of the proposed project were explored with the Department of Social Welfare officer. The officer provided insights into numerous financial incentive schemes established by the government to support the economically disadvantaged and disabled individuals. The conversation also encompassed ongoing allowances and the government's efforts in executing social initiatives through this department including the current employment situation and the allowances provided for orphans. A crucial aspect of the discussion revolved around ensuring social safety and security for the local community, particularly addressing issues related to violence and gender. This exchange provided valuable information about the existing social support mechanisms the importance of addressing social challenges in the context of the proposed project.	Industries that have minimal environmental impact should be given precedence. Additionally, it's important to include industries that are based on local ingredients, utilizing the available resources within the region. This approach can contribute to sustainable development and economic growth while also supporting the local economy. Moreover, a focus on employing local residents within these industries can enhance community engagement and benefit the overall development of the area.

Md. Abu Nasir
Upazila Social Service Officer,
Bheramara, Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (Department of Fishery)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with Senior Upazila Fisheries Officer of Bheramara Upazila, Kushtia District on 22nd June, 2022, at 2.30 PM.

The meeting commenced with introductions, and the consultants elucidated the purpose of their visit. Following a brief discussion about the project, the consultants proceeded to pose questions. In response, the officer provided valuable insights into the local fisheries practices, production trends, and related aspects. Moreover, the officer discussed the potential environmental and social consequences that the project might bring about in the area. The officer also offered recommendations for minimizing any adverse impacts on the fisheries sector and the community. This exchange helped in gaining a comprehensive understanding of the project's potential effects on the local fisheries and identifying suitable measures to mitigate those effects.

Discussion	Suggestions/Key concerns
Currently, there are a total of 198 fishermen in the upazila. However, approximately 50% of these fishermen are now engaged in the Ruppur nuclear power plant project. Fish caught from the rivers are directly transported to the Ishwardi market for sale. The common fish species found in the area include Peuli, Bashpati, Chingri, Ritha, and Bowal. The officer also highlighted the presence of endangered fish species, such as Meni or Veda fish. There is a temporary sanctuary established in the Hishna River within the Chandgram Union. The officer identified various factors contributing to the decrease in fish production, including excessive extraction, habitat contraction, and sedimentation. Despite these challenges, the overall fish production in the area is on the rise, with a rate of 4112 metric tons.	In any condition, no waste water should be allowed to dump in the surface waterbody. High degree of treatment is required before dumping the waste water in the water to ensure the treated water will dilute at expected concentration with the existing water flow.

The officer expressed her readiness to provide assistance if required in the future.

Shammi Shirin
Senior Upazila Fisheries Officer,
Bheramara, Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (BWDB)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with Md. Rois Uddin, the Executive Engineer of Bangladesh Water Development Board (BWDB) of Kushtia District on 21st June, 2022, at 10:30 AM.

In the beginning, the consultants introduced themselves and offered an overview of the purpose of their visit. The Executive Engineer cordially welcomed the consultants and sought clarification on the study's goals. After a brief conversation about the project, the consultants presented their inquiries. The primary focus of the discussion centered around water availability to the proposed site, water-related disasters in the vicinity, and the possible environmental and social ramifications of the project, particularly concerning the potential contamination and probable scarcity of water that may occur. The Executive Engineer also contributed by offering several suggestions for mitigation measures. The primary conclusions drawn from the discussion are as follows:

Discussion	Suggestions/Key concerns
The Chief BWDB Engineer of the project zone emphasized that the zone offers effective surface water connectivity. He pointed out that during the dry season, a decrease in fresh water inflow from upstream contributes to diminishing water levels. The soil characteristics are highly suitable for agriculture, although he expressed concern about the lithological traits of the area. Designing foundations for heavy structures poses a significant challenge. He further highlighted the elevated elevation of the zone, making it non-prone to flooding. The drainage system facilitated through the Ganges-Kobadak Irrigation Project, also known as the G-K Project, is robust and effective, with no instances of waterlogging in the area. He mentioned that nearly 4000 cusecs of water are utilized within the G-K Project.	To establish a productive ecological zone, it is essential to undertake canal excavation and revive stagnant water bodies surrounding the study area. Effective coordination with the BWDB (Bangladesh Water Development Board) and Fishery Department is necessary for the restoration of fish resources. In the context of wastewater management, the chosen Effluent Treatment Plant (ETP) or any treatment unit must possess the capability for continuous operation, efficiently treating hazardous wastewater. The engineer stressed the significance of the Ganges-Kobadak Irrigation Project and recommended discharging treated wastewater downstream of the GK canal, acknowledging its importance in the region. This approach ensures that treated wastewater is properly managed and does not negatively impact the water quality within the canal.

In conclusion, the officer expressed his willingness to provide assistance if required in the future.

Md. Rois Uddin
Executive Engineer
Bangladesh Water Development Board (BWDB)

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (DoE)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with the Deputy Director of Department of Environment, Kushtia District on 21st June, 2022, at 3:30 PM.

The meeting commenced with introductions, and the consultants elucidated the purpose of their visit. Following a brief discussion about the project, the consultants proceeded to pose questions. The existing environmental conditions along the proposed project site were thoroughly discussed. The officer and consultant discussed the potential environmental and social consequences that the project might bring about in the area. The officer also offered recommendations for minimizing the adverse impacts of the project. The primary conclusions drawn from the discussion are as follows:

Discussion	Suggestions/Key concerns
with the Department of Environment. The beneficial impacts of the project as well as the negative impacts and their mitigation procedures were discussed as well. Current environmental condition and no harm to the natural equilibrium from the project were discussed. In view of achieving sustainable development goals the project must be done in an environment friendly manner. The scope of improving the environmental condition of the project area through increasing greenery and decreasing GHGs emissions were discussed with DoE. The proposed project area contains various tree species and vegetation cover, so if these species are uprooted or cut down, they must be replanted after the project done. Greenbelt must be developed.	DoE suggested that the report must be done after the approval of ToR from DoE. All the rules and regulations given by DoE must be followed. Ponds and waterbodies available in the project area cannot be filled. Trees cannot be cut down, even if a tree is cut down, it has to be replanted. If the project includes lead (Pb) or dying industry, mitigation measures must be taken so that liquid or hazardous waste do not contaminate the water and soil. ETP, WTP, SWTP needs to be implemented.

In conclusion, the officer expressed his willingness to provide assistance if required in the future.

Md. Atayur Rahman
Deputy Director, DoE
Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (LGED)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with Upazila Engineer, Bheramara of Kushtia District on 22nd June, 2022, at 12.30 PM.

The consultants started by introducing themselves and explaining the purpose of their visit. Following a brief discussion about the project, the consultants proceeded to pose questions regarding several pertinent matters related to the upazila. In response to these questions, the Enhineer expressed his concerns regarding the potential environmental and social impacts of the project, while also offering suggestions for mitigation measures. The key verdicts of that discussion is following:

Discussion	Suggestions/Key concerns
The Upazila LGED Officer provide information on the existing socio-economic conditions surrounding the proposed project implementation area. The discussion encompassed both the positive and negative impacts of the project, along with the strategies for mitigating these impacts.	The Upazila LGED Officer recommended the implementation of a comprehensive drainage system within the project site. He stressed the importance of addressing drainage issues to ensure effective management of water and prevent potential disruptions.
The officer highlighted the potential beneficial impacts the project could bring, while also addressing the potential negative effects and the corresponding measures for their mitigation. It was emphasized that the project would contribute to the overall socio-economic development of Kushtia, already considered an economically developed city, by further enhancing its socio-economic status.	Furthermore, the officer emphasized the necessity of improving the road network within and around the proposed Economic Zone. A well-functioning road network is crucial for the smooth operation of the Economic Zone and to facilitate easy transportation of goods and resources. These suggestions underline the significance of addressing infrastructure concerns for the successful implementation of the project.

Md. Abul Hashem
Upazila Engineer, LGED,
Bheramara, Kushtia.

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes (RHD)

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with the Executive Engineer of Roads and Highways Department of Kushtia District on 21st June, 2022, at 9.30 AM.

The meeting began with introductions, and the consultant provided a brief explanation of the purpose behind their visit. The Executive Engineer welcomed the consultants and after a brief conversation about the project, the consultants presented their inquiries. During the meeting, a discussion ensued covering topics such as the communication system, ongoing projects by the Road and Highway Department (RHD), upcoming projects, accident statistics in Kushtia, and more specifically in the Bheramara district. The potential impact of the proposed project on the transportation system was discussed as well and the Executive Engineer offered suggestions for mitigation measures to address these effects. The key verdicts of the discussion are following.

Discussion	Suggestions/Key concerns
The Executive Engineer from the Roads and Highway Department in Kushtia shared that the current roads have a width of 18 feet, while a 34 feet wide road is currently under construction. There's also a proposal for the construction of a six-lane road for Kushtia highway. He pointed out that the majority of accidents on roads are caused by local vehicles and motorcycles. He mentioned that with the implementation of the Economic Zone (EZ), heavy vehicles would need to travel on these roads, necessitating their widening and ensuring their durability. In view of decreasing traffic jam, timing should be formulated for the movement of loaded vehicles/truck.	He advised proposing a distinct road network for the economic zone to prevent traffic congestion on the highway. Additionally, he recommended expanding the width of both existing and newly constructed roads to accommodate the potential increase in traffic.

In conclusion, the officer expressed his willingness to provide assistance if required in the future.

Shakirul Islam
Executive Engineer,
Roads and Highways Department, Kushtia

Government of the Peoples Republic of Bangladesh

Bangladesh Economic Zones Authority

Level 7,8,9 Biniyog Bhaban Plot#E-6/B, 1207 W Agargaon, Dhaka 1207

Meeting Minutes

Subject: Minutes of Institutional Key Informant Interview (KII)

Name of the Project: Environmental and Social Impact Assessment (EIA) Study for Kushtia EZ

The Institutional Key Informant Interview for the project titled "Environmental and Social Impact Assessment (EIA) Study of 4-sites Economic Zones (Kushtia EZ, Bheramara Kushtia)" was conducted with the District Relief and Rehabilitation Officer (DRRO) of Kushtia District on 21st June, 2022, at 11:30 AM.

At the outset, the consultants introduced themselves and provided an explanation of the purpose behind their visit. The District Relief and Rehabilitation Officer (DRRO) extended a warm welcome to the consultants and inquired about the study's objectives. Following a concise discussion about the project, the consultants posed their inquiries. In response to these questions, the DRRO expressed his concerns regarding the potential environmental and social impacts of the project, while also offering suggestions for mitigation measures. The key verdicts of that discussion is following:

Discussion	Suggestions/Key concerns
The current state and the available facilities for coping with natural disasters were deliberated with the District Relief and Rehabilitation Officer. Common calamities such as thunderstorms, lightning, and floods were discussed as typical occurrences in the Kushtia district. The district relief office stands prepared to provide assistance to the local population during such events. It was emphasized that the proposed economic zone has the potential to enhance the economic situation of the local residents, rendering them more self-reliant in tackling any disasters. This positive prospect instilled hope for the prompt initiation of the project.	Arranging skill development training for local residents is crucial to enable their employment within the Economic Zone (EZ). Another suggestion regarding the community benefits by the DRRO was to prioritizing the establishment of shelter homes for individuals affected by riverbank erosion and floods is essential. Ensuring the safety and well-being of these vulnerable populations should be a primary concern.

Finally, the officer conveyed that he is ready to offer his assistance if needed in the future.

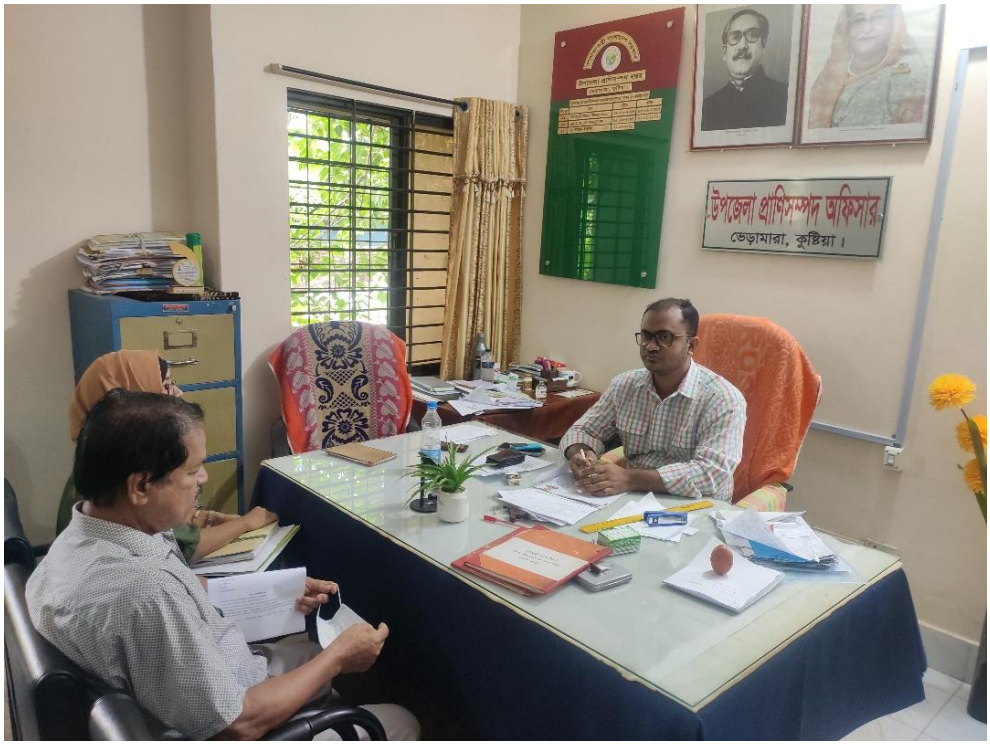
Md. Abdur Rahman
District Relief and Rehabilitation Officer

Appendix 18: Pictures of Institutional Consultations

Consultation with Upazila Agriculture Officer

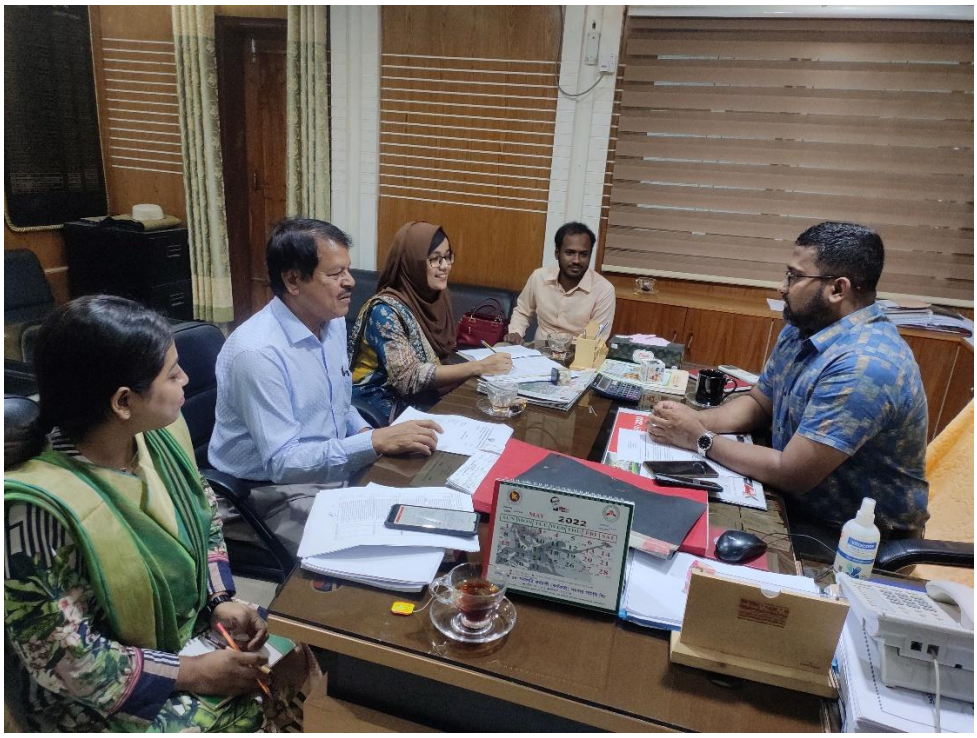
Consultation with Sub-Assistant Engineer DPHE

Consultation with Upazila Forest Officer



Consultation with Upazila Livestock Officer

Consultation with Fisheries Officer



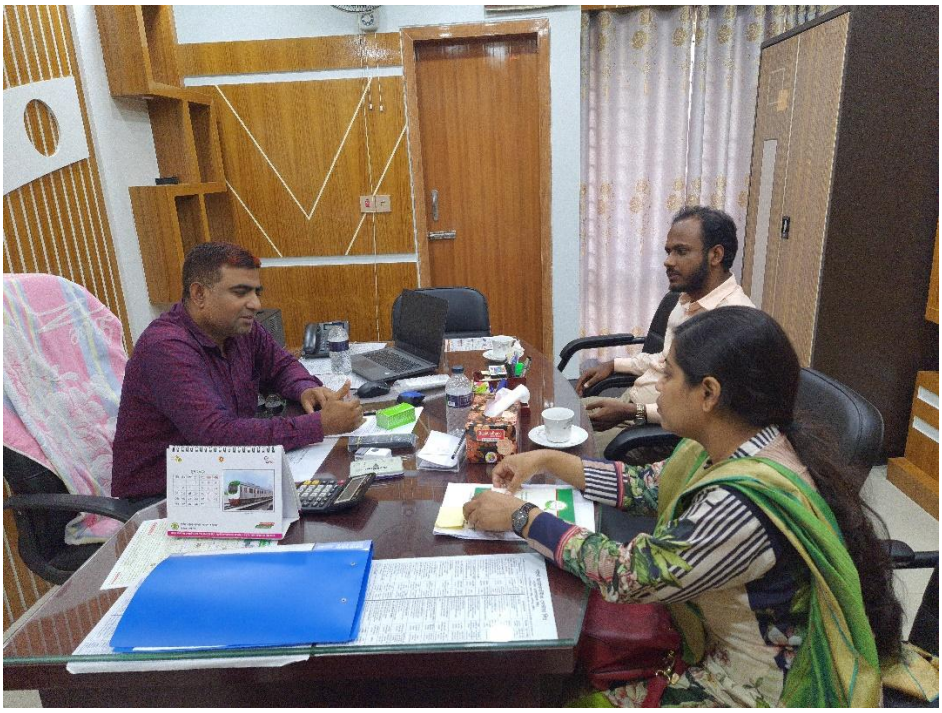
Consultation with Roads and Highway Department

Consultation with department of Social Service

Consultation with Upazila LGED Officer

Consultation with Department of Environment

Consultation with Upazila BWDB Chief Engineer



Consultation with District Relief and Rehabilitation Officer