WTE POWER PLANT NORTH DHAKA PRIVATE LIMITED

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR WASTE-TO-ENERGY POWER PROJECT AT AMIN BAZAR, DHAKA, BANGLADESH

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR WASTE-TO-ENERGY POWER PROJECT AT AMIN BAZAR, DHAKA, BANGLADESH

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ACRONYMS AND ABBREVIATIONS

AAQ	Ambient Air Quality
AAS	Atomic Absorption Spectroscopy
AC	Alternating Current
ACC	Advanced Combustion Control
ADB	Asian Development Bank
AIDS	Acquired Immune Deficiency Syndrome
AIIB	Asian Infrastructure Investment Bank
ALARP	As Low as Reasonably Practicable
AOI	Area of Influence
APC	Air Pollution Control
APHA	American Pharmacists Association
AQM	Air Quality Monitoring
ARAP	Aquatic Resource Alteration Permit
ARIPA	Acquisition and Requisition of Immovable Property Act
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
BARC	Bangladesh Agricultural Research Council
BAT	Best Available Technology
BBS	Bangladesh Bureau of Statistics
BCSIR	Bangladesh Council of Scientific and Industrial Research
BDT	Bangladesh Taka
BFIDC	Bangladesh Forest Industries Development Corporation
BFRI	Bangladesh Forest Research Institute
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BNH	Bangladesh National Herbarium
BOD	Biological Oxygen Demand
BS	Bangladesh Survey
BWDB	Bangladesh Water Development Board
CCL	Cash Compensation Law
CDM	Clean Development Mechanism
CEET	Carbon Emission Estimation Tool
CETP	Common effluent treatment plant
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMEC	China Machinery Engineering Corporation
CNG	Compressed Natural Gas

CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CRM	Closed Reflux Method
CSR	Corporate Social Responsibility
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DCS	Distributed Control System
DD	Deputy Director
DEM	Digital Elevation Model
DG	Director General
DMP	Dhaka Metropolitan
DNCC	Dhaka North City Corporation
DO	Dissolved Oxygen
DOE	Department of Environment
DPHE	Department of Public Health and Engineering
DSW	Department of Social Welfare
DTRO	Disk Tubular Reverse Osmosis
EC	Electrical Conductivity
ECA	Ecologically Critical Areas
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
EDI	Electronic Data Interchange
EFCC	Economic and Financial Crimes Commission
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environmental Protection Agency
EPC	Engineering, Procurement and Construction
EPR	Extended Producer Responsibility
EQS	Environmental Quality Standards
ERP	Emergency Response Plan
ESE	East- Southeast
ESEL	Environmental and Social Exclusion List
ESF	Environmental and Social Framework
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESP	Environmental and Social Policy

ESS	Environmental and Social Standards
ETP	Effluent Treatment Plan
EU	European Union
FCPS	Fellow of the College of Physicians & Surgeons
FD	Forest Department
FGD	Focus Group Discussion
FI	Financial Intermediary
FPIC	Free, Prior, and Informed Consultation
FS	Feasibility Study
GAP	Gender Action Plan
GB	Garbage Bowl
GBV	Gender-Based violence
GC	Gas Chromatography
GHG	Greenhouse Gas
GIS	Geographic Information System
GOB	Government of Bangladesh
GPS	Global Positioning System
GR	Grievance Redress
GRC	Governance, Risk, and Compliance
GRM	Grievance Redress Mechanism
GSB	Geological Survey of Bangladesh
GWP	Global Warming Potential
HDPE	High-Density Polyethylene
HF	Hydrogen Fluoride
HFC	Hydrofluorocarbon
HH	Household
HIES	Household Integrated Economic Survey
HIV	Human Immunodeficiency Virus
HSC	Higher Secondary School Certificate
HSE	Health, Safety, and Environment
HZ	Hertz
IAP	Identify Affected People
IBA	Important Bird & Biodiversity Area
ID	Induced Draught
IEC	Important Environmental Components
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IPP	Indigenous Peoples Plan

IPPF	Indigenous Peoples Planning Framework
IPS	Instant Power Supply
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
JTU	Jackson Turbidity Unit
KII	Key Informant interviews
KM	Kilometer
LA	Land Acquisition
LAP	Land Acquisition Plan
LAPF	Land Acquisition Policy Framework
LARP	Land Acquisition & Resettlement Plan
LARPF	Land Acquisition and Resettlement Policy Framework
LC	Least Concern
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LRP	Livelihood Restoration Plan
LS	Lump-Sum
MBBS	Bachelor of Medicine, Bachelor of Surgery
MBR	Membrane Bioreactor
MOEFCC	Ministry of Environment, Forest and Climate Change
MSW	Municipal Solid Waste
MT	Metric Ton
MVA	Megavolt-Amperes
MW	Megawatts
NA	Not Applicable
NE	Not Evaluated
NEMAP	National Environment Management Action Plan
NEQS	National Environmental Quality Standards
NF	Nanofiltration
NGO	Non-Governmental Organization
NL	Noise Level
NOC	No Objection Certificate
NO_X	Nitrogen Oxides
NSR	National Skills Registry
NT	Near Threatened
NTU	Nephelometric Turbidity Units
NWMP	National Water Management Plan

OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PA	Primary Air
PAH	Polycyclic Aromatic Hydrocarbons
PAP	Project Affected People
PATC	Public Administration Training Centre
PCDDS	Polychlorinated Dibenzodioxins
PCDFS	Polychlorinated Dibenzofurans
PC	Public Consultation
PCU	Platinum-cobalt Units
PFC	Perfluorocarbons
PGCB	Power Grid Company of Bangladesh
PH	Potential of Hydrogen
PIU	Project Implementation Unit
PM	Particulate Matter
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PPP	Public-Private Partnership
PV	Photovoltaic Cell
PWD	Public Works Department
RAP	Resettlement Action Plan
RF	Reserved Forest
RMG	Ready-Made Garment
RO	Reverse Osmosis
RP	Resettlement Plan
SA	Secondary Air
SCR	Silicon-controlled Rectifier
SDA	Spray Dry Absorbe
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SMA	Statistical Metropolitan Area
SNCR	Selective Noncatalytic Reduction
SO_X	Sulphur oxides
SPARRSO	Space Research and Remote Sensing Organization
SPM	Suspended Particulate Matter
SQ	Soil Quality
SRDI	Soil Resource Development Institute
SRTM	Shuttle Radar Topography Mission

SS	Suspended Solids
SSC	Secondary School Certificate
STS	Secondary Transfer Station
SW	Surface Water
SWM	Solid Waste Management
TC	Total Coliform
TDS	Total Dissolved Solids
TEQ	The Toxic Equivalency
TL	Total Loss
TOC	Total Organic Carbon
TOR	Terms of Reference
TSS	Total Suspended Solids
UASB	Up flow Anaerobic Sludge Blanket
UK	United Kingdom
UNO	Upazila Nirbahi Officer
UP	Upazila Parishad
USA	United States America
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
UVS	Ultraviolet–visible spectroscopy
VC	Very Common
VOC	Volatile Organic Carbon
VU	Vulnerable
WARPO	Water Resources Planning Organization
WB	World Bank
WHO	World Health Organization
WNW	West-North-West
WTE	Waste to Energy

EXECUTIVE SUMMARY

E-1 Introduction

Background of the Project

With the increase in urban population every year, the amount of garbage is also increasing, which has caused serious environmental and ecological problems and affected the city's development and the citizens' healthy life. The waste in the north of Dhaka is discarded at will and cannot be treated in time and effectively. A sustainable waste management system must be developed, which needs institutional, financial, economic, and social sustainability. Waste to Energy is a very renowned technology for sustainable waste management. A Chinese company named WTE Power Plant North Dhaka Private Limited is the investor and intends to develop a 42.5 MW waste to energy power plant, while Ministry of Power, Energy and Mineral Resources of Bangladesh will purchase the electricity. The plant will be constructed on vacant land provided by the (DNCC) which is located on the right bank of the Karnatali River. Administratively, the site is situated at Bongaon Union of Savar Upazila under Dhaka District. When the Aminbazar waste to energy plant is in operation, it will require approx. 3,000 metric tons of garbage every single day. As a result, the expected outcomes of the proposed intervention will not only improve the city's long term electricity generation and power supply capacity for the city dwellers by best utilization of the domestic waste but also for the betterment of waste management practices in the DNCC area.

This environmental and social impact assessment of the Project has been prepared based on an understanding of the technical specifications of the Project, existing studies and reports relevant to the project, a scoping exercise, site visits, stakeholder consultations, baseline environmental monitoring, and socio-economic surveys.

E-1.1 Scope of the Study

The main objectives of the Environmental and Social Impact Assessment (ESIA) study are to identify and assess potential impacts on the natural and social environment and pollution caused by the Project and to prepare an ESIA Study Report which includes environmental and social management plan & monitoring plan for the necessary actions to the identified impacts. The scope of work encompassed the following key activities:

- Screening of the Project based on applicable reference framework based on reconnaissance survey and desk-based review of Project documents.
- Scoping for the ESIA study.
- General description of the proposed project.
- Review and compilation of relevant national rules, legislation, guidelines, and standards.
- Environmental, Social & Ecological baseline data collection from the project study area.
- Air dispersion modeling, Noise modeling.
- Gender-Based Violence (GBV) baseline data and assessment of GBV Risk in Projects supported by Asian Infrastructure Investment Bank (AIIB) Financings.
- Alternative Analysis for the proposed project.
- Assess the proposed activities to identify their potential impacts, evaluate the impacts and determine their significance.
- Preparation of an Emergency Response Plan.
- Delineation of Environmental and Social Management Plan (ESMP) including mitigation measures and monitoring plan for effective implementation of mitigation measures by the project personnel during different phases of the project.
- Institutional framework for managing ESMP.
- Stakeholder Identification and Information Disclosure

- Public consultation (PC)
- Grievance Redress Mechanism
- Submission of Draft ESIA report and corresponding management plans.
- Final ESIA report submission

E-1.2 Applicable Reference Framework

The applicable reference framework for this study includes:

Environment Conservation Act, 1995 and its subsequent amendments

Environment Conservation Rules, 2023

EIA Guideline for Industries 2021

Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) requirements, 2022.

IFC Performance Standards (PS) on Social and Environmental Sustainability 2012.

World Bank Group General Environmental, Health and Safety Guidelines, 2007.

Environmental, Health, and Safety Guidelines for Waste Management Facilities, 2007.

Other guidelines and standards are practiced by the Department of Environment (DOE), Bangladesh.

E-1.3 Methodology

The Environmental and Social Impact Assessment (ESIA) study for WtE Project involves assessing social and environmental impact throughout the project's lifecycle. The methodology includes thorough baseline data collection, impact prediction, stakeholder engagement and mitigation measures in attaining sustainable development aligning with applicable regulatory standards. Pursuant to the scope of the study, this process aims to identify analyze and address potential risks associated with the project activity while maximizing positive outcomes for both environmental and social components benefiting the local community residing within the project jurisdiction, employing a combination of both primary as well as secondary data collection approach in a participatory manner. The methodology employed for establishing the environmental and socio-economic and ecological baseline of the impacted villages entails a synergistic approach, incorporating an extensive review of secondary literature alongside strategic consultations with key stakeholders under primary data collection pertinent to the proposed project activity

The collection of primary social and environmental baseline data was carried out by a survey team, engaged between April 2022 to August 2022. The secondary data were sourced from government's domains (*Socio-economic survey and Census Report,2021*), previous reports and research papers and reviewed at the backdrop of the proposed project considering environmental, ecological and socio-economic aspects of the project influenced areas.

Based on the evaluation of the probable impact, mitigation measures have been identified and a comprehensive management plan has been formulated to address any adverse impacts while adopting strategies to avoid, minimize mitigate and compensate for those identified impacts while enhancing positive outcome for the surrounding environment of the project area.

E-2 Administrative and Legal Framework

To address the environmental and social risks of any proposed project and its associated components to protect and conserve the environment from any adverse impacts, the Government of Bangladesh (GoB) has specified regulations, policies, and guidelines. It is understood that the Project is also intended to receive international financing from AIIB for project execution and there are specific environmental and social safeguard requirements of international financial institutions. As per the Schedule-1 of the Environment Conservation Rules (ECR) 2023, the corresponding category related to the power plant (e.g., waste Incinerator) falls under Red Category for the following components. The project developer has already obtained site clearance certificate (SCC) from DOE which is given in Appendix A. The transmission line project falls under Orange Category which also required SCC/ECC from DOE, Bangladesh. The project developer must prepare a separate Initial Environmental Examination (IEE) study to get the DoE clearance.

Given the nature and scale of this project, and in accordance with the Environmental and Social Framework (ESF) of AIIB guidelines, 2022, this project has been classified as a "**Category A project**". This classification is applied to projects that are likely to have several potentially significant adverse environmental and/or social impacts. In this instance, the potential social impacts due to land acquisition affecting project-affected persons justify a high-risk categorization. For Category A projects, the Bank determines the necessary environmental and social assessment documentation wherein the Client is required to prepare a detailed ESIA for this project.

E-3 Project Description

The proposed site is situated south of the Amin Bazar landfill, on the west side of North Dhaka, approximately 17 km from Dhaka city center. The Power Plant Project is located in Bongaon Union, Savar Upazila, Dhaka District. According to the District Commissioner's land information, the land categories for the proposed power plant include null, viti, bari, and low - lying land. However, the current land use of the proposed project is fallow land and low land. There are no permanent water bodies or hills within the project area, and the project will not require filling any ponds, canals, or waterbodies during site development, nor will it necessitate hill cutting. The project site is near the Aminbazar landfill and Karnatali River to the north, agricultural land to the north and northwest, a brick kiln to the east, and the Dhaka-Aricha Highway to the south. The Dhaka-Aricha Highway (N5) passes beside the project site. Fuel and equipment can be transported by road using this highway. A 360 m long access road has been planned in the east side to enter the project site from highway. The road pavement width is mainly 7.0 meters, and the road bending radius in the main factory area is 12.0 meters.

The proposed transmission line is located in the north-central region of Bangladesh. The specific project site is in Dhaka District, Savar Upazila under Ward 6, Ward 9, Bongaon union and Tentuljhora Union. This transmission line crosses the Karnatali River 2 times. The transmission line route is initiated from the North-West corner of the plant along the Karnatali Riverbank. The length of the route is approximately 5.99 km. Total angle points are 14, and the number of Towers will be 27. The proposed transmission line will require approximately 89.063 decimal of land for tower footing construction. Most of the land is privately owned land which is currently used for cultivation. During the ESIA report preparation phase the land purchase for transmission line is under processing.

E-3.1 Nature and Size of the Project

The WTE Power Plant North Dhaka Private Limited proposes to set up a waste-to-energy power project of 42.5 MW (NET) capacity near the Savar Upazila in Dhaka District. The details of the proposed power plant are presented in Table 1.

Table 1: Brief Information of WTE Power Plant Project

Particulars		Basic Project Data
Net Plant Capacity	:	42.5 MWh (NET)
Planned land	:	31.18 acres (126187.41 m^2) (Including incineration plant land and new access roads)
Treatment capacity	:	3000~3600 ton/day (entry capacity) with an annual waste disposal capacity of 1.095 million tons
Source of Waste	:	Dhaka North City Corporation (DNCC)
Incinerators	:	Four (4) sets of 750 t/d incinerators
Boilers	:	Four (4)
Turbine generator sets	:	Two (2) sets of 35 MW turbine generator sets
Steam turbine	:	Two (2)
Annual operation time	:	Not less than 8,000 hours
Leachate treatment station with a treatment capacity	:	1500 m^3/day
Wet slag volume	:	182,500 t/a
Amount of flying ash	:	24512 t/a
Cooling tower	:	Three (3) sets, Cooling water 7000 t/h
Furnace type	:	Mechanical grate furnace with 4×750t/d incineration line
Flue gas treatment system	:	Selective Non-Catalytic Reduction (SNCR) (urea water injection in the furnace)
Stack Height	:	100m
Number of Stack/Stack Inside Diameter	:	1 Stack/2.2m*4
Fuel Name	:	Diesel fuel
Source of Fuel	:	Local Market
Fuel Requirement	:	About 40ton diesel fuel is consumed for each start and shutdown. Diesel fuel consumption by ignition throughout the year = 40 × 2 × 4 = 320 ton Electricity consumption: 0.73×108kWh/a
Water Requirement	:	The main industrial water source will be both surface water and groundwater and will also be used as a reserve water source for industrial water purposes. The total industrial water and domestic water supply scale of this project is approx. 349.5 m^3/d.
Employment	:	Construction-2320 Persons Operation-280 persons
Power Evacuation	:	132 kV Savar Substation
Project Cost	:	BDT. 1,131.16 crore

Source: Feasibility Report

E-3.2 Power Plant Layout

According to the requirement of production process and function, the project is divided into four functional areas: the main building area, auxiliary area, water treatment area, and ash & slag comprehensive treatment area. The total site area within the red line is 31.18 acres (126,187.41 m2) where 50.90% is used for building occupation, 25.20% is a green area and 19.53% will be used for road utilization. The details of main project components have been given below

Incinerator: The main project components are Inclinator, waste heat boiler, turbine generator, colling tower, stack, etc. According to the requirements of the processing scale of 3000 t/d in this project and the experience of the completed project, 4 incineration production lines will be configured with that processing capacity of 750t/d of a single furnace, and the production line which will improve the reliability of operation and bring significant economic benefits.

Waste heat boiler: is the main component of this power plant where four (4) boilers will be installed. The total amount of steam generated by the matching waste heat boilers of four incinerators with a pressure of 5.3 MPa and a temperature of 430 °C was 4 × 77.07 = 308.28 t/h. For this blowdown system of waste heat boiler, four furnaces were used to set one continuous blowdown flash tank, and continuous row expansion steam was introduced into the deaerator for recovery and utilization.

Steam turbine: Two (2) units of the steam turbine will be required for this power project which rated power will be 35MW. The turbine has a three-stage non-adjustable steam extraction. The Steam pressure and temperature in front of mainstream are 5.1 MPa and 425℃ respectively.

Generator: Two sets of 35MW generators will be used for this project, in which an output voltage is 10.5 kV, rated speed of 3000r/min and an efficiency is more than 97.4%.

Cooling tower: The factory has three sets of countercurrent mechanical ventilation cooling towers (considering a 110% margin) with a cooling water volume of 7000 t/h, equipped with a fiberglass axial flow fan. The single power is 205 kW. The cooling tower building dimensions is length 75m, Width 22.6m, and Height 16.5m.

Stack: In this Waste to Energy project, one stack will be used which height will be 100m. The inside diameter of the stack is 2.2m*4. The gas exit temperature is ～140°C and the velocity is 10～20m/s. The Gas flow rate for one line is ~150000Nm3/h.

E-3.3 Process Flow

After the waste transport vehicle enters the factory and is weighed and measured by the weighbridge, it enters the waste tipping hall, discharges the waste into the waste storage pit for storage, and mixes the waste with the waste grab crane before sending the waste into the incinerator. The system mainly includes the following facilities: Weighbridge, waste tipping hall, waste tipping gate, waste storage pit, waste crane, and deodorization facilities. A mechanical grate furnace has been selected for this project. Moreover, the air combustion system, waste incineration process, flue gas, slag, fly ash, steam, and water process including water balance are described in detail in project description chapter (Chapter 2, section 2.12) of the main report.

E3.4 Resource and Utility Demand

WTE Power Plant North Dhaka Private Limited plans to acquire 31.18 acres (126187.41 m2) of land, inclusive of space for the incineration plant and new access roads. Previously, the DNCC had an access road to transport waste from the Solid Waste Transfer Stations (STS) to the landfill site. DNCC has now constructed a new access road on the east side of the project area, designated for both DNCC landfill and the WTE power plant. The land requirement for this access road is approximately 1.18 acres. Through the Deputy Commissioner (DC) of Dhaka District, DNCC has acquired 30 acres of land. In the acquisition process, DNCC acts as the requiring body, while the Deputy Commissioner (DC) serves as

the acquiring body. DNCC has subsequently leased this 30-acre land parcel to WTE Power Plant North Dhaka Private Limited.

After completion of the land acquisition process, DNCC developed the land inside the project site. The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about 850,000 cubic meters. The sand has been sourced from Padma River, Meghna River and Brahmaputra Jamuna River.

The waste requirement for the proposed incineration scale of this project is 3,000 t/d, which waste can completely meet the processing requirements of this project.

During the monsoon season, water uptake will occur from both surface and groundwater sources. The total water requirement from surface sources is estimated at 349.5 m3 per hour. The primary surface water source will be the nearby Karnatali River, located north of the project boundary, from which the majority of the surface water will be extracted.

The Aminbazar Waste-to-Energy (WTE) Project's main industrial water source is planned to be surface water. However, in the event of reduced surface water availability or compromised water quality during the dry season, rendering surface water insufficient for the project's needs, groundwater will be utilized as a temporary alternative source at a rate of 349.5 m3/h.

To facilitate groundwater extraction, three boreholes will be established within the project boundary, with two designated for regular use and one serving as an auxiliary well. The total depth of the groundwater wells is 260 meters. Each well is designed with a capacity of 190 m3/h. The project has already obtained permission from Water Resources Planning Organization (WARPO) and Local UP Chairman which is given in Appendix B.

About 40t diesel fuel is consumed for each start and shutdown. Diesel fuel consumption by ignition throughout the year = 40 × 2 × 4 = 320 t. Electricity consumption for this project will be 0.73×108kWh/a.

The manpower during the peak time of the construction period will be about 2320 people where 450 male and 10 female Chinese workers will be hired and around 1835 male and 25 female local workers will get employment opportunity due to construction activities. During the operational stage around 280 people will be required for the plant operation where 30 male and 10 female Chinese skilled workers will be hired, and 150 male and 50 female local skilled workers will be engaged. During plant operation, approximately 35 male and 5 female unskilled workers will also be required for different purpose.

E3.5 Treatment Process

The Flue Gas Treatment process of this project is "SNCR (urea water injection in the furnace) + semi-dry method (lime pulp solution) + dry method (Ca (OH)2 dry powder) + activated carbon injection + bag filter + (reserved SCR)" treatment process. The order of heat incinerator within the Flue Gas passes through the waste heat boiler, Flue Gas Treatment System, drawn by the ID fan and discharged into the atmosphere through the chimney.

The output of flying ash under the rated operating conditions of this project (waste is dumped for 365 days and incinerated for 333 days) is: 73.6 m3/d. The fly ash collected by the Flue Gas Treatment System consists of the fly ash collected by the semi-dry reaction tower and the ash hopper of the bag filter. Fly ash is transported to the hoist through scraper conveyors, fed into the ash bin, and then stabilized by fly ash. The fly ash treatment technology in this project is selected as the main scheme: synergistic treatment with cement kiln, the fly ash will be sent to the cement kiln plant for subsequent treatment.

The project produces about 500t/d wet slag per day and 182,500 t/a wet slags per year. The slag after solid waste incineration falls into the slag extractor through the slag outlet at the grate tail. A conveyor transported the leaked slag from the grate to the slag remover. The boiler ash collected by the duct ash

hopper at the rear of the boiler is controlled into the scraper conveyor by an ash removal valve and delivered to the slag extractor. The slag in the slag pond is lifted by a grab truck and sent to the comprehensive utilization workshop for brick making or asphalt concrete making or to be dumped at slag disposal plant.

The treatment process of waste leachate is designed according to the maximum daily production, leaving a certain amount of residue, and the total scale of its leachate design treatment capacity is defined as 1500 m3/d. The leachate treatment system is engineered to handle up to 1,500 tons per day during peak rainfall periods, with a storage tank volume of 12,000 cubic meters. This capacity provides a minimum retention time of 8 days for optimal treatment and management. The tentative leachate treatment process combination of this project is: Anaerobic + aerobic + membrane method (ultrafiltration + nanofiltration + reverse osmosis (RO)) process combination.

Flue gas, fly ash collection and treatment systems, slag, water, and leachate treatment systems are described in Chapter 2 of the main report. Moreover, the water treatment system includes Effluent Treatment Plan (ETP), details of the disposal of sludge, groundwater drainage system, and leachate drainage systems have been discussed in the Project description section of the main report.

E3.6 Project Implementation Schedule

Theentire project activity has been categorized under different phases. The preliminary preparation of the project is expected to be completed within 6 months. The construction period is approximately 24 months. The details are as follows:

Phase	Period
Pre-construction	6 months
Construction	24 months
Operation	Need input from China Machinery Engineering Corporation (CMEC)
Decommissioning	Need input from China Machinery Engineering Corporation (CMEC

E-4 Analysis of Alternatives

No Project Scenario: This alternative would result in no environmental or social impacts on the site or the local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. The no project option takes the following into consideration:

- Continue current dumping of waste as a method to manage waste for DNCC.
- Cost related to the project activities will be avoided.
- Further environmental damage to the proposed area will be avoided.
- Existing public suffering will continue to worsen due to lack of proper waste management system in surrounding of Amin Bazar landfill area.
- Electricity generation will remain constant (i.e., no additional energy generation will occur on the proposed site), and the local economy will not be diversified.
- There will be no opportunity for additional employment in an area.

However, the above adverse outcomes will not be obtained if the project is implemented (No Project Scenario is not chosen).

- **Suitability of the Site:** The selection of the project site/location has been based on the following considerations:
- **Available Land Area:** Availability of adequate land for the proposed plant. A total of 31.18 acres (126187.41 m^2) of land is required which has been acquired by DNCC.

- **Existing Land Use**: The existing land use of the proposed project boundary is low fallow land.
- **Sub-station Proximity**: As per the Power Purchase Agreement (PPA), the proposed project will employ a dual-circuit 132 kilovolt (kV) transmission line to establish connectivity with the Savar 132/33 kV substation. The total length of the 132 kV transmission line is approximately 5.99 kilometers.
- **Approach Road:** The Dhaka-Aricha Highway (N5) passes beside the project site. Fuel and equipment can be transported by road using this highway.

The present waste to energy project has been planned to address the issue of municipal solid waste of Dhaka North City Corporation. The existing landfill site has exhausted its capacities and is presently overburdened. Considering available land, existing land use and good accessibility for waste transportation route, the proposed site shall be chosen for establishing waste to energy power plant.

Alternative Incineration Technologies: There are four main types of solid waste incinerators: Mechanical grate furnace, Fluidized bed incinerator, Pyrolysis incinerator, Rotary kiln incinerator. Considering Characteristics of furnace bed and body, Waste pretreatment, Heat Cauterization of Slag, processing scale of a single furnace at present, Combustion air supply, Dust content in flue gas, Automatic combustion control, Operating expenses, Flue gas treatment and Maintenance workload, WTE Power Plant North Dhaka Private Limited selected the mechanical grate furnace as the incinerator for solid waste incineration and power generation projects.

E-5 Description of the Environment

Area of Influence

The Area of Influence (AOI) with respect to the environmental and social resources was considered based on the following reach of impacts:

- Impact on ambient air quality from vehicle exhaust- 500 meters from the project site. Air pollutants disperse from the project site up to 1 km from the power plant stack and Dust fall- typically up to 500 m from construction activities.
- Noise impact area (defined as the area over which an increase in environmental noise levels due to the project can be detected) - typically 500 m from the power plant center and 100 m from the access road.
- Surface water bodies within 1 km of the project footprint and Groundwater in a 1-2 km radius of the project footprint.
- The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence, and project-related activities (e.g., trampling, water intake/outfall, transportation). This kind of disturbance has been estimated to occur within the project footprint and surrounding areas of about 500 m to 1 km from the activity areas.
- The AOI for social receptors has been defined as a fixed radius extending 5 km from the project footprint, including the area of proposed transmission. This conclusion was arrived at, following preliminary site visits and stakeholder consultations with local communities to demarcate project areas of influence.

E-5.1 Meteorological Data

Meteorological data for the last thirty years (1991-2021) of Dhaka Meteorological Station were analyzed. The lowest average temperature recorded in the past 30 years was in January 2013 (10.4°C). The highest average temperature reached 34.4°C in April 2014. The highest temperatures are generally from April through September, and the lowest is from November to February. The maximum temperature varies from 24.7°C to 34.0°C. The average monthly minimum temperature ranges from 13.4°C to 26.5°C. The average annual rainfall is about 2016.0 mm. The rainfall also varies considerably within a year with 88.4% of rainfall occurring within seven months, from April to October. The highest

rainfall is recorded in September 2004 (839.0 mm). The meteorological data of relative humidity indicates that the monthly average relative humidity varies from 60.2% to 82.0%, with an average humidity of 73.7%. The wind direction in Dhaka meteorological station is generally from West-North-West (WNW) to East-South East (ESE) direction. Average monthly wind speeds were also higher during March, June, and November, with the maximum wind speed of 8.3/s recorded during March. The wind blows from south to north during monsoon.

E-5.2 Topography

The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. According to Digital Elevation Model (**DEM) SRTM**, 2013, the project area's minimum and maximum spot height are 4.1 meters and 8 meters, respectively.

E-5.3 Land Use

The evaluation of the existing land use pattern of the study area was considered 5 km where Agricultural land dominates the landscape, constituting 51.012% of the total area, followed by settlement areas with homestead vegetation at 21.838%. Notably, significant portions of land are allocated to rivers and canals (8.092%), wetlands (8.569%), and water bodies (2.697%), indicating the presence of natural features crucial for ecological balance. Other land use categories include brickfields (3.198%), roads (2.151%), and recreational sites (0.183%), contributing to infrastructure and leisure activities. Relatively smaller areas are dedicated to cultural sites, religious sites, and zoo and botanical gardens, highlighting cultural and recreational amenities. Dumping sites and landfill areas represent essential facilities for waste management, while bus/truck terminals facilitate transportation logistics. The data underscores a diverse landscape with a mix of natural, agricultural, residential, and infrastructure elements, emphasizing the need for balanced development and sustainable land management practices to preserve ecological integrity and meet societal needs.

E-5.4 Hydrology

The Karnatali, Buri, and Turag are the major rivers that flow through Amin Bazar and are close to the project area. The Turag and Karnatali Rivers have been considered for the nearby surface water sources and their water availability has been studied based on the flow model and the environmental flow requirement in both dry and monsoon season. Surface water availability for these two rivers were expressed in terms of monthly average and dependable flow. The Weibull formula has been used for the estimation of dependable flow for each month.

Based on the last 30-years data analysis, mean monthly flow ranges 1.2 – 3.4 m^3/s from January to April, 16.4 – 81.2 m^3/s from May to June, 233.2-138.0 m^3/s from July to October and 28.3 – 6.0 m^3/s November to December. Monsoon season environmental flow has been found to be minimum 59,040 m3/hr and in the dry season flow rates have been found to be minimum 4,320 m^3/hr, which meets the requirement of both environmental and industrial water usage of the study area. Based on the water demand of the Waste-to-Energy (WtE) project, only 8% (4,320 m^3/hr) of the environmental flow will be abstracted from the surface water sources during dry season, thus no significant impact on the 80% dependable environmental flow of the river.

Some groundwater monitoring stations have been studied for the WtE project. The borewells were located near the project site area. Last 10-years borewell data have been studied to understand the groundwater level fluctuation of the study area. Long term hydrographs showed a gradual declination of groundwater levels near the study area. The groundwater borewell station (ID: GT 2648010) was located near the study area (referred to previous groundwater assessment by CEGIS, March 2022). Based on the borewell data study, groundwater levels have been found to be a decline trend. Groundwater levels have declined up to 7m from the base year 2013 to 2020. From the isotopic analysis of the groundwater flow within the study area, it has been found that the study area groundwater is connected to base flow the Dhaleshwary river located around 14km upstream from WtE project area

and the project area groundwater have been recharging from that flow. Annual groundwater recharge has been found 250-300mm/year which is not sufficient for any heavy industry abstraction-recharge ratio, thus imply on the groundwater impacts on the nearby societal and environmental demands.

E-5.5 Natural Disasters

As per the Seismic Zoning Map of Bangladesh, the county is divided into four seismic zones. The Project site falls in the Zone–II area, with a basic seismic coefficient of 0.5g and at low risk of earthquakes. No major earthquake has been reported in the project area in recent years or in the recent past. The project area lies under no risk of the cyclone area of Bangladesh.

Flood is an annual phenomenon in Bangladesh. Normally, the most severe flood occurs in Bangladesh during July and August. Regular river floods (during monsoon season) affect 20% of the country, which may increase up to 67% in extreme years like the 1998 flood. The country has a long history of destructive flooding that has had very adverse impacts on lives and property. In the 19th century, six major floods were recorded: 1842, 1858, 1871, 1875, 1885 and 1892. Eighteen major floods occurred in the 20th century. Those of 1951, 1987, 1988 and 1998 were of catastrophic consequence. More recent floods include 2004 and 2010. Floods also occurred in 2015 and 2017.

E-5.6 Ambient Air Quality

A total of eight (8) ambient air quality monitoring locations were selected in and around the project site in the study area. Ambient air quality monitoring was conducted for both dry and wet seasons.

Considering wet season data as worst-case scenario, the study found that the concentration level of PM10 and PM2.5 remains within the standard limits of Air Pollution (Control) Rules, 2022 in all study locations. But the PM10 and PM2.5 concentration has exceeded the WHO Ambient Air Quality Guideline Values (2021) at all the locations. The average concentration of PM10 in all locations varies from 58.27 µg/m3 to 147.11 µg/m3, in AQ8 and AQ3 locations, respectively. In the case of the average concentration of fine particulate matter (PM2.5), the value ranges from 22.06 µg/m3 in AQ8 to 48.92 µg/m3 in AQ4. Although no values of the concentration of PM2.5 in any location did not exceed the standard limit of Bangladesh, it exceeded the WHO standard at all the locations. The concentration of PM10 and PM2.5 is comparatively moderate in the monitoring locations situated in urban or semi-urban areas compared to rural locations. The concentration of SO2 was found within the standard limit of Air Pollution (Control) Rules, 2022 in all monitoring locations. But it exceeded the WHO standard in all the locations except for the AQ5 location. The concentration of NO2 varies from 52.83 (µg/m3) to 82.24 (µg/m3). The study found that the concentration level of NO2 remains within the Air Pollution (Control) Rules, 2022 standard limit at all the locations except for the AQ1 location and exceeded the WHO standard at all locations. The concentration of Carbon Monoxide (CO) was found within the standards of both Air Pollution (Control) Rules, 2022 and WHO. The highest concentration of NO2, SO2, CO, and O3 were found in AQ1 (82.24 µg/m3), AQ3 (62.42 µg/m3), AQ1 (1.12 mg/m3), and AQ3 (38.22 µg/m3) respectively. On the other hand, the lowest concentrations of NO2, SO2, CO, and O3 are found in AQ8 (52.83 µg/m3), AQ5 (39.40 µg/m3), AQ8 (0.42 mg/m3), and AQ8 (33.53 µg/m3) respectively.

E-5.7 Water Quality

Water samples were collected from four (4) locations, mainly from groundwater (02 locations) and surface water sources (2 locations) in both dry and wet seasons. These samples were taken as grab samples and analyzed for various parameters to be compared with the standards as per DOE, Bangladesh guidelines.

Surface Water Quality

The surface water sampling was collected from 100 m upstream and downstream of Karnatali river close to the project area. During the dry season, two surface water samples were collected (SW1 & SW2) in April 2022. Wet season (Monsoon) surface water samples (SW1 and SW2) were collected in August 2022.

The water quality assessment of the project area reveals that the pH levels are within the acceptable range of 6.5 to 8.5 set by the DoE, ensuring adequate protection for aquatic life. pH values range from 7.81 to 7.91 in the dry season and 7.39 to 7.87 in the wet season. Dissolved oxygen (DO) levels, crucial for aquatic organisms, are below the Bangladesh standard in the dry season (4.9 to 5.3 mg/L) but meet the standard in the wet season (6.0 to 6.4 mg/L), indicating organic pollution. Turbidity is higher in the dry season (27.6 to 29.1 NTU) than in the wet season (5.5 to 5.7 NTU). Total hardness varies from 108 mg/L in the dry season to 13-73 mg/L in the wet season. Biochemical Oxygen Demand (BOD) exceeds the national standard in the dry season (5.5 to 6.5 mg/L) but is within limits in the wet season (0.8 to 0.9 mg/L), reflecting higher organic matter in the dry season. Chemical Oxygen Demand (COD) ranges from 58-68 mg/L in the dry season and 0.8-11 mg/L in the wet season. Total Dissolved Solids (TDS) are within the standard, ranging from 690 to 790 mg/L in the dry season and 80 to 90 mg/L in the wet season. Oil and grease levels are higher in the dry season (15.71 to 17.42 mg/L) compared to the wet season (11.24 to 11.42 mg/L). Chromium levels are low, with slight variations between seasons. Other parameters such as COD, temperature, and metal concentrations were also tested.

Groundwater Quality

During the dry season, two groundwater samples were collected (GW1 & GW2) in April 2022. Wet season (Monsoon) groundwater samples (GW1 and GW2) were collected in August 2022. The analyzed results for groundwater were compared to the Bangladesh Standards (ECR, 2023) and WHO guidelines. The groundwater analysis for both the dry season and wet season reveals that all the parameters are within the standard value of ECR, 2023, and WHO guidelines. Considering the result of the Groundwater testing, it can be assumed that the groundwater quality is satisfactory for drinking in the study area.

E-5.8 Ambient Noise Quality

Ambient noise level measurements were carried out at six (6) locations; one reading for every minute was taken for 24 hours. The day noise levels have been monitored from 6 am to 9 pm and night levels from 9 pm to 6 am. The highest noise level at nighttime was recorded at 72.8 dB(A) at NL4, and the lowest was 43.1 dB(A) at NL2 during the monitoring period. According to the Noise level measurement result, the noise level for NL3 exceeded the Bangladesh standard on both day and nighttime. According to International Finance Corporation (IFC) guidelines, the NL3 result is within the standard for both day and nighttime. And the noise level for NL4 exceeded the Bangladesh and IFC standards on both day and nighttime. It is because the location of Noise level measurement in NL3 and NL4 is beside the Dhaka-Aricha highway and thousands of vehicles pass through the highway.

E-5.9 Soil and Sediment Quality

Two (2) soil samples were collected in both dry and wet seasons from representative locations of the study area and analyzed for Physico-chemical parameters to assess the existing soil characteristics. nitrogen and sodium concentration vary from 0.102% to 0.113% and 401 ppm to 441 ppm, separately. The Environmental Conservation Rules (ECR), 2023 has no soil quality standard.

Soil pH is crucial for absorbing essential trace elements for plant growth. While the ideal pH range for most plants is mildly acidic (5.8 to 6.2), plants can tolerate a range from 5.0 to 7.0. In the study area, the soil texture is primarily sandy loam, with pH levels ranging from 7.19 to 7.27 in the dry season and 7.21 to 7.38 in the wet season, indicating moderate to slight alkalinity. Phosphorus levels range from 1560 to 1580 ppm in the dry season and 786 to 894 ppm in the wet season. Potassium levels are 2189 to 2288 ppm in the dry season and 2876 to 3125 ppm in the wet season. Magnesium varies from 4051 to 4170 ppm (dry) to 2568 to 2748 ppm (wet). Iron concentrations are 1.491% to 1.785% (dry) and 3.45% to 3.66% (wet). Chromium levels range from 29.91 to 37.82 ppm (dry) and 19.48 to 21.31 ppm (wet). Salinity is 2.41 to 2.53 ppt (dry) and 3.76 to 3.87 ppt (wet). Total nitrogen and sodium concentrations are 0.219% to 0.224% and 287.19 to 294.4 ppm (dry) and 0.102% to 0.113% and 401 to 441 ppm (wet).

Two (2) sediment samples were collected in both dry and wet seasons from representative locations of the study area and analyzed for Physico-chemical parameters to assess the existing soil characteristics. The Environmental Conservation Rules (ECR), 2023 has no sediment quality standard.

It has been observed that the texture of the sediment is mostly silt loam in the study area. The pH of the sediment ranged from 7.47 to 7.51 for the dry season and 7.23 to 7.48 for the wet season, indicating that the sediment is moderate to slightly alkaline. The phosphorus values for dry and wet seasons ranged from 671 to 695 ppm and 689 to 715 ppm, respectively. The potassium value ranged from 3086 to 3432 ppm and 4132 to 4433 ppm, respectively for dry and wet seasons. The magnesium values have varied for dry and wet seasons from 8249 to 8769 ppm and 6144 ppm to 6832 ppm, respectively. The iron concentrations were observed to be ranging from 3.153% to 3.249% ppm for the dry season and on the other hand, the wet season data ranges from 3.023 ppm to 3.964 ppm. Total nitrogen, calcium, and sodium concentration for the dry season range between 0101 to 0.1287%, 1661 to 1674 ppm, and 441.81 to 472.5 ppm; and for the wet season it varies from 0.101% to 0.102%, 1942 ppm to 2241 ppm, 306 ppm to 378 ppm. The analysis reveals that these sediments are moderate to slightly alkaline with acceptable potassium, iron, and magnesium content and less to medium phosphorous ranges.

E-5.10 Flora and Fauna

The terrestrial flora covers most of the vegetation in the study area. A total of 44 species under 23 families of floral species were enumerated during the field survey from the five (5) quadrat samples. The highest number of floral species (7 species) were recorded under the Fabaceae family and the second-highest number of species (6 species) were under Moraceae. Major tree species observed in and around the project AOI area were Kathal (Artocarpus heterophyllus), Mango (*Mangifera indica*), Chalta (*Dillenia indica*) Jam (*Syzygium cumini*), Mahogoni (*Swietenia mahagoni*), Coconut (*Cocos nucifera*), Shishu (*Dalbergia sissoo*) etc.

A total of 40 species under 23 families have been found within the study area. The highest number of birds that dominated the study area belong to the family Alcedinidae and Ardeidae (06 species). In addition, Columbidae, Corvidae, and Sturnidae are the second dominated family (03 species). Homestead forests, grassland and bush, and some aquatic habitats of this area have supported the wild birds for feeding and roosting ground. All the bird species found in this are the least concern (LC) both locally and globally according to the International Union for Conservation of Nature (IUCN) red list.

A total of four (4) species of amphibians belonging to two (2) families and eight (8) species of reptiles belonging to six (6) families were listed from the project area based on primary and secondary data. Among the recorded amphibian species, the highest number of amphibians (3 species) dominated in the study area belonging to the family Dicroglossidae.

A visual Encounter Survey was followed for observing and counting the wild mammalian species. Mammals that were reported observed in the project area are the Common mongoose (*Herpestes edwardsii*), Common Indian field mouse (*Mus booduga*), Indian Fruit Bat (*Pteropus giganteus*), Common House Rat (*Rattus rattus*) and Irrawaddy Squirrel (*Callosciurus pygerythrus*).

Fisheries resources of the study area are rich and diversified. Aquatic ecosystem within the AOI comprises the Riverine Habitat of Karnatali River and Turag River, some natural drainage canals, floodplain area, beels and ponds. A total of Forty-seven (47) species of fish under eighteen (18) families were recorded in the study area. In addition, six (6) species of Prawn and shrimps under two (02) were recorded. Most of the fish found in the study area were culture species. Among the recorded fish species, five (05) Endangered species (*Mastacembelus armatus, Clupisoma garua*, *Botia Dario*, *Channa marulius*, *Chitala chitala*) and four vulnerable species (*Monopterus cuchia*, *Sperata aor*, *Gudusia chapra*, *Labeo boggut*) were enlisted. A total Ten (10) aquatic macrophyte species were

recorded from the shallow water of the Karnatali River, floodplains, ponds, and swamps around the proposed project site.

The Ganges River Dolphin, known as "shusuk" in Bangla, (*Platanista gangetica*) inhabits the Ganges-Brahmaputra-Meghna River systems in Bangladesh. Listed as Vulnerable (VU) by the IUCN Red List of Bangladesh 2015 and Endangered (EN) by the Global IUCN Red List 2022, it is protected under the Bangladesh Wildlife (Conservation & Security) Act, 2012. Studies from 2003-2004 and 2012-2013 on the Buriganga River reported dolphin densities of 0.25 and 0.38 per kilometer, respectively. In 2009, dolphins with pollution-related fungal infections were sighted near Shoalmachi on the Turag River and Jhaochar on the Buriganga River. Research from 2012 to 2013 identified the Turag River near Aminbazar and Birulia as key dolphin habitats, with the highest sighting rate of 0.49 dolphins per kilometer in October 2013, varying seasonally with water levels and pollution.

E-5.10 Biodiversity Sensitive Areas

According to the Department of Environment, the Turag River has been declared an ECA in 2009. Turag River is located on the North-Eastern side of the project area at approximately 4 km aerial distance. The proposed project AOI holds a Primary Air (PA) and the nearest PA from the project site is the National Botanical Garden, Mirpur, Dhaka which is approximately at an aerial distance of 4.8 km North-East. Although there is no Important Bird & Biodiversity Area (IBA) in the project AOI. The nearest IBA is the Jamuna-Brahmaputra River is at an aerial distance of 57 km west.

E-5.11 Socio-economic Environment

The proposed project is located in the Bongaon Union of Savar Upazilla. According to the census carried out in August 2021 and land data from the respective Government Department, it was identified that a total of 242 households (HH) will be affected due to the land acquisition of the proposed project. The socio-economic survey was carried out among 146 households out of 242. A total of 607 people were identified from the 146 surveyed households, of which 304 males and 303 females respectively. The sex ratio of the population is 100.33:100 with an average Household (HH) size is 4.15. The Census and Socio-Economic Survey (SES) found the distribution of population in the project area on the basis of age composition.

The total male is 50.08% and rest is female of total Project Affected Persons (PAPs). It shows that the highest section of the population constitutes the age category of 19 to 30 years (20.10%) where female (10.87%) group is higher than the male (9.32%) group. The second highest category is 31 to 40 years (19.77%). In most of the age groups the number of males is higher than that of females.

Survey data reveals that among the total surveyed population, there are 30 Hindus and 575 Muslim identified. Within the Hindu community, there are 15 males and 15 females while within the Muslim community, there are 287 males and 288 females but, no indigenous community members were identified during the survey in project area.

Out of total 607 family members across 146 households, the highest number of individuals (150 females) were identified as housewives while 148 individuals were categorized as not working due to old age, physical barriers or unemployment status. In terms of occupational distribution, various occupational groups exist in the project location with the main occupations being small and medium scale business (28.62%), private service (7.08%) and agriculture (2.80%), predominantly amongst males. The transport workers account for 1.48% of earners. On the other hand, 12 females are engaged in business, representing the highest number of working women among other occupational groups. Around 2.64% of male earners work abroad and remit funds to their households, while no female workers work abroad. The majority of female members are housewives (24.71%) and involved in

household chores. In addition, approximately, 12.69% of family members are students across different grades and around 24.38% are unemployed.

The household income of the surveyed populations indicated that the majority of households 54 (36.99%) fall within the income range of Bangladesh Taka (BDT) 25,001 to BDT 30,000 per month. The next most common income range is noted between BDT 30,001 to BDT 40,000 per month amongst 34 (23.29%) households. As the income range increases, the frequency of surveyed households decreases. Around 10.27% of households earn between BDT 100,001 to BDT 200,000 per month Notably, there are fewer households earning higher incomes reflecting only 4 (2.74%) households whose income is reported more than 500,000 BDT per month.

In Bangladesh, similar to many other countries, the poverty threshold is set at USD 1.9 (177 BDT) per person per day. Families earning below this amount per person daily, which translates to approximately USD 256.5 (23854 BDT) per month with an average household size of 4.5, are deemed vulnerable. Without proper mitigation measures are in place during project implementation, these households are at higher risk of their deteriorating economic conditions. Survey data reveals that the lowest monthly income for 54 households (36.99%) falls between BDT 25001 and 30000 BDT per month, with no households found to have a monthly income below the defined poverty threshold.

E-6 Anticipated Environmental Impacts

The potential impacts of the proposed project on different environment and social components are systematically identified for evaluation of significance.

Positive Impact

The construction of a waste-to-energy power plant at the chosen site would yield numerous benefits. This waste-to-energy (WtE) facility will provide a solution for the disposal of untreated municipal solid waste that would otherwise go to a landfill. Key advantages include generating electricity, creating jobs, boosting the local economy, contracting opportunities for local transportation companies, and fostering socioeconomic development in the project area. Additionally, this WtE plant would mitigate several issues associated with the current landfill system, such as reducing risks to community health, minimizing foul odors, and preventing contamination of water sources and soil.

Potential Environmental Impacts

Impact on Land use

The planned land requirement for WTE Power Plant North Dhaka Private Limited is 31.18 acres (126364.80 m2) including incineration plant land and new access roads. The existing land use of the proposed power plant is mostly low land. No major tree species are present within the project boundary. No permanent water bodies and hills have been found in the project area. This project will not fill any pond, canal, or waterbodies during site development. No hill cutting is required due to project development. The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about 850,000 cubic meters. The land use pattern of the project site will be changed from fallow low land to industrial category.

Impact on Ambient Air Quality

Excavation for land development, movement of transporting vehicles carrying the construction materials, etc. are all part of the activity involved in building the power plant facilities, which include the main building, auxiliary area, water treatment area, Ash & Slag Comprehensive Treatment Area, and transmission line. All of these operations would result in the release of dust particles, which would have a temporary negative impact on the site's air quality. In addition to dust generation, construction vehicles and other construction equipment will generate exhaust emissions.

The proposed power plant has different provisions for air pollution abatement measures therefore, the model has been carried out considering mitigation measures. The proposed power plant has four sets of incinerators and waste heat boilers. A major emission source of the plant is NO2, SO2, CO, and Particulate Matter. Besides the criteria pollutants, the plant will also contribute heavy metals (Pb+Cr, Hg), HCL, Hydrogen Fluoride (HF), and Dioxin Furan (DF) to the atmosphere. Details of air dispersion model are given in Chapter 6.

Dust from Construction Activities

During site cleaning, land filling, site establishment, earthwork and transportation activities in dry condition significant dust will be generated. Due to land development, settlements located near to the project site and access road will be impacted due to dust generation.

The key construction activities likely to result in increased dust levels are the movement of trucks transporting infrastructure to and from the site, and the movement of construction vehicles along dusty roads. An increase in traffic number is expected on the adjacent highway (N5) as a result of the vehicles carrying construction materials, machinery, and equipment that could increase dust pollution. Dust emissions are exacerbated by dry weather and high wind speeds. The impact of dust also depends on the wind direction and the relative locations of dust sources and receptors.

During the operation phase dust generation will be very minimum inside the project site. But still, the inflow of waste transporting and carrying workers during operation is likely to generate dust emissions.

Exhaust Emissions

Different equipment, Burge and vehicles will be used for land cleaning, dredging material transportation, filling, levelling, land development activities and transportation purposes. The equipment and vehicles will generate gaseous substances (NOx, SO2) which will contribute to deteriorating the ambient air condition during the preconstruction stage. Construction vehicles and other construction equipment will generate exhaust emissions. Heavy equipment such as bulldozers, excavators, dump trucks, and compactors will be used onsite. Emissions from this equipment and from diesel generator sets used to generate power will cause impacts on ambient air quality. Construction vehicles and equipment engine exhaust emissions include CO, PM2.5, PM10, and NO2. It is not anticipated that large volumes of exhaust emissions will be generated during the construction phase of the power plant and transmission line as well. Impacts from vehicle emissions decrease rapidly with increasing distance from the source.

Pollutants of concern released by the power stations are Particulate Matter (PM), Oxides of Nitrogen (NOx), Sulfur dioxide (SO_2), and Carbon Monoxide (CO). The waste-to-energy power station will also emit Hydrogen Fluoride (HF), Hydrochloric Acid (HCl), Dioxin & Furan, and Heavy Metals (Cadmium, Mercury, Titanium). The resulting ground level concentration (GLC) from air quality modelling will be referred to the applicable limits of ambient air quality from schedule 1 of Bangladesh air pollution control rules 2022.

Impact due to Odor from waste

The implementation of this project involves several types of construction works that may generate substances with bad odors. For example, land preparation and clearing work, sewage from mobile and stationary toilets, solid waste, slurry, etc. Offensive odors from preconstruction and construction activities, arising from materials like asphalt, solvents, and heavy machinery emissions, can adversely affect nearby residents' health and well-being. Issues such as headaches, respiratory problems, and increased stress are common. These odors also contribute to air pollution, harming local wildlife and vegetation.

The source of malodor pollution mainly comes from the original waste entering the plant and the produced leachate. The malodorous gas will be emitted by the waste transport vehicle during the unloading process and the waste heap placed in the waste tank, and the malodorous gas may also be

emitted by the leachate in the collection facilities and transmission process. Respiratory problems, nausea, headache, and psychological stress could be the main impacts of waste odor.

Impact on Ambient Noise Levels

The potential sources of noise during the Project's construction phase include equipment, machinery, and transportation used for the construction activities. The heavy equipment used for construction activities will be a significant source of noise. This will include piling and preparing concrete foundations for plants and buildings. Transportation of construction materials to the stockyard for associated transmission lines may cause negligible noise pollution. The traffic volume will increase during the construction phase due to the transportation of equipment, construction materials, and workers on the access road, which will be the noise source to the closest receptor.

During the operational phase, the sources of noise emission are machine-generated noise mainly process machines (Boilers, generators, and Cooling Towers), airflow-generated noise, compressors, and other sources like noise escaping from buildings or caused by the transport of materials. The predicted noise level at NL1 is 75.0 and 73.9 dB(A) for day and nighttime respectively which exceeded the IFC permissible limit. As the point is very close to the main power plant noise level will be higher. However, the noise level in the boundary of the power plant will vary from 55 to 60 dB(A) which is well below the IFC industrial permissible limit of 70 dB(A). NL3 is located beside the Dhaka-Aricha highway, therefore, the baseline noise is exceeded, and the project operation will increase the baseline noise by 0.1 dBA in the nighttime.

Impact on Water Quality

Surface water

Wastewater generated from the site during the construction contains suspended materials, spillage and washings from the various areas. For the sanitary sewage from toilets and showers, it is anticipated that about 2320 workers will be on site during the peak period of construction. At an average water use by one person of 0.1 m^3/day, it is estimated that 232 m^3/day of wastewater will be generated. Effluents from the construction area mainly contain suspended solids while the sanitary waste from the labour colonies contains suspended as well as organic matter. This is a significant amount of sanitary wastewater that without proper treatment and disposal methods could be discharged off-site with detrimental impacts on the environment. During the construction phase of the proposed power plant, water will be used for the building of civil structures, dust suppression and drinking purposes. The loose construction material like sand, cement etc. and excavated earth/ construction debris may get washed off during heavy precipitation and finally reach the nearby River. This may increase the suspended solids of the receiving water body. Unplanned events such as hazardous material leakage from machinery, e.g., overflow of the existing surface runoff infrastructure caused by a major rainfall event could also impact surface water quality.

Throughout the operation period, the Karnatali River has been considered as the primary water source for this project. The water inlet and pump house of this project is placed on the riverbank. The monthly average flow of the Karnatali River varied from 1.2 to 3.4 m^3/s from January to April. The flow is minimum from February to March (1.2 m^3/s) and the dry period prevails until May. Then the flow rises rapidly and reaches its peak during August (274.7 m^3/s). Therefore, during December to April, the water flow at Karnatali River becomes less than 6.0 m^3/s. The rest of the month from May to November, the water flow increases (range 16.4 m^3/s to 274.7 m^3/s) gradually which can serve water requirement for the proposed project. Monsoon season environmental flow has been found to be minimum 59,040 m^3/hr and in the dry season flow rates have been found to be minimum 4,320 m^3/hr, which meets the requirement of both environmental and industrial water usage of the study area. Based on the water demand of the Waste- to-Energy (WtE) project, only 8% (4,320 m^3/hr) of the environmental flow will be abstracted from the surface water sources during dry season. Thus, no significant impact on the 80% dependable environmental flow of the river. The total amount of water that will be needed to uptake

from surface water will be 349.5 m3/h. The major water demand for the proposed power plant is cooling water system and it has been estimated 16991.6 m^3/hr. However, enhancing storage capacity from monsoon season, continuous monitoring of the water quality and flow rates, adaptive and conservation measurements will bring sustainable management of the water resource systems of the WtE project in the study area. It is planned to use river water as the source of industrial water for this project, and groundwater as the standby source of industrial water.

Groundwater

The water requirement is estimated to be approximately 280 m^3/day during peak construction. The required water shall be met from the groundwater wells. The total depth of the ground water well is 260m. Each well is designed with a capacity of 190 m3/h. Due to abstraction of groundwater; the ground aquifer will decline. The existing groundwater quality analysis around the project does not reveal any existing contamination or pollution. Soil compaction may increase the intensity and volume of surface water runoff as a result of a decrease in water infiltration recharging the groundwater. Therefore, the local villagers will not get the water during the dry season which may create social conflict. To reduce the pressure on ground water, it is strongly encouraged to identify the alternative source of Surface Water and to use it in different purposes. In case of any adverse impact on the nearby community due to groundwater abstraction by the company, immediate mitigation measures and compensation must be ensured. Groundwater contamination during the construction phase may occur from unplanned events such as leaks and spills of oil, lubricants, fuel from heavy equipment, and improper handling of sewage.

The total amount of water that will be needed to uptake from ground water will be 349.5 m3/h. The major water demand for the proposed power plant is cooling water system and it has been estimated 16991.6 m^3/hr. The consumption of ground water mainly comes from the consumption of domestic water, some production experimental water, evaporation loss of cooling towers, windage loss, sewage loss, fly ash solidification, flue gas treatment, demineralized water preparation, etc.

Groundwater contamination during the construction phase may occur from unplanned events such as leaks and spills of oil, lubricants, fuel from heavy equipment, and improper handling of sewage. Mitigation measures such as storage of oil, lubricants, and fuel at concrete laydown areas will be implemented to minimize contamination in the event of a spill. Furthermore, Improper sewage and wastewater disposal from the labor camp and construction debris can contaminate the groundwater resources in the area. Groundwater impacts associated with leaks and spills are reduced during the operation phase since on-site storage of hydrocarbons and site activities will be considerably reduced.

Impact on Soil Quality

After land acquisition DNCC has developed the land inside the project site. The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about 850,000 cubic meters. The sand has been sourced from Padma River, Meghna River and Brahmputra Jamuna river. The transport of materials and equipment will involve additional movement of vehicles; construction machinery which will also lead to some degree of compaction within the site premises. Soil compaction and possible damage to the soil structure due to heavy vehicular movement will only be limited to the vicinity project site. Spills could have a long-term impact on soil quality but are expected to be localized in nature. During the construction stage of the power plant, a large number of workers/employees (about 2320 persons) will be engaged with the proposed project. At the same time, a significant amount of solid waste will be produced from domestic waste, garbage, sludge from food waste, by-product material, etc. Solid waste can contaminate soil if it is not managed properly.

During the operation phase of the project, the soil may get polluted/ contaminated from littering of various kinds of municipal wastes, leakage of leachates, and due to fly ash or bottom ash. The incineration process will produce fly ash and bottom ash as well. Estimated fly ash output form the

whole plant is about 73.6 m3/d. Based on the calculation in the above table, the storage capacity of a landfill for 5 years is about 122560 cubic meters. The existing landfill site can meet the requirements of operation and maintenance for 5 years, and the project will adopt the way of fly ash and cement kiln to handle fly ash. This landfill will be used as an emergency fly ash landfill. If this landfill is not managed properly, the soil quality may be contaminated. After WtE, some minerals and elements are enriched in incineration ash. Compared with the original waste, the content of toxic elements in urban waste incineration fly ash is 10 to 100 times higher than that in general soil. Compaction of soils from increased leveling and grading of areas within the site will result in lower permeability and therefore, decreased infiltration and increased runoff. Without appropriate measures, compacted areas and hard-standing areas in addition to erosion by wind may increase erosion and increase the sediment load in run-off. Once the project is commissioned there will be a limited disturbance to the soil, however, repair and maintenance of underground cables and associated utilities will lead to generation of hazardous wastes such as used transformer oil. The defunct/damaged equipment will also be generated and storage/disposal on the unpaved ground can lead to contamination of soil is hazardous waste.

Impact due to Waste Generation

During the construction phase, the primary form of waste will be debris generated from excavations for building foundations, erection of the structural frame, interior outfitting, electrical installations, and exterior site work. Additional, waste is expected to include food scraps and packaging materials discarded by construction workers. If not properly contained and managed, solid waste from the construction sites could adversely impact surrounding soil quality as well as water quality. Inadequate waste handling practices during the construction stage pose a risk of soil and water contamination. The incineration process will produce fly ash and bottom ash as well. Estimated fly ash output from the whole plant is about 73.6 m3/d. The storage capacity of a landfill for 5 years is about 122560 cubic meters. The existing landfill site can meet the requirements of operation and maintenance for 5 years, and the project will sell the fly ash to the cement factory. This landfill will be used as an emergency fly ash landfill. The sludge in this project is obtained from the feed water Treatment System and the leachate treatment system. The project will produce about 500t/d wet slag per day and 182,500 t/a wet slags per year. The main plant is equipped with slag pits that can meet the storage capacity of the whole plant for more than 3 days. The slag in the slag pond is lifted by a grab truck and sent to the comprehensive utilization workshop for disposal and production of asphalt concrete or the slag treatment plant for landfill. The components after sorting and sifting will be treated according to their nature, e.g., the metal to be sold and the remaining will be used for brick making. However, the project does not include the brick-making facilities.

Fuel and chemicals like acids/alkali for water treatment purposes can be generated during the operation phase. Various types of hazardous and non-hazardous wastes would be generated during normal operation of the power plant which has the potential to degrade soil quality and sediment quality if not stored and handled properly. Land around the Project site is mostly fallow land and low land, and some agricultural land has been found north-west direction from the project boundary. The Karnatali River is located adjacent to the project site on the north side. Improper storage, handling, and disposal of solid and hazardous waste may lead to contamination of the land and water bodies nearby.

Impact on Terrestrial Flora

During the construction phase, dust generated from different activities viz. vegetation clearance, transportation and stockpiling of construction materials, and movement of construction vehicles will lead to dust deposition on plant leaves, twigs, and stems which may hamper photosynthesis, respiration, and other physiological processes. As a result, it will affect plant growth and cause diseases.

The major sources of impact on terrestrial flora during operation phase include flue gas and fly ash production due to incineration of wastes. It will affect plant growth and cause diseases. Also, emission of SOx, NOx and other flue gases will impact on the plant growth. However, the dispersion of Flue gas

emission and deposition of fly ash contents decreases over the distance considering wind speed, topography, and the presence of physical barriers.

Impact on Terrestrial Fauna

Dust, noise, and excessive light generated from the construction sites may affect terrestrial fauna residing in the adjacent areas of the project sites and might lead to habitat degradation or disturbance to movement of wildlife.

Flue gas and fly ash production due to incineration of wastes during the operation phase will impact on the health, behavior, and reproduction of terrestrial fauna. However, the dispersion of Flue gas emission and deposition of fly ash contents decreases over the distance considering wind speed, topography, and the presence of physical barriers. Generation of noise and light from the plant operation will impact the movement of nocturnal faunal species and degrade the habitat of them.

Impact on Aquatic Flora and Fauna

During pre-construction and construction phase, landfilling and disposal of construction waste will hamper aquatic plants. Also, accidental spillage of hazardous materials through surface runoff and construction waste disposal to waterbodies will degrade the habitat for aquatic resources i.e., fish, aquatic plants, and aquatic invertebrates (Plankton and Macrobenthos).

In operation phase, fly ash deposition, bottom ash leachate and sludge disposal into the waterbodies in monsoon will degrade the chemical composition of the surface water which result to degradation of habitats for aquatic resources. In addition, heavy metal pollutants from flue gas might get into waterbodies by runoff of rainwater might impact on the biogeochemical cycles.

Potential Social Impacts

Impact on Land and Structure

As per joint verification list of the Deputy Commissioner (DC) Office of Dhaka district, a total of 30 acres of land had been identified of which 29.65 acres are private land, and 0.35 acres of khas/govt land have been earmarked. The total acquired land parcel has been categorized as Bari, Viti and Null respectively as per Govt's Land Category record. with representative with 2.039 acres of Bari, 9.2567 acre of Viti and 18.7043 acre of Null category. Out of total 29.65 acres of private land acquired, only 2.039 acres of the land were used for business purposes where all the business structures of two bus depot, cow farm and water plant were established.

Based on the discussion with landowners, DC office and DNCC, it was identified that a total of 242 landowners will be impacted for the implementation of the proposed project. Moreover, as per the gazette (**Appendix E-7**) published on 6/22/2022 a total of 59.36% amount of compensation has been disbursed. However, the compensation amount for remaining landowners who have not been contacted, couldn't be disbursed due to the ongoing litigation and land mortgage issue.

As per joint verification list of the Deputy Commissioner (DC) Office of Dhaka district, it was found that business structures of two bus depot, along with one cow farm and one drinking water plant have been impacted by the project intervention. During the land acquisition process and possession of land taking period those structures were demolished upon completion of compensation award to the rightful owners as per the Acquisition and Requisition of Immovable Property Act (ARIPA) 2017.

The impacted structure mainly comprises Pucca, Semi-pucca, steel structure and tin made category along with the associated items whereas, secondary structure covers tiles, door, window, stair, electrical and utility connections, water reservoir etc. The impacted structures were used for some official purposes and storage area of bus depot. Cow farm and water plant have separate structures which were also impacted by the project intervention. The owners of these structures have given satisfactory amount of time as per their request for shifting to a new location within the given time to avoid business loss as well as establishing new structures.

Impacts on Non-Titled holders

Apart from the legal titled holders, 5 non-titled holders have also been affected due to the project intervention. Five tin made temporary structure owned by the non-titled person were shifted due to the project site preparation. Their businesses were temporarily impacted by the process of relocation to nearby places. It was evident that none of the non-titleholders were compensated or even considered for the compensation list prepared by DC. The non-titled business owners mainly run small businesses such as tea, locally made snacks, rice and mobile recharge shop on acquired land parcel. After getting verbal notice for removal of their structures from the previous place, the owners have made arrangement on their own to shift structures in a suitable nearby place. However, from the consultation with them, it was found that they run their business without paying any rent except for electricity bill ranging between an average of 300-500 BDT per month to the bus depot owner as the electricity connection is provided by the bus depot owner.

Impacts on Waste pickers

Construction work will restrict access for waste pickers in the landfill area, as the project authority plans to construct fencing around the power plant vicinity. Despite existing restrictions on the outsiders access to the land fill stie, the ongoing site preparation and sand filing for the power plant have inadvertently provided opportunities for some waste collectors to enter without any security encounter following alternative routes. However, the commencement of construction activities including the installation of site fencing and deployment of additional security personnel, will impede the entry of waste collectors into the landfill area. This obstruction could lead to disruptions in their income generation activities derived from collecting waste materials from the landfill.

The operation of waste-to-energy (WtE) project can significantly affect waste pickers, particularly when these projects result in decreased waste availability at the landfill sites. As reported by the DNCC, 40 individuals comprising both men and women have been identified as waste collectors at the site. Here are some key impacts:

- Waste pickers rely on scavenging recyclables and other valuable materials from landfills to earn a living. With WtE projects diverting waste away from landfills, their access to these materials diminishes that, directly affecting their daily income.
- With less waste available, competition among waste pickers can increase, leading to lower incomes and potential conflicts.
- The transition to new methods of waste collection or finding alternative livelihoods requires adaptation, which can be difficult without proper support and resources.

Impact on Traffic

During the pre-construction and construction phase of the project, the project will anticipate increased volume of traffic and vehicular movement on the existing road which witness huge traffic volume at present, bearing the important economic exchanges on Dhaka-Aricha highway, National highway (N5), that highlights the importance of traffic management associated with the project activity. According to the data from DNCC, 140 waste collection and dumping vehicles were engaged covering 4 trips by each vehicle per day and the demand for such waste collection and dumping vehicles will increase during the construction phase for carrying construction materials and other relevant items associated with the construction activity. Moreover, the Labor movement at the site during the construction phase also may add traffic congestion.

During the operation phase,a new connecting road on the east side of the plant is planned to be connected with the N5 highway, which will be used as the entry road of the project. A total of 140 trucks will be operational during the operation phase to transport waste to the plant. The existing highway (N5) has connected the capital city Dhaka to the northern part of Bangladesh. The DNCC is responsible for the garbage transport vehicles in this project, and the number of vehicles transporting the garbage to the landfill site will be around 30 per hour. There are many types of vehicles, which vary in size. This

highway remains busy with several kinds of vehicles such as buses, Microbus, Minibus, Jeep, Truck, Covered Van, Ambulance, Motorcycle, etc. Road transportation will be used for waste commuting to and from the project site, there would be added existing traffic due to plying of trucks of DNCC.

After retrieving the data of DNCC weighbridge room for three consecutive days, the vehicles are counted for 24 consecutive hours. The specific data are as follows:

- On May 8, 2024, 634 garbage trucks entered the site with 3436 tons of garbage, an average of 27 vehicles per hour.
- On May 9, 2024, 629 garbage trucks with 3476 tons of garbage, an average of 27 vehicles per hour.
- On May 10, 2024, 650 garbage trucks with 3436 tons of garbage, an average of 27 vehicles per hour.

Assuming that the maximum daily traffic volume is approximately 30 vehicles per hour, each vehicle is 15 meters long and 4 meters wide, covering an area of 60 square meters. There is a 368-meter-long road entering the factory area, plus a 2226-square-meter unloading hall. Even if they enter the site at the same moment, it is enough to suspend and store more than 60 vehicles, so it will not affect the road traffic outside the site. And there is sufficient room for all the vehicles in the Project site. The inflow of waste transporting and carrying workers during operation is likely to generate noise and dust emissions.

Perceived Conflict of Interest

As potential employment opportunities will be anticipated during the construction period that may lead to the likelihood of conflict of community interest amongst workers during construction phase. Approximately a total of 2320 nos. of both Local and Chinese workers will be engaged during the construction phase and on the other hand, a total of 280 local as well as Chinese workers will be hired during operation phase of the project. The detailed break-up of the workers will be shared in manpower section of the report, The likelihood of conflict of interest within the local community stemming from the project's intervention in the nearby area. Several reasons could lead to a local conflict of interest, concerning the project activity. The project might encounter several potential sources of conflict within the community, primarily centered around resource allocation, influx of labour associated with cultural and community values, environmental impact, land use, and perceived inequities due to the operation of the project. Community members may feel that the project diverts crucial resources away from other pressing local needs, sparking friction among those who prioritize different issues.

Gender Based Violence (GBV)/ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)

During project construction phase, it's notable that a total of 35 female laborers will be engaged encompassing both skilled and unskilled categories. This reflects a departure from typical gender dynamics in similar projects, where female participation might be limited. By actively involving female workers, the project demonstrates a commitment to gender inclusivity and empowerment. This decision not only promotes equality but also acknowledges the valuable contributions that women can make in traditionally male-dominated sectors. The presence of workers in the Project sites might evoke gender-based violence activities. They are as follows:

- Harassment of women and young girls by workers at the project site.
- Disturbance of women and young girls' mobility around the Project area.
- Discrimination against women in terms of employment and applicable benefits,

It's essential to ensure that these female workers receive fair treatment, including equal pay, safe working conditions, and opportunities for advancement, thus fostering a more inclusive and equitable work environment. However, it's crucial to design an appropriate mitigation measure considering specific sensitivities and potential impacts associated with gender-based violence issue throughout the project life-cycle.

Children's Rights

The proximity of primary and high schools to the project area raises concerns about child labor employment. There is a heightened risk of child labor during the construction period, as vulnerable children might be drawn into exploitative work situations instead of attending school. It's imperative to implement comprehensive mitigation measures to safeguard the well-being of children, including strict adherence to safety protocols, minimizing noise and air pollution, and implementing robust child labor monitoring and prevention mechanisms. Additionally, close coordination with local authorities, schools, and community stakeholders is essential to address any emerging issues promptly and ensure the protection of children's rights and welfare throughout the project duration.

Infectious Diseases, such as HIV/AIDS

During pre-construction and construction phase, a lot of migrant workers flow into the sites is anticipated, that may give rise to the incidence of potential HIV/AIDS infections or any other infectious disease that can spread among local people.

During operation phase, about 280 people (skilled and unskilled) will be involved in the plant operation and the likelihood of their engagement with the local community can spread infectious diseases amongst local community and plant as well.

Occupational Health and Safety

At the backdrop of WtE project, occupational health and safety issue happens to be a significant component. The potential threat lies in handling and processing of hazardous materials present in the waste collection area and exposure to toxic substances can pose immediate risks to workers' health if proper safety measures aren't in place. Moreover, the operation of heavy machinery and equipment in the project might witness the risks of accidents and injuries if not managed carefully. Even, the combustion process itself can generate pollutant and emissions, if not controlled effectively, may comprise air quality both within the facility and surrounding areas, that may impact the health and performance of the workers.

To address these potential threats, a comprehensive risk assessment, safety protocols, ongoing monitoring and continuous improvement initiatives need to be ensured to safeguard the well-being of the workers and local environment to promote sustainable waste management practices.

Community Health and Safety

Considering the importance of community health and safety with respect to WtE Project is crucial as the project has potential to impact air, water and soil quality as well as pose risks from transportation and handling of waste materials. Possible sources of impacts on community health and safety during the construction phase are Changes in environmental quality due to construction activities along with increased prevalence of infectious diseases arising from the influx of construction workers, and Heavy traffic movement. Even, during operation phase of the project, the main sources of impact on community health and safety are Noise from the power plant, Vehicular movement, Gaseous emissions from the power plant, Accidental leakage of untreated water or leachate, unwanted odor, etc Therefore, prioritizing the importance of community health and safety involves implementing a robust pollution control measures ensuring proper waste management protocols.

E-7 Consultation with Stakeholders

Several types of stakeholder consultations like PCM, Focus Group Discussion (FGD), and Key Informants Interview (KII) have been conducted in surrounding areas of the project. The details of stakeholder consultation have been given in Chapter 7.

The community welcomes the proposed project and is supportive. Their main livelihoods are business and mixed farming, primarily growing rice and vegetables, and raising livestock like cattle, sheep, goats, and poultry. They prefer cash compensation for land and expect job opportunities based on their skills.

While content with the compensation, some request additional funds for crop loss. Land ownership is mostly inherited or bought with cash. Transactions are often informal. The community is concerned about pollution and odor management.

In Baliarpur, women primarily handle household chores, and some engage in business and private jobs. With 80% having completed primary education, many girls drop out due to economic hardships, often marrying by age 19-20. There are no reports of domestic violence. Women are excluded from community decision-making but express interest in gender-wise employment and vocational training. They also seek odor control from project-related waste.

Non-title business owners near the landfill are aware of the project and its impact. Despite disruptions, they support the project for national betterment and improved waste management. Construction evicted their structures. Anticipating business growth from labor influx, they wish to remain undisturbed. These small businesses, including tea shops, a food stall, and a mobile recharge shop, generate monthly incomes of 15,000-30,000 BDT. Only one owner holds a trade license. They seek alternative income or project employment if businesses shut down.

Rag picking at the landfill, restricted by security guards, involves about 40 men and women who sell collected items like plastic, metal, and glass, earning an average of 200-300 BDT daily per person. The monsoon season hampers their activity. The construction project threatens their access and income, exacerbating sanitation and hygiene issues. No children were found in rag picking activity, but some accompany parents. Many live- in slums 5-7 km away from the landfill site. They seek safer, alternative income sources, with some showing interest in project-related jobs despite lacking experience. Women face additional health and hygiene challenges and are unaware of employment opportunities within the project.

Public consultation was held on 30th August 2022 at Jamuna Natural Park, Baliarpur, Savar, Dhaka. The proceedings commenced at 10:30 am and was presided by Md Saiful Islam, Chairman Bangoan Union of Savar Upazila. The meeting was attended by a total of 65 people (Attendance sheet have been attached in Appendix D-2), which represent the elected representatives of Bongaon Union, non-government organization, land affected people, local people including women and senior citizen, local businessman, employees, and shopkeepers of project area.

E-8 Grievance Redress Mechanism

The GRM has been developed with the intention of it being an effective tool for early identification, assessment, and resolution of complaints during project entire life cycle of the project. It is a means through which acceptance, assessment and resolution of community and workers complaints concerning the performance or behavior of the project proponent are ascertained and addressed. There can be a range of issues arising during a project phase. Some of these issues could be related to

- Compensation payment (if any PAPs is not satisfied with the given compensation can raise grievance to the project authority through GM process),
- Issues related to non-titled holder (structures owners) regarding their relocation and shifting cost
- Any issues raised by non-titled holder (structures owners)
- Failure to fulfil commitments,
- Poor management of construction activities,
- Accidents due to the inappropriate planning of vehicle movement,
- Cultural conflicts between migrant workers and local communities,
- Disturbance due to excessive noise or other nuisance during construction or operation to unfair treatment of workers or unsafe working conditions.
- Community health and safety related issues.
- Gender based violence and Child Labor

- Workers might express work-related grievances towards contractors.

Hence, a robust GRM is required that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution.

To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a GRM is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns.

Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective actions proposed using understandable and transparent processes that are gender-responsive, culturally appropriate, and readily accessible to all segments of the affected people. The responsibility for addressing the grievances along with proper timelines will be indicated. Records of grievances received, corrective actions taken, and their outcomes will be properly maintained.

The Project Implementation Unit (PIU) shall make the public aware of the GRM with the support of PIU through methods such as public awareness campaigns. Grievances can be filed in writing or by phone with any member of the PIU.

Project-affected People's Mechanism: People who believe they have been or are likely to be adversely affected by a failure of the Bank to implement the Environmental and Social Policy (ESP) may submit complaints to the Bank's PPM in accordance with the Policy on the PPM, when their Project related concerns cannot be addressed satisfactorily through Project-level GRMs or the Bank's management processes. The Bank requires all Clients to inform Project-affected people about the availability of the PPM. Information on the availability of the PPM is provided in an accessible and understandable manner in locally appropriate language(s), including on the Client's (or beneficiary's) Project-related website.

Use of Co-financier's Independent Accountability Mechanism. If the Project is financed with another MDB, bilateral development organization or other development finance institution, and the Bank agrees to the application of the environmental and social policies and procedures of the co-financier (in lieu of the ESP) to the Project, the Bank may also agree to rely on the IAM of such co-financier (in lieu of the PPM) to handle submissions from Project-affected people.

E-9 Environmental and Social Management and Monitoring Plan

A number of mitigation measures to manage potential impacts and recommendations to enhance benefits are captured in the ESMP. A standalone ESMF report has been prepared for transmission line. The ESMP also includes the following:

Environmental and Social Mitigation Plan	Environmental and Social Monitoring Plan

The ESMP and other plans will be implemented during the construction and operation of the project. The ESMP takes each of the impacts identified in the impact assessment of the ESIA and sets out the management/mitigation measures needed to deal with the impacts as well as describes the responsibility for implementing these.

Environmental and Social Monitoring Program

Environmental monitoring will help in:

- Assessing the changes in environmental conditions.
- Monitoring the effective implementation of mitigation measures.
- Measuring and deterioration of environmental quality for further preventive action(s).

The following monitoring programs are to be carried out at the project to meet the above objectives:

- Ambient air and noise, water, soil, and sediment quality
- Emission and discharge from the plant
- HSE audits
- Social parameters
- Inspection of prevention and control measures.

Details of the environmental monitoring plan have been depicted in the section 10.8 of this report.

Institutional Setting and Implementation Arrangement

The overall management and coordination of the Project will be the responsibility of the Project Manager of WTE Power Plant North Dhaka Private Limited. The Contractor shall ensure that the ESMP (for the project) is implemented, the performance of which will be evaluated by WTE Power Plant North Dhaka Private Limited from time to time. The Contractor shall also be responsible for provisioning adequate arrangements and resources for implementing the corrective action developed as part of the internal and external audit reports developed from time to time. Institutional Setting and Implementation Arrangement are described in detail in section 10.9 of this report.

Environmental and Social Budget

The Contractor will allocate a separate budget for environmental and social management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring, and capacity building. It should be noted that the cost for many in-built mitigation measures, such as dust management, traffic management, construction safety, etc., are already included in the construction cost estimate and/or operating cost estimates. The overall costs of the ESMP will comprise:

- Environmental and Social monitoring through sample collection and analysis.
- Any remedial measures necessary to reduce or avoid environmental and social damage.
- Designing and implementing all mitigating and enhancement measures.

The preconstruction and construction stage environmental and social management budget are 6.3 million (BDT)/year and operation stage environmental and social management budget is 10.8 million (BDT). Environmental and Social Monitoring Cost during construction and operation stage/year are estimated 5.256million (BDT). This budget does not include the decommissioning stage since the minimum operation period is 20 years and the rate will vary largely from the present cost. Environmental and Social mitigation measures and monitoring budget detail has been shown in Section 10.10 of this report.

Reporting and Documentation

WTE Power Plant North Dhaka Private Limited will develop and implement a program of reporting across all stages of the project cycle. Assigned personnel shall be required to fully comply with the reporting program in terms of both timely submissions of reports as per an acceptable level of detail. Reporting will be done in the form of an environmental check list, incident record register, grievances redressal and environmental and social performance reports (monthly, quarterly, yearly, etc.)

E-10 Conclusion

The conclusion chapter of the project summaries key findings identifies environmental and social impact and recommends mitigation measures to ensure sustainable development and regulatory compliance. It outlines the project's potential benefits and emphasizes the importance of ongoing monitoring and stakeholder engagement for effective implementation.

Waste to energy (WtE) Project can play a vital role in fulfilling the country's future electricity demands as it provides Bangladesh with a newly opened, huge opportunity to deploy a viable yet sustainable alternative to reduce waste generation and provide power supply to the national grid.

This project is classified 'A' category in accordance with AIIB's environmental and social framework requiring the preparation of an Environmental and Social Impact Assessment Report. As per the Environmental Conservation Act, 1995 and the Department of Environment (DoE) of Bangladesh.

This environmental and social impact assessment of the Project has been prepared based on an understanding of the technical specifications of the Project, existing studies and reports relevant to the project, a scoping exercise, site visits, stakeholder consultations, baseline environmental monitoring, and socio-economic surveys which were undertaken between July 2022 and August 2022. Through this process, an assessment has been made of the potential environmental and social impacts attributable to the construction and operation phases of the Project. Qualitative and quantitative (where possible) assessments of impacts have been presented with an impact rating against each potential impact and mitigation measures to minimize and reduce the impacts.

Many of the impacts are localized and short-term or temporary in nature and can be effectively readily addressed by some embedded control measures in the engineering design of the Project as well as mitigation measures as suggested in the Environmental and Social Management Plan. The Project received favorable support from local people and other stakeholders during consultations. Stakeholders appreciated that in addition to providing a reliable power supply to the region, the Project will have several other benefits such as supporting economic growth in the region by opening avenues for further development, employment (direct and indirect), improving local infrastructure and existing problems due to the current landfill system such as reducing community health risk, bad odors, impacts on water and soil quality.

A total of 30 acres of which 29.6485 acres are private land and 0.3515 acres of khas land will need to be acquired for the proposed power plant. As per the joint verification list of the DC office, 242 landowners have been affected by the project interventions and out of total landowners, 59.36% landowners have been awarded compensation as per ARIPA,2017 Act and project proponent has taken proactive steps in awarding remaining landowners in collaboration with DNCC and DC office. have been awarded. awarded. Two business entities have been identified there with other associated facilities and 5 non-titled holders have been found impacted due to the land acquisition activity. A list of 40 rag-pickers have been shared by DNCC to address the issue of livelihood loss due the project under proposed livelihood restoration plan for impacted vulnerable individuals. The effective implementation of GRM and SEP will ensure project success as per project's objectives. The outcome of community consultation has confirmed positive feedback of the community concerning the project. The Project is not located near any protected areas; there are no critical habitats present within Project AOI. No archaeological or protected monuments are located in the Project vicinity. The nearest settlement (Nandonik Housing Society) is located over 200 m from the Project. During the construction phase of the Project, the key environmental issues are noise and dust generation. There is also a risk of contamination of soil, groundwater, and the Karnatali River from accidental spills and leaks of hazardous materials (e.g., oil) during handling, transportation, and storage at the site. The adverse impacts identified are generally manageable through good housekeeping and diligent implementation of the ESMP by the EPC Contractor and its supervision by the Project Developer and their team of consultants. The nearest air quality and noise-sensitive receptors will be a focus for monitoring of any impact arising due to the construction activities.

During the construction phase, there will be an impact from the migration of labor into the project area, construction activities, and increased movement of road traffic. The range of impacts identified includes conflicts with the local community, health and safety issues inconvenience due to vehicle movements, risk of spread of communicable and sexually transmitted diseases, waste disposal, and unhygienic conditions. The magnitude and significance of most of these impacts would be limited to the construction period, with limited spillover to the operation phase. Furthermore, by implementing the recommended mitigation measures the project will minimize the identified risks whereas on-going consultation and engagement will support the maintenance of a harmonious relation with the local

community. Community health and safety-related impacts will be managed at the source to reduce the footprint. By adopting the mitigation measures as suggested in the ESMP and systematic participatory approach to involve the community would further minimize these impacts.

During the operation phase, the project will have potential impacts on ambient air quality, odor pollution, water quality, noise, traffic, and occupational and community health and safety. The proposed power plant can be considered located in a mixed area interspersed with residential and commercial uses. There are many brickfields and the Dhaka-Aricha highway roads contributing to emissions within the same airshed (10kmX10km study area). Moreover, air pollution coming outside the project grid, transboundary air pollution and local construction works, paved and unpaved road, residential cooking, river vehicle, and city vehicular movement is contributing to the air pollution of the airshed. The proposed power plant has four sets of incinerators and waste heat boilers. A major source of the plant is NO2, SO2, CO, and Particulate Matter. Besides the criteria pollutants, the plant will also contribute heavy metals (Pb+Cr, Hg), HCL, Hydrogen Fluoride (HF), and Dioxin Furan (DF) to the atmosphere. The project will have different flue gas treatment systems. The flue gas treatment process is to remove pollutants such as soot, acidic gases (HCl, HF, SO2 as well as NO2, etc.), heavy metals (Hg, Pb, Cr, etc.) and dioxins from the flue gas emission according to flue gas standards to meet the emission standards of the project. The generation of flue gas includes different kinds of air pollutants which are harmful to the local air quality. Continuous emission monitoring from the stacks and periodic ambient air quality monitoring throughout operations will confirm compliance to the applicable standards/ guidelines and enable the identification of further measures to reduce the impact. Incremental noise levels due to the operation of the Plant will meet the applicable GOB standards/IFC guidelines for industrial areas. Discharges from the proposed project's operation activities are likely to have an impact throughout the project life, and likely to pose a significant impact on the surface water quality, if discharged without adequate treatment and mitigation measures.

The proposed project necessitates the utilization of three bore/tube wells during the dry season to meet its water requirements. To mitigate potential environmental risks associated with groundwater extraction, such as groundwater depletion, the project will implement a comprehensive set of mitigation measures. These include regulated extraction rates, continuous groundwater monitoring, and the adoption of water conservation practices across all project operations. Potential social impacts, particularly concerning water accessibility for local communities, will be addressed through transparent communication and the establishment of a robust grievance redress mechanism. This will ensure that stakeholder concerns are promptly acknowledged and addressed through appropriate channels. The project will stringently comply with all relevant environmental regulations and obtain the necessary permits for bore/tube well drilling and operation. Ongoing engagement with local communities, promotion of sustainable water uses practices, and continuous environmental monitoring will be essential components of the project's implementation strategy. These measures will contribute to ensuring the project's overall success while minimizing environmental impacts.

To mitigate the risks of avian collisions along the proposed transmission line (TL) route, particularly at the locations where it crosses the Karnatali River twice, the project proponent will implement the installation of colored discs/bird diverters. These highly visible diverters, characterized by their bright and contrasting colors, will be strategically placed at regular intervals along the transmission lines. This approach aims to enhance the visibility of the transmission lines for birds, thereby reducing the likelihood of collisions. Regular maintenance and monitoring activities will be undertaken to ensure the continued effectiveness of the installed bird diverters. The implementation of this mitigation measure will contribute to the protection of local bird populations and ensure compliance with relevant environmental regulations governing avian safety. The project proponent's commitment to adopting effective mitigation strategies, such as the installation of bird diverters, underscores their dedication to minimizing the environmental impacts associated with the project activities and promoting sustainable practices throughout the project's lifecycle.

The effective implementation of the ESMP and adherence with the GOB and international guidelines will assist in minimizing the environmental and social impacts to acceptable levels. Post-environmental assessment, surveillance, and monitoring are essential to track and sustain the effectiveness of the mitigation measures suggested. A detailed monitoring plan has been prepared as part of the ESMP. The focus areas of monitoring cover air, surface water quality, groundwater quality, noise, soil and sediment, occupational health, and safety as well as community health and safety. The reporting requirements along with the follow-up actions in case of deviation from the norms have been detailed in the ESMP. The frequency has also been set in consideration of the likely impacts.

The construction phase of the Project will have an important role in the socioeconomic development of the area, whereas the operation phase of the Project will play an important role by supplying power in the region and will reduce the problem associated with the disposal of unprocessed waste as a landfill.A reliable and expanded power supply will support the future economic development of dependent sectors including agriculture, industry, and manufacturing enabling them to operate and compete. Based on the analysis conducted in this environmental and social assessment, it is concluded that overall, the Project will result in positive socio-economic benefits and the negative environmental impacts that have been identified are mostly short-term and localized in nature, and can be minimized adequately through good design, appropriate application of mitigation measures and regular supervision of implementation.

All the identified issues and gaps associated with the WtE project will be addressed under ESMP alighting with applicable national and AIIB's 2022 guidelines towards sustainable implementation sustainable implementation of the project while enhancing environmental and social accountability from development perspective in the project area.

EQMS would like to recommend WTE Power Plant North Dhaka Private Limited to implement the ESMP mentioned in this ESIA report to safeguard the environment and society.

1 INTRODUCTION

CMEC and Waste-to-Energy (WtE) Power Plant North Dhaka Private Limited (the Client or Project Company) are investors proposing a 42.5 MW waste-to-energy project in Dhaka, Bangladesh. The project is being developed by WtE Power Plant North Dhaka Private Limited and will be constructed on vacant land provided by the DNCC, situated on the right bank of the Karnatali River within the Bongaon Union administrative area of Savar Upazila district in Dhaka. The project will consist of four incinerators with waste heat boilers and two steam turbine generator (STG) units and is planned to commence commercial operation on October 31, 2025.

CMEC is the EPC contractor for the project. Municipal Solid Waste (MSW) will be provided to the project by Dhaka North City Corporation (DNCC) under the Waste Supply Agreement (WSA). The Aminbazar waste-to-energy plant will require an input of approximately 3,000 metric tons of municipal solid waste per day to sustain its energy generation process. The project will sell electricity to Bangladesh Power Development Board (BPDB) under a PPA. The proposed project will use a dual-circuit 132 kilovolt (kV) transmission line to establish connectivity with the Savar 132/33 kV substation, with a total length of approximately 5.99 kilometers.

1.1 Background

Waste is an inevitable byproduct of human activities such as economic development, urbanization, and improving living standards in cities. As a result, there has been an increase in the quantity and complexity of generated waste. The rapid growth of population and industrialization has led to degradation of the urban environment and placed serious stress on natural resources, which undermines equitable and sustainable development. In most cities of the developing world, inefficient management and disposal of solid waste is an obvious cause of environmental degradation. Municipal corporations in developing countries are not equipped to handle the increasing quantities of waste, resulting in uncollected waste on roads and other public places. Therefore, there is a need to work towards a sustainable waste management system that incorporates environmental, institutional, financial, economic, and social sustainability. Waste to Energy technology is a well-known method for sustainable waste management.

Dhaka, the capital city of Bangladesh, is rapidly expanding, turning it into a mega city with a high growth rate of around 6 percent per year. Solid waste is being generated at a faster pace, posing a serious management threat. The rapid growth of industries, lack of financial resources, inadequate trained manpower, inappropriate technology, and lack of community awareness are the major constraints of solid waste management for the fast-growing metropolis of Dhaka. City dwellers demand a healthy life, a cleaner city, and a better environment, but the municipality is traditionally funded for solid waste services from the municipal tax system for waste collection and disposal.

The proposed power plant has a capacity of 42.5 MW and is expected to generate electricity from solid waste of 3,000 MT collected from DNCC areas. This project is in pre-construction phase at the time of carrying out site assessment.

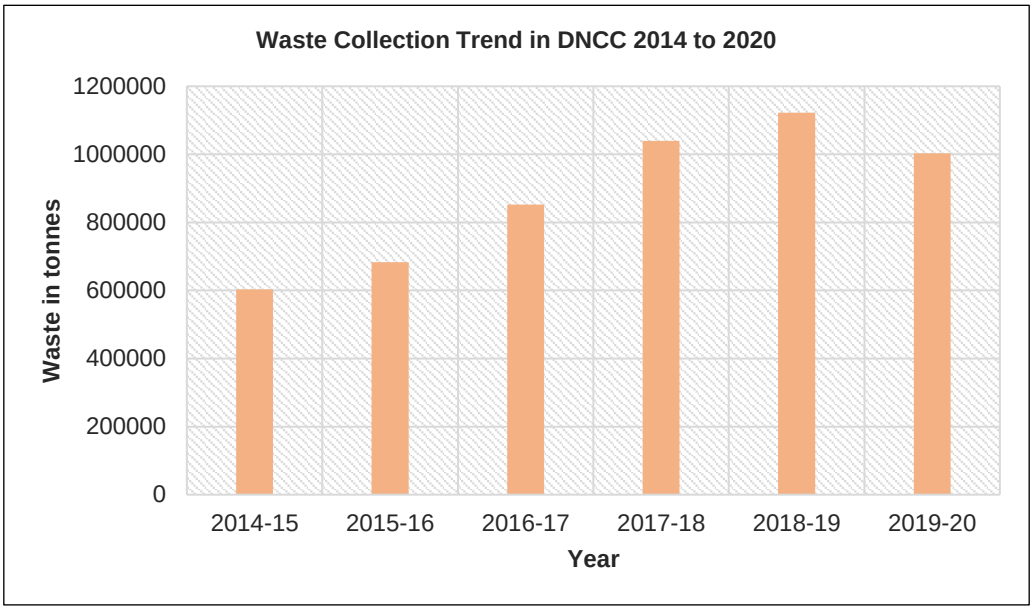
1.2 Brief Description

Improper disposal and lack of timely and effective treatment of municipal solid waste in the northern part of Dhaka has resulted in serious environmental and ecological issues. As the urban population continues to grow annually, the volume of solid waste generated has also increased, negatively impacting citizens' quality of life and hindering the city's development. Prior to 2015, designated and undesignated sites across northern Dhaka's streets were used for indiscriminate waste disposal, including large concrete containers utilized to store waste at public spaces, sidewalks, or roadside locations. Informal waste pickers often operated near these uncontrolled dumping grounds. These substandard municipal waste management practices caused environmental degradation and frequently

obstructed traffic flow. Unfortunately, these issues did not receive official attention until the incumbent mayor took office. However, government entities, relevant political parties, and the general public are now urging action to resolve these longstanding solid waste problems. One of the mayor's election manifestos this year is "Clean Dhaka". Since September 2016, DNCC has consistently addressed these issues. Although neighborhood avoidance is encountered during the process of practice, 51 transfer stations have been built within the scope of the project to quickly transfer garbage to living areas and greatly improve the urban environment.

After improving the management of garbage in the field of collection and transportation, final disposal of garbage has become a more important issue. The Amin Bazar landfill is the only treatment facility corresponding to the DNCC service area. Construction began in 2005, and it has been in operation since 2006, covering an area of about 53 acres. Currently, the landfill is only in operation in DNCC. The Waste collection trend in tones in DNCC from 2014 to 2020 is given in Figure 1-1.

Figure 1-1: Waste collection trend in tones in DNCC from 2014 to 2020



Source: Dhaka North City Corporation (DNCC) Waste Report (FY 2014-15 to FY 2019-20)

Between 2014-2018, a total of 177,870 tons of garbage were dumped. For the period 2016-2017, 852,390 tons were disposed of in the landfill, and for the period 2017-2018, 1,039,331 tons were disposed of, with a growth rate as high as 21.9%. During the 2019-20 fiscal year, a total of 1,002,561 waste were generated, and currently, the dump has reached a height of 30 feet. After 2018, garbage should be stacked at a height of 60 feet to make full use of the vertical space. Landfills play a vital role in garbage management, but the tangible economic cost of original garbage dumping is very low, while the invisible environmental cost is very high, mainly due to the pressure on land. If the landfill continues to be used between 2020 and 2035, DNCC will need 300-400 acres of land, which is a difficult task for land requisition.

To address this issue, proposed power plant with capacity of 42.5 MW is being considered. The plant will be constructed on vacant land provided by DNCC located on the right bank of the Karnatali River, in the Bongaon Union of Savar Upazila under Dhaka District. When the Aminbazar waste-to-energy plant is operational, it will require approximately 3,000 metric tons of garbage every day. The proposed intervention is expected to not only improve the city's long-term electricity generation and power supply capacity but also improve waste management practices in the DNCC area. The proposed waste-to-energy plant may significantly reduce the amount of garbage lying indiscriminately along the roadsides, drains, green spaces, etc., including open dumps and unplanned burning, which results in emission of smokes, Volatile Organic Carbon (VOC), NOx, CO2, Furan, etc. in the present scenario. This may also

contribute to reducing the waterlogging crisis during peak monsoon and improving environmental health in the DNCC area.

The proposed power plant has a capacity of 42.5 MW, expected to be generated from solid waste of 3,000 MT collected from the DNCC areas.

1.3 Rationale of the Project

The proliferation of infrastructure developments such as shopping malls, restaurants, markets, and bazaars, coupled with the presence of roadside tea stalls, mobile vendors, and sidewalk flower shops within the Dhaka North City Corporation area, has resulted in a year-over-year increase in the quantity of municipal solid waste generated. The total area of DNCC is 196.23 square kilometers, and the current population is 6.1 million. According to the DNCC waste report 2019-20, 3,433 tons of waste are generated every day, and about 1,002,561 tons of waste were generated in FY 2019-20. The waste is disposed of at only one location, the Aminbazar landfill, which requires more land at the existing landfill site and is increasing year over year. This landfill site poses major environmental and social concerns, including community health risks, bad odors, and impacts on water and soil quality. The increased generation of methane (CH4) from this MSW is alarming because it is 34 times stronger than carbon dioxide. Bangladesh's methane gas plumes cause alarm as the country is found to be a major emitter of CH4 originating from a combination of rice paddy fields, landfills, leaky natural gas pipelines, and coal stockpiles.

To address this issue, the Waste to Energy (WtE) strategy for MSW management in urban areas is a promising option, as it not only reduces the land pressure problem but also generates electricity and green jobs. With the operation of the proposed project, the electricity will be generated using municipal waste collected by DNCC. This project not only highlights an effort to enrich the country's power generation towards sustainable waste management initiatives, but it will also reduce excessive exploitation of existing landfill storage capacity, leading to reduced incidences of land pressure and environmental and health safety impacts from ongoing waste generation activity.

1.4 Scope of ESIA Study

The key objective of this assignment is to conduct ESIA with a view to identify the critical environmental, ecological and social concerns of the proposed WtE power plant and transmission line and address them as an integral part of project design.

The specific scope of work includes:

- To assess the existing environment and social status in the study area and area of influence and to identify issues which have potential to adversely impact important environmental, ecological and social features of the project influence area. As per the scope of work, the impacts of the Project are assessed for the pre-construction, construction and operation phases of the Project;
- Analyse the proposed project area and transmission line route, along with the documentation of sensitive receptors in the vicinity of proposed project site and transmission line route;
- Identify and review the applicable local, state, national and international environmental and social legislation and regulatory framework;
- Collect and analyse baseline information for physical, biological and social environment through primary and secondary information;
- Stakeholder analysis (key expectations, impacts, issues as related to each stakeholder) and public consultations;
- Assess positive and negative social and environmental impacts/risks likely to occur for different people or groups as a result of project interventions and suggest measures to avoid/ minimize/ mitigate negative impacts and derive the maximum from positive impacts. The cumulative

impacts of the whole Project, i.e. power plant and transmission line on physical environment, social and biodiversity are covered in the relevant sections of this report, along with impacts due to land procurement for the whole Project.

- To prepare an ESMP including the description of relevant activities, mitigation measures, institutional arrangements for implementation of ESMP, identify portions of the codes of practice/management framework that need to be integrated with the bidding documents to ensure that the prospective Bidders are aware of what all will be required during project implementation and operation from an environmental, health and safety, as well as social perspective

1.4.1 Scope of Work

The detailed scope of the ESIA study is as outlined below:

- Screening of the Project based on applicable reference framework based on reconnaissance survey and desk-based review of Project documents.
- Scoping for the ESIA study.
- General description of the proposed project.
- Review and compilation of relevant national rules, legislation, guidelines, and standards.
- Environmental, Social & Ecological baseline data collection from the project study area.
- Air dispersion modeling, Noise modeling.
- GBV baseline data and assessment of GBV Risk in Projects supported by AIIB Financings.
- Alternative Analysis for the proposed project.
- Assess the proposed activities to identify their potential impacts, evaluate the impacts and determine their significance.
- Preparation of an Emergency Response Plan.
- Delineation of ESMP including mitigation measures and monitoring plan for effective implementation of mitigation measures by the project personnel during different phases of the project.
- Institutional framework for managing ESMP.
- Stakeholder Identification and Information Disclosure
- Public consultation (PC)
- Grievance Redress Mechanism
- Submission of Draft ESIA report and corresponding management plans.
- Final ESIA report submission

1.4.2 Applicable Reference Framework

The applicable reference framework for this study includes:

- Environment Conservation Act, 1995 and its subsequent amendments
- Environment Conservation Rules, 2023 for Bangladesh
- EIA Guideline for Industries 2021 for Bangladesh
- Acquisition and Requisition of Immovable Property Act (ARIPA) 2017
- Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) requirements, 2022.
- IFC Performance Standards (PS) on Social and Environmental Sustainability 2012.
- World Bank Group General Environmental, Health and Safety Guidelines, 2007.
- EU Commission
- Environmental, Health, and Safety Guidelines for Waste Management Facilities, 2007.
- Other guidelines and standards are practiced by the Department of Environment (DOE), Bangladesh.

1.5 Approach and Methodology

The approach and methodology of an ESIA study plays a pivotal role in ensuring the sustainable operation of the WtE project. Based on the above Scope of Work, the ESIA study has been carried out using a systematic process that can predict and evaluate impacts that may arise from the project on various environmental aspects e.g., physical environment, biological environment, and socio-economic environment. This study would be based on the review of the available project-related information and including primary and secondary baseline environment and social data, prediction, and evaluation of impacts of significance. The methodology employed in an ESIA study involves review of project related information including primary as well as secondary baseline environment and social data, predictive modeling, risk assessment and scenario analysis and assess potential impacts under varying conditions. Based on the evaluation of the impact, mitigation measures have been identified and a management plan has been prepared through which the project can avoid, minimize, mitigate, and compensate for the adverse impact and enhance the positive impact on the surrounding environment. The approach proposed for conducting the Environmental and Social Impact Assessment (ESIA) study for the selected project is presented in Figure 1-2.

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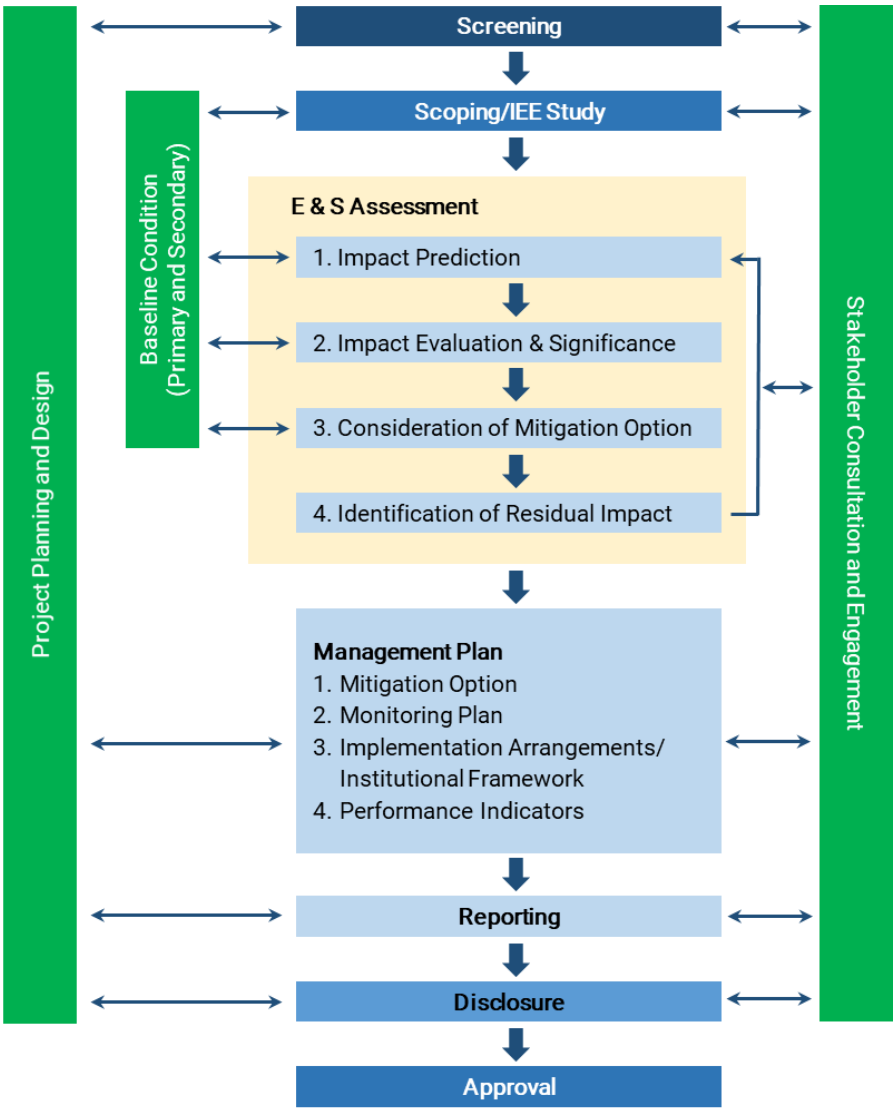
Figure 1-2: Approach to the ESIA Study



Source: EQMS

The various tasks under the ESIA study are depicted in Table 1-1 below:

Table1-1: Tasks Undertaken for the ESIA Study

Task Number	Task
Task-1	Kick-off Meeting
Task-2	Project Description
Task-3	Analysis of alternatives
Task-4	Environmental and Social Baseline Conditions
Task-5	Environmental and Social Impact Assessment
Task-6	Development of ESMP
Task-7	Stakeholder consultation and information disclosure
Task-8	Preparation of Draft ESIA Report
Task-9	Preparation of Final ESIA Report

1.5.1.1 Task-1: Kick-off Meeting and Team Mobilization

Immediately following the completion of the contract negotiation and contract signing, the proponent, together with the project manager completed all logistical arrangements. In accordance with the EQMS quality requirements, the project manager formalizes team briefing notes outlining the scope of work and outputs required from each of the team members. A kick-off meeting was held online on 16 March 2022 with the officials of the client for understanding and major objectives of the project, project details, activities, status, project milestones, legal requirements, scope, etc.

1.5.1.2 Task-2: Project Description

A section on the project description was prepared. This was developed to the level of detail needed to adequately understand potentially significant project impacts. This covered project location, size, schedule, implementation arrangements, and information inventories and maps using appropriate scales.

1.5.1.3 Task-3: Analysis of Alternatives

An analysis of alternatives, including benefits due to the proposed project versus no project scenario and best technology analysis was considered. This requires close liaison with client contract personnel to understand the alternatives and decision-making processes considered to date.

1.5.1.4 Task-4: Environmental and Social Baseline Conditions

An expert team from EQMS Consulting Limited was engaged to carry out environmental and social baseline data collection from April 2022 to August 2022. Socio-economic data collection and consultations with the local community and other government departments were conducted at the same time. Secondary data were collected from different government departments, local bodies, and through literature review, etc. All the data were compiled and compared against applicable standards and presented in the ESIA report. Environmental and social baselines studies include the following:

- Meteorological data at the project site.
- Ambient Air Quality.
- Ambient Noise Level.
- Water Resources and Quality - both surface and groundwater.
- Soil Quality.
- Sediment Quality
- Flood Risks Events
- Ecology - covering terrestrial and aquatic flora and fauna, habitats, and ecologically sensitive spots within the project site and surrounding areas.
- Road network and Traffic factor.
- Prevailing land use.
- Socio-economics, Health, and Aesthetics

1.5.1.4.1 Primary Baseline Data Collection

With the assistance of the WTE Power Plant North Dhaka Private Limited, EQMS has identified an accredited environmental laboratory of repute which was engaged in the analysis of the collected environmental quality samples on ambient air quality, surface water quality, groundwater quality, ambient noise level, Phytoplankton, Zooplankton, Benthos and soil and sediment quality as per aspects detailed in Table 1-2.

Table 1-2: Environmental and Social Monitoring for the project

SL#	Environmental / Social attribute	Parameters	No of locations	Frequency	Remarks
1.	Ambient Air Quality (AAQ)	PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, O_3	8 locations	8 locations, 6 weeks, twice a week	AAQ monitoring covers upwind, downwind, and crosswind directions and at the Project site.
2.	Surface Water Quality	DO, BOD, Temperature, Electric Conductivity (EC), Turbidity, pH, TDS, Salinity, Iron, Arsenic, Phosphate, Zinc, Chromium, Nitrate, Magnesium, Aluminium, Coper, COD, Hardness (as CaCO3), Ammonia, Ammonium, Color, TSS, Oil and Grease	4 (Dry and rainy seasons)	Two rounds (one during low flow and one during higher flow)	From the adjacent waterbody at upstream and downstream.
3.	Ground Water Quality	Temperature, Electric Conductivity (EC), Turbidity, pH, TDS, DO, Salinity, Iron, Fluoride, Arsenic, Total Coliform, Faecal Coliform, Chloride, Total Alkalinity, Total Hardness	4 (Dry and rainy seasons)	Two rounds (one from low aquifer water tables and one from high aquifer water tables)	Ground Water Quality of the study area and surroundings.
4.	Noise level	24-hour Leq_{day} and Leq_{night}	6 locations	Total 12 during the dry and wet season	6 places according to Noise Pollution (Control) Rules 2006 and IFC Environmental, Health and Safety(EHS) guideline
5.	Ecology	Flora and fauna, Habitat/Forests, ecologically sensitive areas, Others	Project site		In and around 1 km of the proposed power plant.
6.	Soil Quality	Particle Size Distribution, Texture, Cation Exchange	2 locations	Total 4 during the	-

SL#	Environmental / Social attribute	Parameters	No of locations	Frequency	Remarks
		Capacity, Permeability, Porosity, pH, Salinity, Potassium, Nitrogen (Total), Phosphorus, Iron, Sodium, Calcium, Magnesium, Cadmium, Chromium		dry and wet season	
7.	Sediment Quality	pH, Nitrogen (Total), Potassium, Calcium, Magnesium, Sodium, Phosphorus, Iron, Zinc (Zn), Cadmium	2 locations	Total 4 during the dry and wet season	-
8.	Phytoplankton, Zooplankton, Benthos	-	2 locations	Total 4 for each covering both dry and wet season	-
9.	Survey of impacted households for the proposed project	Household (HH) survey conducted following the landowner list procured from the respective department.	Covered project areas where landowners were available,	During ESIA study phase	Key findings of survey shared in stakeholder consultation section as reference in ESIA report.
10.	Impacted non-titled holders and identified vulnerable	Consultations were carried out adhering to AIIB's ESF guidelines	Across project locations	During ESIA study phase	RAP cann't be considered at this point as LA has been completed and compensation as well as relocation assistance has also been disbursed to impacted landowners and business units as per ARIPA,Act, 2017. But, a separate study on LIA/LRP can be proposed for

SL#	Environmental / Social attribute	Parameters	No of locations	Frequency	Remarks
					identified vulnerable impacted due to the proposed project
11.	Key Informant Interview (KII) and Focus Group Discussion (FGD)	KII and FGD were conducted following the AIIB's ESF guidelines with the relevant stakeholders at the community level.	12 locations across project area.	During ESIA study phase	Any information related to pending compensation of impacted landowners need to be incorporated in ESIA report.in collaboration with CMEC and WtE Project.
12.	Stakeholder consultation	Discussions with key stakeholders associated with the project	1 location	Once during preparation of ESIA and another, during disclosure of ESIA	Relevant government, non-government officials and local community were consulted during stakeholder consultation exercise.

1.5.1.4.2 Stakeholder Consultation

Extensive consultations were conducted with key stakeholders, including the local community, and government departments/agencies during the field visit. Stakeholder consultation was conducted with the intent of collecting baseline information on the environmental and social conditions and sensitivities, developing a better understanding of the potential impacts, informing the public of the proposed project, and to obtain an understanding of the perspectives/concerns held by stakeholders.

1.5.1.4.3 Secondary Baseline Data Collection

Secondary data were collected from the following organizations like Bangladesh Meteorological Department (BMD), Bangladesh Bureau of Statistics (BBS), Bangladesh Agricultural Research Council (BARC), Geological Survey of Bangladesh (GSB), IUCN, Space Research and Remote Sensing Organization (SPARRSO), Department of Agricultural Extension (DAE), Bangladesh Water Development Board (BWDB), Bangladesh Inland Water Transport Authority (BIWTA), and published Journals and Books for the following aspects.

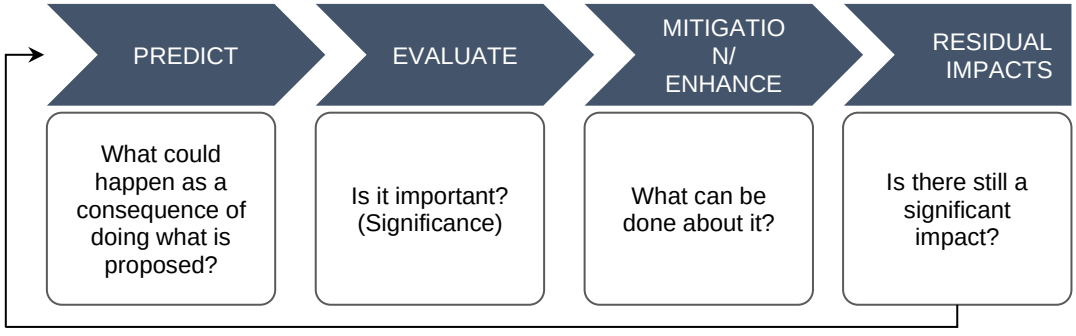
A. Physical Environment	• Regional Setting - Physiography, Geomorphology, Land Use, Geology, Drainage, Hydrology, and Soil types. • Climate and Meteorology - Climatic Pattern, Ambient Temperature, Relative Humidity, Rainfall, and Regional Wind Patterns (Wind Speed and Direction). • Hazard and Risks - Natural Hazards: Floods, Seismic Activities, Seasonal Storms and Cyclones, Salinity Intrusion, and Erosion.
B. Socio-economic Environment	• Demographic Profile • Education and Literacy • Economic Activities and Livelihood Pattern • Socio-economic Infrastructure and Indicators - Health Care Facilities - Education Facilities - Drinking-Water and Sanitation - Transportation Facilities - Sites of Cultural/Archaeological Importance
C. Ecology and Biodiversity	• IUCN Red List Status 2015 • Flora and Fauna • Biodiversity Condition • Existing Terrestrial Ecosystem • Aquatic Fauna and Vegetation

1.5.1.5 Task-5: Impact Assessment

The ESIA evaluated potential impacts using a methodology based on the evaluation of the "significance" of identified issues and impacts on baseline parameters. Analysis of the baseline results and the incremental impacts anticipated from the project in accordance with the national standards for air, water, and noise as mentioned in the ECR, 2023, Air Pollution (Control) Rules, Noise Pollution (Control) Rules, and its subsequent amendments and IFC/World Bank and AIIB guidelines.

The impact assessment covered the full project lifecycle, including pre-construction, construction, and operations activities. The impact assessment has involved the prediction, evaluation, and mitigation of impacts and report on impacts. Impact prediction was considering control measures that are part of the project design. Impact assessment process for the ESIA study is given in Figure 1-3. Additional mitigation measures have been proposed with the aim of further minimizing the potential impacts forecasted by the assessment.

Figure 1-3: Impact Assessment Process for the ESIA Study



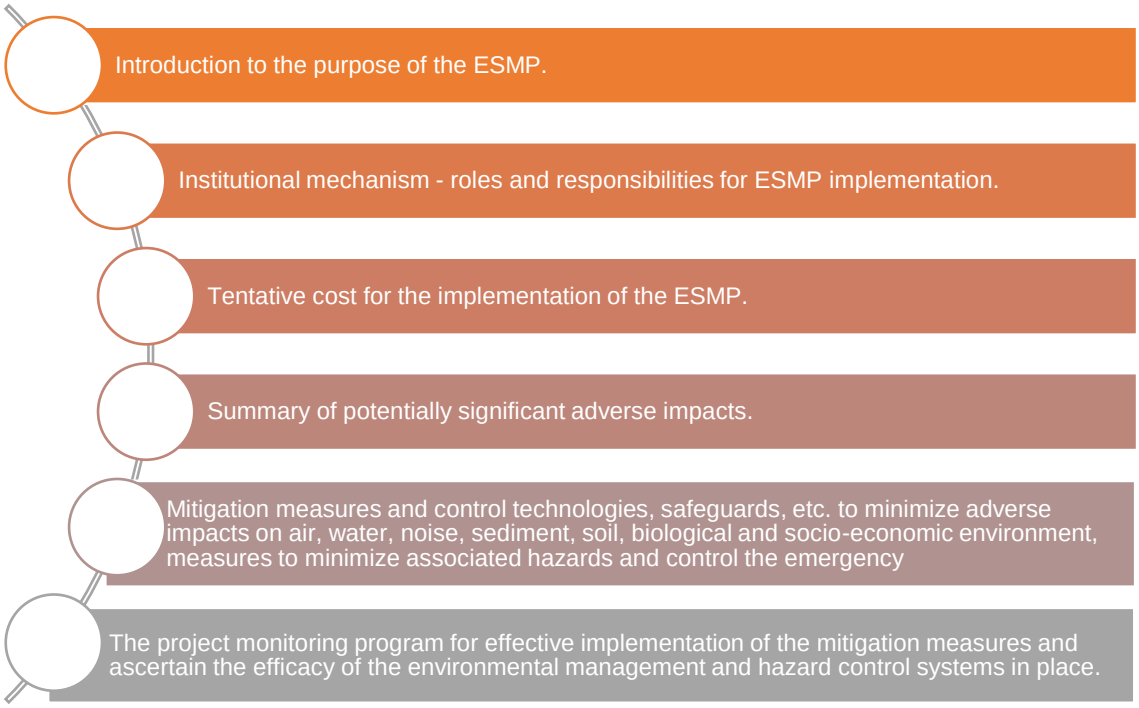
The impacts were identified and quantified for intensity using matrix techniques and evaluated as very high, high, medium-high, medium-low, low, and very low impacts on the environment and communities in the study area. Aspects that were considered in the impact assessment, for the pre-construction, construction, and operation phase of the proposed project, include land acquisition/requisition, land use, indigenous population, water quality (surface and ground), air quality, noise, ecology, waste, landscape and visual, traffic, flood and other natural disaster risks, socio-economic, occupational and community health and safety, etc.

The principal aim of this task was to identify and assess potential impacts on various environmental and social components due to the proposed project. Based on baseline data collected in the study area, information on the type and quantity of pollutants, and surveys of the study area, the EQMS ESIA team identifies and predicts potential impacts due to the proposed project on the surrounding environment during pre-construction, construction, and operation phases of the project.

The key issue, identify after collecting the baseline information. Each issue consists of components that on their own or in combination with each other, give rise to potential impacts, either positive or negative, from the project onto the environment or from the environment onto the project. In the ESIA, the significance of the potential impacts will be considered before and after identifying mitigation is implemented, for direct, indirect, and cumulative impacts, in the short and long term.

1.5.1.6 Task-6: Development of Environment and Social Management Plan (ESMP) and Environment and Social Management Framework (ESMF)

Requirements and details of the mitigation measures for minimizing identified negative impacts and enhancement measures for increasing the benefit of positive impacts are suggested in the ESMP for implementation by the client during the pre-construction, construction, and operation phases of the project. The ESMP is comprised of the following aspects based on the impacts assessed for the project:



This sets out the mitigation and management measures required during project implementation to avoid or reduce the environmental and/or social impacts, including developing the action plan in accordance with AIIB and other international framework requirements. A monitoring plan is included here, covering the type of monitoring to be done, responsible parties, schedule, standards to be used, resources, and tentative cost.

The ESMF consists of -

- Identifying potential risks and impacts of the project or activity on the environment and communities, including health and safety risks, social impacts and climate change impacts
- project activities and detail strategies to avoid or minimize the identified risks and impacts including best practices, technological solutions regulatory and international compliance
- establishing protocols for monitoring effectiveness of mitigation measures, assessing ongoing risks and impacts and reporting to stakeholders including the frequency and format of reporting
- defining mechanisms for engaging with and responding to stakeholder concerns and feedback

capacity building to outline plans to enhance the capacity of the project staff, local communities to comply with international frameworks including training, education and awareness raising activities

1.5.1.7 Task 7: Stakeholder consultation and information disclosure

Stakeholder consultation is a process of engaging with individuals, groups and community that have stake in WtE Project. This process involves actively seeking input, feedback, concerns and perspective from stakeholders concerning the project to substantiate baseline information on the environmental and social conditions and sensitivities associated with the project. It typically includes identifying relevant stakeholders such as landowners, service providers, community members, local authorities, government departments and NGOs. By engaging with stakeholders throughout the project, the project proponent can enhance its relationship and credibility leading the success of the project. A summary of the stakeholder engagement process and the profile of the respective groups and their opinions have been summarized in Chapter 7 in the ESIA report.

On the other hand, Information disclosure plays a crucial role in fostering transparency, trust and accountability in WtE project. Transparent information disclosure allows stakeholders to understand the potential impacts of the project on their environment, health and quality of life. It encourages them to voice their concerns, capture their feedback and facilitates them in the decision-making process, ultimately leading to better informed about project outcomes. Moreover, it helps in mitigating potential conflicts, reduce misinformation and foster sustainable linkages between community and project proponent.

1.5.1.8 Tasks-7 and 8: Reporting - Draft and Final ESIA Report

A draft ESIA report was prepared upon completion of the above tasks as per the prescribed TOR given by the WTE Power Plant North Dhaka Private Limited and submitted to the client for providing their comments and suggestions.

Based on one set of consolidated comments from the client, Draft ESIA will be finalized for submission to the AIIB, to get approval.

1.6 Limitation

This report has been developed mainly based on the project related information provided by WTE Power Plant North Dhaka Private Limited and other available site surrounding information within the study area defined. This ESIA is confined to the study of the potential impacts of the project on the physical, biological, and socio-economic environments of the study area. This study has been carried out by accessing data from a wide range of primary and secondary data. These include literature reviews, feasibility reports, and other documents, which have been supplemented with primary field data collection including FGD, KII and public consultations. Assessment of the Project is limited by the quantity and quality of available data. If information to the contrary is discovered or any additional project activities which is under planning or construction has been found out at a later stage and which can have any specific influence on the proposed project environmental settings individually or cumulatively, the findings in this ESIA may need to be modified accordingly. The impact assessment for the proposed Project is based on the project configuration as described in Project Description in Chapter 2.

Professional judgment and subjective interpretation of facts and observations has been applied for the preparation of the ESIA Report.

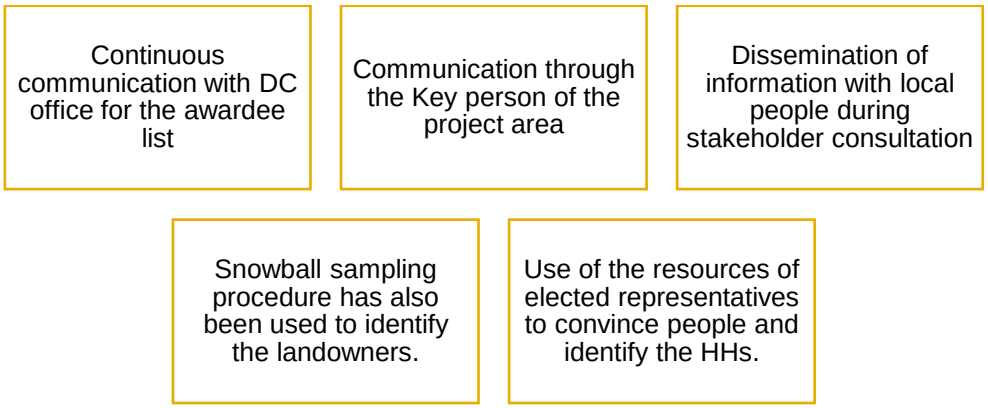
The land purchase for the transmission line is under process. The project developer will purchase the land by willing buying and willing selling method. Due to absence of the landowner details, an ESMF has been proposed during preconstruction, construction and operation of transmission line. The permanent labor camp location is not finalized yet. The EPC contractor will select a suitable location for establishing a labor camp following AIIB's ESF, 2022 guidelines. It should be ensured adequate facilities in the labor camp like housing facility with proper ventilation, electricity, separate kitchen, solid waste collection facility, drinking water facility, sanitation facility, etc. Inadequate facilities and unhygienic conditions may have impacts on the occupational health of the laborer.

Analysis was conducted on various physical and chemical water properties, such as Chemical Oxygen Demand, Temperature, Electrical Conductivity (EC), Salinity, Iron, Arsenic, Phosphate, Zinc, Nitrate, Magnesium, Aluminum, Copper, Ammonia, Ammonium, Color, and Total Suspended Solids (TSS). However, no established national standards exist for the above-mentioned parameters.

This ESIA has some limitations from social aspects. Initially, the study team identified landowners as per the provided plot index of land. After the identification of the landowner all landowners are supposed to be surveyed as a part of ESIA preparation. However, during the socio-economic census and survey 55 out of 242 number of landowners were not found due to for the following reasons:

- Inadequate information against their address as per the joint verification list provided by DC.
- Reluctant to respond as most of the respondents have already received compensation from DC office.
- Not available at the present address stipulated in the gazette prepared and published by government.
- People involved in litigation have been advised by their legal advisor not to provide information that could potentially affect their case or legal standing.
- 41 landowners refused to be part of the socio-economic survey and give any information to the enumerators and to the study team as well. The EQMS site team made the efforts of reaching out to these stakeholders on their personal phones as well with the help of the village head and nearby residents.
- 11 landowners reside outside of Dhaka in different district of Bangladesh; therefore, they couldn't not reach during the survey.
- Landowners having litigation on their land are not willing to give information.
- Most of the female landowners those who have the share of patriarchal and were not found in their patriarchal address as they were reside in the husband's address which were found in different district (distance 45 km to 200 km).
- The land acquisition section of DC office was reluctant to provide the contact details of the awardee.

However, the copy of litigation and mortgage that has been found in the award book are incorporated in the appendix- D-9 & D-10. Furthermore, to resolve the issues regarding the identification and survey of respondent study team initiated several strategies which includes the following.



1.7 ESIA Team

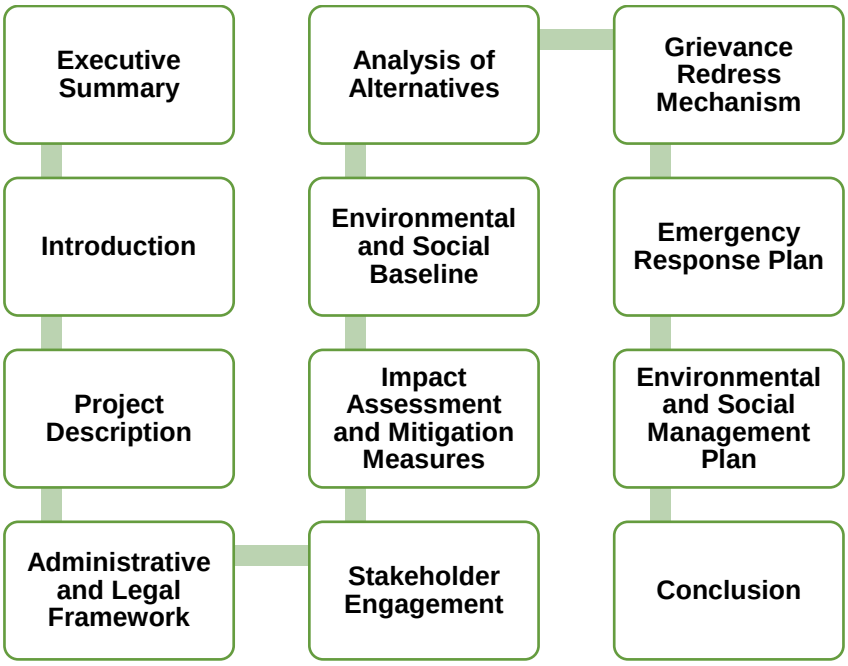
EQMS Consulting Limited is a specialist consultancy firm contracted by WTE Power Plant North Dhaka Private Limited to prepare and deliver the ESIA report for the proposed Project. EQMS Consulting Limited has utilized a multi-disciplinary team comprising environmental and social experts. The team members have extensive professional experience working in the fields of environmental impact assessment and social impact assessment in Bangladesh. The composition of the ESIA team is shown in Table 1-3.

Table 1-3: ESIA Team Composition

SL#	Name	Position Assigned/Role
1	Kazi Farhed Iqubal	Project Director/ESIA Expert
2	Md. Tauhidul Hasan	Senior Environmental Expert/Model Expert
3	Ferdowsi Rita	Senior Social Expert
4	Najmul Hossain	Environmental Expert
5	Md Shafiqul Islam	Environmental Expert
6	Mosabbir Hossain	Social Expert
7	Shihabuddin Imran	Disaster Management Expert
8	Nourin Ahosan Habib	Ecologist
9	Farah Shamima Sultana	Geographic Information System (GIS) Expert

1.8 Structure of the Report

The outline of the present ESIA is as under:



0. **Executive Summary:** The executive summary provides an overview of the ESIA report.
1. **Introduction:** The chapter describes the background of the study, brief description, scope of the study, approach and methodology, limitations, ESIA study team combination, and structure of the report.
2. **Project Description:** This chapter provides a detailed description of the proposed project comprising project justification, location, layout, and project components.
3. **Administrative and Legal Framework:** This chapter covers all the legal provisions, including environmental and social laws, applicable to the project. The chapter also covers all the national and international standards applicable to the project.
4. **Analysis of Alternatives:** This Chapter discusses the alternative considerations that have been studied before finally proposing the present project.
5. **Environmental and Social Baseline:** This chapter covers the environmental baseline parameters on the physical environment such as *land use, topography, geology, physiography, geomorphology, agroecology, soil conditions, soil and sediment quality, natural hazards, meteorology, ambient air quality, ambient noise level, hydrology, drainage systems, surface water quality, and groundwater quality* including biological environment, as well as socio-economic environment within the jurisdiction of the study area.
6. **Impact Assessment and Mitigation Measures:** This chapter covers the detailed impact of the proposed project along with appropriate mitigation measures on different environmental and social components during the construction and operation phase of the project.
7. **Stakeholder Engagement:** This Chapter presents the findings of various consultations carried out as part of the environmental and social assessment, that include consultation with community, local administration government departments, non-government organizations, and community leaders. A systematic stakeholder engagement plan can be integrated into the project planning and implementation process, ensuring the adoption of appropriate mitigation strategies aligning with national and international protocols. Therefore, this approach will not only strengthen community relationships but will facilitate a conducive working atmosphere towards promotion of business.

8. **Grievance Redress Mechanism:** This chapter describes the proposed GRM to allow people to voice their concerns regarding the environmental and social impacts or grievances associated with the proposed project, enhancing their trust, confidence and satisfaction. The application of effective GRM facilitates works/staff and community to lodge their complaints associated with the operation of the project for timely and transparent redressal.
9. **Emergency Response Plan:** This Chapter discusses common risks in the power plant associated with accidents that may occur, natural disasters, and external threats and outlines important measures to minimize those risks/threats while adhering to standard organizational safety and applicable compliances in managing emergency crisis in line with emergency preparedness and response plan of the project proponent.
10. **Environmental and Social Management Plan:** The chapter covers a comprehensive ESMP including recommendations for its implementation during the pre-construction, construction, and operation phase of the project. The ESMP consists of the set of mitigation, management, monitoring, and institutional measures and the ESMP budget to be prepared during the implementation of the proposed project that aims to eliminate adverse environmental impacts or offset them or reduce them to acceptable limits.
11. **Conclusion:** This chapter presents key findings of social, environmental and ecological sensitivities associated with the project along with proposed mitigation mechanism to address those identified issues throughout the project life cycle adhering to applicable guidelines.

2 PROJECT DESCRIPTION

2.1 Introduction

The Project Description sets out the scope of the Project features and activities, with particular reference to the aspects which can impact the environment. Details of the Project facilities' design characteristics, as well as planned and unplanned Project activities, are provided in the subsequent sections of this chapter.

WTE Power Plant North Dhaka Private Limited is going to set up a waste-to-energy power plant located in the Dhaka district of Bangladesh. The project site is located on the north side of the Dhaka-Aricha Highway. The operation principle will be based on the national electricity demand of the region and country as well. Electricity generated in the power plant will be evacuated to the Savar 132 /33 kV existing Substation with a double loop 132kV line, with a length of about 5.99 km. The basic data of the WTE Power Plant North Dhaka Private Limited are furnished in Table 2-1.

Table 2-1: Basic Information of WTE Power Plant Project

Particulars		Basic Project Data
Company Name	:	China Machinery Engineering Corporation (CMEC)
Project Name	:	Waste-To-Energy Power Plant Project at Amin Bazar, Dhaka, Bangladesh
Project Director	:	Liu Fangzhou
Address	:	F11, Anamika Concord, 583 Rokeya Sarani, Dhaka 1216
Email	:	liufz@cmec.com
Contact No	:	01905659871 & 01957088066
Project Location	:	Village: Baliarpur, Union: Bangoan, Upazila: Savar, District: Dhaka
GPS Location	:	23°47'39.80"N 90°17'48.86"E
Type of Business	:	Power Generation
Project Tenure	:	20 years
Net Plant Capacity	:	42.5 MW (NET)

Source: WTE Power Plant North Dhaka Private Limited

2.2 Location of the project site

The proposed site is located on the south of the Amin Bazar landfill site, on the west side of North Dhaka, about 17 km from the Dhaka city center. The site encompasses power plant site, access road and Transmission Line considering RoW as per applicable national and international guideline. The proposed Power Plant Project is located at Bongaon Union under Savar Upazila of Dhaka District. Geographical coordinates of the proposed waste to the energy project site are presented in Table 2-2.

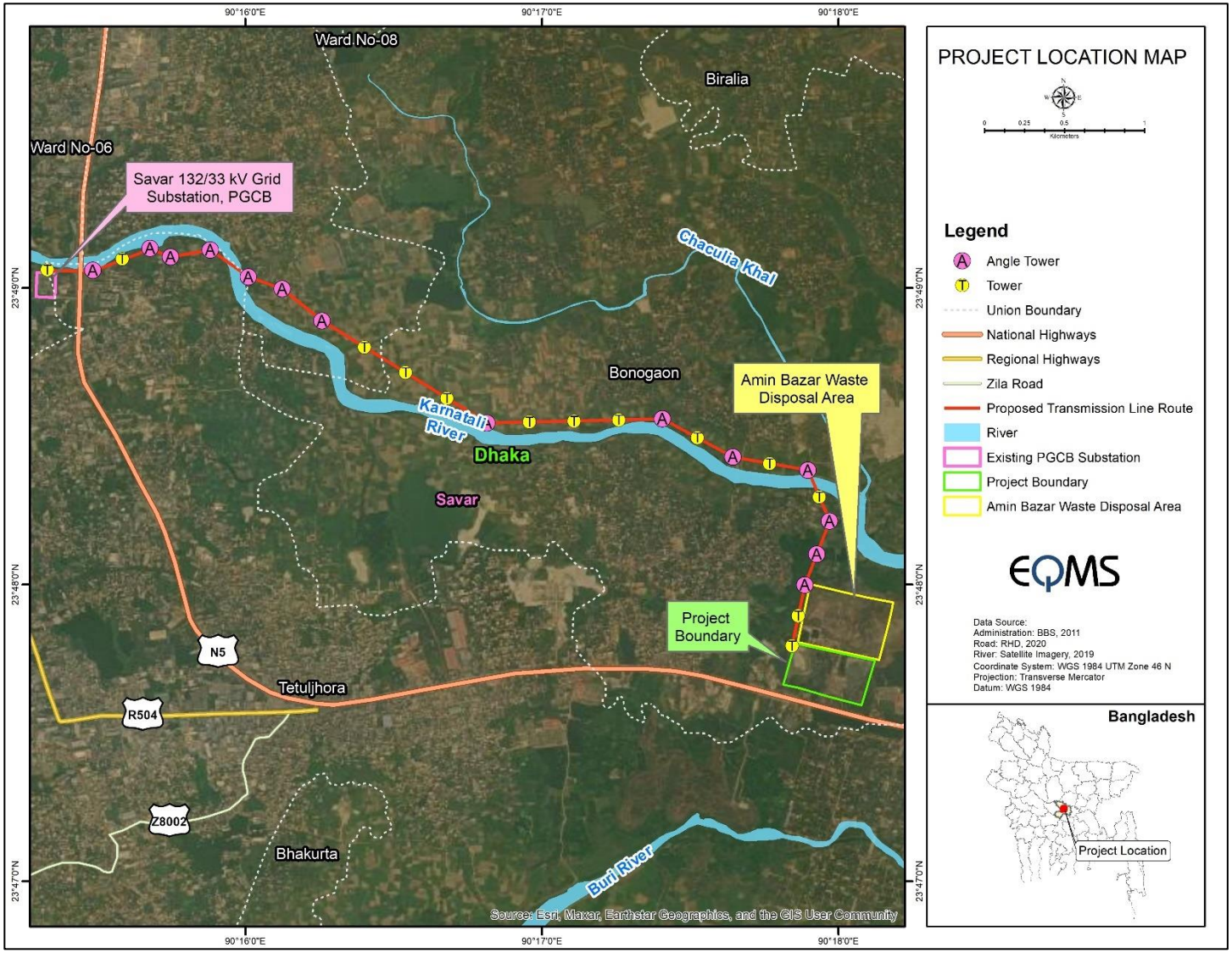
Table 2-2: Geographic coordinates of the proposed project

Points	Direction/Corner	Latitude	Longitude
1	South-West	23°47'39.80"N	90°17'48.86"E
2	South-East	23°47'35.62"N	90°18'4.64"E
3	North-East	23°47'44.63"N	90°18'7.37"E
4	North-West	23°47'48.10"N	90°17'51.16"E

As per DC's land information, the land category for the proposed power plant is null, viti, bari and low land. However, the current land use of the proposed project site is fallow land and low land. No

permanent water bodies and hills have been found in the project area. This project will not fill any pond, canal, waterbodies during site development. The development of this project will not require any hill cutting. The proposed project site is near the Aminbazar landfill and Karnatali River in the North, agricultural land on the north and north-west, brick kiln on east, and Dhaka-Aricha Highway on the South. The following Figure 2-1 shows the project location.

Figure 2-1: Location Map of Proposed Power Plant Project



Source: EQMS, 2022

2.3 Access Road

The project site is located adjacent to the Dhaka-Aricha Highway (N5), facilitating the road transportation of fuel and equipment required for the plant. The Government of Bangladesh has initiated an upgrade program to expand approximately 20 kilometers of this highway, from Gabtoli to Nabinagar, increasing the number of lanes from four to ten. The highly trafficked Gabtoli Bridge, situated along this route, has already undergone an expansion from four lanes to eight lanes. Additionally, the Salehpur Bridge-2 has been upgraded from two lanes to four lanes.

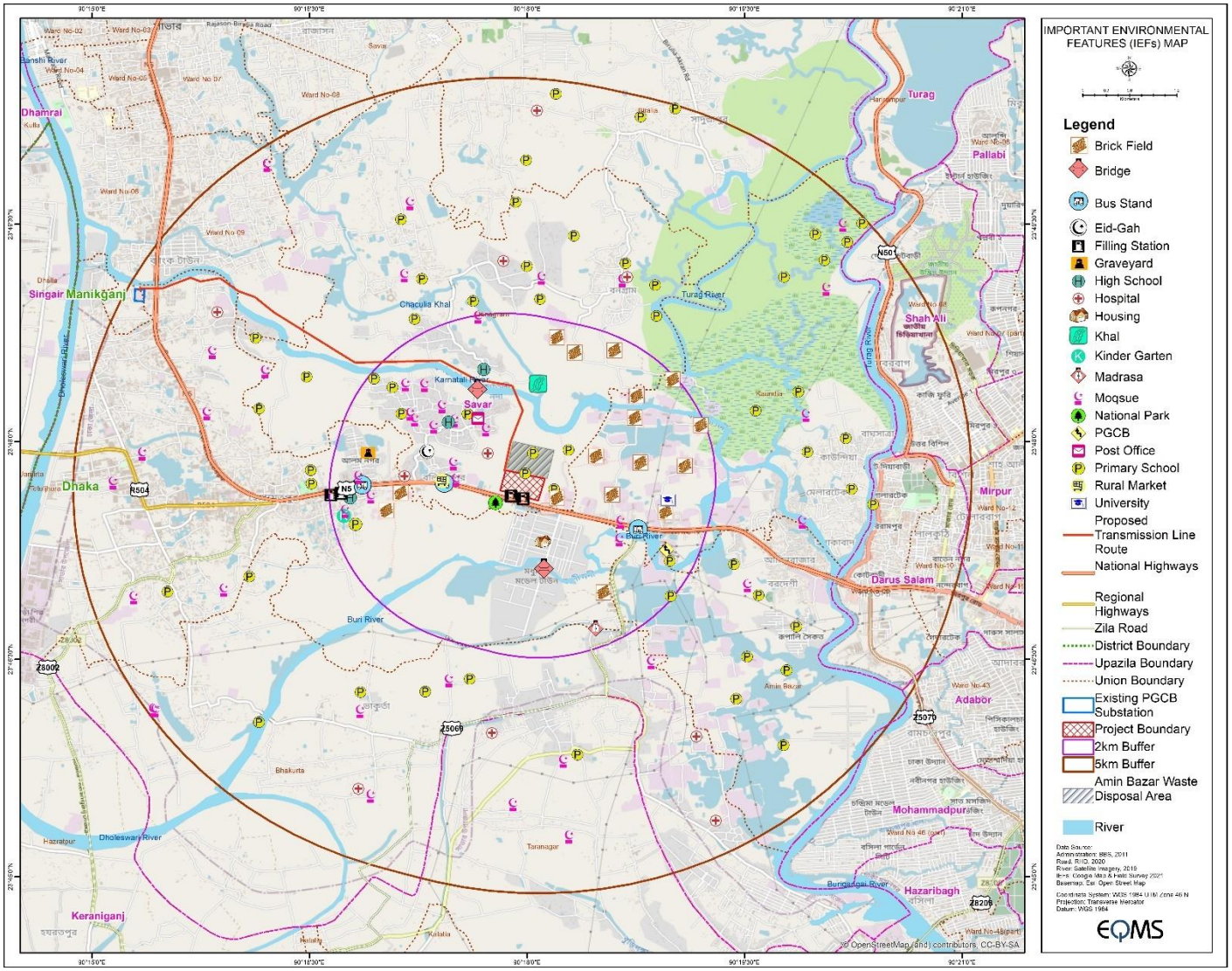
To enable access to the project site from the highway, a 360-meter-long access road has been planned along the eastern side. The proposed access road will have a pavement width of approximately 7.0 meters, with a turning radius of 12.0 meters within the main plant area (Figure 2-5).

2.4 Key Features of the Site and Surroundings

Most of the land of the proposed project boundary has been found low-fallow land. No trees have been found within the project periphery. Two business entities have been identified within the project boundary which is used for transportation depot and workshop, repair, and maintenance shop, water treatment plant and a cow farm. Five non-titleholders have also been identified within the project site.

Some scattered commercial structures such as brick fields and Compressed Natural Gas (CNG) filling stations are situated adjacent to the proposed project site. The nearest brickfields are located approximately 200m east side from the project boundary. N.R. CNG Filling Station is located approximately 30 m southern directions from the project site. Karnatali River is approximately 600m northern direction from the Project Site. The nearest agriculture land has been found on the west side which is approximately 300m from the project site. Key features around the project site are presented in Figure 2-2. Photographs taken from the project site are shown in Figure 2-3.

Figure 2-2: Key features around the proposed project site



Source: EQMS, 2022

Figure 2-3: Photographs of Key features around the proposed project site

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Proposed Project Site</td><td>Existing Access Road to the project site</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>N.R. CNG Filling Station (approximately 30m southern directions from the Project Site)</td><td>Karnatali River (approximately 600m away from the Project Site)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Vegetable Cropping on the North side of the Landfill area (approximately 650m away from the Site)</td><td>Beraid Government Primary School (approximately 1.2km North-West direction from the Project Site)</td></tr>
</table>

Konda Bazar (approximately 750m North-West direction from the Project Site)

Konda High School (approximately 870m North-West direction from the Project Site)

Nandonic Housing Society (approximately 200m Southern direction from the Project Site)

Brick Field near the Proposed Project Site (approximately 200m East directions from the Project Site)

Agriculture activities on the West side (approximately 300m West to the project site)

Konda Bazar (approximately 750m North-West direction from the Project Site)

Settlement at the Around 540m north-west side of the project site

A bridge on the West side (around 1.05km away) of the project site

92 No Baliarpur Government Primary School (West side approximately 880m) to the project site

Baliarpur community clinic (approximately 950m North-West directions from the Project Site)

Temple at Nagar Konda (approximately 1.1km North-West direction from the Project Site)

Konda-Beraid Road (approximately 1.4km North-West direction from the Project Site)

Source: Field Survey, 2022

2.5 Nature and Size of the Project

The WTE Power Plant North Dhaka Private Limited proposes to set up a waste-to-energy power project of 42.5 MW (NET) capacity near the Savar Upazila in Dhaka District. The details of the proposed power plant are presented in Table 2-3.

Table 2-3: Brief Information of WTE Power Plant Project

Particulars		Basic Project Data
Net Plant Capacity	:	42.5 MW (NET)
Planned land	:	31.18 acres (126187.41 m^2) (Including incineration plant land and new access roads)
Treatment capacity	:	3000~3600 ton/day (entry capacity) with an annual waste disposal capacity of 1.095 million tons
Source of Waste	:	Dhaka North City Corporation (DNCC)
Incinerators	:	Four (4) sets of 750 t/d incinerators
Boilers	:	Four (4)
Turbine generator sets	:	Two (2) sets of 35 MW turbine generator sets
Steam turbine	:	Two (2)
Annual operation time	:	Not less than 8,000 hours
Leachate treatment station with a treatment capacity	:	1500 m^3/day
Wet slag volume	:	182,500 t/a
Amount of flying ash	:	24512 t/a
Cooling tower	:	Three (3) sets, Cooling water 7000 t/h
Furnace type	:	Mechanical grate furnace with 4×750t/d incineration line
Flue gas treatment system	:	SNCR (urea water injection in the furnace)
Stack Height	:	100m
Number of Stack/Stack Inside Diameter	:	1 Stack/2.2m*4
Fuel Name	:	Diesel fuel
Source of Fuel	:	Local Market
Fuel Requirement	:	About 40-ton of diesel will be consumed for each start and shutdown. Diesel consumption by ignition throughout the year = 40 × 2 × 4 = 320 ton Electricity consumption: 0.73×108kWh/a
Water Requirement	:	The main industrial water source will be both surface water and groundwater and will also be used as a reserve water source for industrial water purposes. The total industrial and domestic water supply scale of this project is approx. 349.5 m^3/h
Employment	:	Construction phase – 2320 persons Operation phase - 280 persons
Power Evacuation	:	132 kV Savar Substation
Project Cost	:	BDT 1,131.16 crore

Source: Feasibility Report, CMEC

2.6 Existing Waste Management Scenario

The waste generated within DNCC encompasses several types such as MSW, electronic waste, hazardous medical waste, food waste, construction waste, and industrial hazardous waste. DNCC waste management function is mainly focused on MSW. Composition of MSW that DNCC deals with includes ‘anything’ that people throw into DNCC's waste bins and collection points. The amount of waste generated within DNCC is increasing year by year due to increased number of infrastructure developments, shopping complexes, restaurants, markets, bazars along with roadside tea-stalls, floating vendors, and flower markets on the footpath.

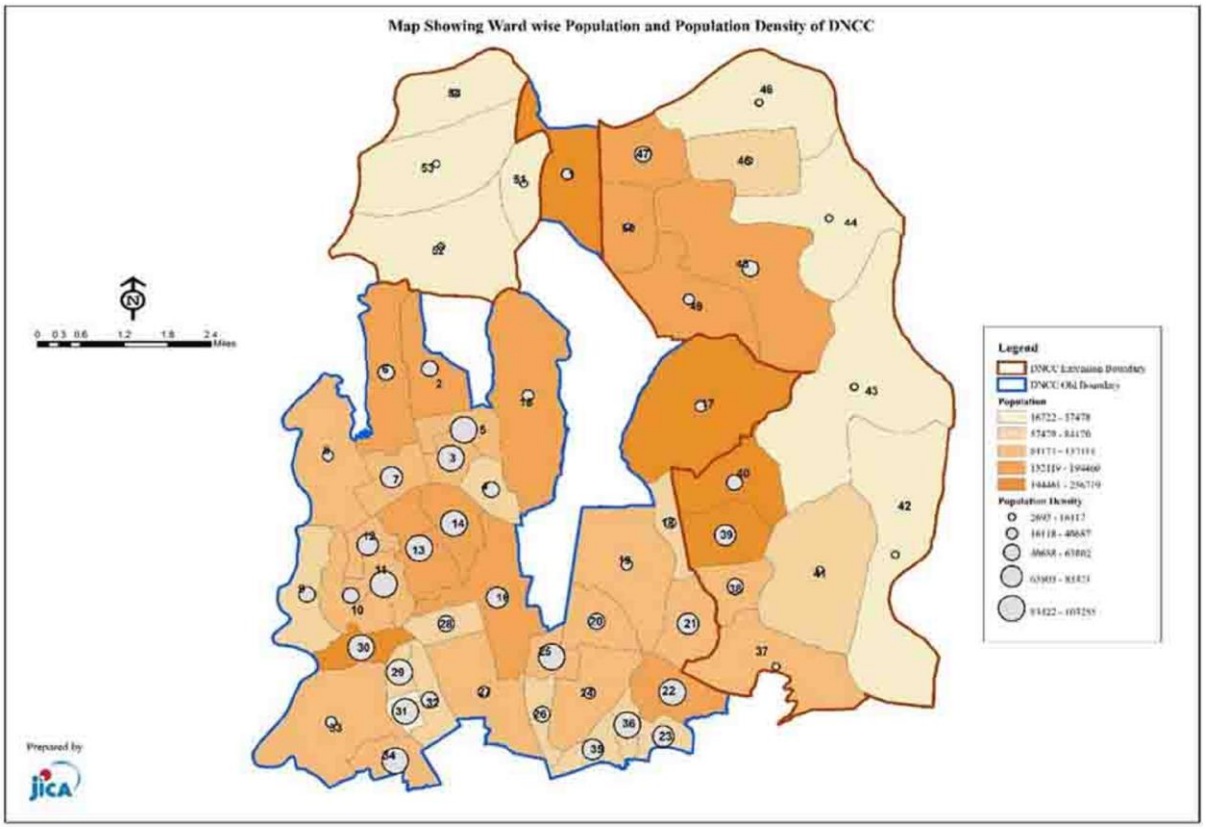
Though DNCC collects municipal solid waste generated by citizens in a daily basis, people sometimes discharge waste into open spaces, drains, canals, or their own backyard rather than DNCC's designated secondary collection points. The total area of DNCC is 196.23 square kilometers, and the current population is 6.1 million. Every day, 3,433 tons of waste are generated, according to the DNCC waste report 2019-20. This large volume of waste is disposed of at only one location, the Aminbazar landfill. As a result, it requires more land at the existing landfill site and is increasing year over year. In 2019-2020, the total amount of generated waste was 1,002,561 tons where collection percentage is 80% (292 days). The Solid waste management (SWM) operation in DNCC is categorized into four types: i) Cleaning of roads and drains, ii) Collection and transport, iii) Landfill development & operation, and iv) Repair works.

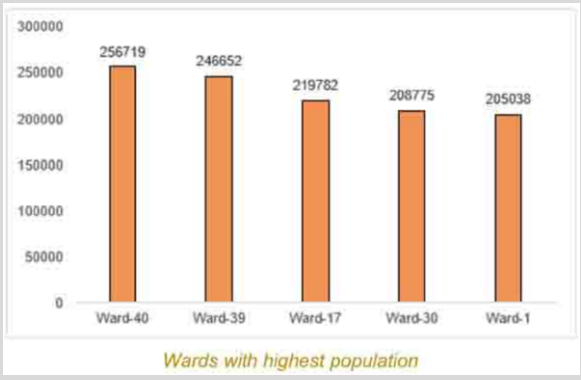
Dhaka is the largest urban city in Bangladesh and one of the largest and most densely populated cities in the world[1]. Employment opportunities, health care services and educational services are readily available in Dhaka city which influence rapid human settlement. As daily waste generation amount is augmenting simultaneously with rapid urban growth, solid waste management system is getting more intricate and diversified.

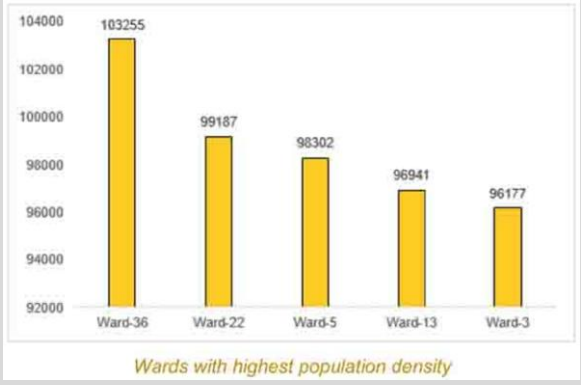
According to New Clean Dhaka Master Plan 2018-2032 (under approval process by LGD), population of DNCC has been estimated as 6.1 million in FY 2019-20, which was 3.95 million in the census of 2011. In this city, Ward-40 has the highest population (256,719); while Ward- 42 has the lowest population (16,722). DNCC has an average population density of 31,488 per sq. km with maximum and minimum population density of 103,255 and 2,693 in Ward-36 and 42, respectively. The project impacted wards have been classified as per defined criteria based on both population and population density which is reflected in the map shown in Figure 2-4. According to the said classification criteria, Ward-1, 17, 30, 39 and 40 are categorized as having the highest population, whereas, ward-36, 22, 5, 13 and 36 are classified as having the highest population density.

[1] The World's Cities Data Booklet, United Nations.

Figure 2-4: Ward wise Population and Population Density of DNCC







Primary Waste Collection

Waste collection from the points of generation i.e., households or buildings is usually considered as primary collection if such wastes are disposed to the secondary collection point of municipal services of DNCC. Door-to-door waste collection activity is common in almost all the wards of DNCC. It is prevalent due to high population density and long distance of secondary collection point. The entities providing primary collection or door-to-door collection services are recognized as PCSP or Primary Waste Collection Service Providers. According to the JICA Project Team's survey (2018), there are around 418 PCSPs regularly working in DNCC. PCSPs collect waste from door-to-door and transport the waste to dustbins/containers, or sometimes to vacant lands by rickshaw vans. PCSPs are using various forms or mix of forms of SCPs such as compactor (in or outside of STS), container (in or outside of STS) and even in some cases, unfortunately, they use open dumping or illegal points. However, DNCC is trying to sort out these issues by several means such as formalizing the PCSPs by tendering process, setting strict guidelines and constructing new STS at the existing and newly added wards.

Secondary Waste Collection (SCPs) and Secondary Transfer Station (STSs):

Waste accumulated in SCPs (STSs, Container and dustbins) are categorized in three types based on the source of waste: household waste, street waste including sludge from drainage, and business waste. There are four different types of secondary collection receptacles: concrete bins/dustbins, containers, arm roll containers, and compactors for direct transport without waste storage. Open curbside waste accumulation is sometimes used at designated points for areas where container placement is difficult. DNCC has built 5 new STSs in FY 2019-20 to stop the open dumping of wastes in the city. The location of all STSs is given on the following page. The Locations of all STSs is given in Table 2-4.

a. The scope of the project only covers the construction and operation within the WTE plant site and the transmission line.
b. Outside of above scope, the Project Company or the Sponsor has no right to interfere. The operation and management of STS, and waste transport to the project site, will be managed by DNCC and other governmental institutes.
c. As a foreign company operates in Dhaka, WTE can only submit their suggestions to DNCC and other governmental institutes for optimization on their operation and keep communication with them. But WTE cannot guarantee any outcomes of DNCC/ other governmental departments' future improvements.
d. The project will not impact the existing operation of STS/ waste transport route, operated by DNCC. According to DNCC annual report and local media, there are no traffic congestion or safety issues reported.

Table 2-4: Location of all secondary transfer stations

Zone	Ward	STS Location	Zone	Ward	STS Location
1	1	BDR Bazar, Uttara	3	22	Banasree
		Section-12, Kabasrthan, Uttara		23	Khilgoan Kabasrthan
		Jashim Uddin Road, Uttara		24	Tejgoan, Orion Circle
		Ranabhola, Section-10, Uttara			Tejgoan, Rolling Mills
	17	Kuril Bishwa Road			Tejgoan, Begunbari
		Nikunja-2, West Side Road-18		35	Under the Maghbazar Flyover, Eskatan
		Khilkhet Railgate		36	BTCL Wasa Pump, Maghbazar
		Niketan, Gate-02	4	9	BTRC Bus Counter, Gabtoli
2	2	Mirpur Ceramic Road		10	Majar Road, Diabari
	3	Mirpur Jalladkhana			Mohona Pump, Technical
	3	Mirpur DNCC Market		11	Kallyanpur Bus Stand
	4	Baishteki Culvert, Mirpur		12	Tollerbag
	5	East Side of Kashli Road, Mirpur		14	Agargoan, Taltola Bus Stand
	6	Arambag Culvert, Mirpur		16	Kachukhet, Wasa Pump
	7	Shailbari Mor, Mirpur	5	26	Tejkunipara, Khelaghar Math
		Adjacent to Proshikha Building			Karwanbazar
	8	Rainkhola, Mirpur		28	Orthopedic Hospital, Shyamoli
	15	Vashantek Bazar, Mirpur			Agargoan Science Museum

Zone	Ward	STS Location	Zone	Ward	STS Location
		Manikdi Kabasrthan		29	Ringroad Badshah Faisal School
	18	Notun Bazar		30	Dhaka Uddyan
		TNT Playground, Korail		31	Mohammadpur Town Hall
3	19	Gulshan Shooting Club		32	Mohammadpur Fertility
		Banani BTCL Office			PGR, Ganabhaban
	20	Mohakhali Kachabazar		33	Bosila Bridge
					Jaker Dairy Firm
				34	Rayer Bazar Beribadh
			10	37	Eastern Housing Ltd., Aftabnagar

Source: DNCC Waste Report 2019-20

There are altogether 147 waste collection and transport vehicles in DNCC among which 140 vehicles are under operation and other vehicles are under repair for maintenance purposes. DNCC is gradually shifting towards compactor driven waste collection and transportation system considering its environmental friendliness. There are altogether 46 compactors in DNCC which is 31% of the total waste collection vehicles. The summarized list of the collection and transport vehicle of DNCC is stipulated in the table of the following page.

Table 2-5: Existing waste management scenario at a glance

Total Area		196.23 sq. km
Population		6.1 million[2]
Average Population density		31,488 per sq. km
Total Number of Zone		10
Total Number of Ward		54
Amount of Waste Generation		3,433 ton/day
Total amount in FY 2019-20		1,002,561 ton
Waste Collection percentage		80%[3]
Total Number of Trips		2,08,808 nos.
Waste collection	Highest in a month	1,00,630 ton (August 2019)
	Lowest in a month	60,710 ton (April 2020)
SWM Cleaners	DNCC cleaners	2,479 nos.
	Private company cleaners	1,435 nos.
Number of Sanitary Landfill		One (Aminbazar landfill site)
Load Per Trip		4.8 ton/trip
Number of Waste Collection Vehicles		Waste collection vehicle: 147
Heavy Equipment		Heavy equipment: 16
Landfill Operation Cost		244.41 BDT/ton

Source: Waste report, 2019-20, Waste management department, Dhaka North City Corporation

[2] New Clean Dhaka Master Plan 2018-2032

[3] Mostly uncollected from drain and newly extended area

2.7 Waste Composition and Analysis

2.7.1 Background

The municipal solid waste in DNCC is comprised of different types such as kitchen waste, paper, robber, and plastic, wood and bamboo, textile, bricks/ash, metal, and others. The DNCC waste management role focuses mostly on MSW. DNCC's MSW includes 'everything' that people throw into garbage containers and collection stations. The quantity of garbage created within DNCC is rising year after year due to the increased number of infrastructure improvements, retail malls, restaurants, marketplaces, and bazaars, as well as roadside tea booths, floating vendors, and flower shops on the sidewalk.

2.7.2 Methodology

Samples of municipal solid waste were collected from three Secondary Transfer Stations (STS) and the Aminbazar site of DNCC, across various dates in 2020 and 2021. Four samples each were collected from STS locations in Gulshan 1, Notun Bazar, Indira Road, and Amin Bazar. These samples encompassed various waste components such as kitchen waste, rubber and plastic, wood and bamboo, textile, paper, bricks/ash, metal, and others. Following collection, the samples were sent to the Laboratory of the Department of Chemical Engineering at Bangladesh University of Engineering and Technology (BUET) for analytical testing. Test parameters included moisture content, ash content, net calorific value, carbon, hydrogen, nitrogen, sulfur, oxygen, and chlorine. The details of test parameters and analysis method are given in Table 2-6.

Table 2-6: Test parameters and analysis method of collected municipal solid waste

Sl. No.	Test parameters	Unit	Analysis Method
1	Moisture	wt%	ASTEM E 871
2	Ash, db[4]	wt%	ASTM D1102
3	Net Calorific Value, db	Kj/kg	ASTM E711
4	Carbon, db	wt%	ASTM E777
5	Hydrogen (H), db	wt%	ASTM E777
6	Nitrogen, db	wt%	ASTM E778
7	Sulphur (S), db	wt%	ASTM E775
8	Oxyzen (O), db	wt%	ASTM E870
9	Chlorine (Cl), db	wt%	ASTM E776

2.7.3 Waste Composition Analysis

The municipal solid waste collected comprises various components, with approximate percentage ranges as follows: kitchen waste (55% to 80%), rubber and plastic (10% to 20%), wood and bamboo (1% to 10%), textile (1% to 5%), paper (2% to 5%), brick/ash (0.5% to 1%), metal (0.02% to 0.68%), and other materials (about 0.5% to 1%). Waste composition reports are given in **Appendix M**.

Moisture

The moisture content of the collected samples varies across different locations: Sample 1 from STS, Gulshan 1 ranges from 55.29% to 75.78%, Sample 2 from STS, Notun Bazar ranges from 54.52% to

[4] Here, db means dry basis

78.97%, Sample 3 from STS, Indira Road ranges from 57.52% to 73.44%, and Sample 4 from Aminbazar ranges from 62.46% to 78.40%. Overall, the moisture content of the samples fluctuates between approximately 50% and 80%.

Ash

The ash content of the collected samples displays variability across different locations: Sample 1 from STS, Gulshan 1 shows a range from 5.43% to 27.42%, Sample 2 from STS, Notun Bazar ranges from 8.48% to 19.90%, Sample 3 from STS, Indira Road ranges from 8.50% to 25.49%, and Sample 4 from Aminbazar ranges from 7.18% to 27.34%. The highest ash content, 27.42%, was recorded in February 2021 at Sample 1, Gulshan STS, while the lowest, 5.43%, was observed in October at the same location. In summary, the ash content of the collected samples varies within a range of approximately 5% to 30%.

Net calorific value

Sample 1- STS, Gulshan 1 has a net calorific value ranging from 18496 to 20392 kJ/kg; Sample 2-STS, Notun Bazar, has a range of 14715 to 19013 kJ/kg; Sample 3-STS, Indira Road, has a range of 16231 to 19247 kJ/kg; and Sample 4-STS, Aminbazar, has a range of 13166 to 19290 kJ/kg. It is evident that the collected samples' net calorific values range from 13166 to around 20392 kJ/kg.

Carbon

The carbon content in the samples collected from different locations varies significantly, ranging from approximately 34.61% to about 50.05%. Specifically, sample 1 from STS, Gulshan 1, exhibits a carbon content between 34.61% and 46.28%. Sample 2 from STS, Notun Bazar, shows a carbon content within the range of 40.19% to 50.05%. Similarly, sample 3 from STS, Indira Road, displays a carbon content ranging from 38.17% to 46.62%, while sample 4 from Aminbazar ranges from 37.38% to 47.08%. This demonstrates a variation in carbon content across the collected samples, spanning from 34.61% to approximately 50.05%.

Nitrogen

The labroratory test results found that the nitrogen content of the collected waste samples ranges from about 1.16 to 2.23% for all locations. The highest N content was found 2.23% in sample 4 in February 2021 and the lowest content was recorded 1.16% in sample 1 in January 2021.

Sulphur

The labroratory test results found that the S content of the collected waste samples ranges from about 0.06 to 0.38% for all locations.

Hydrogen

The Hydrogen content of the collected sample 1- STS, Gulshan 1 ranges between 5.10 to 7.12%; Sample 2-STS, Notun Bazar ranges between 6.11 to 7.67%; sample 3-STS, Indira Road ranges from 5.83 to 7.10% and sample 4 at Aminbazar it ranges from 5.54 to 7.08%. It is clear that the Hydrogen content of the collected samples varies between 5.54 to around 7.08%.

Oxygen

The oxygen content of the collected samples 1- STS, Gulshan 1 found from 28.09 and 42.06%; sample 2-STS, Notun Bazar ranges between 27.71 and 40.34%; sample 3-STS, Indira Road ranges from 26.03 to 45.54%; and sample 4 at Aminbazar ranges from 15.86 to 42.01%. It is obvious that the Oxyzen concentration of the collected samples ranges from 15.86 to 45.54%.

Chlorine

The labroratory test results found that the Chlorine content of the collected waste samples ranges from about 0.01 to 2.01% for all locations.

In conclusion, as per collected waste samples from four different locations no hazardous waste was found. The main waste types were kitchen waste, paper, rubber and plastic, wood and bamboo, textile, bricks/ash, metal and others. As per the waste supply agreement between DNCC and CMEC, DNCC will deliver mixed waste to the waste delivery point that shall be inspected and pre-treated at the site by CMEC. The parties acknowledge and agree that the mixed waste delivered by the waste supplier from time to time may contain a certain amount of unqualified waste. The company will remove any unqualified waste from the delivered mixed waste and will issue a notice to the waste supplier. As per the agreement no E-waste, medical waste, and any hazardous waste will be used in the incinerator.

2.8 Power Plant Layout

According to the requirement of production process and function, the project is divided into four functional areas: the main building area, auxiliary area, water treatment area, and ash & slag comprehensive treatment area. The total site area within the red line is 31.18 acres (126187.41 m^2) where 50.90% will be used for main building, auxiliary area, water treatment area and ash & slag comprehensive treatment area, 25.20% will be used for green area, and 19.53% will be used for road construction.

1) Main Building Area

The main building area is composed of the main powerhouse, a concentrated green area in front of the main building, and the booster station. The main building includes a waste tipping hall, waste pool, incineration boiler house, flue gas cleaning house turbine house, central control room, and chimney.

2) Auxiliary area

This area is composed of a guard room, weighbridge room, access ramp, and oil depot.

3) Water Treatment Area

This area is composed of an industrial fire tank, a comprehensive water pump house, a cooling tower, a water purification station, and so on.

4) Ash & Slag Comprehensive Treatment Area

This area is composed of an emergency fly ash landfill and a slag comprehensive utilization workshop. The proposed plant layout is shown in Table 2-7.

Table 2-7: List of Major Functional Area Cover

No	Name	Unit	Quantity
1	Land Area within the Red Line	m^2	126,187.41
2	Total Area Covered	m^2	64,230.58
	Building Coefficient	%	50.90
3	Total Floorage	m^2	55,171.28
	Total Calculated Plot Ratio Area	m^2	86,152.66
	Plot ratio	—	0.68
4	Green area	m^2	31,800.00
	Greening rate	%	25.20
5	Road and Site Paving Area	m^2	22650.00
6	Road utilization factor	%	19.53
7	Gate	Set	2.00

Source: Feasibility Study, CMEC

Due to its large mass and prominent position, the complex main building in the production area becomes the focus and core of the whole plant. Therefore, the main production area is allocated in the east part of the site, and other functional areas are arranged in the west and should be as close to their service objects as possible. This arrangement not only enables convenient transportation and process connections between other functional areas and the main production area, reduces the length of pipeline connections between each other, and reduces operating costs after commissioning, but also the building group combination of the whole plant has prominent emphasis, clear master and subordinate, and each component element is interdependent and mutually restricted, with a good sense of organization and order.

The water treatment area mainly disinfects and purifies the water in the whole plant and sends it to each water point. Among all the pipelines, the circulating cooling water pipe has a larger diameter. Therefore, the entire water supply and water treatment area are arranged on the southwest side of the main building to shorten the length of the circulating water pipe, reduce energy consumption, and ensure the convenience of water use such as firefighting.

The Ash & Slag Comprehensive Treatment Area is composed of the emergency fly ash landfill and slag comprehensive utilization workshop, considering the convenience of logistics and transportation, this area is arranged on the northwest side of the plant and is also arranged far from the front area of the plant.

Other auxiliary production areas mainly include logistics gates, waste weighing facilities, and parking lots. For the convenience of weighing, the weighbridge and the weighbridge room are arranged on the main line of waste transportation.

The total land including incineration plant land and new access roads is planned about 31.18 acres (126,187.41 m^2). Land requirements for the facility, including its breakup for various purposes, are given in Table 2-8.

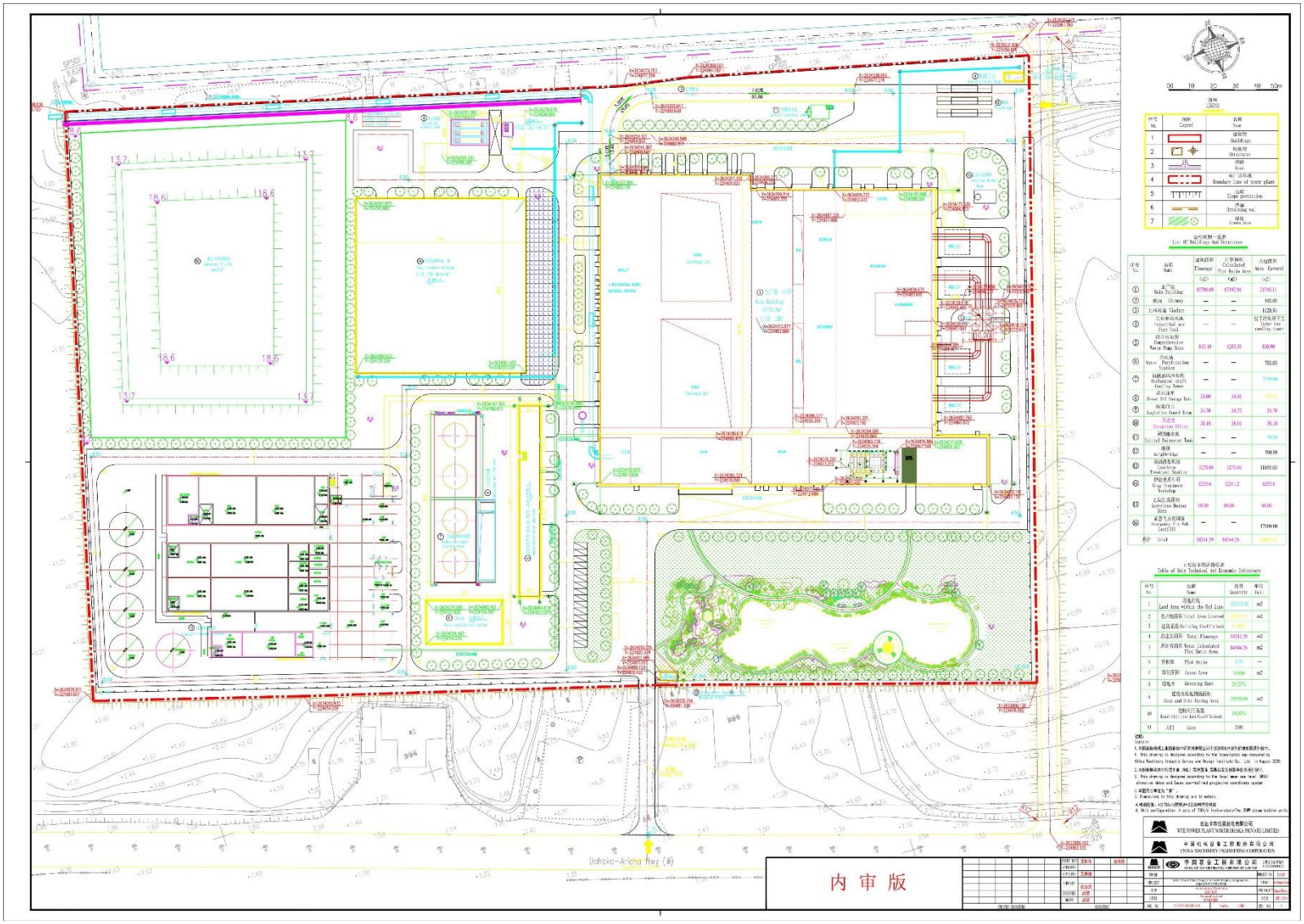
Table 2-8: Land requirements for various purposes

No.	Name	Floorage (m^2)	Calculated Plot Ratio Area (m^2)	Area Covered (m^2)
1	Main building	44,022.10	67,714.00	22,005.60
2	Chimney	—	—	100.00
3	Viaduct	—	—	1600
4	Industrial and fire pool	—	—	Under the cooling tower
5	Comprehensive water pump house	843.10	1,203.30	830.90
6	Water purification station	—	—	560
7	Mechanical-draft Cooling tower	—	—	2,110.00
8	Diesel oil storage tank	34.00	34.00	797.00
9	Logistics guard room	34.70	34.70	34.70
10	Reception Office	38.10	38.10	38.10
11	Initial rainwater tank	—	—	70.00

No.	Name	Floorage (m^2)	Calculated Plot Ratio Area (m^2)	Area Covered (m^2)
12	Weighbridge	—	—	300.00
13	Leachate treatment station	3,270.00	3,270.00	11,855.00
14	Slag treatment workshop	6,929.28	13,858.56	6,929.28
15	Emergency fly ash landfill	—	—	17,000.00
	Total	**55171.28**	**86152.66**	**64230.68**

Source: Feasibility Study, CMEC

Figure 2-5: Proposed Power Plant Layout



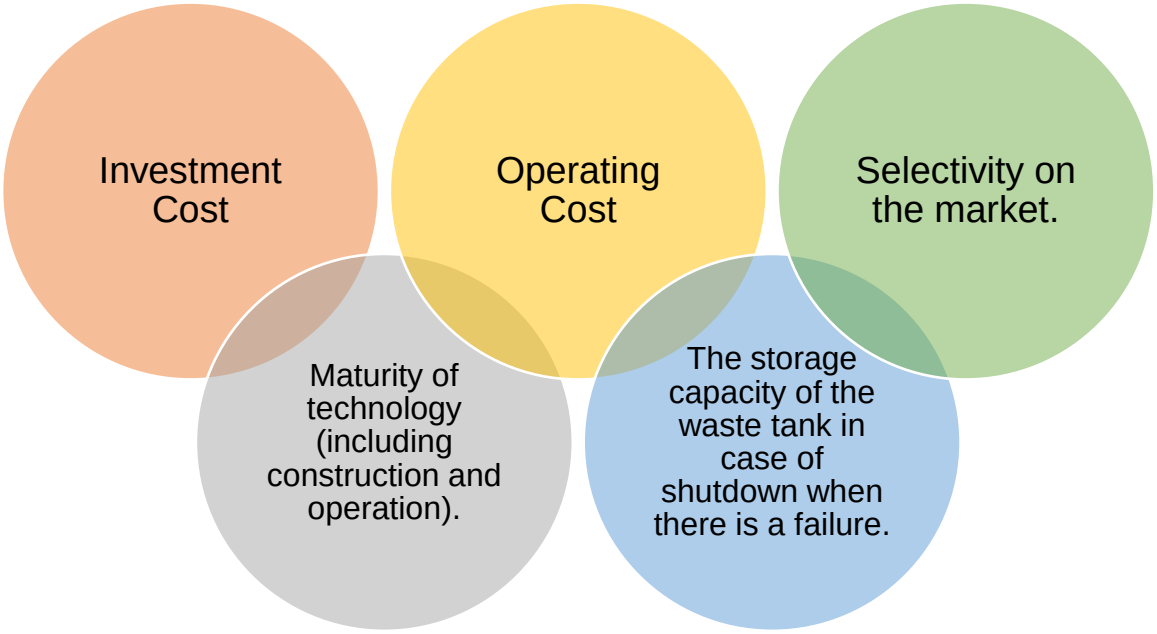
Source: Feasibility Study Report, 2022

2.9 Main Project Components

2.9.1 Incinerator

According to the requirements of the processing scale of 3000 t/d in this project and the experience of the completed project, 4 incineration production lines will be configured a processing capacity of 750t/d of a single furnace, and the production line which will improve the reliability of operation and bring significant economic benefits.

The selection of the number of incineration lines and the size of a single line shall comply with the following principles:



2.9.2 Waste Heat Boiler

A waste heat boiler is the main component of this power plant where four (4) boilers will be installed. The total amount of steam generated by the matching waste heat boilers of four incinerators with a pressure of 5.3 MPa and a temperature of 430 °C was 4 × 77.07t/h = 308.28 t/h. The waste heat boiler design parameters of this project are shown in the table below:

Table 2-9: Waste heat boiler technical parameters

No.	Project	Parameters
1	Overheated steam temperature of waste heat boiler	430℃
2	Waste Heat Boiler Overheated Steam Pressure	5.3 MPa (g)
3	Single boiler overheated steam-rated flow	74.3 t/h
4	Exhaust Temperature of Waste Heat Boiler	185 ~220℃
5	Feed water temperature of waste heat boiler	130℃
6	Incinerator - Heat Efficiency of Waste Heat Boiler	About 83.5 percent
7	Number of operational hours per year	> 8,200 h

Source: Feasibility Study, CMEC

Waste heat boiler composition

A waste heat boiler for waste incineration is generally a single drum natural circulation water tube boiler composed of 3-4 channels, which can be usually divided into the vertical boiler and horizontal boiler according to the arrangement form of its convection heating surface, and there are also many designs that combine horizontal and vertical boilers. The main basis for the determination of the arrangement of convection heating surface is cost, steel consumption, service performance, the convenience of installation, and maintenance. A horizontal waste heat boiler will be used in this project.

Blowdown system

For this blowdown system of waste heat boiler, four furnaces will be used to set one continuous blowdown flash tank, and continuous row expansion steam will be introduced into the deaerator for recovery and utilization. The emergency drain of the boiler will be sent to the fixed drain. The regular discharge of the boiler will be 1-2 times per shift, depending on the water quality test of the furnace.

2.9.3 Turbine Generator

Steam Turbine: Two (2) units of the steam turbine will be required for this power project which rated power will be 35 MW. The turbine has a three-stage non-adjustable steam extraction. The Steam pressure and temperature in front of the mainstream will be 5.1 MPa and 425℃ respectively. After the condensate water and recharge water off of the steam turbine generator group are heated to 130 ℃ through the steam turbine regenerative system and deaerator, they are sent to the boiler economize through the boiler feed water pump to transfer with boiler Flus Gas to heat.

Table 2-10: Main technical parameters of steam turbine

Items	Parameters
Quantity	2 units
Model	N35-5.1/425℃
Rated power	35MW
Steam turbine-rated intake	155 t/h
Steam pressure in front of the main steam	5.1 MPa
Steam temperature in front of the main steam	425℃
Extraction Series	3 non-adjusted extraction
Designed back pressure	~8Kpa
Feed water temperature	130℃
Designed cooling water temperature	27℃
Maximum cooling water temperature	33℃

Source: Feasibility Study, CMEC

Generator: Two sets of 35MW generators will be used for this project, in which an output voltage is 10.5 kV, a rated speed 3000 r/min and an efficiency is more than 97.4%. This project uses the solid waste incinerator and waste heat boiler with international advanced level and higher thermal efficiency, as well as the turbine generator unit with higher power generation efficiency, which saves energy to the greatest extent.

Table 2-11: Main technical parameters of the generator

Items	Parameters
Quantity	2 units
Model	QFW-35-2-10.5

Items	Parameters
Rated power	35MW
Output voltage	10.5kV
Rated speed	3000r/min
Power factor	0.8
Frequency variation range	48.5~51.5 HZ
Cooling mode	Air cooling
Generator efficiency	>97.4%

Source: Feasibility Study, CMEC

2.9.4 Cooling Tower

The factory has three sets of countercurrent mechanical ventilation cooling tower (considering a 110% margin) with a cooling water volume of 7000 m^3/d, equipped with a fiberglass axial flow fan. The single power is 205 kW. The cooling tower building dimensions are length 75m, Width 22.6m, Height 16.5m.

The working principle of mechanical ventilation cooling tower is to spray hot circulating water from the top of the cooling tower, and then flow to the sump, At the same time, dry air is pumped by the cooling tower, and enters the tower from bottom to top in reverse with the water flow. Therefore, when the water film on the packing is widely contacted with the cold air, the mass and heat transfer process occur between different media, which takes away the heat of the circulating water, to achieve the purpose of cooling.

The circulating cooling water system adopts the main pipe water supply, which is divided into two separate water supply systems.

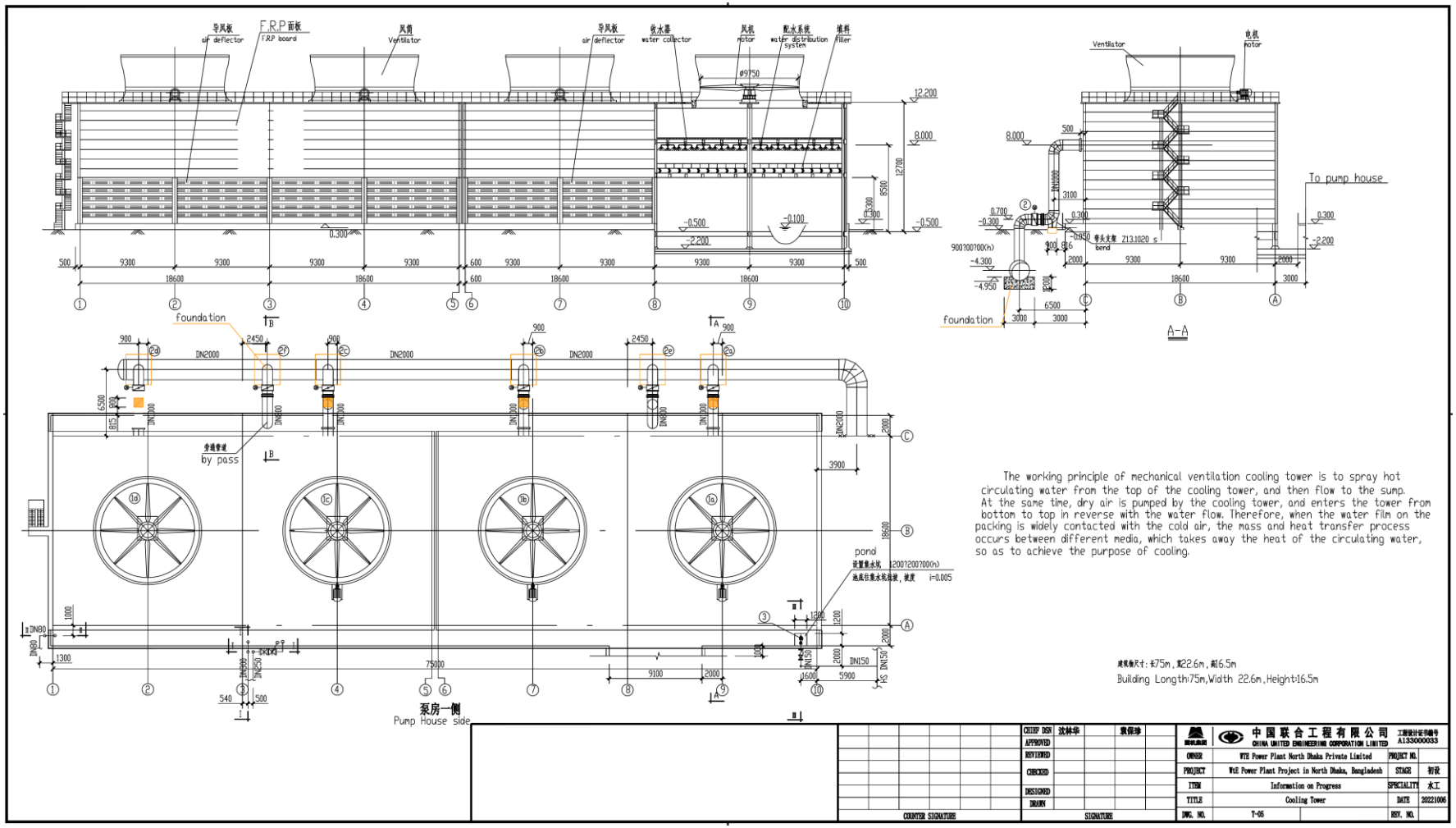
- Circulating cooling water system of steam turbine generator set
- Cooling water system of process equipment

The feed water of circulating cooling water system of the steam turbine unit is supplied to the steam turbine room of the main workshop by the steam turbine circulating water pump set in the circulating water pump room through the outdoor circulating water supply pipe, and then sent to the two-steam turbine generator sets and supporting equipment respectively.

The cooling water system of the process equipment is supplied to the process equipment such as heat exchangers in the main workshop by the industrial cooling water pump allocated in the circulating water pump room through the outdoor circulating water supply pipe. The above cooling water effluent is merged into the cooling water return jelly pipe and sent back to the cooling tower.

The cooling facility adopts 4 mechanical ventilation cooling towers with water collecting pools. The working principle of the mechanical ventilation cooling tower is: the high-temperature circulating water after heat exchange by the condenser and heat exchanger is sent to the top of the cooling tower for spraying, and then flows into the water collection tank. The air is drawn from the bottom to the top, and the water film on the filler is in extensive contact with the cold air, and the mass transfer and heat transfer process occurs, taking away the heat of the circulating water. The evaporation and other loss of circulating water is about 409.9 m^3/hr. Therefore, it needs to be replenished in time with fresh industrial water. The water source of industrial water comes from purified river water and groundwater. The cooling tower design has been given in Figure 2-6.

Figure 2-6: Design of Cooling Tower



Source: Feasibility Study, CMEC

2.9.5 Stack

In this Waste to Energy project, one stack will be used, and the height will be 100m. The inside diameter of the stack will be 2.2m*4. The gas exit temperature will be ～140°C and the velocity will be 10～20m/s. The Gas flow rate for one line will be ~150000Nm^3/h.

Table 2-12: Main technical parameters of Stack

Sl.	Item	Value
1.	Number of Stacks	1 no.
2.	Stack Height	100m
3.	Stack Inside Diameter	2.2m*4
4.	**Emission Concentration**	
	NO_x (Daily average)	200mg/Nm^3
	SO_2 (Daily average)	50mg/Nm^3
	PM_{10} (Daily average)	NA
	$PM_{2.5}$ (Daily average)	NA
	Dust (Daily average)	10mg/Nm^3
	CO (Daily average)	50mg/Nm^3
5.	Gas exit temperature	～140°C
6.	Gas exit velocity	10～20m/s
7.	Gas exit flow rate	~150000Nm^3/h for one line and 150000Nm^3/h *4=600000Nm^3/h (140°C) for the whole plant.
8.	**Emission rate**	
	NOx (Daily average)	8333mg/s*4
	SO_2(Daily average)	2083mg/s*4
	PM_{10}(Daily average)	NA
	$PM_{2.5}$(Daily average)	NA
	Dust (Daily average)	417mg/s*4
	CO (Daily average)	2083mg/s*4
9.	Boundary wall height	**2.2m**

Source: Feasibility Study, CMEC

2.10 Land Requirements

The proposed land needed r for WTE Power Plant North Dhaka Private Limited is 31.18 acres (126187.41 m^2) which includes the land for the incineration plant land and newly constructed access roads. Earlier, DNCC Previously DNCC had an access road for transporting waste from STS to the landfill site. However, DNCC, has recently constructed a new access road spanning approximately 1.18 acres on the east side of the project, intended for use by both landfill and WTE power plant. Pursuant to ARIPA,2017 guidelines, DNCC has acquired 30 acres of land through the Deputy Commissioner (DC) of Dhaka District. DNCC is the requiring body, and the DC is the acquiring body in the acquisition procedure where DNCC has granted a lease of 30 acres of land to WTE Power Plant North Dhaka Private Limited for the operation of the proposed project The land use agreement between DNCC and WTE Power Plant North Dhaka Private Limited has been given in **Appendix O-3**.

The socio-economic survey and available land document from DC office revealed that the entire land parcel is divided into Null, Viti, Bari[5] and road category. The acquired land area is divided into Null[6] covering 18.5813 acre (68.94%), Bari covering 2.039 acre (0.17%) and Viti[7] covering 9.2677 acre (30.89%) respectively. Out of the total 30 acres of land, 29.6485-acre were identified as privately owned land while0.3515 acre was identified as government-owned land (khas).

2.10.1 Land Acquisition Process

The principal legal instrument governing land acquisition in Bangladesh is the ARIPA, 2017. The ARIPA, 2017 requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Act also provides for the acquisition of properties belonging to religious organizations like mosques, temples, pagodas, and graveyards if they are acquired for the public interest. The Act stipulates certain safeguards for the landowners and provides for payment of "fair value" for the properties acquired.

The ARIPA, 2017, and responsibilities during the Land Acquisition (LA) process have been presented in the table below in a nutshell.

Table 2-13: Sections of ARIPA, 2017 with Steps in the Process LA and Responsibility

Relevant Section under ARIPA 2017	Steps in the Process of Land Acquisition	Responsibility
Section 4 (1)	Publication of preliminary notice of acquisition of property for a public purpose	Deputy Commissioner
Section 4 (3) (1)	Prior to the publication of section 4(1) notice; Identify the present status of the land, structures, and trees through videography, still pictures, or appropriate technology.	Deputy Commissioner
Section 4 (3) (2)	After the publication of section 4(1) notice, a joint verification is conducted with potentially affected households and relevant organizations.	Deputy Commissioner
Section 4 (7)	After the publication of the preliminary notice under section 4(1), if any household has changed the status of the land for beneficial purposes, the changed status will not be added to the joint verification notice.	Deputy Commissioner
Section 4 (8)	If the affected person is not happy with the joint verification assessment, he/she can complain to Deputy Commissioner **within seven days** of issuing sec 4(1) notice.	Affected Person
Section 4 (9)	Hearing by Deputy Commissioner **within 15 working days** after receiving the complaints. In the case of government priority projects, the hearing will be **within 10 working days**.	Deputy Commissioner
Section 5 (1)	Objections to acquisition by interested parties, **within 15 days** of the issue of section 4 (1) Notice	Affected Person

[5] The land where any form of structures found or can be built without any earth filing and having road connection to the land.

[6] Land having no agricultural activity within it and comparatively low-lying having no direct connectivity to the road.

[7] Comparatively high land but not fully prepared for constructing any form of structure, might require earth filling.

Relevant Section under ARIPA 2017	Steps in the Process of Land Acquisition	Responsibility
Section 5 (2)	Deputy Commissioner submits hearing report **within 30 working day**s after the date of section 5(1) notice. In the case of government priority projects, it will be **within 15 working days**.	Deputy Commissioner
Section 5 (3)	DC submits his report to the (i) government (for properties that exceed 16.50 acres; (ii) Divisional Commissioner for properties that do not exceed 16.50 acres. Deputy Commissioner makes the final decision if no objections were raised within 30 days of inquiry. In the case of a government priority project, it will be **15 days**	Deputy Commissioner
Section 6 (1) (1)	The government makes the final decision on acquisition **within 60 working** days after receiving the report from the Deputy Commissioner under section 5(3) notice.	Ministry of Land
Section 6 (1) (2)	Divisional Commissioner decides **within 15 days** or with reasons **within 30 days** since the submission of the report by Deputy Commissioner under section 5(3) notice.	Divisional Commissioner
Section 7 (1)	Publication of the Notice of final decision to acquire the property and notify the interested parties to submit their compensation claims.	Deputy Commissioner
Section 7 (2)	Interested parties submit their interests in the property and claims for compensation **within 15 working days** (in case of priority project **7 days**).	Affected Person
Section 7 (3)	Individual notices have to be served to all interested persons including the shareholders **within 15 days** of issuing Section 7(1) notice	Deputy Commissioner
Section 8 (1)	The Deputy Commissioner makes a valuation of the property to be acquired as at the date of issuing Section 4 Notice; determine the compensation; and apportionment of compensation among parties interested.	Deputy Commissioner
Section 8 (3)	Deputy Commissioner informs the award of compensation to the interested parties and sends the estimate of compensation to the requiring agency/person **within 7 days** of making the compensation decision.	Deputy Commissioner
Section 8 (4)	The requiring agency deposits the estimated award of compensation with the Deputy Commissioner **within 120 days** of receiving the estimate.	Requiring Agency
Section 9 (1)	During valuation of assets, Deputy Commissioner will consider the following: (i) Average market price of land of the same category in the last 12 months; (ii) Impact on existing crops and trees; (iii) Impact on other remaining adjacent properties; (iv) Impact on properties and income; and (v) Relocation cost for businesses, residential dwellings, etc.	Deputy Commissioner
Section 9 (2)	An additional **200%** compensation on transaction deeds of the preceding 12 months is added to the estimated value if the land is acquired for govt. entity. If the land is acquired for	Deputy Commissioner

Relevant Section under ARIPA 2017	Steps in the Process of Land Acquisition	Responsibility
	private organizations, added compensation will be an additional **300%** with estimated value**.**	
Section 9 (3)	Additional **100%** compensation on top of the current market price for impacts mentioned under sections 9(1)	Deputy Commissioner
Section 9 (4)	Appropriate action will be taken for relocation on top of the above-mentioned subsections.	Requiring Agency
Section 11(1)	Deputy Commissioner awards the compensation to entitled parties **within 60 days** of receiving the deposit from the requiring agency/person.	Deputy Commissioner
Section 11 (2)	If an entitled person does not consent to receive compensation, or if there is no competent person to receive compensation, or in the case of any dispute with the title to receive compensation, Deputy Commissioner deposits the compensation amount in a deposit account in the Public Account of the Republic. Thereafter, the Deputy Commissioner acquires the land. (Landowners can obtain such deposited money at any time, having appealed to the Deputy Commissioner, and providing evidence in support of his/her claim.	Deputy Commissioner Affected Persons
Section 12	When the property acquired contains, standing crops cultivated by Bargadar the apportion of compensation due to him will be determined by the Deputy Commissioner and will be paid to the Bargadar in cash.	Deputy Commissioner

Source: Acquisition and Requisition of Immovable Property Act (ARIPA) 2017

Common major steps of the land acquisition process by the DC office according to ARIPA 2017 law are shown below for easy reference.

Table 2-14: Common Steps of LA Process as per ARIPA 2017

Step	Description
Administrative approval from the line ministry	The requiring body (in this case DNCC) needs to take administrative approval from the line ministry (in this case Ministry of Road Transport and Bridges)
Prior consent from Ministry of Land	As per Article 18 and 19 of the 1997 LA Manual, for any land acquisition within some designated areas, prior approval is needed from Land Ministry ***(This Project is not within those designated areas)***
LA proposal (Land Acquisition Plan: LAP) submission by Project owner to respective DC office	LA proposal document includes: • facilities layout plan, • proposed acquisition area shown on Mouza maps (indicating the project boundary in handwriting on a cloth map), • list of affected plots (known as Plot Index),

Step	Description
	• amount of land in each plot and land required (known as Land Schedule), • general running video of the affected area, • filled up "CHA" Form showing names of the owners as per Khatians (ownership records), • administrative approval from the Line Ministry, The first 6 items will be obtained from the LAP to be prepared by the project proponent
Document check and Reconnaissance survey	DC office will check if all required documents are submitted. The representative of the DC office will make a preliminary reconnaissance survey
Meeting of District Land Allocation Committee (DLAC) and allocation of case number by DC office	The submitted documents are sent to DLAC to allocate an LA case number (**within 21 working days** of LA proposal submission). This marks official recognition of the LA proposal. DLAC meeting may be omitted, when prior approval from Land Ministry is available
Notice of Acquisition under Sec 4	The official start of the LA process Also acts as a legal "Cut-off Date" for titleholders
Joint Verification Survey (JVS) as per Sec 4 (3) (Kha)	A joint verification survey should start **within 7 working days** of serving Sec-4 notice, jointly conducted by the acquiring body (DC office) and the requiring body (in this case, DNCC), but must be completed before Sec 7. Joint video filming for asset confirmation is conducted.
Objection against JVS as per Sec 4 (8)	To be submitted to Divisional Commissioner **within 7 working days** after publication of JVS report
Decision on objection as per Sec 4 (9)	To be solved by Divisional Commissioner **within 15 working days** after the Sec 4-8 time limit.
Objection against acquisition (Sec 5-1)	To be submitted to DC office **within 15 working** days of Sec 4 notice
Decision on the objection (Sec 5-2)	To be solved by DC office **within 30 working days** after the Sec 5-1 time.
Submission for approval (Sec 5-3)	Depending on the acquisition amount, the LA proposal is sent to either Divisional Commissioner or Central Land Acquisition Committee (CLAC) **Within 30 working days** after Sec 5-2 time limit.

Step	Description
Final approval by Divisional Commissioner or CLAC (Sec 6)	**Maximum 60 working days** after Sec 5-3 time limit. It may be omitted when prior approval from Land Ministry is available
Final notice of acquisition to persons of interest (Sec 7)	Official recognition of PAPs. PAPs should submit their all documents **within 15 working days** of notice issuance.
Preparation of cash Compensation under Law (CUL)	The compensation amount should be prepared **within 30 working days** after Sec 7. Land register prepares land value, Public Works Department (PWD) prepares structure values, DAE prepares crops values, Forestry prepares tree values, etc.
Notice of compensation amount (Sec 8)	After CUL preparation, notice is to be served within 7 working days.

Source: Acquisition and Requisition of Immovable Property Act (ARIPA) 2017

Details of the Relevant Sections of ARIPA 2017 that Governs Land Acquisition and Requisition Process:

1. Section-4. Publication of preliminary notice of acquisition of immovable property:

1. Whenever it appears to the Deputy Commissioner that any property in any locality is needed or is likely to be needed for any public purpose or in the public interest, he shall cause a notice to be published at convenient places on or near the property in the prescribed form and manner stating that the property is proposed to be acquired.
2. In case of acquisition of immovable property for any non-governmental person or organization, whatever be the amount of the immovable property, sanction of the government must be taken before the initiation of acquisition proceeding.
3. The Deputy Commissioner, under sub-section (1)-
    a. before the publication of notice, in the prescribed manner and form, shall record the real nature, condition and infrastructures built therein, crops and trees of the proposed immovable property in video or still picture or any other technology and thereafter prepare a report accordingly; and
    b. after the publication of notice, in the prescribed manner and form, shall prepare a joint-list of Requiring persons or organizations and persons interested.
4. If the nature of land is changed in reality from its recent record of rights, the Deputy Commissioner, at the time of preparation of the joint list, shall decide about the change of the nature of the land.
5. The Deputy Commissioner shall mention in the joint list, in the prescribed manner, if any house or infrastructure is built or is being built in the proposed immovable property for acquisition, in contravention of public purpose for illegal gain.
6. The joint list prepared sub-section 3(b) shall be affixed in the notice board of the local land office and in the convenient place of the project.
7. The Deputy Commissioner shall not record the change of the nature of land in the joint list, if after the initiation of proceeding under sub-section 3(a), the nature of the land is changed by building houses or infrastructures in bad motive.

8. If any person is aggrieved by the decision of the Deputy Commissioner under sub-section 7, he may file an appeal to the Commissioner within the next 7 working days.
9. The Commissioner, in the prescribed manner, shall hear the appeal under sub-section 8 and shall provide with the decision within next 15 working days and in case of a nationally important project, shall provide with the decision within the next 10 working days.
10. The decision of the Commissioner under sub-section 9 shall be deemed to be final.
11. If there is any disposal of appeal under sub-section 9 or no appeal is preferred within the prescribed period in sub-section 8, within the next 24 hours, the concerned persons shall in his own cost remove the houses or infrastructures from the proposed immovable property, otherwise the Deputy Commissioner shall take steps to evict those in accordance with the existing provisions of law.
12. The Deputy Commissioner may, after choosing the place for a nationally important project, by order, impose control over the sale of plots and building of infrastructures thereon.
13. Generally religious places, graves or crematoriums can be taken into acquisition; provided that, if it essential in public purpose or public interest, by relocating and rebuilding, in the own money of the requiring persons or organizations, it may be taken into acquisition.

Explanation: The term “purpose in contravention of public interest” in this section means the purpose for obstructing in the implementation of the project, creating hindrance or doing anything that retards the implementation of a project or doing something to get monetary benefit by compensation.

2. Section-5. Objections against acquisition:

1. Any person concerned may file an objection against the acquisition proceedings to the Deputy Commissioner within 15 working days.
2. The Deputy Commissioner shall, speedily hear the objection filed under sub-section 1 in the presence of the appellant or an agent, after hearing all such objections and after making such further inquiry, if any, as he thinks necessary, prepare a report within thirty working days, and in case of a nationally important project within 15 working days, following the expiry of the period specified under sub-section (1) containing his opinion on the objections.
3. The Deputy Commissioner-
    a) if the property exceeds 50 [fifty] standard big has (or 16.5 acre) of land, submit the record of the proceedings held by him, together with his opinion, for the decision of the Ministry of Land; and
    b) if the property does not exceed 50 [fifty] standard big has (or 16.5 acre) of land, submit the record of the proceeding held by him, together with his opinion, for the decision of the Commissioner: Provided that if no objection is raised within the period specified in sub-section (1), the Deputy Commissioner shall ,instead of submitting the records of the proceedings to the Divisional Commissioner, make a decision within ten days of the expiry of the aforesaid period, or within such further period but not exceeding thirty days, as the Divisional Commissioner permits on the request of the Deputy Commissioner in writing] and in case of a national important project within 15 days, about the acquisition of the property and such decision of the Deputy Commissioner shall be final

4. Section-6. Final decision regarding acquisition:

(1) Under section 5(3), after considering the report of the Deputy Commissioner, as the case may be-
    (a) The government shall, not exceeding 60 days after the submission of the report, and
    (b) within 15 days of the submission of the report of the Commissioner or recording the report of delay within not exceeding 30 days-shall take final decision.

(2) When the Government, the Divisional Commissioner or the Deputy Commissioner, as the case may be, makes a decision for acquisition of the property under sub-section (1) of this section or section 5(3), as the case may be, such decision shall be conclusive evidence that the property is needed for a public purpose or in the public interest.

5. Section 7. Notice to persons interested:

(1) When the Government, the Divisional Commissioner or the Deputy Commissioner, as the case may be, has made a decision for acquisition of any property under section 5 or the proviso to section 6, as the case may be, the Deputy Commissioner shall cause public notice to be given in the prescribed manner at convenient places on or near such property stating that the Deputy Commissioner, has decided to acquire the property and intends to take possession thereof.

(2) Such notice shall state the particulars of the property to be acquired and taken possession of, and shall require all persons interested in the property to appear personally or by agent before the Deputy Commissioner at a time, fifteen days after the date of publication of the notice or in case of a nationally important project after 7 days, and such notice shall also contain the time and place to be present and state the nature of their respective interests in the property and the amount and particulars of their claims to compensation for such interests.

(3) The Deputy Commissioner shall also serve notice to the same effect in the prescribed form on the occupier, if any, of such property and on all persons known or believed to be interested therein.

(4) The Deputy Commissioner may also, by notice, require any such person to make or deliver to him at a time, not being earlier than fifteen days after the date of service of the notice, and place mentioned therein a statement containing, so far as may be practicable, the name of every other person possessing any interest in the property or any part thereof as co-sharer, mortgagee or otherwise, and of the nature of such interest and profits, if any, received or receivable on account thereof.

(5) Every person required to make or deliver a statement under this section shall be deemed to be legally bound to do so within the meaning of sections 175 and 176 of the Penal Code (XLV of 1860).

5. Section-8. Award of compensation by Deputy Commissioner:

(1) On the date so fixed, or on any other date to which the enquiry has been adjourned, the Deputy Commissioner shall proceed to enquire into the statement, if any, which any person has made pursuant to a notice given under section 7 and into the value of the property at the date of the publication of the notice under section 4, and into the respective interests of the persons claiming the compensation and shall make an award of

a. the compensation which, in his opinion, shall be allowed for the property; and
b. the apportionment of the said compensation among all the people known or believed to be interested in the property, of whom, or of whose claims, he has information from the latest record of the proposed mouza for acquisition.

(2) The award made by the Deputy Commissioner shall, except as hereinafter provided, be final.

(3) The Deputy Commissioner shall, within seven days from the date of making award of compensation,

(a) give notice of his award to the person interested.

(b) send the estimate of the award of compensation to the Requiring persons or organizations.

(4) The Requiring person or organization shall pay the estimated amount within 120 working days after receiving the estimation under sub-section 3 to the Deputy Commissioner.

(5) within 30 working days of the publication of notice under section 7 or in case of a national important project 15working days, as the case may be, the preparation of the estimated amount of the award of compensation shall be complete.

6. Section-9. Matters to be considered in determining compensation:

(1) In determining the amount of compensation to be awarded for any property to be acquired under this Part, the Deputy Commissioner shall take into consideration-

a. the market value of the property at the date of publication of the notice under section 4: Provided that in determining such market value, the Deputy Commissioner shall take into account the average value, to be calculated in the prescribed manner, of the properties of similar description and with similar advantages in the vicinity during the twelve months preceding the date of publication of the notice under section 4.
b. the damage that may be sustained by the person interested, by reason of the taking of any standing crops or trees which may be on the property at the time of the making of the joint list.
c. the damage that may be sustained by the person interested by reason of severing such property from his other property.
d. the damage that may be sustained by the person interested by reason of the acquisition injuriously affecting his other properties, movable or immovable, in any other manner, or his earnings; and
e. if in consequence of the acquisition of the property, the person interested is likely to be compelled to change his residence or place of business, the reasonable expenses, if any, incidental to such change.

(2) While the government is acquiring land, it shall provide the persons eligible for compensation with an additional 200 percent on the assessed value as defined in sub-section 1(a): Provided that if the government acquires the land for any non-government entity, then the amount of compensation shall be with an additional 300 percent on assessed value.

(3) In cases of injuries made under sub-section 1(b), (c), (d) and (e), additional 100 per centum compensation shall be provided.

(4) Notwithstanding any compensation provided under this section, necessary steps may be taken to rehabilitate evicted persons due to acquisition in the prescribed form.

7. Section-10. Matters not to be considered in determining compensation:

In determining the amount of compensation to be awarded for any property to be acquired under this

Part, the Deputy Commissioner shall not take into consideration-

a. the degree of urgency which has led to the acquisition.
b. any disinclination of the person interested to part with the property to be acquired.
c. any damage that may be sustained by him which, if caused by a private person, would not render such person liable to a suit.
d. any damage which is likely to be caused to the property to be acquired, after the date of service of notice under section 7, by or in consequence of the use to which it will be put.
e. any increase to the value of the property to be acquired likely to accrue from the use to which it will be put after the publication of notice under section 7; or(f) any alteration or improvement in, or disposal of, the property to be acquired, made or effected without the sanction of the Deputy Commissioner after the date of publication of the notice under section 4.

8. Section-11. Payment of compensation:

(1) On making of an award under section 8, before taking possession of the property, after the submission of the estimated amount of compensation by the Requiring persons, the Deputy Commissioner shall pay the aforesaid compensation within not exceeding 60 days from the date of deposit by the Requiring persons under sub-section 2.

(2) If the persons entitled to compensation do not consent to receive it, or if there be no person competent to receive the compensation, or if there be any dispute as to the title to receive the compensation or as to the apportionment of it, the Deputy Commissioner shall keep the amount of the compensation in a deposit account in the Public Account of the Republic which shall be deemed payment for the purpose of taking over possession of the property without any prejudice to the claim of the parties to be determined by the Arbitrator :Provided that any person admitted to be interested may receive such payment under protest as to the sufficiency of the amount: Provided further that no person who has received the amount otherwise than under protest shall be entitled to make any application under section 30.

(3) The Deputy Commissioner shall, realizing the compensation from the recipient, who may have received the whole or any part of the compensation awarded under this Part, take measures to give to pay the same to the person lawfully entitled thereto.

9. Section-12. Payment of compensation to bargadar (Sharecroppers):

Notwithstanding anything contained in this Act, when the property acquired under this Part contains standing crops cultivated by bargadar, such portion of the compensation as may be determined by the Deputy Commissioner for the crops shall be paid to the bargadar.

Explanation: In this section “bargadar” means a person who under the system generally known as ‘Adhi’, ‘Barga’ or ‘Bhag’ cultivates the land of another person on condition of delivering a share of produce of such land to that person.

10. Section-13. Acquisition and possession:

a) When the compensation mentioned in the award has been paid or is deemed to have been paid in pursuance of section 11, the property shall stand acquired and vest absolutely in the Government free from all encumbrances, and the Deputy Commissioner shall thereupon take possession of the property.
b) Immediately after the acquisition of the property under sub-section (1), a declaration by the Deputy Commissioner in the prescribed form to that effect shall be published in the official Gazette.

11. Section-15. Acquisition of part of a house or buildings:

1. an acquisition cannot be made if the owner desires that the whole of such house, manufactory or building should be so acquired: Provided that the owner may, at any time, before the Deputy Commissioner has made his award under section 8, by notice in writing withdraw or modify his expressed desire that the whole of such house, manufactory or building should be so acquired.
2. If any question arises as to whether any property proposed to be taken under this Part does or does not form part of a house, manufactory or building within the meaning of this section, the decision of the Deputy Commissioner shall be final.

12. Section-29. The Arbitrator shall, on receipt of an application under section 28, cause a notice specifying the date on which he will proceed to hear the application, and directing their appearance before him on that day, to be served on the following persons, namely: -

1. the applicant.
2. all persons interested in the objection.
3. the Deputy Commissioner; and
4. the requiring person.

13. Section-30. Application to Arbitrator

1. Any person interested who has not accepted any award made by the Deputy Commissioner under this Ordinance may, within forty-five days of the date of service of notice of the award, make an application to the Arbitrator for revision of the award.
2. The application shall state the grounds on which objection to the award is taken.
3. Under section 31. The Arbitrator shall, on receipt of an application under section 30, cause a notice specifying the date on which he will proceed to hear the application, and directing their appearance before him on that day, to be served on the following persons, namely: -
   (a) the applicant.
   (b) all persons interested in the objection.
   (c) the Deputy Commissioner; and
   (d) the requiring person.

The Arbitrator shall, within 90 days of the receipt of the application, upon hearing of the application give his order.

14. Section 34: Award determined by the Arbitrator: (1) Every award under this Part shall be in writing and signed by the Arbitrator and shall specify the amounts awarded under different clauses of section 9(1) or section 22(5), as the case may be, and the Arbitrator shall inform the Deputy Commissioner together with the grounds of awarding each of the said amounts.

(2) Where the amount of compensation determined by an Arbitrator is higher than the amount specified in the award of the Deputy Commissioner, an additional compensation at the rate of ten per cent per annum on such additional amount shall, subject to the decision of an Appellate Arbitration Tribunal, if any, be payable till that amount is paid or offered for payment.

2.10.2 Land Acquisition of the Project

2.10.2.1 Methods of Valuation for Land

The Deputy Commissioner follows the principles/rules written down in the ARIPA-2017 to determine the market prices of land and all movable and immovable assets on the acquired land. The Acquisition and Requisition of Immovable Property Act 2017 stipulates rules for assessing the market price of land. These are as follows:

- The Deputy Commissioner will determine the value of acquired land by taking an average of the previous one (1) year's land transaction price from the serving date of notice under Section 4 for each type and same quality of land within the vicinity.
- The Deputy Commissioner will pay an additional 200% of the determined land price acquired for the public interest.
- The Deputy Commissioner will pay an additional 300% of the determined land price acquired for private purposes and
- An additional 100% compensation will be paid against crops, trees, and structures found on the acquired land parcel.

However, The AIIB's ESS prescribes to assessment of the market value through an independent evaluator and a comparison with the DC price should be provided to see any differences that remain and need to be addressed properly. The following section provides the proposed methodology for land market price assessment.

2.10.2.2 Land Requirement for Power Plant

The Power Plant will require a total of 30 acres of land from three categories (Null, Viti & Bari). Out of the total 30 acres of land, 29.6485 acres were identified as privately owned land while 0.3515 acres were identified as government-owned land (khas).

2.10.2.3 Methods of Assessing Current Market Price (CMP) of Land in the Affected Mouza

The EQMS team carried out a market survey for the project in Bongaon Union to assess the land market price for Boliarpur Mouza focusing on the surrounding lands of the project, as the mouza situated in that union. To get the current market price of land, the study team consulted with seven local senior persons (elite persons who are well known in that locality, elected representatives i.e. Members of Union Parshid of Bongaon), land brokers, and deed writers in the project and adjacent area. Their responses regarding land price have been considered for detailed assessment regarding land market survey in that area. During the market survey, only cash transaction amounts between the buyer and seller of the land price have been considered as the price for the last year. Once the study team had obtained the price from the consultees a cross-verification was also conducted to see if the collected market price had a basis on reality. The cross-verification took place among the local people in 5 different locations (Konda, Nogor Kunda, Boliarpur, Kandi Boliarpur, and Bongona) where the price has been asked to random landowners in the project's surrounding area to see the price matches in field level. The land market price collected from the listed consultees has been found to match with the cross-verification price.

After getting the market price a table representing land price per decimal/acre is presented to see the detailed market price of land as per the land category. Following Table 2-15 shows the consultees of the land market survey and Table 2-17 Comparison of compensation between DC's Assessment and Current Market Price Assessment.

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Table 2-15: List of Consulted Persons during the Land Market Survey

SL	Consulted Person	Profession	Years in Profession	Area
1.	Mr Mosarraf Hossen	Deed Writer	22	Boliarpur Mouza
2.	Mr Shah Alam	Land Broker	16	Boliarpur Mouza
3.	Abu Jafar Ahmed	Deed Writer	38	Boliarpur Mouza
4.	Sree Nitish Chandra	Land Broker	15	Konda, Boliarpur
5.	Mr Aminul Islam	Deed Writer	18	Boliarpur Mouza
6.	Mr Modin Mia	Local Leader	15	Bongona, Boliarpur
7.	Advocate Jahangir Mia	Land Lawyer	25	Bongoan, Boliaprur

Based on the data available, it is understood that out of 242 landowners 138 have received compensation and 104 haven't yet received the compensation, the reasons mentioned in the DC office award book for not issuing the compensation are mentioned below:

1) A total of 88 landowners has Litigation (mostly among shareholders of the property)

2) A total of 9 landowners live abroad and;

3) 7 Landowner's land was mortgaged to the bank, upon receiving NoC from the bank the landowner would be eligible for compensation.

Additionally, it should be noted that the structure's owners have been fully compensated. Additionally, it should be noted that the structure owners have been fully compensated. The following table shows

the data for landowners as per the recipient and non-recipients of compensation along with the quantum of land.

Table 2-16: Quantum of land as per the recipients and non-recipients from the owners

Status of Payment Disbursement as per Quantum of Land					
	Recipient	**Non-recipient owners, land Parcel & Money**			**Total**
		Litigation	**Mortgage**	**Overseas**	
No of Owners	138	88	7	9	**242**
Quantum of Land	17.745	10.1535	1.204	0.8975	**30**
Amount of Money	**1996850492**	**489672726**	**58065294.48**	**43283722**	**2,587,872,234.48**

Source: Deputy Commissioner's Award Book, June 2022

2.10.2.4 Comparison between DC's Assessed Price and Current Market Assessment

A comparison between the DCs assessed price and current market price has been conducted during the study period to assess the fair compensation rate for affected land. It has been identified that DC's awarded amount as per land category is higher than the current market price, which is in line with compliance with the replacement cost principle of AIIBs ESF2. The detailed comparison between DC's Assessed Price and the Current Market Assessment is presented in the following Table 2-17.

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Table 2-17: Comparison of compensation between DC's Assessment and Current Market Price Assessment

			DC's Assessment			Current Market Price Assessment		
Sl	**Land Type**	**Land Amount in Acre**	**Price awarded by DC per Acre**	**Total Price Awarded by DC**	**Total Price of Land After adding 200% to DC's Price**	**Open Market Price per Acre**	**Total Price of land as per Market Value**	**Differences +/- with DC Price (DC price adding 200% - Market Price)**
a	**b**	**c**	**d**	**e =(c*d)**	**f= (e*200%)**	**g**	**h = (c*g)**	**i =(f-h)**
1	Bari	2.039	5,02,85,700	102,532,542.30	307,597,626.90	150,000,000.00	305,850,000.00	1,747,626.90
2	Viti	9.2567	3,83,07,700	354,602,886.59	1,063,808,659.77	80,000,000.00	740,536,000.00	323,272,659.77
3	Null	18.7043	2,16,78,900	405,488,649.27	1,216,465,947.81	20,000,000.00	374,086,000.00	842,379,947.81
Total		**30**		**862,624,078.16**	**2,587,872,234.48**		**1,420,472,000.00**	1,167,400,234.48

Source: EQMS Current Land Market Survey 2024

The above table depicts a comparison of the price of compensation between DC awarded land price and the current market price of land aligning with the ARIPA,2017 Act.

2.10.2.5 Methods of Valuation for Structure

The valuation of structures has been determined according to the schedule rate of the Public Works Department (PWD), Government of Bangladesh. As per the request on 07-04-2022 by the Land Acquisition Officer to the Executive Engineer of the Public Works Department for accessing the value of structures within the project boundary. After receiving the letter from the Land Acquisition Department, PWD has taken the following steps as a method of their valuation process:

- Sub-divisional Engineer along with the sub-assistant engineer and their surveyor from the civil & electrical department visited the site in person.
- During the site visit, the PWD team measured up the structures and prepared a category-wise list of structures and valuation as per the schedule rate determined by the PWD.
- Following the Public Works Department's infrastructure assessment rules and according to the "Book of Specification and Office of Practice", Public Works Department 17.18% of the total value for private ownership of infrastructure has been deducted and based on the information received from the local people bearing in mind the construction period of the facilities in 2013 with 5% depreciation cost a total 22% from total assessed value has been deducted.
- PWD considers an additional 100% value on the assessed price for structures during the valuation process for structures as per ARIPA 2017.

Upon direction of the Executive Engineer on 13/04/2022 the site was visited by the team comprising DNCC personnel, DC's representatives, and owners of the structures, and measurement of every structure was taken to prepare the estimation for structures.

Market assessment for structure is challenging due to varying regional standards, diverse material costs, and fluctuating market conditions. Unlike the PWD Bangladesh analysis, which benefits from standardized data and regulatory consistency, other assessments must navigate inconsistent information and local market discrepancies. Moreover, In Bangladesh, conducting a market assessment for affected structures can be challenging for several reasons, leading to reliance on the Public Works Department (PWD) or similar authorities for valuation:

1. Lack of Comprehensive Data: Market data on property values and construction costs may be incomplete or outdated. This makes it difficult to perform accurate and current market assessments for affected structures.
2. Infrastructure and Property Variability: The condition and value of structures can vary significantly due to local factors such as quality of construction, maintenance levels, and specific regional market conditions. Standardized market assessments might not capture these nuances effectively.
3. Expertise and Resources: Specialized market assessment expertise and resources may be limited within project teams or local authorities. The PWD often has technical expertise and established methodologies for valuing affected structures, ensuring consistency and accuracy.
4. Regulatory and Procedural Framework: Regulatory frameworks might mandate reliance on established government departments like the PWD for property valuation to ensure fairness and adherence to standardized procedures.
5. Operational Efficiency: The PWD has established protocols and experience in handling property assessments, making it a more efficient option compared to setting up new market assessment mechanisms for each project.
6. Local Practices: In some regions, traditional practices and reliance on government departments for property valuation are well-established, making it more practical to follow these practices rather than developing new methods.

Overall, while market assessments are ideal for capturing current property values, practical constraints in Bangladesh often lead to reliance on the PWD to ensure reliable and standardized compensation for

affected structures. It has been practiced for many development projects by WB, ADB, JICA, IFC and AIIB as well to rely on PWD's rate for structures.

2.10.2.5.1 Payment Status of Affected Structures

The compensation that has been determined by the DC for affected structures was fully (100%) compensated to the owners dated 29/09/2022.

2.10.2.6 Methods of Valuation for Trees

As per ARIPA-2017, an additional 100% of the assessed price for impacted trees belonging to private owners has also been calculated.

2.10.2.6.1 Payment Status of Affected Trees

The compensation for affected trees, as determined by the Deputy Commissioner (DC), was fully (100%) disbursed to the owners on June 30, 2022.

2.10.2.7 Status of Land Acquisition

The land has been acquired duly following all applicable rules and laws stated in the ARIPA,2017 Act. Payment of compensation has already been disbursed based on the outcome of the consultation with the landowner. The Majority of the landowners have received compensation but few of them are yet to receive their compensation due to their litigation, inheritance, and documentation upgradation issues against their land title. The project proponent has taken proactive measures in collaboration with the DC office and DNCC to ensure the smooth disbursement of compensation to the remaining landowners who are yet to receive their awarded compensation.

According to the DC office Land Acquisition (LA) section Total estimated budget for this project is 336,34,68,952.87 BDT, where 199,68,50492.46 BDT has been disbursed to the 138 awarded persons for 17.745 acres of land which is 59.36% of the total land price. This information was obtained during the study, and the document collected from the DC office in favor of this statement has been provided in **Appendix D 6** and **Appendix D 7**.

2.11 Resource and Utility Demand

2.11.1 Land Development

After completion of the land acquisition process, DNCC developed the land inside the project site. The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about 850,000 cubic meters. The sand has been sourced from Padma River, Meghna River and Brahmputra Jamuna river. The supplier responsible for supplying this significant quantity of sand is Maisha Construction Pvt Ltd (MCPL). As of the present scenario, the process of sand filling has been ongoing, with the aim of meeting the site's requirements for construction and development. Sand filling activities started in January 2023 and will end in June 2024.

2.11.2 Waste Requirement

According to the existing agreement of this project, the processing capacity of this project is 3,000~3,600 tons/day, with an annual processing capacity of 1.095 million tons. When the supply of solid waste is insufficient, industrial waste can be collected for supplement. Therefore, the waste requirement for the proposed incineration scale of this project is 3,000 t/d, which waste can completely meet the processing requirements of this project.

2.11.3 Water Requirement

Water will be uptake from surface water sources. The total amount of water required from surface water will be 349.5 m^3/h. Most of the amount of water will be taken from surface water sources like nearby river named “Karnatali River” located at the north of the project boundary.

The primary industrial water source of the Aminbazar Waste to Energy (WTE) Project will be surface water. However, groundwater will serve as a reserve water source for industrial water purposes within the project site. The filtration or water purification system should be designed to handle low-quality water. During the dry season (January to March), when water flow decreases and quality deteriorates, or in the event of damage to the water intake pipeline, groundwater will be used as an emergency water source to meet the day-to-day operation of industrial water needs of the project site.

The waste-to-energy (WTE) project will utilize 3 deep bore/tube-wells for the abstraction of groundwater from the proposed project site. Three boreholes will be installed inside the project boundary, with two designated for regular use and one serving as an auxiliary well. The total depth of the ground water well is 260m. Each well has been designed with a capacity of 190 m^3/h.

WARPO and local government permission is necessary for water intake. The project has already obtained permission from WARPO and Local Union Parishad Chairman which is given in **Appendix B**. The boreholes point has given in **Appendix G**.

Water Intake and Drainage Pipeline

There are three water intake points has been proposed by the design team of project proponent. The total length of the water intake pipeline is approximately 1.434 km north from the proposed project site. The water intake pipeline outside the factory adopts straight-seam welded steel pipes with a diameter of DN350. The drainage pipeline outside the factory adopts reinforced concrete pipes with a diameter of DN1000. The road and pipeline leading to the water intake pump room outside the factory covers an area of approximately 18501.4 m^2 (or 4.57 acre), including road and road slopes, external drainage pipes, and water intake pipes. Most of the land is privately owned land currently being used for farming and some land has been found unused. During the ESIA report preparation phase the land purchase for water intake and drainage pipeline is under processing. As the project developer will purchase the land willing buying and willing selling method. Therefore, the project developer should follow the AIIB ESF guidelines (2022). The water intake pipeline and drainage pipeline route has been given in **Appendix G.**

2.11.4 Fuel Requirement

Diesel fuel will be used for the incinerator start and shutdown. Each incinerator shall be maintained once every six months, 2 times a year. About 40t diesel fuel will be consumed for each start and shutdown. Diesel fuel consumption by ignition throughout the year = 40 × 2 × 4 = 320 t. The diesel oil storage tank diagram is given in **Appendix G.**

2.11.5 Electricity Requirement

According to the processing load of the whole plant, the operation condition of the incineration line, and the power supply range of the plant transformer, the statistical calculation of the plant load per hour is carried out, and the house-service consumption rate is about 15.3%. Electricity consumption for this project will be 0.73×108kWh/a.

2.11.6 Road

The roads in the factory area are arranged in circular form to meet the requirements of production, transportation, and fire control. A 360 m long access road has been planned in the east side to enter the project site from highway. The road pavement width is mainly 7.0 meters, and the road bending

radius in the main factory area is 12.0 meters. The minimum bending radius of roads dedicated to waste transportation is 18.0 meters.

2.11.7 Telecommunication System

The communication system in the plant in this project is composed of production management and production dispatching communication system. Due to the imperfect current data, the introduction point of external optical cable and telephone cable is to be determined. In this project, due to the small unit capacity, the production management communication is combined with the production dispatching communication, and a set of dispatching program-controlled switch with a capacity of 160 lines is configured in the plant, which is also used as administrative switch. Program-controlled switch and wiring equipment are to be located in the electrical equipment room of the main control building. The program-controlled switch is normally powered by 220 V Alternating Current (AC) power supply. When AC power supply fails, it is automatically switched to 48 V DC power supply (48 V DC power supply is provided by the manufacturer).

Telephone and network information sockets shall be set in rooms such as control rooms, office, and duty room in all buildings of the plant. The installation height of the information socket and telephone socket shall be 0.3 m from the bottom to the ground. As far as the information socket is concerned, the "super five-category" standard eight-bit RJ45 socket shall be used. It shall be protected by hot galvanized steel pipe and concealed along the wall, ground, or ceiling.

In order to meet the needs of mobile communication for production and maintenance personnel, an application for 10 pairs of wireless walkie-talkies shall be submitted to the local radio committee.

2.11.8 Manpower Requirement

The waste incineration power plant, the slag's comprehensive utilization, treatment facilities, and the fly ash landfill all need certain personnel to operate and maintain. The manpower during the peak time of the construction period will be about 2320 people where 450 male and 10 female Chinese workers will be hired and around 1835 male and 25 female local workers will get employment opportunity due to construction activities.

During the operational stage around 280 people will be required for the plant operation where 30 male and 10 female Chinese skilled workers will be hired, and 150 male and 50 female local skilled workers will be engaged. During plant operation, approximately 35 male and 5 female unskilled workers will also be required for different purpose.

Table 2-18: Total Manpower Requirement during Construction and Operation Stage

Stage	Nationality	No of Skilled worker		No of Unskilled worker		Total
		Male	Female	Male	Female	
Construction	Chinese	450	10	0	0	460
	Bangladeshi	1800	20	35	5	1860
Operation	Chinese	30	10	0	0	40
	Bangladeshi	150	50	35	5	240

Source: Feasibility Study, CMEC

2.12 Process Flow of Waste to Energy

After the waste transport vehicle enters the factory and is weighed and measured by the weighbridge, it enters the waste tipping hall, discharges the waste into the waste storage pit for storage, and mixes the waste with the waste grab crane before sending the waste into the incinerator. The system mainly includes the following facilities: Weighbridge, waste tipping hall, waste tipping gate, waste storage pit,

waste crane, and deodorization facilities. The description of the process involved in the generation of electricity from municipal waste is given below:

2.12.1 Weighing and receiving

Waste weighing system

The main function of the waste weighing system is to count and weigh the waste that enters the factory, mainly weighing, recording, transmission, printing, and data processing. The Waste Weighing system consists of 3 sets of automatic electronic automobile scales, two sets with a maximum weighing capacity of 60 tons and one set of 80 tons, with an accuracy of 20 kg. According to the daily flow of vehicles into the factory, there are 2 sets of vehicles weighting apparatus into the factory and 2 sets of vehicles weighting apparatus out of the factory, to avoid congestion caused by the peak of waste truck into the factory.

Tipping hall

The entrance of the unloading platform is equipped with red-green signal lights and coil-type vehicle detectors, and the crane control room controls the incoming and outgoing vehicles. According to the size of large waste container transport vehicles, the width of tipping hall was set at 28 meters, the length was set at 116meters, and the height was 7 meters. When the waste truck enters from the south side of the tipping hall, the tipping port can be reached by one turn; when the transport vehicle tipping, there can be 3 ~ 6 m space left on the east side of the tipping hall for other vehicles to enter and exit.

Tipping gate

Twelve sets of electro-hydraulic driven double-open tipping halls were set on the tipping gate, and the size was tentatively set at 3600 (width) × 6500 (height). The opening and closing of the tipping gate shall be interlocked with the feeding and grasping of the waste grab crane, and the opening and closing of the waste grab crane can be controlled by control room operators in the tipping gate. In order to make the waste truck driver aim at the waste tipping gate accurately, a white zebra mark and collision bar are set in front of each seal door. A car stop was set before each tipping gate to prevent the vehicle from backsliding into the waste pit.

Waste Pit

The waste storage tank is a closed reinforced concrete structure storage tank with anti-seepage and anti-corrosion function and in negative pressure state. The volume of waste tank should be determined by considering the large fluctuation that may occur in the daily supply of balanced waste; Secondly, considering that a certain space for waste receiving and storage should be reserved during the shutdown and overhaul; Thirdly, considering that the primary waste entering the factory has a large water content and is not suitable for direct furnace incineration, it needs to be stored in the waste tank for moderate fermentation of waste and the precipitation of waste leachate as far as possible to ensure the stable combustion of incinerator.

The waste pond is a closed reinforced concrete pond with anti-seepage and anti-corrosion function. The total volume design of two waste tanks set in this project is about 35,000 m^3 (two waste tanks, each of which is length 50m × 32m width × average height 15.5m and the depth below the ground is about 6 meters). According to the average bulk density of waste stored in the tank of 0.45 t/m^3 and the average daily intake of 3600t, the incineration amount of about 10 days can be stored.

The Company (WTE Power Plant North Dhaka Private Limited) will construct Waste receiving pits and storage facilities on the Site pursuant to the Power Purchase Agreement for the purpose of receiving, storing and utilizing Mixed Waste supplied by the Waste Supplier (DNCC) pursuant as per Waste Supply Agreement, which will in all respects be compliant with the requirements and specification under the Power Purchase Agreement and the Detailed Design. These facilities, collectively the 'Receipt and Storage Facilities' shall, include:

- Receipt and storage facilities allow 4-6 Compatible Vehicles to unload the Mixed Waste simultaneously.
- Storage facilities with a capacity to store 30,000 Metric Tons of Mixed Waste.
- Weighing facility.
- The Waste Delivery Point; and
- Advanced controls and pre-treatment facilities.

As per the Waste Supply Agreement between Company and DNCC in clause 6.3, Mixed Waste delivered to the Waste Delivery Point shall be inspected and pre-treated at the Site by the Company. The Parties acknowledge and agree that the Mixed Waste delivered by the Waste Supplier from time to time may contain a certain amount of Unqualified Waste.

The Company may remove any Unqualified Waste from the delivered Mixed Waste and issue a notice to the Waste Supplier (the "Diversion Notice").

Within three (3) Days after receiving the Diversion Notice, the Waste Supplier may inspect the Unqualified Waste removed by the Company and shall take the Unqualified Waste away from the Site to the Dumping Ground at its own costs and expenses.

Collection and discharge of leachate

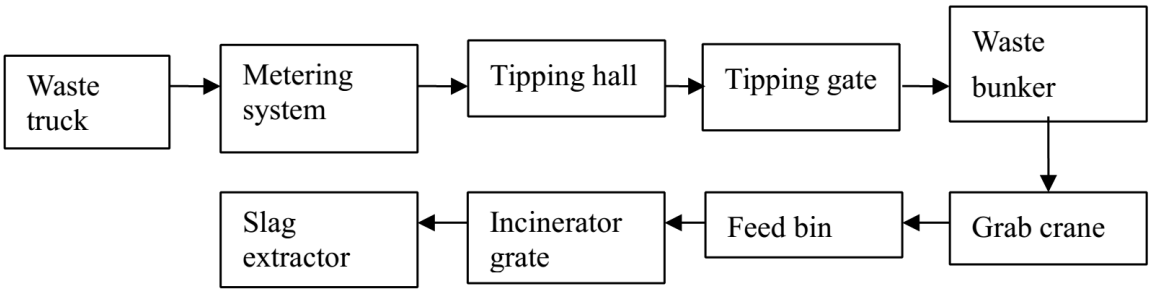
A 560m^3 leachate sump is set at the side of each waste tank near the tipping hall. The leachate sump can store the amount of leachate for not less than 0.5 days. The tank is equipped with a liquid level measuring device and the leachate pump for interlocking control, and the liquid level and alarm signal can be fed into the DCS system for monitoring. The waste leachate in the leachate sump is pumped out by the leachate pump and fed into the leachate treatment station for treatment. Two submersible sewage pumps with fixtures (One for use and one for standby) for the delivery of waste leachate are set in each waste leachate sump, and the specifications are: The flow rate is 50m^3/h, the head is 60 m, and the power is 18.5 kW. The submersible sewage pump shall be stainless steel corrosion resistant sludge pump.

Necessary anti-seepage measures are taken at the bottom and around the waste storage pit and leachate sump, which not only prevents the seepage of leachate, but also avoids the seepage of groundwater. Through the above measures, the timely conduction and discharge of leachate can be achieved, which greatly reduces the deposition of leachate in the waste storage pit, thereby reducing the water content of waste into the furnace and increasing the calorific value.

Waste grab crane

Two orange semi-automatic waste grab cranes with a starting weight of 20 t and a waste grab volume of 12.5m^3 were set above each waste tank for incinerator feeding and carrying, stirring, and pouring of waste, and stacked to a predetermined area in sequence to ensure uniform composition and stable combustion of waste into the furnace. It can realize semi-automatic operation (programmed operation state) and manual operation. Both methods can meet the process requirements and can be quickly switched. The waste grab crane is located above the waste storage pit; this project has four semi-automatic garbage bucket cranes and one spare garbage bucket, which mainly undertake the feeding, handling, stirring, collating, and accumulating waste. The waste grab crane is equipped with a metering device, which has the functions of automatic weighing, automatic display, automatic accumulation, printing, overload protection, and limit protection.

The storage and transportation block diagram of waste is as follows:

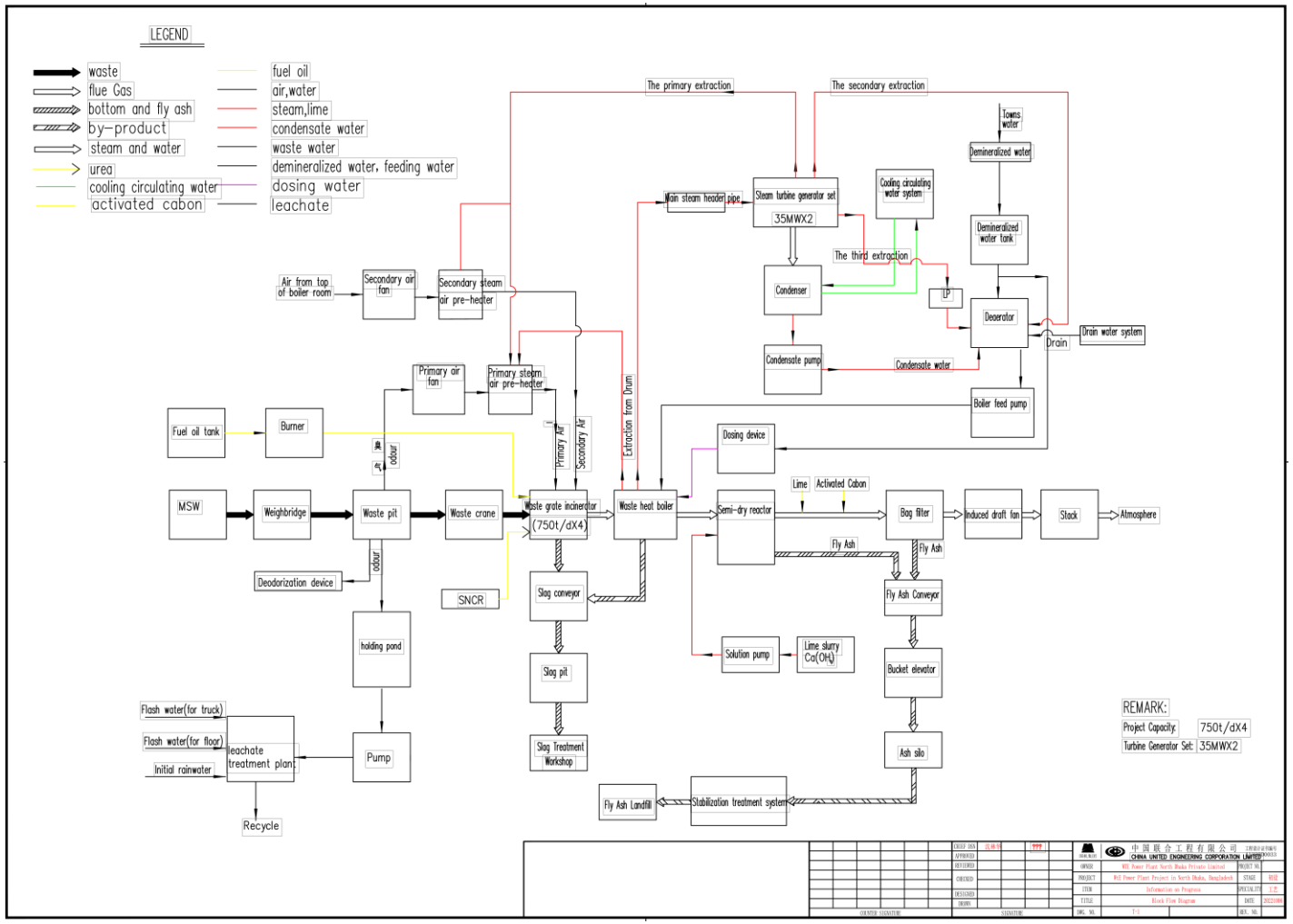


The waste was transported by a truck to the incineration plant, weighed by a car balance, entered the tipping hall through the ramp, and discharged into the waste bunker for temporary storage. The waste crane grab sends the waste into the feed hopper of each incinerator. The waste passes through the feed hopper and chute and is pushed by the feeder into the incinerator.

The waste falls on the grate and is made dry through the grate drying section, and it is pushed to the combustion section with the motion of the grate reciprocating and completes the combustion in the combustion section in turn. The burnt slag falls into the slag extractor through the slag outlet.

There are four types of domestic waste incinerators: mechanical grate furnaces, fluidized bed incinerators, pyrolysis incinerators, and rotary kiln incinerators. The main domestic waste incinerators with more applications and mature technology are mechanical grate furnaces.

Figure 2-7: Process flow diagram of WTE Power Project



Source: Feasibility report, CMEC

2.12.2 Mechanical Grate Furnace

There are four types of domestic waste incinerator: mechanical grate furnace, fluidized bed incinerator, pyrolysis incinerator, and rotary kiln incinerator. The main domestic waste incinerators with more applications and mature technology are mechanical grate furnaces which technology is recommended by the feasibility consultant.

Layered combustion technology is used in mechanical grate furnaces, which has the advantages of a low requirement for waste pretreatment, a wide range of adaptation to the calorific value of waste, and easy operation and maintenance. A mechanical grate furnace, the most commonly used municipal solid waste incinerator with the largest processing capacity and the best applicability globally, is widely used in developed countries such as Europe and the United States. The waste passes through three sections on the grate: Preheating and drying, combustion, and burnout. The waste is ignited on the grate, and the heat comes not only from the furnace's radiation and the flue gas's convection but also from the interior of the waste layer. The waste that has been ignited on the grate, through the reciprocating motion of the grate, produces strong flipping and agitation, causing waste combustion at the bottom. Continuous flipping and agitation also loosen the waste layer and strengthens air permeability, which is conducive to waste drying, ignition, combustion, and burnout.

Table 2-19: Performance and characteristics of the common waste incinerators

Project	Mechanical grate
Characteristics of Furnace Bed and Furnace Body	Large mechanical grate area and furnace volume
Waste Pretreatment	No required
The floor area of the equipment	Large
Heat Cauterization of Slag	Easy to reach the standard
The resident's time of waste in the Furnace	Longer
Excess air coefficient	Large
Combustion air supply	Easy to adjust
Adaptability to the moisture content of waste	Adapt to waste with different water content by adjusting the movement of the drying section
Adaptability to inhomogeneity of waste	It can be reversed by toggling the waste through the grate to homogenize it
Dust content in flue gas	Low
Combustion medium	No carrier
Automatic combustion control	Easy
Operating expenses	Low
Flue gas treatment	Easy
Maintenance workload	Less
Operational performance	Maximum
Comprehensive evaluation	It has strong adaptability to waste, few faults, good treatment performance and environmental protection performance, and low cost

Source: Feasibility Study, CMEC

The mechanical grate type waste incinerator has the following characteristics compared with other furnace types:

- It has matured and reliable technology. Most of the large solid waste incineration power plants in developed countries use the mechanical grate furnace type. The large incineration power plants built or under construction in China also mostly use this furnace type.
- It uses the residual heat generated by incineration for power generation, which has certain energy-saving and economic benefits. It has a better CO_2 emission reduction effect than other solid waste treatment facilities.
- It has strong adaptability to the characteristics of waste composition change; it has an independent preheating and drying area, and the heat generated by waste incineration in the furnace can preheat and dry the newly entered waste, and it can especially adapt to the characteristics of high moisture and low calorific value of waste.
- It is easy to operate and not easy to cause secondary pollution.
- The incinerator is stable and reliable, the equipment life is long, and the annual operation time is greater than 8000 hours.

2.12.3 Air combustion system

The combustion air system includes two parts: primary air and secondary air. The primary air is introduced by the PA fan through the space above the waste tank while ensuring that the waste tank is in a negative pressure state to avoid odor leakage. After a steam-air preheater preheats the primary air, it enters the bellows through the lower part of the grate and then enters the furnace for combustion support by the grate air supply hole and the waste layer on the grate.

The secondary air is drawn through the SA fan from the hot area in the upper part of the incineration room while decreasing the temperature of the top region of the incinerator. Two sets of high-speed nozzles spray the secondary air into the combustion chamber. The high-temperature Flue Gas in the combustion chamber forms a turbulent flow so that the incompletely burned volatiles are entirely burned. CO and other Flue Gas pollutants in the high-temperature Flue Gas are reduced.

The cooling air of the furnace wall is drawn from the incineration room by a cooling fan. After cooling the furnace wall's temperature through the furnace wall's air layer, it is directly blown into the furnace by the primary air (PA) duct.

2.12.4 Waste incineration process

The incinerator has an ignition burner and auxiliary burner and has light diesel as an auxiliary fuel. The function is to make the outlet temperature of the incinerator reach the rated operating temperature (more than 850℃) through natural gas when the incinerator is ignited without waste, and then to start to put waste into the furnace to prevent waste from being put into the furnace at a low temperature, resulting in excessive exhaust pollutants. Also, in the normal shutdown process, the burner input is required to maintain a temperature above 850 °C when the furnace's waste is not entirely burned out. When the calorific waste value is low, the water content is high, and the Flue Gas temperature of the furnace outlet cannot be maintained above 850 °C, enabling the burner at this time can increase the furnace temperature and stabilize combustion. During the shutdown process, the burner must be started before stopping the waste feed until the grate is burned.

The waste passes through three areas on the grate: drying, burning, and burnout. The combustible portion of the waste has been entirely burned, and the slag falls into the slag extractor. The slag extractor acts as a water seal and cooling slag and pushes the slag to the slag storage pit.

There is a DCS control system for continuous monitoring, and the combustion control system (ACC) will control the flue gas temperature to ensure that the temperature reaches more than 850°C. When the process is operating normally, there is a temperature measuring instrument at the furnace outlet to monitor the furnace temperature in real time. The combustion adjustment system keeps the furnace

temperature above 850°C. In addition, the burner will be used to assist combustion to adjust the control temperature so that the furnace temperature is kept above 850°C.

Table 2-20: Incinerator performance guarantee values table

Project	Guaranteed value	
	Unit	Data
The annual operating time of each incinerator is not less than	Hours	8200
Disposal capacity for long-term operation under MCR operating conditions for waste under incineration contract (per unit)	t/h	31.25 (MCR1) 27.5 (MCR2)
Handling capacity during short-term o verload (2 hours per 24 hours)	t/h	34.375
When rated treatment capacity, no auxiliary fuel can be added to stabilize combustion, keep furnace flue gas temperature above 850℃, flue gas residence time 2 s, can adapt to the low calorific value of waste	kJ/kg	4605
The flue gas temperature at the outlet of the furnace shall not be lower when incineration of the specified refuse and rating	℃	850
Duration time of flue gas at temperatures above 850℃	seconds	2
Heat Cauterization of Slag	%	≤3
Organic matter content of slag	%	≤0.1

Source: Technical Agreement, CMEC

2.12.5 Flue Gas Process

The order of heat incinerator within the Flue Gas passes through the waste heat boiler, Flue Gas Treatment System, drawn by the ID fan and discharged into the atmosphere through the chimney.

2.12.6 Slag process

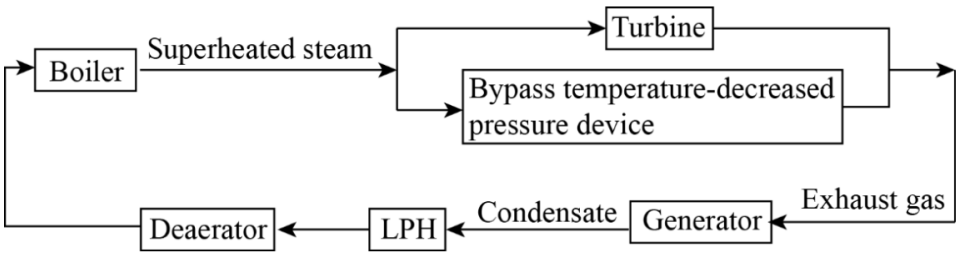
The slag after solid waste incineration falls into the slag extractor through the slag outlet at the grate tail. A conveyor transported the leaked slag from the grate to the slag remover. The boiler ash collected by the duct ash hopper at the rear of the boiler is controlled into the scraper conveyor by an ash removal valve and delivered to the slag extractor. The slag in the slag pond is lifted by a grab truck and sent to the comprehensive utilization workshop for brick making or asphalt concrete making or to be dumped at slag disposal plant.

2.12.7 Fly ash process

The fly ash collected by the Flue Gas Treatment System consists of the fly ash collected by the semi-dry reaction tower and the ash hopper of the bag filter. Fly ash is transported to the hoist through scraper conveyors, fed into the ash bin, and then stabilized by fly ash. The fly ash treatment technology in this project is selected as the main scheme: synergistic treatment with cement kiln, the fly ash will be sent to the cement kiln plant for subsequent treatment. If the alternative scheme - stabilization of chelating agent is selected, the fly ash stabilization treatment will be carried out in the fly ash stabilization workshop.

2.12.8 Steam and water process

The flow chart of the steam and water system is as follows:



The superheated steam generated by the waste heat boiler was sent to the steam wheel generator group. The steam expands in the turbine to work, and the exhaust gas is discharged into the condenser. The exhaust gas condenses into water in the condenser. It enters the deaerator for deaeration through the condensate pump heater, the low-pressure heater, and the boiler replenishing water, respectively, and is temporarily stored in the deaeration water tank. The deoxygenated water reaching 130 °C was pressurized by a feed water pump and sent to the boiler economizer. The waste heat boiler uses water as a working fluid to absorb heat in the hot Flue Gas, which produces a vapor of 5.3 MPa (g), 430 °C, for power generation in the turbine generator group. In addition to the electricity generated for the use of this factory, the excess electricity is sent to the regional power grid.

The steam for primary air heating is supplied in two stages, a steam turbine extracts the primary heated steam, the secondary heated steam uses saturated steam, and the condensate is produced after steam heat returns to the deaerator.

2.12.9 Water Balance

Surface water will be sourced from Karnatali River for the proposed project is 347.7 m^3/hr. The major water demand for the proposed power plant is cooling water system and it has been estimated 16991.6 m^3/hr.

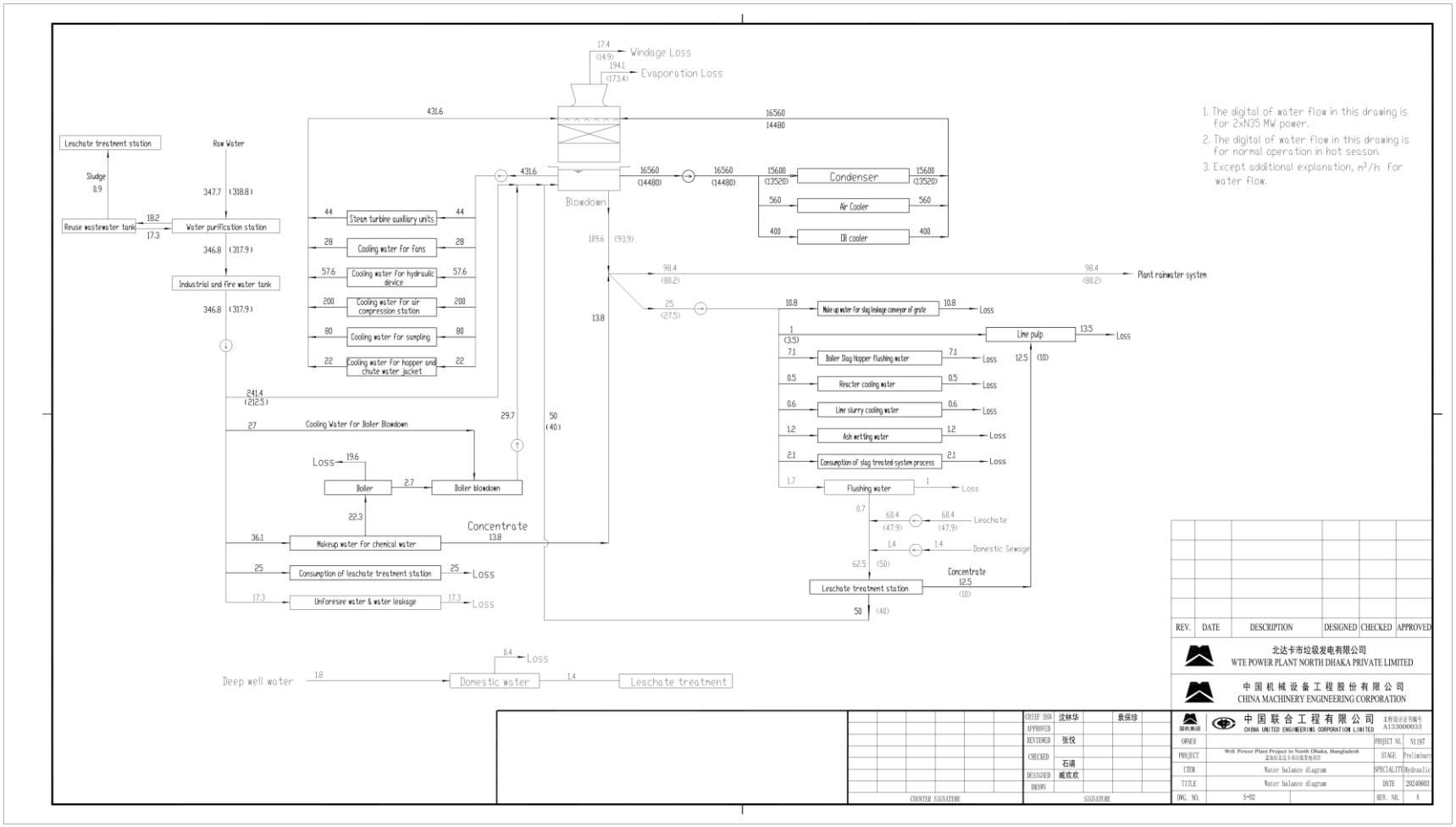
Table 2-21: Water Requirement during Plant Operation

Sl.	Activity	Water Requirement (m^3/hr)
Water use		
1.	Water purification station	347.7
2.	Domestic water	1.8
Total Water Requirement		**349.5**
Water loss		
3.	Windage Loss	17.4
4.	Evaporation Loss	194.1
5.	Water purification station	0.9
6.	Boiler	19.6
7.	Consumption of leachate treatment station	25
8.	Unforesee water & water leakage	17.3
9.	Flushing water	1
10.	Consumption of slag treated system process	2.1
11.	Ash wetting water	1.2

Sl.	Activity	Water Requirement (m^3/hr)
12.	Lime slurry cooling water	0.6
13.	Reacter cooling water	0.5
14.	Boiler Slag Hopper flushing water	7.1
15.	Lime pulp	13.5
16.	Make up water for slag leakage conveyor of grate	10.8
17.	Domestic water loss	0.4
18.	Drainage Plant rainwater system	98.4
Total Water Loss		**409.9**
Make up water requirement from surface or ground		**349.5**
Water recovery from Leachate treatment		**60.4**

Source: Feasibility Study, CMEC

Figure 2-8: Water Balance Diagram of the Proposed Project

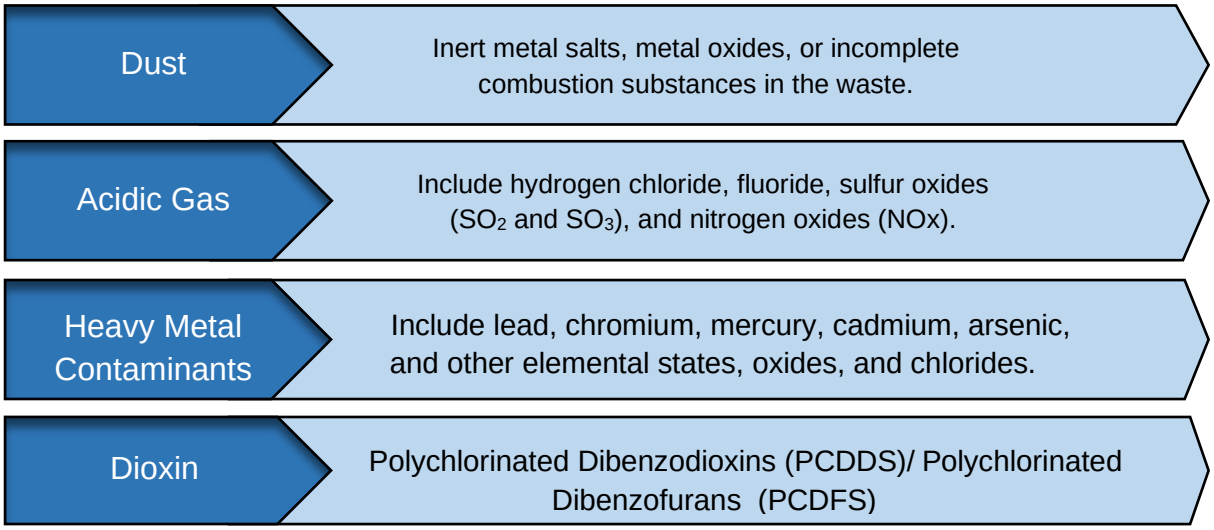


Source: Feasibility Study, CMEC

2.13 Description of the Treatment Process

2.13.1 Flue Gas Treatment System

In the Flue Gas generated by the WtE process, there are many pollutants, and the main pollutants are the following:



Depending on their quantity and nature, these substances mentioned above can be hazardous to the environment to varying degrees. The design and operation management of the Efficient Flue Gas Treatment System is the key to preventing secondary pollution in waste incineration plants, and it is also the guarantee that the Flue Gas Treatment effect reaches the specified emission index.

2.13.1.1 Design parameters of Flue Gas

According to the composition of solid waste, combined with the pollutant concentration parameters of conventional waste incineration plants.

Table 2-22: Table of main components of Flue Gas at boiler outlet

SL	Project	Unit	Quantity
1.	Flue gas	Nm^3/h	139782
2.	N_2	%	67.15
3.	CO_2	%	7.86
4.	O_2	%	8
5.	NO_X	mg/Nm_3	400
6.	SO_X	mg/Nm_3	600
7.	HCl	mg/Nm_3	1200
8.	Dust	mg/Nm_3	3000
9.	Cd, Ti	mg/Nm_3	0.8
10.	Hg	mg/Nm_3	0.26

SL	Project	Unit	Quantity
11.	Sb, As, Pb, Cr, Co, Cu, Mn, Ni	mg/Nm3	65
12.	PCDD &PCDF	mg/Nm3	4

Source: Feasibility Study, CMEC

Table 2-23: The Flue Gas emission standard of this project

SL.	Pollutant name	Unit	EU 2010/75/ EU	
			Daily average	Half hour 100%
1.	Dust	mg/Nm3	10	30
2.	HCl	mg/Nm3	10	60
3.	HF	mg/Nm3	1	4
4.	SO2	mg/Nm3	50	200
5.	NOx	mg/Nm3	200	400
6.	CO	mg/Nm3	50	100
7.	Hg	mg/Nm3	0.05 (mean measured)	
8.	Cd+T1	mg/Nm3	0.05 (mean measured)	
9.	Pb+Cr and other heavy metals	mg/Nm3	0.5 (mean measured)	
10.	Dioxins (TEQ)	ng-TEQ/Nm3	0.1 (mean measured)	

Source: Feasibility Study, CMEC

Notes:

- The standard limits specified in this table are converted using dry Flue Gas containing 11% O_2 in the standard state as the reference value.
- HF was not measured by online monitoring in this project.

2.13.1.2 Flue Gas Treatment Process

The Flue Gas Treatment process is to remove pollutants such as soot, acidic gases (HCl, HF, SO_2 as well as NOx, etc.), heavy metals (Hg, Pb, Cr, etc.) and dioxins from the Flue Gas emission according to Flue Gas standards to meet the emission standards of the project.

The Flue Gas Treatment process of this project is **"SNCR (urea water injection in the furnace) + semi-dry method (lime pulp solution) + dry method (Ca (OH)2 dry powder) + activated carbon injection + bag filter + (reserved SCR)"** treatment process.

Then the urea solution nozzle of the SNCR system is set on the first flue of the boiler at the waste incinerator outlet. The urea solution is sprayed into the flue using the high-temperature environment in this Flue Gas for denitrification reaction to reduce the NOx concentration in the waste heat boiler and ensure that the concentration at the urea outlet is controlled below 200 mg/Nm3.

The Flue Gas at the waste heat boiler outlet (about 190℃) enters the semi-dry absorption tower for the first step of deacidification. The top of the tower is provided with a Ca $(OH)_2$ solution and a cooling water injection device. After the first step of deacidification treatment, the Flue Gas leads to the bag filter after coming out of the Spray Dry Absorbe (SDA).

An activated carbon injection system and dry powder hydrated lime injection system were set up between the SDA and the bag filter. Activated carbon is used to adsorb heavy metals, dioxins, furans, TOC, etc. The hydrated lime dry powder can assist in the removal of acidic gases from Flue Gas. This reaction starts within the flue and continues on the bag. The dry hydrated lime injection system can be used as a pre-spraying system in the opening stage to protect the bags. Hydrated lime and activated carbon are supplied quantitatively in a pneumatic conveying manner, and the pneumatic conveying system consists of a feeder, fan, and conveying pipeline.

The Flue Gas then enters the bag filter and its reaction products (calcium chloride, calcium sulfite, calcium sulfate, sodium chloride, sodium sulfite, etc.) with chemicals, activated carbon, and dust adsorbing pollutants are separated when passing through the filter bag. At the same time, the unreacted dry powder also attaches to the filter surface. It reacts with the acidic gas in the Flue Gas passing through the filter bag to further improve the removal efficiency of the acidic gas. The cleaning of the bag filter is a pulse reverse blowing mode, which can realize the regular online cleaning of the fly ash attached to the filter bag.

The Flue Gas from the dust collector is discharged into the atmosphere through the chimney.

2.13.1.3 Composition of Flue Gas Treatment System

The Flue Gas Treatment System of this project consists of the following sections:

- SNCR system
- Semi-dry reaction tower system
- Activated carbon storage and injection system
- Dry powder (Ca $(OH)_2$ powder) spray precoating system
- Bag filter system
- ID fan system
- Fly ash transportation and storage system
- Chimney and flue system

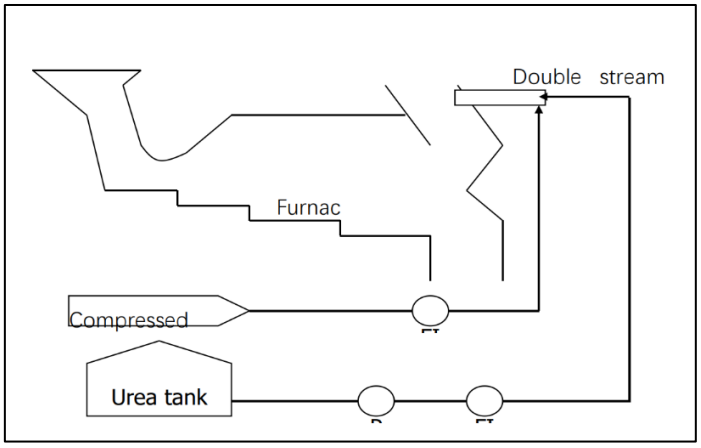
2.13.1.3.1 SNCR system

In this project, the SNCR system uses urea as the reducing agent, and at high temperatures of 850 ~ 1100℃, urea reacts with nitrogen oxide as follows:

$$(NH_2)_2CO + H_2O \rightarrow 2NH_3 + CO_2$$

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$$

Figure 2-9: Process flow diagram of SNCR method



Source: Feasibility Study Report, 2022, CMEC

The urea solution is ejected into the post-combustion chamber through multiple nozzles, and its cooling or atomizing medium is compressed air and water. The reducing agent is sprayed into the combustion furnace through the nozzle. A three-layer nozzle is set, and a nozzle is equipped, and the specific level used will be determined during the equipment debugging stage.

Ammonia, carbon monoxide, hydrogen carbide, and other thermal decomposition gases produced during waste drying are used to restore NO_X; the NO_X concentration in Flue Gas is less than 400 mg/Nm^3 when no urea is sprayed into the furnace.

NO_X reducing agent urea is sprayed into the high-temperature part of the incinerator at 850 ~ 1000℃ and reacts with NO_X to generate harmless nitrogen (N_2). Ammonia has the effect of preferential reduction of NO_X under a high-temperature atmosphere. After spraying urea, the NO_X concentration was below 200 mg/Nm^3 in the final emitted Flue Gas.

In this project, the incinerator can inhibit the emission concentration of NO_X below 400 mg/Nm^3 by using Advanced Combustion Control (ACC) for combustion management. The SNCR technique can reduce the NO_X concentration to less than 200 mg/Nm^3. The NOx concentration in the final flue gas is in accordance with the EU standard control value, and the daily average emission value does not exceed 200 mg/Nm^3, which will be monitored in real time by the flue gas continuous monitoring system or Continuous Emission Monitoring System (CEMS) and will follow Table 2-24 showing the 2010/75/EU standard VS the guaranteed value of the Project).

Table 2-24: Emission Standards for Flue Gas Purification Equipment

本项目烟气净化设备出口烟气条件见表 5.2-2。

表 5.2-2 出口烟气条件表

序号	污染物名称	单 位	欧盟 2010/75/EU		本工程保证值	
			日平均	半小时平均	日均值	半小时平均
1	烟尘	mg/Nm³	10	30	10	30
2	HCl	mg/Nm³	10	60	10	60
3	HF	mg/Nm³	1	4	1	4
4	SO_x	mg/Nm³	50	200	50	200
5	NOx	mg/Nm³	200	400	200	400
6	CO	mg/Nm³	50	100	50	100
7	TOC	mg/Nm³	10	20	10	20
8	Hg	mg/Nm³	0.05（测定均值）		0.05（测定均值）	
9	Cd+T1	mg/Nm³	0.05（测定均值）		0.05（测定均值）	
10	Pb+Cr 等其他重金属	mg/Nm³	0.5（测定均值）		0.5（测定均值）	
11	二噁英类（TEQ）	ng-TEQ/Nm³	0.1		0.1	

1) 本表规定的各项标准限值，均以标准状态下含 11%O_2 的干烟气为参考换算；

Source: Feasibility Study Report, 2022, CMEC

2.13.1.3.2 SDA system

The Flue Gas is mixed with lime slurry and water in a semi-dry deacidification tower. The reaction tower has two important functions: One function is to create the best conditions for neutralization reaction, which makes the Flue Gas distributed evenly in the whole reaction tower, and ensures that the Flue Gas is fully mixed with the highly uniform atomized lime solution; and to ensure that the sufficient residence time is sufficient to obtain the dry reaction product; The other function is to cool the Flue Gas in a limited time by using the evaporation of water to absorb heat so that the Flue Gas reaches the set optimal reaction temperature, and the dry reaction product is obtained.

The Flue Gas was discharged from the lower part of the reaction tower after SDA treatment. Part of the dust in the Flue Gas would fall to the bottom of the ash hopper of the reaction tower due to the change in the direction of the flue flow. After an ash hopper collects the dust at the bottom of the reaction tower, it is sent to the fly ash conveying equipment by a rotary valve. An electric heater is installed at the bottom of the ash hopper of the reaction tower to prevent dust accumulation and corrosion.

2.13.1.3.3 Dry powder spray pre-spray system

$Ca(OH)_2$ is transported from the plant by a tanker and fed into the storage bunker with compressed air. Then $Ca(OH)_2$ was quantitatively exported from the storage bunker and sprayed into the pipeline between the SDA and the bag filter with a jet fan. Here, $Ca(OH)_2$ reacts with acidic gases (SO_2, HCl, etc.) in the Flue Gas and ensures that the concentration of acidic gases is below the emission standard.

Five sets of $Ca(OH)_2$ supply fans (one standby) were set up, and dry powder was sprayed into the flue before the bag filter. The top of the storage bunker is provided with a ceiling bag filter, which belongs to the pulse blowing bag filter.

2.13.1.3.4 The activated carbon injection system

The activated carbon is sprayed into the Flue Gas pipeline before entering the dust collector, which adsorbs heavy metals and dioxins and ensures the discharge of heavy metals and dioxins reaches the standard.

Activated carbon is transported to the activated carbon storage bunker by a tanker. A blockage prevention device is arranged at the bottom of the storage bunker, the activated carbon of the storage bunker is discharged to the disc feeder, a quantitative feeding device is arranged at the bottom of the disc feeder, 4 Flue Gas Treatment lines can be supplied at the same time, the materials are discharged to the activated carbon injection device through the rotating discharge valve, and the activated carbon injection fan sends them into the Flue Gas pipeline before the bag filter after spaying in the semi-dry reaction tower.

The activated carbon storage bunker is equipped with an N_2 protection system, mainly composed of N_2 gas cylinders and solenoid valves. A temperature measuring element is installed in the activated carbon storage bunker to monitor the temperature in the activated carbon storage bunker.

Five sets of activated carbon supply fans were set up (4 with 1 preparation), and activated carbon was injected into the flue before the bag filter. An active bag filter is installed on the activated carbon storage bunker to absorb the positive pressure during activated carbon loading. The bag filter not only operates in the process of receiving activated carbon in the activated carbon storage bunker but also operates at regular intervals after receiving activated carbon.

2.13.1.3.5 Bag filter system

Pulse dust collector and off-line ash cleaning are selected for bag filter, which is suitable for the dust Flue Gas treatment with high temperature, high humidity, and strong corrosion generated by waste incineration. The dust in the Flue Gas is removed, and the Flue Gas reacts with acidic substances and hydrated lime powder for further reaction to meet the discharge requirements.

The bag filter consists of the following equipment: Ash hopper, bag, cage, maintenance and overhaul passageway devices, isolation baffles for inlet and outlet flue of each chamber, bypass flue and baffle devices, ash hopper heating, bag sweep controllers, and pulse valves, etc. Each bag filter consists of a gas welded steel shell and compartment, which can be completely isolated from the Flue Gas flow when cleaning the ash. The shell and compartment are designed to withstand the maximum pressure differential within the system. The supporting structure adopts a steel structure.

Each compartment is equipped with inlet and outlet isolation barriers. When a compartment is isolated, it can keep the bag filter working usually. In other words, when the bag filter is in operation, it can replace the filter bag of the compartment online. Adequate inspection and maintenance of doors are provide for this purpose.

The gap between the top of the bag filter and the top of the chamber is large enough for operation when changing the bag. Steel beams for the hoist for bag replacement are also available if necessary. The design of electrical and mechanical connection holes on the shell, maintenance door, and shell can ensure the sealing performance of the bag filter.

In order to achieve good uniform Flue Gas distributions, a flue gas equal-flow device inside the flue is considered in advance.

To prevent condensation of acid and/or water, the bag filter will be equipped with heat preservation and heating. The insulation is thick enough to prevent the wall temperature from falling below the dew point.

Heating systems are considered for the outer walls of bag filters, conveyor systems, and equipment to prevent the bridging and accumulation of ash and reaction products in the storage bunkers of the equipment (e.g., hoppers, valve, piping, etc.). The hopper of the bag filter uses electric tracing.

The filter material of the bag filter is resistant to a temperature higher than the maximum temperature of the economizer outlet Flue Gas. It will not cause damage to the filter material of the bag filter even if the Flue Gas temperature is out of the economizer and does not decrease. The ash hopper of the dust collector is equipped with electric tracing to ensure that its temperature is not less than 140 °C. When starting at a low temperature, the ash hopper must be preheated to at least 140°C before introducing the Flue Gas (temperature above 140°C).

During start-up and short stops, hydrated lime powder is sprayed on the upstream flue of the bag filter to add to the ash-facing surface of the bag filter when the bag filter needs to be protected.

The hopper must be dry and warm during conditioning to prevent condensation. Because once there is condensate, the effect of ash removal would be hindered. The ash hopper is equipped with a mature ash arch breaking device that is arranged on the outer wall of each ash hopper as a permanent device, which can be operated on a platform under the ash hopper when the bag filter is running.

The lower part of the ash hopper is equipped with a conveyor, a rotary valve, and a rotary sealing valve. Special consideration is given to ensure that the flue gas is uniformly distributed on the surface of the cloth bag.

The bag dust collector includes support and accessories to ensure effective flue gas cleaning and long service life.

The cleaning system shall be optimized to ensure high dust removal efficiency, low-pressure drop, and long service life. Compressed air used for the instrument will be used for cleaning the filter bags (i.e., compressed air pulse system). Compressed air shall be of a nature that ensures that no obstructions or caking occur in the filter media.

2.13.1.3.6 ID fan system

An ID fan shall be set after each bag filter to maintain a certain negative pressure in the furnace and ensure the normal and stable operation of the incineration and flue gas treatment system. The ID fan is controlled by "electric baffle + frequency conversion." The bearing cooling water comes from the process water and circulating water, respectively, and can be used separately, and the return water directly enters the circulating water system. The ID fan shall be provided with a maintenance bracket to ensure disassembly and transportation. Appropriate measures shall be taken to check lubrication systems, field thermometer, and temperature transducers and ensure that alarm signals can be transmitted to the central control Room. ID fan can be started or stopped in situ or DCS. The temperature detector shall be installed in the motor coil of the fan, the temperature values of each phase shall be displayed on the DCS, and an alarm shall be set. Each flue gas treatment line shall be equipped with one ID fan. When the fan is selected, the maximum air volume of the fan shall meet the requirement of 120% of the air volume under MCR operating conditions

2.13.1.3.7 Flue pipeline system

The flue gas pipeline and pipe fittings include all accessories connected between various equipment from the outlet of the boiler to the chimney through flue gas treatment equipment. All equipment, flue gas pipelines and expansion joints of the flue gas system require heat preservation to ensure that the external surface temperature is not higher than 50 °C. The bending part of the flue gas pipeline shall be minimized, so as to reduce the pressure loss.

2.13.1.3.8 Chimney

The flue gas is sent to the chimney made of steel pipes with a height of 100 m for discharge. Each incineration line shall be provided with a separate cylindrical carbon steel flue gas pipe with anti-corrosion treatment inside and a concrete sleeve outside. The flue gas online monitoring room is located at the bottom of the sleeve.

2.13.1.3.9 Flue gas online monitoring

A local industrial computer automatically controls the flue gas treatment system; The information of the flue gas sampling detector, SO_2 analyzer, NOx analyzer, HCl analyzer, CO analyzer, dust analyzer, and flue gas flowmeter for online monitoring and other monitoring information is transmitted to the central control room via sensors and displayed by a computer. Each production line shall be equipped with an online monitoring device.

2.13.1.3.10 Raw Material Consumption

Table 2-25: List of Consumption of Main Raw materials (100% MCR)

Name	Consumption (ton/year)
Slaked lime	14843
Activated carbon	479.6
40% urea solution	2684
Chelating agent	633.1

Source: Feasibility Study, CMEC

2.13.1.3.11 Measures taken to prevent excessive emission of flue gas components from domestic waste incineration

1. Optimize the incineration process: adjust the combustion conditions, such as temperature, oxygen supply, combustion time, etc., to ensure that the waste is fully burned and reduce the generation of incomplete combustion products.
2. Improve equipment performance: Regularly maintain, overhaul and upgrade incinerators, waste heat boilers, flue gas purification equipment, etc. to ensure their normal operation and efficient work.
3. Strengthen feed management: reasonably control the feed amount, composition and humidity of garbage to avoid uneven combustion.
4. Improve the flue gas purification system: adopt more advanced and efficient flue gas purification technologies, such as increasing the amount of activated carbon injection, optimizing the filtration efficiency of the bag filter, and improving the desulfurization and denitrification device.
5. Real-time monitoring and data analysis: Install high-precision online monitoring equipment to monitor flue gas emission indicators in real time, conduct in-depth analysis of monitoring data, find problems in time and take targeted measures.
6. Personnel training and operation specifications: Strengthen the training of operators to familiarize them with the incineration process and equipment operation specifications, so as to avoid excessive emissions due to improper operation.
7. Establish an emergency response mechanism: Formulate an emergency plan for sudden emissions exceeding the standard, and take timely measures to reduce emissions, such as suspending feeding, adjusting operating parameters, etc.
8. Regular environmental protection testing and evaluation: Conduct regular environmental protection testing in accordance with the regulations to evaluate the flue gas emission compliance and provide a basis for improvement measures.

2.13.1.3.12 Measures taken for domestic waste incineration flue gas component emissions exceeding the standard

1. Optimize the incineration process: adjust the combustion conditions, such as temperature, oxygen supply, combustion time, etc., to ensure that the waste is fully burned and reduce the generation of incomplete combustion products; Reduces combustion compliance and reduces pollutant emissions.
2. Adjust the flue gas purification system: increase the amount of activated carbon injection, increase the frequency of bag filter cleaning, and increase the injection amount of reactants of the desulfurization and denitrification device, so as to reduce the emission of pollutants until the standard is reached.

2.13.1.3.13 Flying ash conveying and storage system

This system is the equipment that conveys the flying ash from the reaction tower and the flying ash from the bag filter (bag ash) to the fly ash silo and stores it in the storage warehouse.

Flying ash from the deacidification reaction tower is conveyed to the typical scraper conveyor for flue gas treatment through the bag filter and start discharging valve. Flying ash from the bag filter is conveyed to the scraper conveyor at the bottom of the bag filter through the plug valve and star unloading valve, then enters the common scraper conveyor for flue gas treatment through a three-way reversing valve, which is connected with a bucket elevator, and then is sent to the ash silo through spiral distribution conveyor. There are 2 fly ash storage silos where each single silo capacity will be 250m.

2.13.2 Flying Ash Collection and Treatment System

This system starts from the bottom of the rotating spray semi-dry Ca $(OH)_2$ reaction tower and the ash hopper of the bag filter to the discharge valve at the bottom of the flying ash storage silo, including the rotating spray semi-dry Ca $(OH)_2$ reaction tower, bag filter flying ash collection, conveying and storage equipment, driving device, auxiliary facilities, and other relevant facilities. Flying ash shall be conveyed mechanically. The flying ash collected by the four incineration lines will be discharged onto two common scraper conveyors, conveyed to the top of the flying ash storage silo by bucket elevator, and distributed to the two storage bins by the two-way screw conveyor at the top of the storage silos.

2.13.2.1 Flying ash treatment system

The output of flying ash under the rated operating conditions of this project (waste is dumped for 365 days and incinerated for 333 days) is: 73.6 m^3/d.

The fly ash treatment technology in this project is selected as the main scheme: synergistic treatment with cement kiln; and stabilization of chelating agent ("chelating agent + water" fly ash solidification landfill) can be as the backup."

1. Introduction to the scheme

Option 1: Sending to cement factory.

(1) Flyash is "Hazardous waste". Before used as material of cement, it must be washing + high-temperature detoxification treated. After treated, flyash to be tested to see whether safe for cement. If not safe enough, needs to be re-treated.

(2) There are 2 ways to cooperate with cement factory:

A. cement factory invests the facility of washing + high-temperature detoxification, then do the test. Then they receive original flyash and do the treatment.

B. the WTE plant invests the facility of washing + high-temperature detoxification, then do the test, then produce the treated flyash, the cement factory receive the treated flyash, directly used in cement.

In either way, WTE plant needs to pay to cement factory. While the payment will be higher in A. The detailed commercial terms can be negotiated between WTE Plant and the cement factory. Currently, we are discussing with cement factory in A, and relevant cost have been considered in OPEX.

Option 2: Flyash sending to landfill.

(1) The landfill area is open.

(2) But the flyash to be treated before landfill, in following procedures:

A. chelated with chemical medicament, then the flyash will be solidified, from "ash/dust" into "particles", which is heavier and not easily blowout.

B. tested in the lab, to see the effect of chelate, whether reach the standard for landfill. The core parameter is the "level of toxic leaching". Every batch of flyash will be tested. If the parameter is not satisfied, the Process A will be repeated and retested, until the parameter is OK. So, the test is not to see whether the "particles" are hazard; the test is to see whether the hazard will easily leak out from the "particles". After chelating, the hazard in flyash is not deleted, it is "fixed" so that not easily leaking out.

C. After passing the test, the "particles" will be put in bags, then ready for landfill. The bag is another protection for hazard leaking.

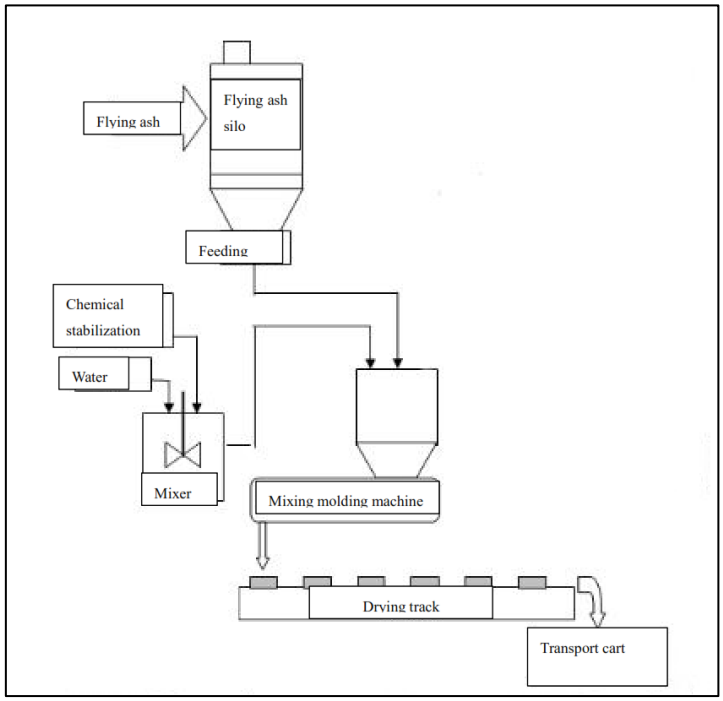
(3) For landfill, there is a standard on construction of flyash landfill area. There will be an impermeable layer in the bottom of the landfill area, preventing water invade and hazard leaking. The flyash bag will be put on the impermeable layer, and covered by the impermeable covers, preventing rain/ wind.

(4) In conclusion, it is seen flyash in landfill has been sealed and protected well. And it will not impact surrounding environment/ water/ community. The correct operation and procedure are the key to protecting this from environment.

The flying ash in the silo is sent to the flying ash metering device through the discharging valve. The flying ash metering device continuously discharges the quantitative flying ash into the mixer. At the same time, the stirred chelating agent is added to the mixer through the delivery metering pump according to the proportion set with the flying ash amount, and the remaining solution is returned to the solution reservoir through the pipeline. The mixer is continuous production equipment. The stabilized flying ash is transferred to the loading workshop through the discharge conveyor for discharging, ensuring that the environment of the flying ash stabilization operation room is clean.

The operator shall flush the mixer after each day of work. The wastewater from flushing shall be discharged into a low-concentration sewage system.

Figure 2-10: Flying Ash Solidification Process Flow Chart



Source: Feasibility Study Report, 2022

After stabilization treatment and the requirements in the Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB 16889-2008) are met, they shall be sent to the landfill site for safe disposal.

2. Disposal standards

Chelating agent stabilization method: the fly ash generated by waste incineration contains a high leaching concentration of heavy metals and other dangerous wastes, so the hazardous Waste Identification Standard - Leaching Toxicity Identification (GB5085.3-2007) and the Pollution Control Standard of Domestic garbage Landfill (GB 16889-2008) must be implemented in the disposal of fly ash according to the requirements of hazardous solid waste disposal. The Proponent must follow Solid Waste Management Rules, 2021, E-Waste Management Rule 2021 and Medical Waste Rules, 2018. After solidification/stabilization treatment, the fly ash will be transported to the landfill site for safe disposal if the following conditions are met: (1) Water content is less than 30%; (2) dioxin content is less than 3 μg-TEQ/kg; (3) Concentration of hazardous components in leach solution prepared in accordance with HJ/T 300 is lower than the limits specified in the Table 2-26

Table 2-26: Concentration limit of contaminants in leach solution (mg/l)

Serial number	Pollutant project	Concentration limits	Serial number	Pollutant project	Concentration limits
1	Mercury	0.05	7	Barium	25
2	Copper	40	8	Nickel	0.5
3	Zinc	100	9	Arsenic	0.3
4	Lead	0.25	10	Total chromium	4.5
5	Cadmium	0.15	11	Hexavalent chromium	1.5
6	Beryllium	0.02	12	Selenium	0.1

Source: Feasibility Study

Flying ash shall be conveyed in closed equipment, and the material storage and conveying equipment shall be equipped with ventilation and dust removal facilities. All equipment of the flying ash stabilization system can be operated automatically and continuously through the local control panel, and the main operating signals are sent to the DCS system (Distributed Control System), while each equipment can also be operated manually locally separately.

2.13.3 Fly ash landfill project

2.13.3.1 Treatment process protocol and scale

After WtE, some minerals and elements are enriched in incineration ash. Compared with the original waste, the content of toxic elements in urban waste incineration fly ash is 10 to 100 times higher than that in general soil; waste incineration fly ash contains high concentrations of dioxins. Fly ash refers to the residue collected in Flue Gas Treatment System (APC) and heat recovery and utilization systems (e.g., vapor economizer, boilers, etc.).

2.13.3.2 Flying ash entry requirements

According to the requirements of the Technical Code for Municipal Solid Waste Sanitary Landfill (GB 50869-2013): Domestic waste incineration fly ash and medical waste incineration residue meets the conditions specified in the current national standard for Pollution Control on the Landfill Site of Municipal

Solid Waste (GB16889) after treatment and can enter domestic waste landfill for landfill disposal. An independent landfill storage area that is effectively separated from the domestic waste landfill storage area should be set up for treatment.

According to the requirements of the Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB16889-2008): WtE fly ash and medical waste incineration residues (including fly ash and sediment) can enter the solid waste landfill for treatment if they meet the following conditions after treatment.

1) The moisture content is less than 30%.
2) Dioxin content is less than 3 μg TEQ/Kg.
3) The concentration of hazardous components in the leachate prepared according to HJ/T 300 is lower than the limit specified in the table below.

Table 2-27: Limit of contaminant concentration in the leaching solution

SL	Pollutant item	Concentration Limit (mg/L)
1	Mercury	0.05
2	Copper	40
3	Zinc	100
4	Lead	0.25
5	Cadmium	0.15
6	Beryllium	0.02
7	Barium	25
8	Nickel	0.5
9	Arsenic	0.3
10	Total Chromium	4.5
11	Hexavalent chromium	1.5
12	Selenium	0.1

2.13.3.3 Landfill Process

The landfill method is a comprehensive scientific engineering technology method that takes effective engineering measures and strict management means according to the natural degradation mechanism of solid waste and the characteristics of ecological environment impact and controls solid waste without causing pollution to the surrounding environment. First, scientific site selection and reasonable planning and design are required, followed by operation and management according to strict operating specifications. Finally, maintenance and monitoring are still required. Leachate released from the landfill reaches the discharge standard and does not cause pollution to the surrounding environment.

The output of flying ash under the rated operating conditions of this project (waste is dumped for 365 days and incinerated for 333 days) is: 73.6 m^3/d. The main scheme is to apply the fly ash in cement kiln as auxiliary raw materials. The alternative scheme is stabilization of chelating agent using "chelating agent+water".

2.13.3.3.1 Types of landfills

Landfill can be classified into four types according to the topography in which they are located: Plain-type landfill, valley-type landfill, slope-type landfill, and beach-type landfill. These four landfills have their characteristics, and the selection is mainly determined according to the actual local situation.

According to the Construction Standard for Solid Waste Sanitary Landfill Treatment Project (JB 124-2009), the construction scale of landfills in China is divided into four categories according to the total storage capacity and four levels according to the daily treatment capacity.

The construction scale of landfills shall be classified according to the total storage capacity as follows:

Class I: The total storage capacity shall be more than 12 million cubic meters.

Class II: The total storage capacity shall be over 5 ~ 12 million cubic meters.

Class III: The total storage capacity shall be more than 2 ~ 5 million cubic meters.

Class IV: The total storage capacity is less than 2 million cubic meters.

From the calculation before and after, it can be seen that the construction scale of this landfill is Class IV.

2.13.3.3.2 Brief introduction of landfill area project

The landfill is a plain-type landfill located northwest of the power plant, near the south area of the existing landfill regulation pool. The total area is about 19350 ㎡, and the construction plan of the landfill area is as follows:

- Set a dam on the west side of the landfill site, make a dam on the other three sides based on the current situation and designed terrain, and form an embankment around the field as the initial storage capacity; A ring road is set on the embankment to facilitate operation. A vertical anti-seepage system is set up along the embankment to prevent the influence of groundwater on the reservoir area.
- A flood interception ditch is set along the outer edge of the landfill reservoir area to reduce the surface runoff into the site and divert rainwater and sewage.
- The foundation in the landfill reservoir area shall be treated appropriately, and the bottom of the site and the slope shall be provided with a horizontal impermeable layer. The leachate drainage system is above the horizontal impermeable layer, and the groundwater drainage system is below.

2.13.3.3.3 Calculation of total storage capacity and service life of landfill area

1. Calculation of storage capacity of solidified fly ash landfill area

The total storage capacity of a landfill is usually to divide the designed landfill stack into several sections horizontally according to different elevations, calculate the volume of each section, and then accumulate to obtain the total designed stack volume, which is the landfill storage capacity. Each section can be considered as a platform body and is calculated according to the following platform body calculation formula:

$$V = \frac{1}{3} \cdot H \cdot \left(S_{upper} + \sqrt{S_{upper} \cdot S_{lower}} + S_{lower} \right)$$

V - Volume of platform body, m^3;

H - Height of platform body, m;

S upper-Upper surface area of platform body, m^2;

S lower-Lower surface area of platform body, m^2.

Notes: This calculation is an estimate made without a topographic map and is subject to detailed design when a topographic map is provided.

Table 2-28: Year-by-year storage capacity demand

Period(Y)	Daily capacity (m^3)	The storage capacity required for the year (m^3)	Cumulative capacity required (m^3)
1	73.6	24512	24512
2	73.6	24512	49024
3	73.6	24512	73536
4	73.6	24512	98048
5	73.6	24512	122560

Source: Feasibility Study, CMEC

Based on the calculation in the above table, the storage capacity of a landfill for 5 years is about 122560 cubic meters. The existing landfill site can meet the requirements of operation and maintenance for 5 years, and the project will adopt the way of fly ash and cement kiln to handle fly ash. This landfill is used as an emergency fly ash landfill.

A. The first 5 year, the fly ash will be firstly chelated and landfill. The landfill area will be constructed in the Project site. The approval will be covered by Plant Site Clerance Certificate (SCC).
B. For the remaining years, there will be 3 options. The project company will decide the option once the Project achieves COD.
    a. washing and low-temperature pyrolysis, the toxic substances will be removed, and the remaining will be used as construction material. This is a new tech in China, and the project company are waiting for more actual operation data for better demonstration.
    b. co-processing with cement: This is the mature tech in China. While to conduct in this way, the project company need local cement factory in Bangladesh to accept the flyash. Currently, the project company is waiting for test results from a large Bangladesh cement factory near the Bangladesh- India border.
    c. If the data or test result from a) and b) are not good enough, the last way is to find additional landfill area.

2.13.4 Slag Treatment System

The system includes the conveying, storage, and delivery of slag.

2.13.4.1 Characteristics and output of slag

The slag in this project is mainly the residue after waste combustion, and its generation depends on waste composition; its main components are MnO, SiO_2, CaO, Al_2O_3, Fe_2O_3, and a small amount of unburned organic matter, scrap metals, etc. The reciprocating grate incinerator is used in this project to ensure that the slag thermal ignition reduction rate can be $\leqslant$ 3%. After high-temperature harmless treatment, this kind of slag separates scrap metals such as scrap steel through magnetic separation and other equipment, which can be comprehensively utilized, such as cushions for paving, covering materials for landfills and making unburned bricks.

Slag amount under rated operating condition: the project produces about 500t/d wet slag per day and 182,500 t/a wet slags per year under the designed treatment condition of the power plant.

The main plant is equipped with slag pits that can meet the storage capacity of the whole plant for more than 3 days. The slag in the slag pond is lifted by a grab truck and sent to the comprehensive utilization workshop for disposal and production of asphalt concrete/brick making or the slag treatment plant for landfill. The slag in the slag pond is lifted by a grab truck and sent to the comprehensive utilization workshop. Slag treatment station diagram is given in **Appendix G.** The main products of the slag comprehensive utilization project are given below table.

Table 2-29: The main products of the slag comprehensive utilization project

Product category	Copper sand	Aluminium	Iron powder	Washed iron	Thick iron
Protone of domestic projects	0.20%	0.20%	2.00%	2.00%	0.20%
Project estimates for Bangladesh	0.05%	0.02%	0.30%	0.40%	0.10%
Where the product goes	After recycling by the metal recycling unit, it needs to be further processed, screened and sent to a special treatment factory for deep processing such as smelting and removing impurities.	After being recovered by the metal recycling unit, it needs to be further processed, screened and removed, and then sent to a special treatment factory for smelting and other deep processing.	After being recovered by the metal recycling unit, it is sent to a specialized scrap iron treatment plant (such as a steel mill) for deep processing.	After being recovered by the metal recycling unit, it needs to be further processed, screened and sent to a specialized scrap iron treatment plant (such as a steel mill) for deep processing.	After being recovered by the metal recycling unit, it needs to be further processed, screened and sent to a specialized scrap iron treatment plant (such as a steel mill) for deep processing.
Product category	Finished sand (thick: medium: fine: mud cake)			Metals	Silver
Protone of domestic projects	85.00% (1.5:4.0:2.5:2.0)			Few	Few
Project estimates for Bangladesh	85.00%			None	None

Note: Finished sand composition: silicon 33.12%, calcium oxide 18.10%, magnesium oxide 6.51%, iron trioxide 5.22%, aluminum trioxide 9.98%, sulfur 0.28%.

2.13.4.2 Slag collecting and conveying system

1) Slag type:

- The slag, after complete combustion, falls into the slag extractor from the slag discharge tube.

- The leaked slag of the incinerator grate is collected by the grate slag conveyor and then sent to the slag extractor through the grate leaked slag conveyor.
- Ash deposits in the residual heat boiler are conveyed to the slag extractor or directly to the slag silo using a boiler bottom ash conveyor. The corresponding ash deposits are collected at the ash hopper and horizontal convection heating surfaces of the second and third galleries. A scraper conveyor shall be set along the total width of the second and third galleries. Under the conveyor and the ash hopper of the horizontal gallery, there shall be a rotary valve, a cast structure, and a carbon steel plate. The boiler ash is then conveyed through the conveyor to the slag conveyor and slag extractor.

2) The main functions of this system are as follows:

- Collection and conveying of leaked slag under a grate
- Collection, extinguishing, and conveying of grate slag
- Conveying of wet ash residue to the ash slag storage room
- Considering the local maintenance control box of conveying equipment, the setting of the control box shall include the local/remote transmission transfer switch, Local start/stop button, emergency stop button and audible and visual alarm, etc.
- The setting of necessary operation platforms, maintenance platforms, stairs, and rails.

3) Slag extractor design description

- If the slag extractor is in the form of a water bath, the slag shall be extinguished by wastewater, and the slag extractor's design shall meet the water-saving requirements.
- To prevent steam generated during slag cooling from eroding the surrounding equipment and structure, the slag extractor shall be completely sealed.
- The slag extractor's hydraulic device shall have sufficient thrust to ensure safe operation in any condition.
- For maintenance and inspection, the slag extractor shall be easily accessible from all sides.
- The shell of the slag extractor shall be made of steel plates.
- In the design, it shall be considered to prevent the splashing of water bath caused by deflagration in the furnace or when a large piece of ash falls.
- Access holes shall be set on the side wall of the water storage tank to prevent any air from entering the boiler from the slag extractor.
- All high-load and high-exposure components of the slag extractor shall be easily replaceable wear-resistant components, and all wear-resistant components shall be easily installed and removed.
- The fault signal shall be transmitted to the central control room.
- The number of slug extractor 3 nos./furnace and conveying capacity of slag extractor 15t/h/furnace.
- The cooling water of the slag extractor shall be recycled, and the water of the cooling tank shall be used as the cooling water of the slag extractor.

2.13.4.3 Slag storage

After combustion from the incinerator, the residue is mainly non-combustible inorganic matter and partially non-combustible combustible organic matter. There are two electric bridge grab cranes in the slag silo to realize the reverse transport and loading of slag. The electric bridge crane lifting weight capacity is 10t and grab volume is 4m^3.

2.13.4.4 Process flow of Slag and Testing

(1) Based on "General Principles of Hazardous Waste Identification Standards" (a Chinese standard), the slag is defined as "ordinary solid waste", while the fly ash is defined as "Hazardous waste". The

reason for this is the composite level of hazardous waste. According to the Standard, there is very few hazardous materials in slag.

(2) For slag, since it is the "ordinary solid waste", the Plant Lab is located within the Project site and will do the test in a fixed term, such as quarterly. The results will be recorded for reference. The Plant will not do test on every batch of slag. Test cost is already included in OPEX.

In China, the test results of slag show no hazardous material. Even if there is hazardous material, it is very limited value, and all metal will be collected in following process.

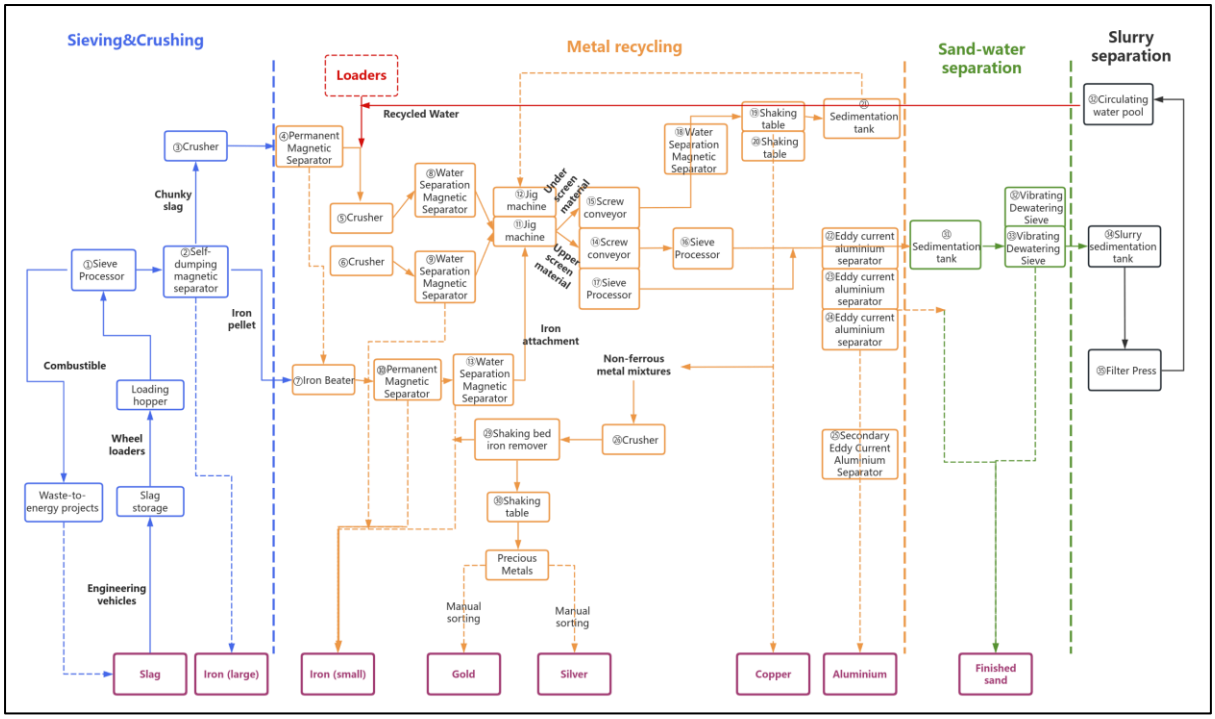
(1) The slag will be pre-treated (as the process flowchart attached), then the metal and useful material can be collected. In the flow diagram, it is seen all useful material will be collected. The remaining material is mainly water and soil/sand. The water will be injected into the Leachate system. The soil/sand will be sold to construction material.

(2) There is an area in the Project Site, specially for the pre-treatment of slag and collection of useful materials.

(3) In operation, the daily volume of slag is around 500 ton/day. And there will be a temporary storage of slag with capacity of 1000 tons, thus 2- day volume.

(6) The project company have a partner from China, which is specialized in dealing with slag. The Partner operates the facility on treating the slag. The cost of dealing the slag, and the income by selling the collected useful material from slag (metal, soil/sand) all belong to the Partner.

Figure 2-11: Process of treatment of Slag



Source: Feasibility Study, CMEC

2.13.4.5 Slag Recycling System

The slag after waste incineration, grate leakage slag, waste heat boiler combustion chamber, the third flue ash drop, economizer ash drops to the slag machine and then discharged into the slag bin. The average daily slag output is about 500t/d. Then comprehensive slag treatment system will be set up with dust prevention, fly control, sewage overflow control, and other facilities.

The main raw material of this project is the slag of the waste-to-energy plant, which belongs to the general industrial waste solid. The main components are masonry fragments, stone, glass, smelted slag, iron, other metals, etc. The particle size distribution is mainly concentrated in 2~50 mm. The project transports slag from the slag pit to the comprehensive slag treatment system. The slag is cooled to normal temperature by soaking in the slag discharging extractor. The slag coming through the transport vehicle is wet material with water of about 20% at normal temperature.

Because of the high moisture content of slag, there will be no dust when the slag is transported to the production site of the project. The temporary storage time of slag in the raw material area is not more than 2 days, and a large amount of water will volatilize naturally in the process of slag stacking. Regularly sprinkle slag, maintain slag humidity to prevent dust, and set up an artificial sprinkler.

In this comprehensive slag treatment system, the main productive individuals of slag resource utilization will be arranged integrally in a comprehensive plant house. When the slag enters the plant, it can be stored in the incoming material stacking area (divided into the finished product slag stacking area and the emergency raw slag stacking area). Other areas are divided into the feeding area, sorting area, and related warehouse and stacking area. The components after sorting and sifting will be treated according to their nature, e.g., the metal to be sold and the remaining will be used for brick making. However, the project does not include the brick-making facilities.

Slag brick is mainly divided into two parts: slag separation and slag separation Compaction bricks.

Slag sorting is the reprocessing of incinerator slag by physical methods (including particle size screening, magnetic separation, buoyancy selection and vortex current separation, etc.), sorting out iron, metal aluminum and a small amount of non-magnetic metal (metal copper, etc.), and obtaining building sand (coarse and fine sand). The sorted metal substances are sold out for reuse. Coarse and fine sand materials into the pressing brick process to produce environmental protection brick.

2.13.5 Leachate Treatment Process

2.13.5.1 Determination of Leachate Treatment Process

The determination idea of the leachate treatment process is as follows:

1. In view of the economic and environmental protection of the biological method, most of the organic pollutants (COD) and ammonia nitrogen in the leachate should be degraded and removed by the biological method to avoid the secondary transfer of pollutants as far as possible.

2. Because of its high organic pollutant concentration (COD) and good biochemistry, it is suitable to adopt an anaerobic-aerobic combined process, that is, regard anaerobic as a pretreatment process, that is, set in front of the aerobic treatment process stage, which can effectively reduce the organic pollutant (COD) load and reduce the cost of subsequent aerobic treatment.

3. According to the water quality characteristics of leachate and the discharge standards required by bidding, the general stability of simple biological effluent is relatively poor and cannot meet the needs, and the residual pollutants after biological treatment should be treated in combination with membrane technology.

The tentative leachate treatment process combination of this project is:

Anaerobic + aerobic + membrane method (ultrafiltration + nanofiltration + reverse osmosis (RO)) process combination

2.13.5.2 Production amount and treatment scale of leachate

Waste leachate is derived from the water fluid exuded from solid waste in waste storage pits. The leachate exuded from the waste is collected by the collecting ditch of the refuse storage pit into the leachate collection and storage tank and then transported by leachate transfer pump to the leachate treatment station pond for treatment after pressurization.

The treatment process of waste leachate is designed according to the maximum daily production, leaving a certain amount of residue, and **the total scale of its leachate design treatment capacity is defined as 1500 m³/d.** The leachate treatment system is engineered to handle up to 1,500 tons per day during peak rainfall periods, with a storage tank volume of 12,000 cubic meters. This capacity provides a minimum retention time of 8 days for optimal treatment and management. Leachate treatment station diagram is given in **Appendix G.**

2.13.5.3 Technical Requirement of Leachate Treatment Station

The design residence time of each process section is as follows:

1 Stay in the regulating pool for ≥8 days (accident pool 9600m³ + second phase 2400m³) total 12000m³
2 The anaerobic section stays for ≥8 days (Phase I 2769m3*4 + Phase II 2769m3*1) Total 13848m³
3 The first-level A/O stays for ≥7 days ((first-level denitrification tank 1920m³*2 + second-phase 968m³*1) + (nitrification tank 3840m3*2+ second-phase 1936m3*1) total 14428m³
4 Secondary A/O stays ≥ 2.5 days ((secondary denitrification 672m3*2 + second phase 323m3*1) + (nitrification tank 720m3*2 + second phase 323m3*1)) total 3430m³

The water inlet indicators designed for the leachate station are as follows:

Table 2-30: Landfill leachate water quality report

Date		20230103	20230207	20230217	20230420	20230516
project	unit	Leachate	BUET-leachate report		BUET-leachate report	WW20230329E149
Parameter	Unit					
Ammonia nitrogen (calculated as element N)	mg/l	<0.1	1200	24.1	616	2187
BOD5(20℃)	mg/l	12	96300	1622	30201	1300
COD	mg/l	38		3528	76439	27500
Chromium (Hexavalent Chromium)	mg/l		44000			54.6
Electrical conductivity (EC)	us/cm	792		41000	10250	12800
Nitrate (calculated as element N)	mg/l	26			240	84
oils and greases	mg/l					7493.42
Total Phosphorus TP	mg/l	1.16		341	400	204
PH	mg/l	7.21		5.03	5.38	4.94
Suspended solids (SS)	mg/l	862		12052	3180	9854

Date		20230103	20230207	20230217	20230420	20230516
Total nitrogen TN	mg/l				0.48%	3600
Chloride/chloride	mg/l	116		2772	960	4500
Nitrogen(N)				0.92%		

Source: Feasibility Study, CMEC

The sources of leachate include garbage pit leachate collection tank, initial rainwater collection tank (slope and weighbridge flushing water collection), and domestic sewage.

The following table is a list of processing capabilities of each process section:

serial number	processing unit	capacity contribute	CODCR (mg/L)	BOD5 (mg/L)	NH3-N (mg/L)	SS (mg/L)	PH
1	Raw water - leachate collection pit	600m³	72000	36000	2500	15000	5～6
2	Pretreatment-conditioning pool	9600m³ (2400m³ in the second phase)	72000	36000	2500	10500	5～6
3	anaerobic system	Single tank 2769m³ (300t/d)*4	12000	6000	2500	2500	5～6
4	Membrane Bioreactor (MBR) system	1200 m³/d (300 m³/d in the second phase)	600	40	12.5	30	5～6
5	Nanofiltration system	1200 m³/d (300 m³/d in the second phase)	90	10	8	~0	6～6.5
6	reverse osmosis system	1020m³/d (255m³/d in the second phase)	50	7	8	~0	6～8
7	Final water production to cooling tower	865m³/d	50	7	8	~0	6.5-8.5
8	Emission Standards	GB/T 19923-2005	≤60	≤10	≤10	≤30	6.5-8.5

Source: Feasibility Study, CMEC

The final water quality at the end of the membrane system must meet: "Water Quality for Industrial Water for Urban Wastewater Recycling" (GB/T 19923-2005) below Table supplementary water standards for open circulating cooling water systems.

Table 2-31: Supplementary water standards for open circulating cooling water systems

serial number	Control items	water quality standards
1	pH	6.5~8.5
2	Nephelometric Turbidity Units (NTU)	≤5
3	Chroma (times)	≤30

serial number	Control items	water quality standards
4	BOD5 (mg/L)	≤10
5	CODCr（mg/L）	≤60
6	Iron (mg/L)	≤0.3
7	Manganese (mg/L)	≤0.1
8	Chloride ion (mg/L)	≤250
9	Silica (mg/L)	≤50
10	Total hardness (calculated as CaCO3) (mg/L)	≤450
11	Total alkalinity (calculated as CaCO3) (mg/L)	≤350
12	Sulfate (mg/L)	≤250
13	NH4-N（mg/L）	≤10
14	total phosphorus	≤1.0
15	Total dissolved solids (mg/L)	≤1000
16	Petroleum (mg/L)	≤1.0
17	Anionic surfactant (mg/L)	≤0.5
18	Fecal coliforms (pieces/L)	≤2000

Source: Feasibility Study, CMEC

The processed moisture is divided into two parts:

1. The water produced at the end of the membrane system enters the circulating water cooling tower for water replenishment.
2. The concentrated water generated by the operation of the membrane system enters the lime paddle and slag extractor systems to replenish water.

Odor treatment process: After all odor generation points are collected through a special pipe network, they are sucked in by a deodorizing fan and sent to the garbage bin under pressure (during shutdown, they are treated by an activated carbon deodorizing device and then discharged to the atmosphere).

Sludge treatment process: Responsible for collecting and dehydrating the sludge produced in the primary sedimentation tank, anaerobic tank, and AO tank. The moisture content of the produced absolutely dry sludge is ≤80%, with a daily output of 10.94t/d, and final transportation Return to the garbage bin and spray and burn.

Production process supervision: A professional leachate laboratory has been set up. Through regular on-site manual sampling and analysis every day, through the detection of sludge and water quality in each process section, and comparison of online data display, abnormal operation systems can be adjusted in a timely manner to ensure the production safety system is fully stable.

Design life control plan: The pipelines in the entire leachate system are all made of corrosion-resistant materials such as stainless steel and High-Density Polyethylene (HDPE). The tank walls and pool body are also inspected and improved through strict leakage testing and waterproof and anti-corrosion measures. It can effectively prevent accidents such as pipeline damage and pool leakage caused by long-term flow of acidic liquid in the system.

Prevention of environmental sanitation: In order to effectively prevent personal equipment accidents and environmental pollution accidents during construction and operation, in the early stage of design, we make full use of various advanced instruments and excellent design plans to fully integrate online instruments, alarm devices, and electrical interlocks. Measures such as protection and hardware protection were reviewed during the design stage to ensure that all system equipment is automated and intelligent. It reduces the production pressure of staff and the accuracy of system operation abnormality identification, ensures personal safety and equipment safety, and protects the personal interests of owners.

Each performance guarantee value is as follows:

1. Leachate system processing capacity: 1200m^3/d+300 m^3/d;

2. The total water production rate of the leachate treatment system: ≥80%; the overall recovery rate of NF is not less than 85%, the overall recovery rate of RO is not less than 75%, and the overall recovery rate of Disk Tubular Reverse Osmosis (DTRO) is not less than 47%.

3. The water quality of the leachate treatment system: reaches the water quality standard of open circulating cooling water in Table 2-31 of the "Water Quality for Industrial Water for Urban Wastewater Recycling" (GB/T19923-2005).

2.13.6 Details of Effluent Treatment Plant

The content of suspended matter in the leachate from the waste bunker is high, and these suspensions are removed by the leachate entering the primary sedimentation tank through a special collection pipeline. And a hydraulic net is installed on the pipeline which is on the center of the primary sedimentation tank to remove the floaters with larger particles. The effluent water of the initial sedimentation tank enters the conditioning pond. The leachate from the waste bunker at different times stays mixed here, playing a role in balancing the water volume, homogenizing the water quality, and cooling. The Conditioning Pond is divided into two functional areas to regulate water quality and water volume, respectively. Conditioning pond has the function of pre-fermentation to reduce the concentration of organic matter in part of the influent through fermentation. and the lattice design plays the role of accident mediation. Two sets of stirring devices were set up. Wastewater after homogenization was pumped to the Efficient Anaerobic Reactor through the supply pump of the Anaerobic Reactor. In the Anaerobic Reactor, high high-concentration organic wastewater is converted into biogas for discharge, and most of the organic matter in the wastewater was degraded and digested. After being filtered by a bag filter, anaerobic effluent enters MBR through the water distribution system to remove biochemical organic matters. The MBR consists of denitrification, nitrification, and ultrafiltration units. The remaining sludge produced by the biochemical system was dehydrated and sent to the incineration plant for incineration. And the supernatant fluid after dehydration was returned to the biochemical system for treatment.

Sludge generated during the processing of the leachate includes Grid slag of the grid system, and residual sludge of from the biochemical treatment system. The sludge is pumped to the sludge tank by a sludge lift pump and is lifted through a screw pump into the dewatering room for dewatering treatment, and the mud cake with a moisture content of less than 80% after dewatering is transported to the waste bunker for incineration treatment. The supernatant fluid in the sludge cell and portions of dehydrated filtrate return to the biochemical system.

Combined with the discharge requirements of this project, the stability of simple biological effluent is relatively poor and cannot meet the needs. Physical methods such as membrane technology should be combined to treat the residual pollutants after biological treatment. Eventually, the sewage treatment process combination of this project is determined as "in leachate tank transfer pump + drum grating machine + Conditioning Pond + anaerobic (UASB) + membrane bioreactor (MBR) + nanofiltration (NF)

+ Reverse osmosis (RO) (NF concentrate is reduced by TUF + STRO)." RO concentrate is used for lime pulping and fly ash stabilization, and the water yield of the overall system is not less than 75%.

The leachate processing equipment consists of seven parts, including: (1) a Pretreatment system; (2) an Anaerobic treatment system; (3) MBR biochemical reaction treatment system; (4) a Membrane deep treatment system (NF/RO); (5) Concentrate treatment system; (6) Sludge treatment system; (7) Methane (odor) treatment system.

2.13.7 Water Treatment Process for Waste Heat Boiler

According to the requirements of Raw Water quality and boiler feed water quality, this system intends to adopt "RO + EDI" chemical water treatment process, so as to ensure that the system produces stable and qualified demineralized feed water system water quality and water volume requirements for Waste heat boiler system. The process flow is as follows:

PAC Scale Inhibitor

↓ ↓

Incoming water from factory water purifier→ Raw water tank → raw water pump → multi-media filter → activated carbon filter → security filter → high-pressure pump → two-stage RO device → intermediate water tank → intermediate water pump → Electronic Data Interchange (EDI) device → desalination water tank → demineralized water pump → water point

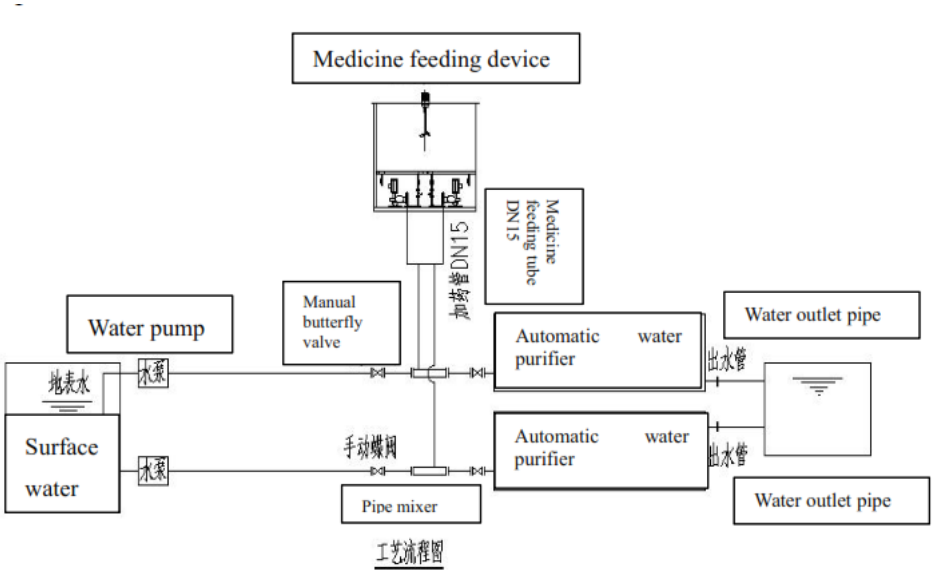
Brief description of process: The incoming water of the chemical water treatment system uses treated industrial water. After entering the raw water tank, the raw water pump is pressurized and then fed into a multi-media filter to remove some impurities in the raw water. After removing some heavy metals, free chlorine, and other impurities from the water through the activated carbon filter, the water is pumped into the RO treatment system through a high-pressure pump to remove anions, cations, inorganic salts, organics, heavy metals, bacteria and viruses. The water treated by the RO treatment system enters the intermediate water tank and enters EDI device after the intermediate pump is pressurized. After all the dissolved solids and other impurities in the water are deeply removed from EDI device, the water that meets the standard for water for waste heat boiler enters the desalination water tank. The desalination water is pumped into the deaerator by the demineralized water pump and is used as the supplementary water for boiler feed water.

2.13.8 Feed Water Treatment Plant

There is a Karnatali River about 1.0 km north of the proposed site, with a wide river and a large water volume, which can also be considered as the water source for this project. According to the investigation report and analysis of water resources, it is planned to use river water as the source of industrial water for this project and use groundwater as the standby source of industrial water. At the same time, it is necessary to set up water intake facilities such as water intakes, the water pump rooms etc. in river water areas. Disinfected water and groundwater will be used as the domestic water source.

The scale of feed water treatment in this project is 349.5m^3/hr. The design of this scheme uses two sets of integrated automatic water purifiers, and the treated water quality meets the circulating water and industrial water use requirements. The equipment integrates mixed reaction, flocculation precipitation, filtration of effluent water, and automatically completes the operating procedures of medicine feeding, water distribution, sludge discharge, backflushing, sewage discharge, etc., through the special device of the equipment itself combined with electrical control. Automatic water purifier automatic operation, no need of personnel operation, to avoid water quality instability caused by the artificial operation. The water quality after treatment is excellent and stable. The process flow is as follows:

Figure 2-12: Process flow Diagram for Purification System



Source: Feasibility Study Report, WTE Power Plant North Dhaka Private Limited, 2022

The integrated water purification device includes Coagulating basin, sedimentation basin, filter basin, back purge system, etc. Its main process segments are described as follows:

1. **Coagulating basin:** The raw water added with coagulant enters the coagulating basin from the inlet pipe so that the suspended matter in the water is fully in contact with the coagulant and reacts to form alum flowers.
2. **Sedimentation room:** After adding a coagulant to the water, alum flowers are formed and flow into the sedimentation basin of the equipment for sedimentation. The sedimentation basin uses the inclined tube sedimentation method. The solid-liquid separation is completed by sedimentation in the trapezoidal inclined plate sedimentation room. The sedimentary sludge is discharged into the mud bucket and sent to the sludge treatment station for treatment.
3. **Filter basin:** The sedimentary water flows into the filter basin. The filter structure is: The bottom is water distributor, the middle is quartz sand, and the upper is anthracite. The filtration rate is 10 m/h, and finally, the clear water flows into the industrial fire-fighting pool for use in the factory area. The filter basin backflush cycle is approximately 12 hours, and the backflush time is 5 to 10 minutes.
4. **Gravity sludge thickener:** Receive the sludge water discharged from the flocculation sedimentation basin and the sludge water discharged from the filtration area of the integrated water purifier; use the principle that the sludge concentration is greater than the water, sludge settles to the bottom of the basin and is pumped to the sludge press system for asphalt treatment through the sludge pump.
5. **Supernatant basin and recovery of supernatant:** Collect the supernatant on the sludge concentration basin and use the pump to deliver it to the water inlet of the integrated water purifier for further clarification.

2.13.9 Design Description for Raw Water Pretreatment in Bangladesh Waste-to-Energy Project

Design and Operating Conditions:

Project Overview: This project involves the construction of a 2×400 m³/h water treatment plant. The primary purpose is to treat river water by removing suspended solids. The raw water treatment system utilizes a micro-vortex coagulation reaction tank and a valve-less filter tank.

Process Flow:

- River water is transported via pipelines into the water treatment plant.
- After treatment, the water is stored in industrial and firefighting water tanks, to be used for industrial and firefighting purposes within the plant.
- Sludge water generated during the water treatment process is directed to a sewage pool. The supernatant is reused, and the sludge is pumped to the leachate treatment station for combined treatment.
- Plant Layout: The water treatment plant is located within the plant premises, covering an area of 20m × 35m. The reaction tank, filter tank, and sewage pool are all arranged outdoors.
- Chemical Dosing: The biocide dosing equipment is planned to be shared between the water treatment plant and the circulating water system.

Full Analysis Report on Source Water Quality:

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2024040134	Sample Receiving date: 08-04-2024
Ref. Memo No: CMECBB/2024/Nill & Dated: 08-04-2024	Sample Source: Test Tube Well
Sent by:Project Manager ,WtE Power Plant Project , Dhaka.	Dist:Dhaka, Upa:Savar
Care Taker: CMEC Bangladesh Branch (Sample : TTW-02)	Union:, Vill.:Amin bazar
Sample Collection date: 08-04-2024	Date of Testing: 08/04/2024-25/04/2024

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Alkalinity	-	30	mg/L	Titrimetic	-
2	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
3	Boron (B)	1.0	0.23	mg/L	UVS	0.20
4	Chloride	150-600	30	mg/L	Titrimetic	-
5	Coliform (Faecal)	0	0	N/100ml	MFM	-
6	Coliform (Total)	0	0	N/100ml	MFM	-
7	Colour	15	0.98	Hazen	UVS	-
8	Hardness	200-500	130	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	0.40	mg/L	AAS	0.05
10	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
11	Nitrogen (Nitrate)	10.0	1.2	mg/L	UVS	0.10
12	pH	6.5-8.5	7.3	-	pH Meter	-
13	Total Dissolved Solid (TDS)	1000	122	mg/L	Multimeter	-
14	Turbidity	10	1.1	NTU	Turbidity Meter	-

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

II. Design Requirements:

1. Engineering Design Scale:

Total Design Capacity of the Raw Water System:

- 400 m³/h, with one unit in use and one unit on standby.

- Circulating Water Dosing Design: Includes one set of scale inhibitor equipment and one set of biocide equipment (shared with the water treatment plant).

2. Process Flow:

- Raw water supply pipeline → Pipeline mixer → Micro-vortex coagulation reaction tank → Valve-less filter tank → Industrial and firefighting water tank

3. Process Design Requirements (Water Treatment Section):

- Primary Objective: The main purpose of the raw water treatment system is to remove suspended solids from the raw water.
- Key Design Inlet Water Indicators:
    - Raw water turbidity: 5~350 NTU
- Key Design Outlet Water Indicators:
    - Turbidity after the micro-vortex coagulation reaction tank: less than 5 NTU
    - Turbidity after the valve-less filter tank: less than 3 NTU

3. System Operation, Operational Requirements, and Performance Guarantee:

- The raw water treatment system must be capable of operating continuously for 24 hours, with the output of a single unit not less than 400 m^3/h.
- The raw water treatment system must ensure safe operation for at least 8,500 hours annually.
- The service life of the equipment body must be no less than 30 years.
- All electrical equipment must reliably operate continuously at a maximum ambient temperature of 45°C.
- Outdoor electrical equipment such as motorized valves must have a protection rating of IP65.

4. Detailed Equipment Requirements:

Micro-Vortex Coagulation Reaction Tank:

- Raw water first passes through a pipeline mixer, where it is fully mixed with the coagulant; then it enters the micro-vortex coagulation reaction tank for treatment. The treated water then flows by gravity into the valve-less filter tank.

Key Technical Parameters of the Mixing Coagulation Sedimentation Tank:

Parameter	Details
Treatment Process	Chemical mixing, coagulation contact, flocculation, and sedimentation
Quantity and Specifications	2 sets
Design Capacity (Per Set)	400 m^3/h
Type	Concrete structure
Inlet Water Source	River water
Outlet Water Quality	Less than 5 NTU
Design Outlet Capacity (Per Set)	400 m^3/h

Here is the table based on the provided information:

Parameter	Details
Model and Specification	HJ-PN-400
Quantity	Not less than 8 sets per unit
Components	DN200/DN50
Sludge Discharge Flow (Per Unit)	1.4 m^3/h

Sludge Concentration	98–99% (Moisture content)

Here is the table based on the provided information:

Parameter	Details
Treatment Process	Filtration
Quantity	2 sets
Design Capacity (Per Set)	400 m³/h
Installation Type	Concrete structure
Inlet Water Source	Outlet from the micro-vortex coagulation reaction tank
Outlet Water Quality	Less than 3 NTU
Design Outlet Capacity (Per Set)	400 m³/h

General Requirements for Valve-less Filter Tank:

- The valve-less filter tank should have reliable automation features, including automatic backwashing (without the need for a separate backwashing device). The staff only needs to perform regular water quality testing and does not need to operate or manage the filtration device.
- It should ensure a normal service life of over 30 years without the need for replacement.

Dosing Equipment:

Four dosing units will be installed in the dosing room of the sludge dewatering workshop (specific layout to be determined after joint review of design drawings with the design institute). These units will be used to add the necessary chemicals for the operation of the water treatment plant and the circulating water system.

Items		**Details**
Model Specifications		JN-JY-2/3; JN-JY-2/3; JN-JY-2/5
Quantity		3 Sets
Conveyed Medium		Coagulants/Flocculants/Disinfectants
Chemical Composition		PAC; PAM; Sodium Hypochlorite (Recirculated Water)
Operating Environment		Indoor Arrangement
Dosing pump	Equipment Type	Diaphragm Metering Pump
	Quantity and Operation Conditions	3 units each, with 2 in use and 1 as backup
	Control Method	All dosing pumps have remote start/stop, local adjustment, and local start/stop capabilities
	Design Flow Rate	PAC: 0-480 L/h; PAM: 0-200 L/h (Reference values)
	Design Head	1.0 MPa
	Diaphragm Material	PTFE
Dissolving medicine box	Quantity and Operation Conditions	2 units/set
	Effective Volume	3 m³ / 3 m³ / 1 m³ / 1 m³
	Mixer	Corrosion-resistant mixer, compatible with the solution tank, low noise, remote control
PAC Storage Tank	Quantity and Operation Conditions	1 unit
	Effective Volume:	3 m³

Items		Details
PAM Storage Tank	Quantity and Operation Conditions	1 Set
	Effective Volume	3 m³

Here's a table for the main technical parameters of the disinfectant dosing device:

Item		Details
Equipment Quantity		1 set
Equipment Purpose		Automatic dosing of disinfectant for recirculated water system
Conveyed Medium		Sodium hypochlorite and other oxidative disinfectants, or phenolic disinfectants (specific types and concentrations to be confirmed during operation)
Equipment Model		JN-JY-2/5
Equipment Type		Complete dosing system
Metering Pumps	Equipment Type	Hydraulic Diaphragm Metering Pump
	Quantity and Operation Conditions	2 units for recirculated water system (1 in use, 1 backup); 2 units for water purifier outlet (1 in use, 1 backup)
	Diaphragm Material	PTFE (Polytetrafluoroethylene)
	Pump Head Material	316SS (Stainless Steel)
Drug dissolving tank	Equipment Type	Vertical Storage Tank
	Quantity	2 units
	Single Tank Effective Volume	1 m³
	Material	PE (Corrosion-resistant)
Mixer (Compatible with Solution Tank)	Quantity:	2 sets
Motor Protection Rating		IP54
Motor Insulation Rating		F
Remarks		Shared by recirculated water and clean water disinfection solution tanks; dosing pumps: 3 units (2 in use, 1 backup)

General Requirements for Dosing Equipment:

The dosing system should be an integrated, modular unit. It primarily includes the following components:

- Chemical Preparation Section: Must have a capacity to support continuous operation for 24 hours and include mixing equipment.
- Dosing Section: Includes metering pumps, level gauges, and the associated connecting pipelines and valves.
- Base and Operation Platform: Includes the base and the operational platform for the equipment.

1) Main technical parameters of tubular mixer:

Item	Details
Model Specification	DN300

Item	Details
Quantity	2 sets
Single Unit Rated Flow Rate	400 m^3/h
Arrangement	Horizontal Layout

2) General Requirements for Tubular Mixer:

The tubular mixer should use flange connections for easy installation and maintenance. Before installation, all pipe openings of the mixing equipment should be covered to prevent foreign objects from entering. The tubular mixing equipment should have a normal service life of at least 30 years without the need for replacement.

3) Wastewater Reuse Tank:

Sludge and backwash water enter the wastewater reuse tank. The clear liquid needs to be recovered, while the sludge at the bottom is lifted and sent to the leachate treatment station for combined processing.

4) Instrumentation and Control Technology Requirements:

Basic Requirements:

All monitoring and control within the system should be integrated into the main plant's DCS (Distributed Control System). This means that system monitoring and control should be achieved through the DCS operator station in the control room, with interlock protection for the equipment. The bidder is responsible for providing control logic to the DCS system supplier and assisting in the configuration and debugging of the system.

2.13.10 Details of Disposal of Sludge

The sludge in this project is obtained from the feed water Treatment System and the leachate treatment system. Feed Water Treatment System Gravity sludge thickener can receive the sludge water discharged from the flocculation sedimentation basin and the sludge water discharged from the filtration area of the integrated water purifier; use the principle that the sludge concentration is greater than the water, sludge settles to the bottom of the basin and is pumped to the sludge press system for asphalt treatment through the sludge pump.

Sludge generated during the processing of the leachate include Grid slag of grid system, residual sludge of the biochemical treatment system. The sludge is pumped to the sludge tank by a sludge lift pump and is lifted through screw pump into the dewatering room for dewatering treatment, and the mud cake with a moisture content of less than 80% after dewatering is transported to the waste bunker for incineration treatment. The residue from leachate treatment consists of concentrated liquid, sludge, and biogas. The collected biogas is reintroduced into the incinerator for burning. After being dewatered, the sludge is sent to a landfill where it is burned alongside the garbage. The concentrated liquid is reused in the flue gas purification system.

The sludge produced by this operation will be pre-treated, during which main metals such as iron, aluminum, and copper will be extracted and sold externally. Once tested, the residual fine sand fulfills the requisite standards and will be supplied to the construction materials market.

2.14 Deodorization

The design of activated carbon adsorption deodorization system as a Waste bunker emergency deodorization measure is recommended for this project. The odor of this project is mainly distributed in the following four places:

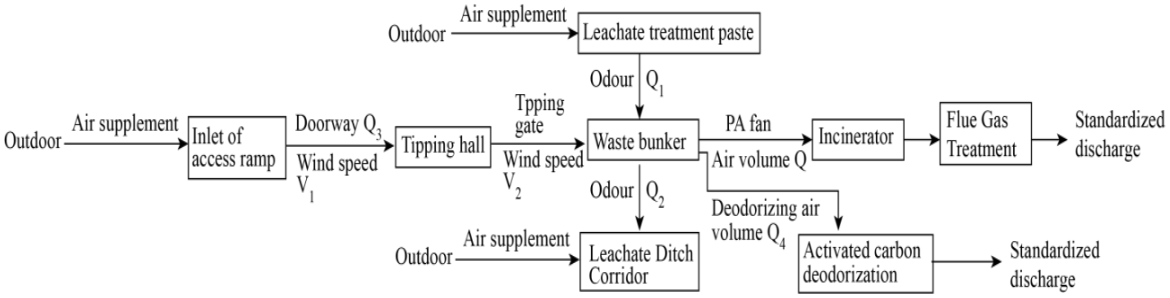
1 Odorous gas is produced by waste bunkers.

2 Odorous gas is produced in the leachate ditch corridor and asphalt collection tank.
3 The Discharging Hall produces odor due to the entry and exit of waste trucks.
4 Leachate treatment station deodorization.

The odor of Leachate ditch corridor and Leachate treatment station is transported to the waste tank. Under normal circumstances, when the incinerator is operated, the odor is preferentially sent to the Waste bunker for high temperature decomposition, and the flue gas meets the standard for emission after purification; only when the incinerator is operated at low load, resulting in insufficient negative pressure of Waste bunker or the incinerator is suspended for maintenance, the incinerator emergency deodorization system is opened. The estimated odor quantity Q1 of leachate treatment station into waste bin of this project is about 15000m^3/h. The estimated amount of odor Q2 from leachate trench to waste bin was about 15,000 m^3/h. When the unloading door is opened, the cross-section wind speed is calculated according to 0.6m/s, so the inlet air volume at the unloading door is about 7000m^3/h; The gas production of waste bin fermentation is about 20,000 m^3/h. Other air leakage volume is estimated to be about 12000m^3/h according to volume. Therefore, the air volume of the emergency deodorization system in this project is about 132000m^3/h, and a set of activated carbon adsorption deodorization devices with processing capacity of 140000m^3/h is set.

The malodorous gas collected from the Waste bunker by the deodorizer enters a set of activated carbon adsorption deodorizers and the malodorous gas reaches the standard emission after the activated carbon adsorption treatment.

Figure 2-13: Deodorization Flow Diagram



Source: Feasibility Study, CMEC

The places where odor is produced, such as construction professional Tipping Hall and Waste bunker, are closed. For the Waste bunker communicates with other rooms, the construction professional sets up Airtight Room, and the ventilation professionally sends outdoor fresh air to the Airtight Room to keep it at a slight positive pressure of 20 ~ 30 Pa.

The ventilation system air volume of Leachate Ditch Corridor and the pump room is calculated for 3 changes / h, Air supply and exhaust system all set up a backup. In order to maintain the negative pressure in the leachate channel, the air supply volume of the system is 80% of the discharge volume. The supply and exhaust fans are interlocked in complete sets, and the exhaust fans must be anti-corrosion and explosion-proof fans. Supply and exhaust fans send the malodorous pollutants in the Leachate Ditch Corridor and collection ponds to the Waste bunker, and at the same time send them into the outdoor fresh air, so as to reduce the concentration of malodorous substances. In addition, when the staff enters the Leachate Ditch Corridor or collection pool to work, the standby air supply and exhaust system must be opened. Only after the odor concentration is reduced to the sanitary standard that personnel can enter, the staff can enter after taking effective protective measures.

To ensure that the negative pressure and odor at the Tipping Hall did not spill, Tipping hall is considered as a recharge point for Waste bunker. When the waste incinerator is completely stopped for maintenance, the waste tipping gate is closed, the deodorization device and centrifugal fan are started,

and the Waste bunker odor enters the deodorization device from the air inlet and air tube for treatment, which is discharged after meeting the relevant standards of national standard GB 14554-1993.

2.15 Anti-seepage Engineering

The main purpose of the anti-seepage project is to prevent leachate from polluting groundwater and surrounding environment. According to the geological survey report, in combination with the relevant contents of the current national standard of China, Technical Code for Sanitary Landfill Treatment of Solid Waste (GB 50869-2013). Landfills must be treated against seepage to prevent contamination of groundwater and surface water, while preventing groundwater from entering the landfill area. The permeability coefficient of natural clay lining, and modified clay lining shall not exceed 1×10-7 cm/s, and the thickness of field bottom and four-wall lining shall not be less than 2m.

The main anti-seepage mode of this project is determined as artificial horizontal anti-seepage. According to the different combinations of leachate collection and drainage system, anti-seepage system, protective layer and filter layer, the standard level is designed and adopted. The lining system of landfill has different structures, such as single-layer lining system, composite lining system, double-layer lining system and multi-layer lining system. The site where the landfill is located does not have natural anti-seepage conditions; and in combination with the actual situation of the site, a double-layer lining anti-seepage structure is adopted.

2.16 Groundwater Drainage System

According to the site excavation scheme, the groundwater level below the lowest level of site elevation must be considered to guide the groundwater at the bottom of the landfill area. The groundwater drainage system is mainly composed of the main blind ditch of groundwater drainage and the branch blind ditch under the anti-seepage layer.

2.16.1 Main blind ditch for groundwater drainage

The main blind ditch of groundwater drainage is located in the groundwater drainage layer. First, a geotechnical filter screen is laid in the blind ditch, then an HDPE perforated floral tube is laid, and finally, the graded pebble is backfilled to the top of the blind ditch of groundwater drainage (the blind ditch is wrapped by geotextile). The slope of the main blind ditch for groundwater drainage is not less than 2%. The main blind ditch in each district will lift the collected groundwater through the groundwater lifting well outside the reservoir area and finally discharge it into the flood interception ditch.

2.16.2 Branch blind ditch for groundwater drainage

On the longitudinal line along the main blind ditch, according to the actual terrain of the site leveling, the groundwater drainage branch blind ditch is laid at an interval of about 30.0 m. The slope of the blind ditch for the groundwater drainage branch is not less than 1%

2.17 Leachate Drainage System

The leachate drainage system comprises the leachate diversion layer and the percolating blind ditch. The design of the leachate drainage system is combined with rain sewage diversion.

2.17.1 Percolating blind ditch of leachate

There are two kinds of leachate drainage blind ditches: main blind ditches and branch blind ditches.

The main blind ditch is responsible for the final discharge of leachate, and the leachate is exported from the field area to the landfill area. In order to facilitate the collection and discharge of leachate, the main blind ditch of the permeation is designed in each area. The collected leachate is lifted by the main blind ditch of each area through the lifting well outside the landfill area and finally discharged into the original leachate conditioning pond in the field area.

The percolating blind ditch of the branch is also located at the bottom of the reservoir area, and the slope on both sides along the bottom of the field is the main blind ditch.

2.17.2 Leak detection system

A leachate leakage detection system is set up between the anti-seepage system's first layer and the landfill area's second layer. The leakage detection tube is finally connected to the leachate leakage detection well.

2.18 Power Evacuation

2.18.1 Introduction

According to PPA, this project uses a dual loop 132kV line to connect to the Savar 132/33kV substation. The length of the 132kV transmission line is about 5.99 km. The Savar 132/33 kV substation transformer's capacity is 3×50/75 Megavolt-Amperes (MVA), with a maximum load of 158 MW and a minimum load of 147 MW.

The benefits of the option are:

- The most reliable portion from the view of fault occurrence because number of faults in 132kV
- transmission rarely occurring.
- Low Interconnection losses 0.278 MW
- Space available for constructing Interconnection facilities at Savar 132kV Substation.
- This option does not create any additional network constraints at 132Kv grid network.

2.18.2 Location of the Transmission Line

The proposed transmission line is located in the north-central region of Bangladesh. The specific project site is in Dhaka District, Savar Upazila under Ward 6 and Ward 9 of Bongaon union and Tentuljhora Union respectively. This transmission line crosses the Karnatali River 2 times. This Karnatali River originated from Dhaleswari river near Savar upazila and outfall into the Turag River near Mirpur.

2.18.3 Land Use Pattern of Proposed Transmission Line

The total Right of Way (RoW) for the transmission line is approximately 5.99 km. No structures have been identified within the transmission line's RoW. The total number of towers is 27. The conversion of agricultural land to industrial use for tower footings will have a long-term impact. The land is currently being used for the cultivation of rice, chillies, vegetables, and cash crops.

During the field survey, it was observed that no residential households are present within the transmission line's RoW. The conversion of agricultural land to industrial use for tower footings may impact the livelihood of landowners cultivating the affected area. However, the impact will be limited to the area within the transmission line's RoW and will not extend to neighboring areas. The field survey confirmed that no residential households are located within the transmission line's RoW. In accordance with the international standards for report writing, the impact has been limited to the area within the transmission line's RoW, avoiding the need to disclose residential addresses and protecting the privacy of residential addresses

2.18.4 Land Requirement for Transmission Line

The proposed transmission line will require approximately 89.063 decimal (0.89 acres) of land for tower footing construction. Most of the land is privately owned land which is currently used for cultivation. As per Electricity act 2018, Chapter 3, Section 14 of 2, if any private company holding license requires any land for constructing any connection line with power station, sub-station or grid substation the licensee may purchase or acquire such land from the concerned landowner in accordance with the existing laws and regulations regarding land acquisition. The land purchase is now under processing. The project

developer has to purchase the land ensuring AIIB ESF, Electricity Act, 2018, Electricity Rules 2020 (amendment 2022) or ARIPA, 2017 guidelines.

As per the Electricity Act, 2018, and the Electricity Rules, 2020 (amended in 2022), the proponent will compensate the landowners based on the current market price. The current market price will be provided by the proponent with support from the Sub-Registry Office of the respective area.

After conducting the market assessment, the proponent will be ensured that the compensation is equivalent to or greater than the Replacement Cost to meet AIIB's ESF guidelines.

The landowner can use the land after TL construction without damaging Tower and Its equipment as per Electricity Rules 2020 Section 10, Subsection 6.

As per the initial field visit, there is no structure found in the proposed land to be acquired for tower footing. So, no physical displacement and relocation is required for this TL. Only economic displacement will be involved. The tower footings for laying transmission lines require land compensation as per Electricity Rules 2020 even if land for tower footings will not be acquired. Compensation will be provided for standing trees under RoW which require felling before laying the transmission lines. During construction, if any crops, structures or any other assets are affected, will be compensation according to the entitlement proposed in the RP.

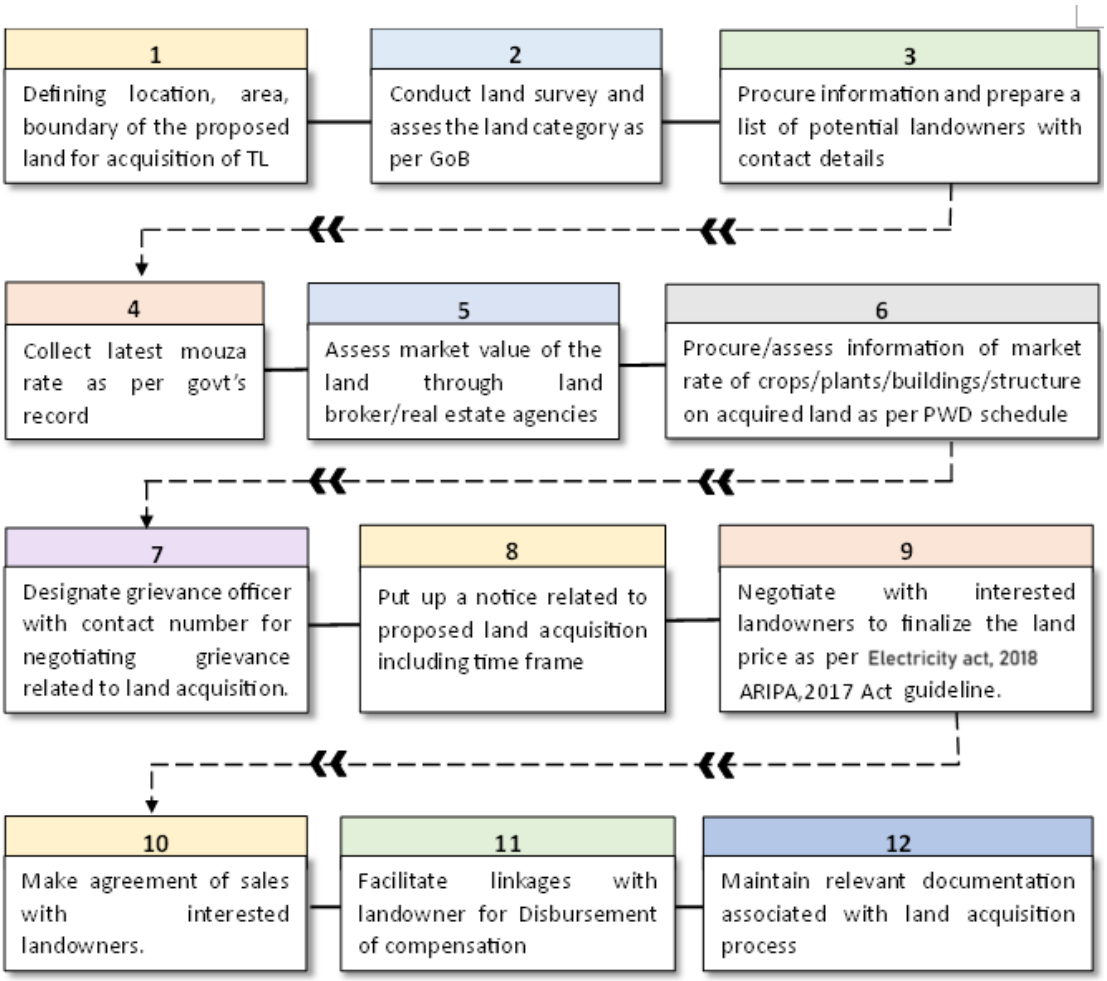
After conducting the market assessment, it will be ensured that the compensation is equivalent to or greater than the Replacement Cost to meet AIIB's ESF guidelines. As per the initial field visit, there is no structure found in the proposed land to be acquired for tower footing. So, no physical displacement and relocation is required for this TL. Only economic displacement will be involved. The tower footings for laying transmission lines require land compensation as per Electricity Rules 2020 even if land for tower footings will not be acquired. Compensation will be provided for standing trees under RoW which require felling before laying the transmission lines. During construction, if any crops, structures or any other assets are affected, will be compensation according to the entitlement proposed in the RP.

The ESMP (Environment & Social Management Plan) for tentative transmission line has been shared in **Appendix Q**.

The project developer has proposed initial plan for land acquisition process for transmission line is guided by the following principles:

- Willing to buy, willing to sell.
- Ensure transparent and participatory process.
- Establish user-friendly grievance redressal process, enabling landowners to lodge complaints associated with land acquisition activity.
- Adhere to Power Grid Company of Bangladesh Ltd (PGCB)'s guidelines for acquisition of transmission line.

The flowchart depicts the process of land acquisition for transmission line adopted by WPPNDPL:



2.18.5 Details of Transmission Line Route

The transmission line route is initiated from the North-West corner of the plant along the Karnatali Riverbank. The length of the route is approximately 5.99 km. Total angle points are 14, and the number of Towers will be 27. The details of each tower/ pole location have been represented in Table 2-32 along with the geographical location and angle deviation for each of the points. Transmission lines are essential components of the electrical grid, used to transport electrical energy from power stations to distribution networks or directly to consumers. Photographs of transmission line route survey have been given in **Appendix N**.

2.18.6 Tower-wise land information

The provided table outlines the existing land use, ownership, and tentative land prices for various tower sites involved in a construction project. Each tower, designated by a specific identifier (e.g., TT-1, AP-1, T-2/1), occupies land with distinct characteristics and ownership statuses. Here's a detailed overview of the information presented:

1. **Fallow Land:**
    - **Tower Sites:** TT-1, TT-1/1, AP-1, AP-12, T-12/1, AP-13, TT-2
    - **Ownership:** Mostly private land, with one potential government land (AP-12).
    - **Price Range:** 2.5 lac BDT per site, except for AP-12, T-12/1, AP-13, and TT-2 where the price is not specified because these locations may be under government land.
2. **Single Cropped Paddy Land:**
    - **Tower Sites:** AP-1/1, AP-3, T-3/1

- **Ownership:** Private land.
- **Price Range:** 3 lac BDT for AP-1/1 and AP-3, and 4 lac BDT for T-3/1.

3. **Vegetable Land:**
   - **Tower Sites:** AP-2, T-2/1, AP-4, T-4/1, AP-5, T-5/1, T-5/2, T-5/3, AP-6, T-6/1, T-6/2, T-6/3, AP-7, AP-8
   - **Ownership:** Private land.
   - **Price Range:** 3 lac BDT for AP-2 and T-2/1; 4-4.5 lac BDT for AP-4 and T-4/1; 2-3 lac BDT for others in this category.
4. **Flower Garden:**
   - **Tower Site:** AP-9
   - **Ownership:** Private land.
   - **Price Range:** 7-8 lac BDT.
5. **Grass Cultivation for Cows:**
   - **Tower Sites:** AP-10, AP-11
   - **Ownership:** Private land.
   - **Price Range:** 7-8 lac BDT for AP-10 and 5-6 lac BDT for AP-11.

This detailed categorization of tower sites highlights the diverse types of land use involved in the project, from fallow and agricultural lands to specialized uses like flower gardens and grass cultivation for livestock. The site is currently used for Paddy, Chilli, Brinjal, Bottle Gourd, Snake Gourd, Pumpkin, Water Pumpkin, Sugar cane, Red Spinach, Water Spinach Seeds cultivation. The land ownership is predominantly private, with most parcels carrying a clear market value, except for a few fallow land sites where ownership and price details need further confirmation. The market value has been assessed based on consultation with local people. Almost all the landowners lease their land to sharecroppers for one year, with lease amounts ranging from 15,000 to 20,000 BDT/year. There are no written agreements between the landowners and sharecroppers. All the landowners are self-sufficient and not solely dependent on this land. They have other businesses to support their families.

Table 1: Tower-wise land information

Tower Number	Existing land use	Land Ownership	Tentative Land Price (BDT)
TT-1	Fallow land	Private Land	2.5 lac
TT-1/1	Fallow land	Private Land	2.5 lac
AP-1	Fallow land	Private Land	2.5 lac
AP-1/1	Single cropped paddy land	Private Land	3 lac
AP-2	Vegetable land	Private Land	3 lac
T-2/1	Vegetable land	Private Land	3 lac
AP-3	Single cropped paddy land	Private Land	3 lac
T-3/1	Single cropped paddy land	Private Land	4 lac
AP-4	Vegetable land	Private Land	4.5 lac
T-4/1	Vegetable land	Private Land	4 lac
AP-5	Vegetable land	Private Land	2-3 lac
T-5/1	Vegetable land	Private Land	2-3 lac
T-5/2	Vegetable land	Private Land	2-3 lac
T-5/3	Vegetable land	Private Land	2-3 lac

Tower Number	Existing land use	Land Ownership	Tentative Land Price (BDT)
AP-6	Vegetable land	Private Land	2-3 lac
T-6/1	Vegetable land	Private Land	2-3 lac
T-6/2	Vegetable land	Private Land	2-3 lac
T-6/3	Vegetable land	Private Land	2-3 lac
AP-7	Vegetable land	Private Land	2-3 lac
AP-8	Vegetable land	Private Land	2-3 lac
AP-9	Flower garden	Private Land	7-8 lac
AP-10	Grass cultivation for cows	Private Land	7-8 lac
AP-11	Grass cultivation for cows	Private Land	5-6 lac
AP-12	Fallow land	May be government land. Need to be confirmed later	
T-12/1	Fallow land		
AP-13	Fallow land		
TT-2	Fallow land		

Figure 2-14: The proposed transmission line and major river crossing sites

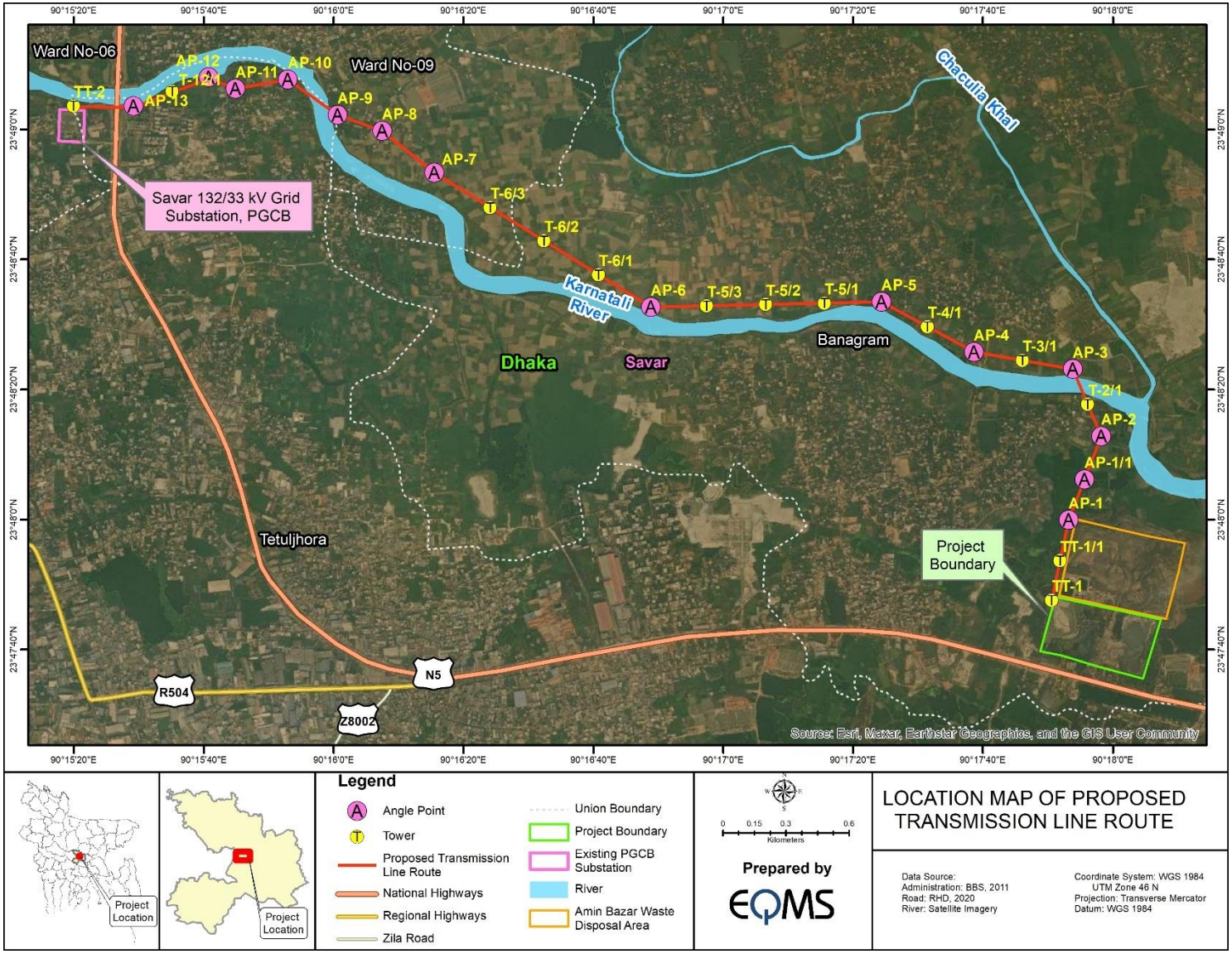


Table 2-32: Detailed Specifications of Transmission Line

RoW	Tower Number	X Easting (m)	Y Northing (m)	RL (m)	Ahead Span (m)	Line Angle (deg)	Tower Type	Struct. Height (m)	Footprint Length (m)	Footprint Width (m)	Footprint Area (dec)
1	TT-1	224614.51	2634325.43	6.93			1DT6-S	41.5	11.32	9.73	2.722
2	TT-1/1	224654.36	2634511.35	6.74	190.14		1DL+9	38.04	6.65	5.77	0.948
3	AP-1	224695.50	2634703.33	5.95	196.34	8.6948	1D1+9	38.04	7.675	6.475	1.228
4	AP-1/1	224767.97	2634894.20	2.96	204.16		1DL+9	38.04	7.675	6.475	1.228
5	AP-2	224845.23	2635097.68	4.20	217.66	-41.0833	1DT6+9	37.6	11.77	10.18	2.961
6	T-2/1	224789.06	2635249.58	4.26	161.95		1D1+12	41.04	8.8	7.6	1.653
7	AP-3	224727.13	2635417.08	4.00	178.58	-57.8757	1DT6+9	37.6	12.67	11.08	3.469
8	T-3/1	224508.54	2635462.87	4.46	223.34		1DL+9	38.04	6.65	5.77	0.948
9	AP-4	224298.22	2635506.94	4.12	214.89	19.7232	1D25+9	38.08	9.41	8.13	1.891
10	T-4/1	224097.13	2635630.43	3.84	235.98		1DL+9	38.04	6.65	5.77	0.948
11	AP-5	223899.63	2635751.72	4.07	231.77	-31.8822	1DT6+9	37.6	11.77	10.18	2.961
12	T-5/1	223650.16	2635750.30	3.60	249.48		1DL+9	38.04	6.65	5.77	0.948
13	T-5/2	223393.68	2635748.83	4.73	256.49		1DL+9	38.04	6.65	5.77	0.948
14	T-5/3	223136.65	2635747.37	4.48	257.03		1DL+9	38.04	6.65	5.77	0.948
15	AP-6	222893.27	2635745.98	4.21	243.39	35.3639	1DT6+9	37.6	12.67	11.08	3.469
16	T-6/1	222668.14	2635903.84	4.72	274.96		1DL+9	38.04	7.11	6.22	1.093
17	T-6/2	222432.80	2636068.85	4.76	287.42		1DL+9	38.04	6.65	5.77	0.948
18	T-6/3	222201.90	2636230.75	4.83	282.01		1DL+9	38.04	7.11	6.22	1.093

RoW	Tower Number	X Easting (m)	Y Northing (m)	RL (m)	Ahead Span (m)	Line Angle (deg)	Tower Type	Struct. Height (m)	Footprint Length (m)	Footprint Width (m)	Footprint Area (dec)
19	AP-7	221960.19	2636400.23	4.94	295.21	7.1099	1D1+9	38.04	8.35	7.15	1.475
20	AP-8	221736.68	2636602.52	5.34	301.46	-19.7118	1D25+9	38.08	10.31	9.03	2.301
21	AP-9	221544.11	2636682.03	7.20	208.34	16.3522	1D25+3	32.08	9.41	8.13	1.891
22	AP-10	221330.86	2636853.41	5.34	273.58	-48.5981	1DT6+9	37.6	11.995	10.405	3.084
23	AP-11	221101.74	2636813.79	5.27	232.52	35.791	1DT6+9	37.6	12.67	11.08	3.469
24	AP-12	220985.92	2636870.23	5.00	128.84	-47.3755	1QT6+9	50.1	26.33	20.19	13.137
25	T-12/1	220825.37	2636807.33	5.73	172.43		1QL+9.0	51.87	19.31	14.72	7.024
26	AP-13	220654.50	2636740.38	7.40	183.52	23.0318	1QT6+9	50.1	26.33	20.19	13.137
27	TT-2	220394.45	2636747.81	6.14	260.16	-68.0464	1QT6T+9.0(AUX)	51.1	26.33	20.19	13.137
28	Savar Gantry	220381.07	2636717.17	8.90	33.43		Gantry 132kV E0+0	20			0.000
											89.063

Source: Feasibility Study

2.19 Project Implementation Schedule

The preliminary preparation of the project is expected to be 6 months. The construction period is approximately 24 months. The project schedule for construction stage has been given in Table 2-33.

Table 2-33: Project Schedule for Construction Stage

serial number	Node work content	Starting time	Complete time
1	The official transfer time of the land		2024.05.07
2	Pile foundation construction in the garbage pool area completed	2024.05.08	2024.08.07
3	The garbage pool is zero meters out	2024.08.08	2025.01.22
4	#1/2 Boiler Basic Safety	2024.09.01	2024.12.15
5	#3/4 Boiler Basic Safety	2024.10.15	2025.01.17
6	Turbine base delivery	2024.10.05	2025.02.28
7	#1 furnace steam drum hoisting completed	2024.12.16	2025.03.15
8	#2 furnace steam drum hoisting completed	2025.01.15	2025.04.15
9	#3 furnace steam drum hoisting completed	2025.02.15	2025.05.15
10	#4 furnace steam drum hoisting completed	2025.03.15	2025.06.15
11	#1 furnace hydraulic test completed	2025.03.16	2025.07.31
12	#2 furnace hydraulic pressure test completed	2025.04.16	2025.08.31
13	#3 furnace hydraulic test completed	2025.05.16	2025.09.30
14	#4 furnace hydraulic pressure test completed	2025.06.16	2025.10.31
15	#1 Boiler wall masonry and insulation completed	2025.08.01	2025.11.15
16	#2 Boiler wall masonry and insulation completed	2025.09.01	2025.12.15
17	#3 Boiler wall masonry and insulation completed	2025.10.01	2026.01.15
18	#4 Boiler wall masonry and insulation completed	2025.11.01	2026.02.15
19	#1 flue gas purification system completed	2025.07.15	2025.10.31
20	#2 flue gas purification system completed	2025.08.15	2025.11.30
21	#3 flue gas purification system completed	2025.09.15	2025.12.31
22	#4 flue gas purification system completed	2025.10.15	2026.01.31
23	Oven #1 is completed	2025.11.16	2025.12.10
24	#2 oven baking oven completed	2025.12.16	2026.01.10
25	#3 oven baking oven completed	2026.01.16	2026.02.10
26	#4 oven baking oven completed	2025.02.16	2026.03.10
27	#1 The overall steam turbine is skid-mounted and the generator stator is in place	2025.03.25	2025.04.10
28	#2 The steam turbine is skid-mounted as a whole and the generator stator is in place	2025.04.25	2025.05.10
29	Reverse power transmission completed		2025.09.30
30	#1 Blowpipe Complete	2025.12.11	2026.01.10
31	#2 Blowpipe Complete	2026.01.11	2026.02.10
32	#3 Blowpipe Complete	2026.02.11	2026.03.10
33	#4 Blowpipe Complete	2026.03.11	2026.04.10
34	Leachate treatment system has the conditions		2026.02.28
35	The garbage pool has the conditions to enter garbage		2026.03.10
36	Machine #1 is switched over and the first grid-connected test is completed.	2026.02.15	2026.03.15
37	Unit #1 with full load	2026.03.16	2026.06.10
38	Machine #2 is switched over and the first grid-connected test is completed.	2026.04.15	2026.05.15
39	#2 unit with full load	2026.05.16	2026.08.10
40	Factory-wide joint debugging, completed within 72+28 hours	2026.08.11	2026.09.07

Source: Feasibility Study, 2022

3 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Introduction

To address the environmental and social risks associated with any proposed project and its associated components and to protect and conserve the environment from adverse impacts, the GoB has established specified regulations, policies, and guidelines. It is understood that the Project is intended to secure international financing, which necessitates compliance with the environmental and social safeguard requirements of international financial institutions. Specifically, the Project will adhere to the requirements of the AIIB ESS Policy (,2022), World Bank General EHS guidelines (2007), and Environmental, Health, and Safety Guidelines for Waste Management Facilities (2007), in conjunction with all GoB requirements.

This section presents key environmental and social rules and regulations as well as international safeguard requirements that will be applicable to the Project, during different phases with respect to the following reference framework:

- Applicable Bangladesh (national, state and local) Environmental and Social Regulations;
- AIIB ESS Policy 2022
- IFCs Performance Standards on Environmental and Social Sustainability (2012);
- World Bank Environmental and Social Safeguard Policies;
- IFC/ WB General EHS Guidelines (2007);
- Applicable National Environmental Standards for Ambient Air, Noise, Water etc.

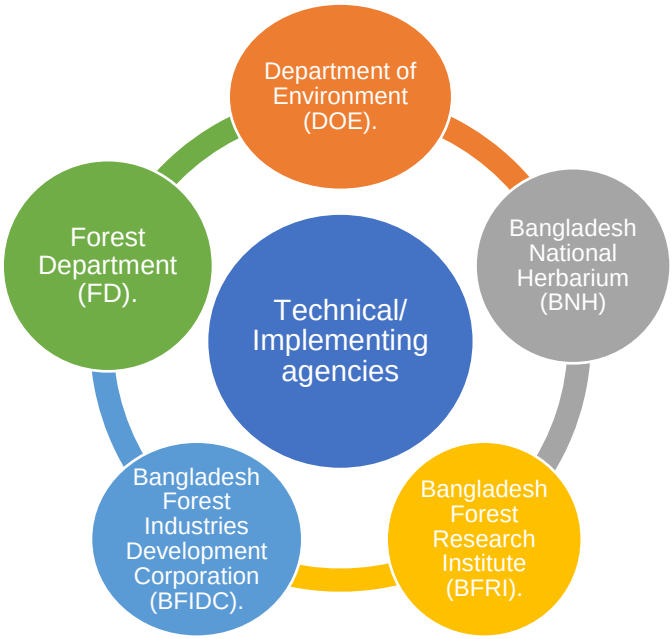
The following activities have been undertaken in this section:

3.2 Applicable National Reference Framework

The appropriate national environmental standards are applied under the Environmental Conservation Rules (ECR) -2023. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding. There is a separate schedule for industry-specific standards, other than the general industrial emission and effluent standards.

3.2.1 Department of Environment (DOE)

The Ministry of Environment, Forest, and Climate Change is the nodal agency in the administrative structure of the GOB, overseeing all environmental matters relating to national environmental policy and regulatory issues in the country. The Ministry of Environment, Forest, and Climate Change oversees the activities of the following technical/implementing agencies:



The DOE has been placed under the Ministry of Environment, Forest, and Climate Change as its technical wing and is statutorily responsible for the implementation of the ECA-1995. The department was created in 1989, to ensure sustainable development and to conserve and manage the environment of Bangladesh. The principal activities of the DOE are:

- Defining EIA procedures and issuing environmental clearance permits the latter being the legal requirement before the proposed Project can be implemented.
- Providing advice or taking direct action to prevent degradation of the environment.
- Pollution control, including the monitoring of effluent sources and ensuring mitigation of environmental pollution.
- Setting Quality Standards for environmental parameters.
- Declaring ECAs, where the ecosystem has been degraded to a critical state; and
- Review and evaluation of IEEs and EIAs prepared for projects in Bangladesh.

3.2.2 Identification of Relevant Policies and Legal Requirements

All legal provisions relevant to environmental protection applicable to the planning, construction, and operation of waste-to-energy projects are identified and summarized in in Table 3-1 and Table 3-2. along with their applicability to the proposed project

The International Standards and their applicability for the Project is provided in Table 3-4, Table 3-7 and Table 3-8.
Earlier, a preliminary review of applicable regulations was conducted in the scoping stage. The present table has been built upon that and is an outcome of a revised review. The table will be updated as the project progresses.

Table 3-1: Policies and Plans Relevant to the Project

Policy/Plans	Responsible Agency-Ministry/Authority	Key Features	Applicability	Pre-Construction	Construction	Operation
National Environment Policy, 2018	Ministry of Environment, Forest, and Climate Change	• Encourage collection and promotion of low carbon emission technology in the country. • Identifying and controlling all types of environmental pollution and degradation activities. • Ensure sustainable, long-term, and environmentally friendly use of all-natural resources. • To undertake Public Private Partnership (PPP) for the development of the environment. • Maintain and streamline the environmental policies and strategies among other policy strategies in the interest of sustainable development. • Ensure the Environmental Impact Assessment (EIA) and SEA in all necessary sectors. • Act to reduce environment through environmental protection. • Strengthen observations system to ensure proper compliance with environmental laws and regulations.	Applicable - as the proposed project has the likeliness of having an impact on the surrounding environment	√	√	√
Bangladesh Climate Change Strategy and Action Plan, 2009	Ministry of Environment, Forest, and Climate Change	• Food security, social protection, and health. • Comprehensive disaster management. • Infrastructure. • Research and Knowledge management. • Mitigation and low carbon development. • Capacity building and institutional strengthening.	Applicable - As the project has the potential to generate pollutants in the air and Greenhouse Gas (GHG) emission.	√	√	√
National Forest Policy, 2016	Bangladesh Forest Department/ Ministry of Environment, Forest, and Climate Change	• Manage all existing forests, wildlife, and other forestry resources, adhering to the principles of sustainable management and climate resilience. • Enrich degraded forest areas and enhance land areas under forest/ tree cover. • Produce a wide array of goods and ecosystem services for the benefit of Bangladesh's present and future generations.	Not Applicable - As the proposed project site is a designated landfill site and going to be developed as a waste to energy project. However, there is no designated forest in the 5 KM buffer of the project boundary.	X	X	X
National Water Policy, 1999	Ministry of Water Resources	• Protection and prevention of the natural environment for ensuring sustainable development. • Minimize disruption to the natural aquatic environment in streams and water channels. • Water development plans will not interrupt fish movement and will make adequate provisions in control structures for allowing fish migration and breeding. • Water development projects should cause minimal disruption to navigation and, where necessary, adequate mitigation measures should be taken. • Full consideration to environmental protection, restoration, and enhancement measures consistent with National Environment Management Action Plan (NEMAP) and the National Water Management Plan (NWMP). • Ensure adequate upland flow in water channels to preserve the coastal estuary ecosystem threatened by the intrusion of salinity from the sea.	Applicable – The project proponent should minimize the water pollution, minimize disruption of aquatic environment and navigation system in the adjacent water body.	√	√	√
National Fisheries Policy, 1999	Ministry of Fisheries and Livestock	• Provide provisions for the protection and conservation of fish in freshwater and brackish water bodies.	Not Applicable - the proposed project site is not a designated fishing zone. Fish capture	X	X	X

Policy/Plans	Responsible Agency-Ministry/Authority	Key Features	Applicability	Pre-Construction	Construction	Operation
		• Preservation, management, and exploitation of fisheries resources in inland open water. • Fish cultivation and management in inland closed water. • Prawn and fish cultivation in coastal areas. • Preservation, management, and exploitation of sea fishery resource. • Conserve fish breeding grounds and habitats; and • promote fisheries development and conservation in all water bodies.	and culture are prohibited for the project workers.			
National Agriculture Policy, 2018	Ministry of Agriculture	• Ensure food security and socio-economic development through the productivity of crops, boosting production and raising farmers' income, diversifying crops, producing safe foods, and developing a marketing system, profitable agriculture & use of natural resources. • Increasing food availability, rights, and purchasing power by increasing crop productiveness and production. • Discourage the use of agricultural land for non-agricultural work to ensure sustainable food security. • Soil, water, flora, fauna and overall environmental conservation and effective use initiative adoption;	Not Applicable - the project is going to be established in the designated landfill area and land from DNCC. There is no impact on agricultural land and associated productivity due to the implementation of the proposed project. Applicable – The transmission line predominantly passes through agricultural land, which will adversely affect agricultural production.	X	√	X
National Land Use Policy, 2001	Ministry of Land	• Resisting the current trend of alarmingly declining the total amount of agricultural land used to produce adequate food for a growing population for a variety of reasons. • To prevent arbitrary use of land. • To formulate guidelines for the maximum use of land according to the natural differences in different parts of the country. • In the case of land acquisition for urbanization and development projects or any other purpose, to ensure its best use by acquiring the least amount of land and to avoid the acquisition of excess land as required. • Arranging for the preservation of such lands, especially government Khas lands, which may be required in the future for various development activities. • To ensure that the use of land is compatible with the natural environment. • Making the best use of land to alleviate poverty and increase employment; and • To play a helpful role in preventing the increase in the number of landless.	Applicable - As the proposed project is going to be established on government leased land in accordance with the National Land Use Policy,2001,and will utilize less productive land for development purpose, thereby, it will significantly enhance its contribution to the national economy compared to its current productivity.	√	√	√
National Energy Policy, 1995	Ministry of Power, Energy, and Mineral Resources	• Utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy sources & environmentally sound sustainable energy development programs. • It highlights the importance of protecting the environment. • EIA should be made mandatory and should constitute an integral part of any new energy development project. • Use of economically viable environment-friendly technology. • Public awareness regarding environmental conservation; and • Ensure environmentally sound sustainable energy development programs causing minimum damage to the environment.	Applicable - As the proposed project is a waste to energy project.	√	√	√
Power Policy, 1995	Ministry of Power, Energy, and Mineral Resources	• Policy statement on demand forecast, long term planning and project implementation, investment terms, fuels and technologies, load management,	Applicable - As the proposed project is a waste to energy project.	√	√	√

Policy/Plans	Responsible Agency-Ministry/Authority	Key Features	Applicability	Pre-Construction	Construction	Operation
		institutional issues, private sector participation, technology transfer, and research program, environmental policy, and legal issues.				
Power System Master Plan, 2016	Ministry of Power, Energy, and Mineral Resources	• The power sector was heavily dependent on gas. Even two/three years back almost 90% of the electricity used to be generated from the natural gas of the country and rest by hydroelectricity and coal. • Stressed on diversification of the fuel such as natural gas, coal, furnace oil, diesel, etc. as well as renewable energy sources. • The target composition of power supply as of 2030 is set at 50% for domestic and imported coal, 25% for domestic and imported (in the form of LNG) natural gas, and 25% for other sources such as oil, nuclear power, and renewable energy.	Applicable - the proposed project will use waste for electricity generation.	√	√	√
National Industry Policy, 2016	Ministry of Industries	• The policy emphasized green productivity and the use of green technology thereby to protect the environment, setting up of ETP, Common effluent treatment plant (CETPs) would be encouraged by the government. • Advocates for setting up the Clean Development Mechanism or Clean Development Mechanism (CDM) in the industries. • Adoption of the 3R principle (Reduce, Reuse, Recycle) strategy would be encouraged for all industries; and • Discourages activities that use agricultural land for industrial purposes.	Applicable - the project will use municipal waste for electricity production as well as maintain a good environment.	√	√	√
National Occupational Health and Safety Policy, 2013	Department for Inspection of Factories and Establishment/ Ministry of Labor and Employment	• Necessary measures to ensure workplace safety and health protection in light of international Conventions/Declarations/ Recommendations/ Instruments. • Review and updating of all laws relating to Occupational Health and Safety (OHS); • Inclusion of OHS issues in the policies and programs of all related Ministries and agencies. • Establish labor courts in the industrial zone as the workers and trade unions can have easy access to the courts for implementing the mandatory provisions of OHS. • Impose mandatory terms and conditions upon construction agencies to follow the OHS policies during govt. run construction works; and • To ensure maximum safety standards during construction and implement all standards and regulations on an internal safety environment.	Applicable - as the policy pertains to the occupational, health and safety rights of workers and has the provision of a comfortable work environment and reasonable working conditions for all employees.	√	√	√

Table 3-2: National Legal Provisions Applicable to the Proposed Project for Ensuring Environmental and Social Protection

Act/Rules/ Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features/Remarks	Applicability
Environment Conservation Act, 1995 and its amendment in 2000, 2002 and 2010	Ministry of Environment, Forest, and Climate Change	• Declaration of ECAs. • Obtaining Environmental Clearance Certificate (ECC). • Regulation for vehicles emitting smoke which is harmful to the environment. • Regulation of development activities from an environmental perspective. • Promulgation of standards for quality of air, water, noise, and soil for different areas and different purposes. • Promulgation of acceptable limits for discharging and emitting waste. • Formulation of environmental guidelines relating to the control and mitigation of environmental pollution, conservation, & improvement of the environment.	**Applicable -** According to the Act "no industrial unit or project shall be established or undertaken without obtaining an ECC from the DoE". Therefore, the provisions of the act apply to all the project intervention phases during the project life cycle.
Environment Conservation Rules, 2023	Ministry of Environment, Forest, and Climate Change	• Categorization of industries, development projects, and other activities on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollution load. The categories are green, yellow, orange, and red. • Procedure for obtaining site clearance and environmental clearance. • Standards for surface water (inland and coastal), drinking water, sewage discharge, and industrial effluents. • Setting out guidelines for the proper disposal of industrial effluents and requiring industries to have proper effluent management systems i.e., industrial effluent treatment plant, sewerage treatment plant, and mixed effluent treatment plan in place. • Requirements for undertaking initial environmental study and environmental impact assessment as well as formulating environmental management plan according to categories of industries/development projects/activities. • Procedure for damage claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life. • Establishing the DOE as the regulatory authority responsible for enforcing the regulations and overseeing environmental protection efforts in Bangladesh. • Provision of listing of environmental consultants and specialists.	**Applicable** - as the Projects fall under Red Category and require site clearance/ ECC from DOE, Bangladesh. The project developer has already obtained SCC from DOE which is given in **Appendix A**. The transmission line project falls under Orange Category which also required SCC/ECC from DOE, Bangladesh. The project developer has to prepare a separate Initial EE study to get the DoE clearance. Besides, it is stipulated that environmental quality standards and other relevant requirements shall comply during the project life cycle.
Environment Court Act, 2010	Ministry of Environment, Forest, and Climate Change. Judiciary	• Establishment of one or more environmental courts in each district and one or more special magistrate courts in each district. • Also provides the jurisdictions of the environment court, the penalty for violating courts order, a trial procedure in special magistrate court, power of entry and search, a procedure for investigation, procedure and power of the environment court, the authority of environment court to inspect, appeal /procedure and formation of the environment appeal court.	**Applicable -** the court has jurisdiction, under the act's provisions, over a trial for an offense or compensation under environmental law, imposing penalties for violation, etc.
Noise Pollution (Control) Rules, 2006	Ministry of Environment, Forest, and Climate Change	• The Rules have been established to manage noise-generating activities, which have the potential to impact the health & well-being of workers and the surrounding communities. • An area up to a radius of 100 meters around hospitals, educational institutions, offices, or similar types of institutions is designated as a silent area. The acceptable sound limit in the silent areas is 50 dB(A) for daytime and 40 dB(A) for nighttime. • The residential areas are primarily occupied by dwellings. The acceptable sound limit in residential areas is 55 dB(A) for daytime and 45 dB(A) for nighttime. • Mixed areas with a mix of residential, commercial & industrial land use. The acceptable sound limit in the mixed areas is 60 dB(A) for daytime and 50 dB(A) for nighttime. • Commercial areas are primarily occupied by businesses and officers. The acceptable sound limit in commercial areas is 70 dB(A) for daytime and 60 dB(A) for nighttime.	**Applicable -** the project will create noise within the project boundary and surroundings. Incremental noise can impact human and terrestrial faunal species. Therefore, compliance with these rules is required.

Act/Rules/ Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features/Remarks	Applicability
		• Industrial areas are used for industry or manufacturing. The acceptable sound limit in the industrial areas is 75 dB(A) for daytime and 70 dB(A) for nighttime. • An area between 500 meters from the last limit of a residential area for construction-related activity use of brick and stone crusher machine is prohibited and operation of mixture machine and construction-related machinery and equipment are prohibited from 7 PM to 7 AM. • The guidelines say exceeding the maximum noise level in certain areas is a punishable offense.	
Air pollution (Control) Rules 2022	Ministry of Environment, Forest, and Climate Change	• Aiming to protect environmental health, the government has published a new rule based on section 20 of The Bangladesh Environment Conservation Act, 1995. • The main objectives of this rule are to prevent, control, and reduce air pollution. • The government will appoint a director general who will be responsible for managing and maintaining the environmental issue. • The Rule specified several types of pollution such as pollution caused by factories, vehicles, construction, garbage, etc. • According to the new rule, there will be a committee that will impose damages and punishment for such pollution. • As stated by the rule, the government will give rewards to those who will protest against pollution and do not cause any type of pollution.	**Applicable -** the project will create air pollution within the project boundary and surroundings. Air pollution can impact human and terrestrial faunal species.
Ecologically Critical Areas (ECAs) Management Rules, 2016	Ministry of Environment, Forest, and Climate Change	• The ECA Management Rule, 2016 has enabled the government to form a “National Committee” headed by the Secretary of Ministry of Environment, Forest and Climate Change (MoEFCC). • To implement the decision of the Directorate, District and Upazila committee may be formed. For the conservation and development of the ecologically critical area, one or more teams may be formed. The responsibility of the team would be to implement the decision and planning of the Government to improve the Environment for Ecology. • The Rule also prohibited many activities and processes which are detrimental to the natural condition of habitat, tranquility, biodiversity, etc.	**Applicable -** the proposed project is located approximately 4 km away from the nearest ECA (Turag River). Due to extraction of surface water and other activities during operation can impact on Karnatali River and Turag River as well. Therefore, this rule has to apply to this project. The developer has to take necessary action to minimize the impacts on the natural condition of habitat, tranquility, biodiversity, etc.
Biodiversity Act, 2017	Ministry of Environment, Forest, and Climate Change	• The Act has enabled the government to form a "National Committee on Biodiversity". The functions of the committee are to conserve biodiversity, genetic biodiversity, identification of biodiversity-related important areas, heritage, etc. • The government is empowered to declare, in consultation with local communities and bodies and coordination with concerned ministries or departments, any place or area significant for its biological heritage as “Biodiversity Heritage Sites”. • Prohibiting the taking of activities that may have an adverse effect on endangered animals or organisms, etc. No person shall take any such activity, viz (a) adversely affect, or may affect on endanger species; (b) adversely affect or may affect the environmental characteristics of the endangered ecological community; or (c) In accordance with the Ramsar Convention, the wetland may adversely affect or affect the environment and environmental characteristics of the declared area.	**Applicable -** The project will be established adjacent to the Amin Bazar landfill area at Savar. During construction and operation stage, the project will impact the surrounding environment. No gazetted endangered species is present in the project site. However, Gangetic Dolphins have been reported in Turag River in January 2022. The project is located 4 km from Turag River. Due to the landfill site, Black Kites are observed in the project influence area. A 132 kV transmission line of approximately 5.99 km has been proposed. Collisional risk of avifaunal species cannot be completely ruled out. Applicability for Biodiversity Act 2017 cannot be completely ruled out.

Act/Rules/ Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features/Remarks	Applicability
Forests Act, 1927 and its amendment in 1982, 1989, 2000 and 2018	Ministry of Environment, Forest, and Climate Change	• The government can prohibit certain activities in the declared Reserved Forest area, causing any damage by negligence in felling any tree or cutting or dragging any timber, etc. • The act makes various provisions for the conservation of forests. • It defines the procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest, or a Village Forest. • It defines what a forest offense is, what are acts prohibited inside an RF, and penalties leviable on violation of the provisions of the act. • Act gives the government power to make any relevant rules to protect the forest. • Guidelines for social forestry practice; and • Control and collection of timber and other forest produces, and duties on those.	**Not Applicable -** The proposed power plant is going to be established in Amin bazar, Dhaka, and no forest (reserve, protected, social, mangrove, etc.) is found within the project site and a 5 km radius.
Wildlife (Conservation and Security) Act, 2012	Ministry of Environment, Forest, and Climate Change	• Prohibition is 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 brickfield within 2 (two) kilometers from the boundary of a sanctuary.	**Not Applicable -** As there are no protected areas found within 5 km radius of the proposed project site.
Protected Area Management Rules, 2017	Ministry of Environment, Forest, and Climate Change	• The legal basis for the management and co-management of forest-protected areas. • Structures, functions, and obligations of management of some of the protected areas, but excluding safari-park, zoo, botanical garden, private park, and wildlife fertility center from their application. • The Rules have 33 sections and provide a model for participatory co-management, consisted of forest-dependent communities, forest departments, civil administration, and civil society organizations. • The rules provide for financial benefits and income incentives to shareholders through participatory social forestry programs to be planted in buffer and landscape areas, and eco-tourism.	**Not Applicable -** The nearest PA from the Project Site is National Botanical Garden Mirpur, which is approximately 5.2 km (aerial distance) away from the project site.
Bangladesh Water Act, 2013	Ministry of Water Resources	• Any infrastructure or landfilling activities over any natural watercourses, stopping the natural flow or create obstacles or divert or attempt to divert the direction is strictly prohibited. • According to the provision of section-43, all the costs may be incurred for the removal of infrastructure or landfilling materials from the person liable for making infrastructure or carrying on landfilling activities. • Any area or any part or any land connected with water resources can be declared as a Water Stress Area. • Ensuring safe abstraction of water from aquifers & executive authority may subject to the lowest safe yield of surface and groundwater. • Any infrastructure shall not be established in the immediate premises of the flood control embankment and ensure the sustainability and protection of the control structure. • No person shall not store, preserve, or divert the water of any water source in any natural or artificial reservoir.	**Applicable –** as the project will use both surface and groundwater resources.
Bangladesh Water Rules, 2018	Ministry of Water Resources	• 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, & use related project & part of the project; and others project;	**Applicable –** as the project will use both surface and groundwater. The project will require NOC from relevant authorities for surface water and groundwater extraction for industrial use.

Act/Rules/ Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features/Remarks	Applicability
		• According to Clause-16 of the rules, a NOC should be taken from the DG of WARPO, District Committee/DC, Upazila Committee/UNO, and Union Committee/Chairman based on the total investment of the specific project.	
National River Protection Commission Act, 2013	Ministry of Water Resources	• 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 -** The proposed project's proximity to the Karnatali River necessitates rigorous monitoring and mitigation measures to prevent potential impacts on water quality during both construction and operational phase
Protection and Conservation of Fish Act, 1950 and its amendment in 1982 and Rules, 1985	Ministry of Fisheries and Livestock	• The act was enacted to provide for the protection and conservation of fish. Under the Act, the Protection and Conservation of Fish Rules were adopted in 1985. • No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow, and arrow in inland waters or within coastal waters. During the Project intervention, it should be noted that if waste effluent is not treated then it may cause significant damage to the local fishery and thus violate the provision of the law. • No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters; and • Protection and conservation of fish in government-owned water bodies.	**Not Applicable -** the proposed project site is situated in a low-lying area adjacent to the Aminbazar landfill within the Dhaka North City Corporation , is confirmed to have no designated fishing zones nearby and will involve no physical interventions in the river.
Electricity Act, 2018	Ministry of Power, Energy, and Mineral Resources	• If the land acquisition is required for the establishment of a power generation plant or sub-station, it shall be deemed to have been necessary for public interest and the existing laws and regulations on an acquisition of land shall have to be followed. • If any private company holding license requires any land for constructing any connection line with the power station. sub-station or grid substation the licensee may purchase or acquire such land from the concerned landowner in accordance with the existing laws and regulations regarding land acquisition. • No licensee shall harm or obstruct or interfere with railways, highways, airports, waterways, canals, docks, wharves and jetties and pipes, during power generation, transmission, supply, or distribution. • The licensee shall take all logical precautions during the construction of power supply lines and doing civil works so as not to have any harmful effect on the communication system of the telegraph, telephone, or electromagnetic signal emitting lines by way of induction or any other means.	**Applicable -** as the project will be subject to the act of generating electricity and supply through a transmission line.
Bangladesh Energy Regulatory Commission Act, 2003	Ministry of Power, Energy, and Mineral Resources	• To determine the efficiency and standard of the machinery and appliances of the institutions using energy. • To ensure efficient use, quality services, determine tariff and safety enhancement of electricity generation. • If anybody obstructs any license or his authorized representative in the works of installation or repair of an electricity line or gas pipeline or the construction or repair of associated equipment, installations, he shall be liable to be sentenced with imprisonment.	**Applicable -** as the project is subject to the generation of the electric energy as primary source through implementation of proposed WtE project
Acquisition and Requisition of Immovable Property Act (ARIPA), 2017	Ministry of Land	• Current GoB ARIPA ,2017 Act, relating to acquisition and requisition of land. • According to the law,if the land is being acquired for government projects, then the affected landowner will be entitled to receive an additional 200% compensation of the assessed market value for the land and on the other hand, if the land is being acquired for private entity, then the affected landowner will be entitled to receive an additional 300% of the assessed market value for the land. • An additional 100% compensation to be awarded for assessed market value of structures, trees, crops and other assets on the acquired land parcel. This law is applicable to deals with any potential social and economic impacts associated with land acquisition activity.	**Applicable** -Upon request of the proponent, DNCC will procure the required land through the Deputy Commissioner (DC). DNCC is the requiring body, and the DC is the acquiring body in the acquisition procedure. WTE Power Plant North Dhaka Private Limited will lease the land from DNCC.
Boiler Act, 1923	Ministry of Industries	• Prohibition of use of the unregistered or uncertificated boiler.	**Applicable -** as the proposed project will use "waste firing in boilers".

Act/Rules/ Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features/Remarks	Applicability
		• Renewal of boiler certificate upon the expiry, accidents, moves, structural alteration, or any dangerous condition. • Regulating the inspection & examination of boilers and steampipes. • Prescribing the duties of the owner at an examination, and production and transfer of certificates. • Exclusion of any specified area from the boiler operation. • Impose local limits and the power of an authorized person to oversee the limit. • Prescribing the maximum pressure at which a boiler may be used and describing the method of determining the maximum pressure. • Revocation of certificate or provisional order if the certificate is fraudulently obtained or the boiler is not in good condition. • Restriction on alterations and renewals of any registered boilers without written sanction of such alteration, addition, or renewal. • Reporting of accidents to boilers or steampipe must be made by the owner within twenty-four hours of the accident in written form. • Registration number allotted to the boiler must be marked on the boiler otherwise penalties apply. Any kind of invisibility of register number by remove, alter or deface is also punishable; and • Prescribed penalties for illegal use of a boiler or use the boiler at a higher speed than the allowed limit.	
Fatal Accidents Act, 1855	Ministry of Law, Justice, and Parliamentary Affairs	• Compensation should be provided to families for losses resulting from the death of a person due to a wrongful act. Section 1 specifies that if a person's death is caused by negligence or intentional wrongdoing that would have justified a legal action for damages if the person had survived, the party responsible remains liable for damages despite death. This liability holds even in cases where the circumstances leading to the death would constitute a felony or other crime under the land.	**Applicable -** as the proposed project has a provision for unlikely and accidental events that may cause fatal accidents.
The Penal Code, 1860	Ministry of Law, Justice, and Parliamentary Affairs	• Valid provisions related to pollution management, environment protection, and protection of health and safety. Chapter XIV of the Penal Code provides offenses effective 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; and • Section 286: Negligent Conduct with respect to Explosive Substance.	**Applicable -** as the proposed project includes provisions that may impact the surrounding ecosystem due to potential pollution threat..
Fire Prevention & Extinguish Act, 2003 and Rules, 2014	Ministry of Home Affairs	• Regulatory enactments regarding the prevention, the successful extinguishing of fire, and reduction of damages and consequences of fire. • States to obtain a license from the Director-General of Fire Service and Civil Defense in case of any warehouse.	**Applicable -** proposed projects will store fuels during construction and operation phase. During operation phase, about 40tons of Diesel will be used each start and shutdown of incinerator. During both the construction and operational phases, there exists the potential for the fire incidents to occur, should adequate preventative measures not be implemented. WTE Power Plant North Dhaka Private Limited would comply with relevant provisions under this ACT.
The Factories Act, 1965, and the Factories Rules, 1979 Bangladesh Labor Act, 2006 and amendments 2009, 2010, 2013 and 2018	Department of Labor/Department for Inspection of Factories and Establishment/ Ministry of Labor and Employment	• Pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions. • Provides health, safety, and well-being of the workforce during the project life cycle. • Children under 18 years are not allowed to be employed during the project life cycle. • Safety precautions regarding explosive or inflammable dust/gas, protection of eyes, protection against fire, work with cranes and other lifting machinery, and lifting of excessive weight.	**Applicable -** as it provides health, safety, and wellbeing of the workforce during the project life cycle. Besides, it also stipulated that children under 18 years are not allowed to be employed during the project life cycle and therefore, this law requires to be complied with.

Act/Rules/ Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features/Remarks	Applicability
Bangladesh Labor Rules, 2015		• Safety measures like appliances of first aid, maintenance of safety record books, rooms for children, housing facilities, medical care, group insurance, etc. • No building, wall, chimney, bridge, tunnel, road, gallery, stairway, ramp, floor, platform, staging, or other structure, whether a permanent or temporary character, shall be constructed, situated or maintained in any factory in such a manner as to cause risk of bodily injury (Rule 38) of factory rules 1979, etc.	
EIA Guideline for Industries 2021	Department of Environment	The EIA Guidelines for Industry, 2021, introduced by the Department of Environment, Bangladesh, is the only guideline for conducting an Environmental Impact Assessment in Bangladesh. It is not only for industries but also for all types of development works. It includes EIA procedures, methodology, guidelines for impact identification, forecasting and evaluation, plans for mitigation measures, and monitoring programs.	**Applicable -**The project activities can create environmental, social and ecological impacts during construction and operation phase. EIA Guideline for Industries 2021 is the only guideline for conducting an Environmental Impact Assessment in Bangladesh that includes guidelines for impact identification, prediction, and evaluation, plans for mitigation measures, and monitoring program.
National 3R Strategy for Waste Management, 2010	Department of Environment	• The concept of this strategy is minimizing waste impacts in terms of quantity or ill-effects, by reducing the quantity of waste products with simple treatments and recycling the waste by using them as resources to produce the same or modified products. The principle of "3R" is stated as reducing waste, reusing, and recycling resources and products. • Reducing means choosing to use items with care to reduce the amount of waste generated. • Reusing involves the repeated use of items or parts of items that still have usable aspects. • Recycling means the use of waste itself, as resources. • It suggests International Organization for Standardization (ISO) 14001 or any other Environmental Management System (EMS) structure which is significant for the development of strategies relevant to the industry and its social and environmental setting. 14001 is increasingly important in international trade.	**Applicable -** This strategy is applicable for the project for the management of waste (i.e., solid wastes) to minimize/ reduce environmental, social, and economic problems.
Solid Waste Management Rules 2021	Department of Environment	• When recovering resources from waste, the principles of management that consider the waste hierarchy, such as the 3Rs, segregation, and reduction, must be followed at all stages from waste generation to the final disposal. • Responsibilities of waste generators, consumers, and users: Dispose of waste in accordance with the regulations of authorities including local government; Dispose of waste separately; Do not dump, store, or burn waste outdoors. • Responsibilities of manufacturers (*not defined) and importers of products: Collect non-biodegradable products such as glass, plastic, polyethylene, multi-layered packaging, bottles, and cans from consumers and recycle or dispose of them if appropriate; Determine work plans and implementation procedures for recycling and disposal; Ensure that Extended Producer Responsibility (EPR) is properly implemented; Submit an annual report to the DOE on the amount of plastic recycled; Raise public awareness of proper waste management. • Any violation of the above provisions shall be subject to imprisonment for not more than two years or a fine not exceeding 200,000 Taka (BDT), or both. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery.	**Applicable -** This rule is applicable for the project for the management of waste (i.e., solid wastes) to minimize/reduce environmental, social, and economic problems associated with management of solid waste.
Antiquities Act, 1968 and Antiquities Preservation Rules, 1986	Department of Archaeology, Ministry of Cultural Affairs	• No person shall deal in antiquities except under and in accordance with a license granted by the Director. • No person shall remove any object of the immovable protected antiquity. • No person shall damage, alter, deface, or imperil immovable protected antiquity. • Any person preserving or storing any kind of movable antiquity without a license shall produce it to the Director on demand for verification of the source of its possession.	Not Applicable -Neither any archaeological site nor any cultural heritage sites have been reported within 5 km radius of the project location.

Source: Different Laws and Regulations of GoB

3.2.3 Applicable International Environmental and Social Standards and Policies Relevant International Treaties and Conventions

Bangladesh is a party to a number (30[8] international environmental conventions, treaties, and agreements. The international treaties and conventions relevant to the Project and their status are detailed in Table 3-3.

Table 3-3: Project Relevant International Treaties and Conventions

Environment related international conventions and Treaties	Status	Applicability
International Plant Protection Convention (Rome, 1951.)	01.09.78 (ratified)	Not Applicable
International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969.)	28.12.81 (entry into force)	Not Applicable
Plant Protection Agreement for the Southeast Asia and Pacific Region (as amended) (Rome, 1956.)	04.12.74 (accessed) (entry into force)	Not Applicable
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (Brussels, 1969.)	04.02.82 (entry into force)	Not Applicable
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) ("Ramsar Convention").	20.04.92 (ratified)	Not applicable as no Ramsar site in Project AOI
Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972.)	03.08.83 (accepted) 03.11.83 (ratified)	Not applicable as no such site in Project AOI
Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) ("CITES convention")	18.02.82 (ratified)	Applicable
United Nations Convention on the Law of the Sea (Montego Bay, 1982.)	10.12.82 (ratified)	Not Applicable

[8] Department of Environment, Bangladesh

Environment related international conventions and Treaties	Status	Applicability
Vienna Convention for the Protection of the Ozone Layer (Vienna, 1985.)	(accessed) (entry into force)	Applicable
Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987.)	02.08.90 31.10.90 (accessed) (entry into force)	Applicable
London Amendment to the Montreal Protocol on substances that Deplete the Ozone Layer (London, 1990)	(accessed) (entry into force)	Applicable
Copenhagen Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992	27.11.2000 (accepted) 26.2.2001 (entry into force)	Applicable
Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1997	27.7.2001 (Accepted) 26.10.2001 (Entry into force)	Applicable
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989.)	01.04.93 (accessed)	Applicable
International Convention on Oil Pollution Preparedness, Response and Cooperation (London, 1990.)	30.01.90 (signed) In the process of ratification	Not Applicable
United Nations Framework Convention on Climate Change, (New York, 1992.)	09.06.92 (signed) 15.04.94 (ratified)	Applicable
Convention on Biological Diversity, (Rio De Janeiro, 1992.)	05.06.92 (signed) 03.05.94 (ratified)	Applicable
International Convention to Combat Desertification, (Paris 1994.)	14.10.94 signed) 26.01.1996 (ratification) 26.12.1996 (entry into force)	Not Applicable
Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, (Geneva, 1976.)	03.10.79 (accessed) (entry into force)	Not Applicable
Agreement Relating to the Implementation of Part XI of the United Nations Convention on	28.07.96 (signed)	Not Applicable

Environment related international conventions and Treaties	Status	Applicability
the Law of the Sea of 10 December 1982 (New York, 1994.)		
Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on their Destruction (Paris, 1993.)	14.01.93 (signed)	Not Applicable
Convention on Persistent Organic Pollutants, Stockholm	23.5.2001 (signed) 12.03.2007 (ratified)	Not Applicable
Kyoto protocol to the United Nations Framework Convention on Climate Change	21.8.2001 (accessed)	Applicable
Prevention and Control of Occupational hazards (Geneva)	-	Applicable
Occupational hazards due to air pollution, noise & vibration (Geneva)	-	Applicable
Occupational safety and health in working environment (Geneva)	-	Applicable
Occupational Health Services (Geneva)	-	Applicable

3.2.4 Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework, 2022

The proposed project is being financed by AIIB and therefore its Environmental and Social Framework will be applicable to the project.

3.2.5 Objectives of AIIB's Environmental and Social Framework

The objectives of the AIIB's ESF are:

- Reflect institutional aims to address environmental and social risks and impacts in Projects.
- Provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to Projects' environmental and social risks and impacts.
- Ensure the environmental and social soundness and sustainability of Projects.
- Support integration of environmental and social aspects of Projects into the decision-making process by all parties.
- Provide a mechanism for addressing environmental and social risks and impacts in Project identification, preparation, and implementation.
- Enable Clients to identify and manage environmental and social risks and impacts of Projects, including those of climate change.
- Provide a framework for public consultation and disclosure of environmental and social information in relation to Projects.

- Improve development effectiveness and impact to increase results on the ground, both short- and long-term.
- Support Clients, through Bank financing of Projects, to implement their obligations under national environmental and social legislation (including under international agreements adopted by the member) governing these Projects.
- Facilitate cooperation on environmental and social matters with development partners.

3.2.6 Key Elements of Environmental and Social Framework

Overarching Policy. The objective of this overarching policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects. The overarching policy comprises Environmental and Social Policy (ESP), and Environmental and Social Standards (ESSs).

Environmental and Social Policy

The ESP sets out mandatory requirements for the Bank and its Clients relating to identification, assessment and management of environmental and social risks and impacts associated with Projects supported by the Bank.

Environmental and Social Standards

The environmental and social standards (ESSs) set out more detailed mandatory environmental and social requirements, as described below.

Environmental and Social Standard 1 (ESS 1) The ESS-1 aims to ensure the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the Bank.

Environmental and Social Standard 2 (ESS 2) The ESS 2 is applicable if the Project's screening process reveals that the Project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project). Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent, or temporary. The ESS 2 Environmental and Social Impact Assessment (ESIA) defined detailed requirements of resettlement planning of the projects involving involuntary resettlement.

Environmental and Social Standard 3 (ESS 3) The ESS 3 is applicable if Indigenous Peoples are present in, or have a collective attachment to, the proposed area of the Project, and are likely to be affected by the Project. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (b) collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories; (c) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (d) a distinct language, often different from the official language of the country or region. In considering these characteristics, national legislation, customary law, and any international conventions to which

the country is a party may be taken into account. A group that has lost collective attachment to geographically distinct habitats or ancestral territories in the Project area because of forced severance remains eligible for coverage, as an Indigenous People, under ESS 3. The ESS 3 defines the detailed requirements of People planning, in case such groups are present in the project area and are likely to be affected by the project.

3.2.7 Applicability of ESS for the Proposed Project

The applicability ESSs for the proposed project is presented in Table 3-4

Table 3-4: Applicability of AIIB ESS to this Project

Environmental and Social Standards		Applicability	Remarks
ESS 1	Environmental and Social Assessment and Management	ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both)	Yes, considering the proposed project is expected to cause adverse environmental and social impacts.
ESS 2	Involuntary Resettlement	ESS 2 is applicable if the project is likely to cause involuntary resettlement impacts.	Yes. This project will lead to economic and physical displacement of both titled and non-titled holders; hence ESS-2 is applicable in this project's context.;
ESS 3	Indigenous Peoples	ESS 3 is applicable if Indigenous People are present in the project area	No, since there are no Indigenous people present in the project area, as defined in the ESS 3; therefore, the applicability of ESS-3 cannot be considered here.

3.2.8 Screening and Categorization Requirements

Screening standards require clients to implement structured processes of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. Together, the ESP and the ESSs comprise an environmental and social management approach designed to: (i) ensure environmental and social screening and categorization, (ii) analyze future project environmental and social threats, and impacts; (iii) identify measures to prevent, reduce, mitigate, cover or make up for project environmental and social impacts; (iv) provide a process to consult the public on environmental and social risks and impacts of projects and to disclose information.

The AIIB classifies all its projects into four categories.

- The project is categorized as Category A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse, or unprecedented and requires the client to conduct an Environmental and Social Impact Assessment (ESIA) with ESMP.
- A project is categorized as Category B when: it has a limited potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are site-specific; and can be successfully managed using good practice in an operational setting and requires clients to conduct an initial review of the environmental and social implications of the Project.

- A Project is categorized C when it is likely to have minimal or no adverse environmental and social impacts and the client is required to prepare a review of the environmental and social aspects of the Project.
- A Project is categorized Financial Intermediary (FI) if the financing structure involves the provision of funds to a FI for the Project, whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed subprojects. The Bank requires the FI to develop and apply an appropriate Environmental and Social Management System (ESMS) that is proportional to the environmental and social risks associated with the Bank-supported portfolio, is consistent with this ESP, excludes from Bank support activities covered in the Environmental and Social Exclusion List (ESEL) and incorporates applicable provisions of the ESSs.

AIIB requires the client to establish, in accordance with the ESP and applicable ESSs, a suitable grievance mechanism to receive and facilitate resolution of the concerns or complaints of people who believe they have been adversely affected by the Project's environmental or social impacts, and to inform Project-affected people of its availability. People who believe they have been or are likely to be adversely affected by a failure of the Bank to implement the ESP may also submit complaints to the Bank's oversight mechanism in accordance with the policies and procedures to be established by the Bank for such mechanism.

AIIB ESF (Approved February 2016 and Amended February 2019 and May 2021) has also provisions for identify measures to avoid, minimize, or mitigate potentially adverse impacts on and risks to physical, biological, socioeconomic, and cultural resources, safety of both workers and affected community and natural resources during the design, construction, operation, and decommissioning of the project.

3.2.9 Aligning Policies: Synergy between AIIB and GoB Harmonization of policies of AIIB and GoB

Some comparative analysis has been drawn between AIIB policy and GoB policies, then a harmonized framework has been provided in Table 3-5.

Table 3-5: Major Gaps between AIIB policy and GoB policies

Aspect of Operational Framework	AIIB Regulation	National Bangladesh Regulation	Identified gaps and Harmonized Framework	Measures Proposed to fill the identified gaps
Environmental and Social Policy and Regulations	The AIIB sets Environmental and Social Policy (ESP) under the ESF, 2016, amended in 2019 and it is applicable for each Project funded by the Bank.	• Environment Conservation Act (1995) and subsequent amendments • Environment Conservation Rules (2023) • EIA guidelines on Industrial projects • No national policies and guidelines for social Compliance.	• In most cases, national requirements and standards for environmental quality is in match with AIIB Policy and Standards (For example, Environmental Assessment is compulsory for both requirements). However, there are some parameters when national and AIIB requirements and standards are different (For example, National legislation does not require the preparation of separate EMP/ESMP for associated facilities or any other environmental documents/plans/checklists for the project). • The absence of Social Policy in Bangladesh.	- Need to prepare some separate plans such as • Labor and Influx Management Plan • Emergency Management Plan • Occupational Health and Safety Plan • Gender Action Plan • AIIB's Social Policy needs to comply.
Screening and Categorization	AIIB carries out project screening and categorization at the earliest stage of project preparation when sufficient information is available for this purpose. The Bank assigns each proposed Project to one of the following four categories and determines the type of assessment and instrument required. • Category A	It is mandatory to obtain Environmental Clearance for each and every type of industry and project as per Bangladesh Environment Conservation Act, 1995. For the purpose of issuance of Environmental Clearance Certificate, the industrial units and projects shall, in consideration of their site	AIIB and Bangladesh project categorization could be harmonized by accepting the following principle: AIIB category: DoE category Category A: Category Red Category B: Orange Category B: Yellow Category C: Green	- Social risk assessment needs to comply with AIIB's ESF.

Aspect of Operational Framework	AIIB Regulation	National Bangladesh Regulation	Identified gaps and Harmonized Framework	Measures Proposed to fill the identified gaps
	• Category B • Category C • Category FI As per AIIB's ESP, associated facilities of a project is required to be identified and considered.	and impact on the environment, be classified into the following four categories: • Green • Yellow • Orange • Red A 132kV transmission line will be installed to connect to the Savar 132/33kV substation. The length of the 132kV transmission line is about 5.99 km. As per the ECR 2023, this associated facility (transmission line) falls under Orange Category. The categorization of social risk assessments under national regulations in Bangladesh has not yet been formed.	The proposed project has been assessed as Category A in accordance with AIIB ESP. The Bank requires the Client, as part of its environmental and social assessment, to identify and assess the potential environmental and social risks and impacts of Associated Facilities and implement measures. For associated facility (Transmission line), the proponent must take environmental clearance certificate from DOE. The categorization of social risk assessments under national regulations in Bangladesh is absence.	
Environmental and Social Impact Assessment Report	In accordance with Environmental and Social Policy (ESP of ESF 2022), ESIA processes report for category A projects includes the following chapters: (a) description of the Project; (b) policy, legal and administrative framework, including the international and national legal framework applicable to the	The EIA report has to include: (i) baseline data, (ii) project description, (iii) anticipated environmental impacts, (iv) waste management, (v) analysis of emergency situations, and (vi) and anticipated changes due to project implementation. Information on applicable	The present ESIA has been prepared adhering to the applicable national as well as AIIB requirements.	- ESIA report is prepared.

Aspect of Operational Framework	AIIB Regulation	National Bangladesh Regulation	Identified gaps and Harmonized Framework	Measures Proposed to fill the identified gaps
	Project; (c) scoping, including stakeholder identification and consultation plan; (d) analysis of alternatives, including the "without Project" situation; (e) baseline environmental and social data; (f) evaluation of environmental and social risks and impacts; (g) public consultation and information	laws and regulation usually is presented in "Introduction" part. For the projects of category Red, the detailed EIA report is required. For category Orange, the EIA report is more simplified. For Green and Yellow an EIA report is not required. Currently Bangladesh's national regulation has not any provision of conducting SIA.		
ESMP	ESMP should be prepared and should specify, along with the proposed mitigation activities, a monitoring plan and reporting requirements, institutional arrangements for ESMP implementation.	National legislation on EIA requires identifying possible impacts, and also require Environmental Management Plan (EMP) with monitoring plan, institutional arrangements for EMP implementation. As per Bangladesh's national regulation preparation of SMP is not required.	The present ESIA has been prepared adhering to the applicable national as well as AIIB requirements.	- ESMP is prepared
Alternatives	Environmental & social impact must be assessed and examined from the earliest possible planning stage. Alternatives studies shall be made to avoid or minimize adverse impact must be examined and incorporated	Analysis of alternatives and the reason for selecting the proposed site is required for environmental assessment study. Analysis of alternatives is not required in Bangladesh	Alternative study shall be undertaken to minimize the project impact.	- Study for alternatives is undertaken

Aspect of Operational Framework	AIIB Regulation	National Bangladesh Regulation	Identified gaps and Harmonized Framework	Measures Proposed to fill the identified gaps
	into the project plan. The assessment considers Project and design alternatives to avoid or minimize physical and/or economic displacement and impacts on Indigenous Peoples.	to minimization of social impacts.		
Grievance redress mechanisms (GRM)	Project-level GRMs, which can be readily accessed by Project-affected people; all in accordance with the ESP, Project-affected People's Mechanism (PPM), and applicable ESSs;	ARIPA 2017 has the provision of Grievance as per the suggested guidelines and timeframe in ARIPA. Such as " **Section 4. (1)** "Any person interested in any property which has been notified under section 3 as being needed or likely to be needed for a public purpose or in the public interest may, within fifteen days after the publication of the notice, object to the acquisition of the property". **Section 28. (1)** Any person interested who has not accepted any award made by the Deputy Commissioner under this Ordinance may, within forty-five days of the date of service of notice of the award, make an application to the Arbitrator for revision of the award.	Project related GRM and AIIB's PPM are required	WTE Power Plant North Dhaka Private Limited established a GRM to ensure social accountability and to answer to queries and address complaints and grievances about any irregularities in application of the guidelines adopted in this ESIA for assessment and mitigation of social and environmental impacts. Specifically note that AIIB's PPM will be made accessible and available in locally appropriate language(s), including on proponent/Project website. The summery of the AIIB's Project-affected People's Mechanism (PPM) has been mentioned in section 8.2 (page 8-9).

Aspect of Operational Framework	AIIB Regulation	National Bangladesh Regulation	Identified gaps and Harmonized Framework	Measures Proposed to fill the identified gaps
Preparation of Resettlement Action Plan (RAP)/Rehabilitation Plan (RP) and Livelihood Restoration Plan (LRP)	ESS 2 applies, as the project involves involuntary resettlement. The land acquisition has already been accomplished and impacted landowners have been compensated as per ARIPA, Act,2017 along with resettlement of impacted business units to new locations in line with AIIB's ESS guidelines.	Not required	The RAP study is typically required before land acquisition begins. However, since the land was acquired by the DC and 59.36% of the total compensation was paid as of 10/06/2022, a RAP is not necessary in this case. Instead, an LIA/LRP can be proposed for affected non-titled holders and vulnerable individuals in accordance with AIIB's ESF guidelines. In that case, the project must still adhere to relevant ESF principles and ensure that any impacts are adequately addressed through other means, such as a stakeholder engagement plan or a social management framework.	ESIA will ensure compliances with respect to compensation provided as per ARIPA, Act,2017 and AIIB's guidelines to the impacted individuals while incorporating impacted individuals for proposed LIA/LRP study in ESIA report. Moreover, preparation of ESDDR is required as supplement of RAP, which is under preparation.
Preparation of an Indigenous Peoples plan (IPP) or Indigenous Peoples planning framework (IPPF)	An IPP or IPPF in accordance with ESS 3 is required to prepare for ESIA study.	Not required	IPP is required as per AIIB's ESS 3	In this project IPP or IPPF is not required. Project has no impacts on Indigenous people because the presence of indigenous people is not identified within the project area of influence during site visit.
Gender-Based Violence (GBV)	ESIA needs to address affected people's concerns and complaints promptly, including gender related concerns and complaints relating to GBV and	Not required	Measures to address GBV not required in national regulations but as per AIIB's ESS 2, Gender should be taken into account in	Gender has been considered in the ESIA and baseline information focusing on gender related data also been incorporated.

Aspect of Operational Framework	AIIB Regulation	National Bangladesh Regulation	Identified gaps and Harmonized Framework	Measures Proposed to fill the identified gaps
	SA, using an understandable and transparent process that is gender sensitive, culturally appropriate, and readily accessible to all affected people		the preparation of baseline information.	Moreover, ESDDR will also cover the Gender aspect as per ESS 2.
Stakeholder engagement	ESS 2 requires meaningful consultation with the persons to be displaced by the Project, host communities, and nongovernmental organizations, and facilitates their informed participation in the consultations.	Limited scale Stakeholder engagement is required as per national regulation.	Meaningful consultation with the project-related stakeholder needs to be carried out in line with the AIIB requirements	ESIA has included displaced people (title and non-title) by the project along with the community adjacent to the project site, govt. organization and other interested parties in the consultation. The process or steps to identify the stakeholders have also been included as an approach in section 7.3 (page 7-2 & 7-3).
Public Consultation	The Borrower is responsible for conducting at least one meaningful consultation for all Categories A, B, and C projects to discuss the issues to be addressed in the EMP or to discuss the draft EMP itself	Public consultation is required during the EIA stage as per the Department of Environment's for the requirement of "Category A Projects"	Both National standard and AIIB's ESF are required public consultation in the ESIA study.	Current ESIA has covered the Public Consultation and proposed future consultation process as well to meet the AIIB's ESF throughout the project life cycle. Public consultations have been carried out with the stakeholders (affected people (title and non-title), other interested people, and elected representatives as part of the present ESIA, in line with the AIIB's ESS 2. The feedback received from the public consultations has

Aspect of Operational Framework	AIIB Regulation	National Bangladesh Regulation	Identified gaps and Harmonized Framework	Measures Proposed to fill the identified gaps
				been used to finalize the present ESIA.
Information Disclosure	The Bank requires disclosure of environmental and social information by ESS 1, Section 19	The National Regulations (Environmental Conservation Rules 2023) has also provisions to disclose the information.	Section 8 indicates that bank signage will be displayed at the Project site	Identify what type of social documentation will be shared and its method of disclosure. Additionally, confirm the places within project locations where bank signages will be displayed.
Monitoring and Reporting	Both the Bank and Client have monitoring and reporting responsibilities on environmental and social measures.	The National Regulations (Environmental Conservation Rules 2023) has also provisions to submit the monitoring report to DoE.	Monitoring and reporting are required as per National Regulations and AIIB's ESF	Client and Bank will periodically follow monitoring and will disclose monitoring reports as a disclosure procedure.

Table 3-6: Major Gaps between ARIPA & AIIBs ESF and Bridge to minimize the Gaps

Sl. No.	AIIB ESS2	Acquisition and Requisition of Immovable Property Act, 2017	Identified Gaps	Actions to Bridge the Gaps
1.	Involuntary resettlement should be avoided wherever possible.	Not defined in the Act	Act 2017 does not deal with the minimization of involuntary resettlement.	Govt. should use this as a best practice to align with the Bank's ESF guidelines. If resettlement is not avoided by any means, govt. should follow the national standard as well as aligning with the best practices of international standards such as WB, IFC, and AIIB guidelines.
2.	Minimize involuntary resettlement by exploring project a design alternative.	Not so clearly defined in the Act. Places of worship, graveyards, and cremation grounds are not to be acquired for any purpose unless the acquisition of these places is deemed unavoidable for the best of interest of the people.	Act 2017 does not deal with these issues and does not comply with AIIB ESS2, as Act 2017 has no strong provision for minimizing adverse impacts on private property or common resources and does not deal with alternate design.	The conceptual project development over the alternative site is quite difficult because the waste transfer process might create social conflicts and risks for the project. Therefore, minimizing the involuntary resettlement through proper alternate engineering design is not feasible for this

Sl. No.	AIIB ESS2	Acquisition and Requisition of Immovable Property Act, 2017	Identified Gaps	Actions to Bridge the Gaps
				case, as the project is based on waste and the landfill site adjacent. Proper compensation has already been paid to establish the economic loss with an adequate timeline for relocation as per the requirement of PAPs.
3.	Conducting census of displaced persons and resettlement planning	The Act 2017 spells out that upon approval of the request for land by the office of the deputy commissioner, the acquiring and Requiring body staff will conduct the physical inventory of assets and properties found in the land. The inventory form consists of the name of person, quantity and quality of land, asset assets affected, and the materials used in the construction of house. The cut-off date is the date of publication of notice that land is subject to acquisition, and that any alteration or improvement thereon will not be considered for compensation.	The Act 2017 does not require the coverage of the census survey. It only reflects the inventory of losses which is more in physical terms and only includes the names of the owners, etc. The AIIB policy spells out a detailed census through household surveys of displaced persons in order to assess the loss of income and vulnerability of the persons going to be affected by land acquisition but also population displacement and other entitlements as per the entitlement matrix.	However, the census survey has already been conducted and the findings **has already** incorporate**ted** in the ESIA for the displaced persons along with other requirements in line with ESF. Furthermore, ESIA has already incorporated the consultation as a separate chapter and the consultation outcome is also provided along with the process. Both title and non-titled PAPs along with other interested people were consulted as per ESS 2.
4.	Carry out meaningful consultation with displaced persons and ensure their participation in the planning, implementation, and monitoring of the resettlement program.	Section 3 of the ordinance provides that whenever it appears to the DC that any property is needed or is likely to be needed for any public purpose or in the public interest, he shall publish a notice at convenient places on or near the property in the prescribed form and manner stating that the property is proposed for acquisition.	The Act 2017 does not directly meet AIIB ESS2. This section of the ordinance establishes an indirect form of information disclosure/public consultation.	ESIA has already incorporated the consultation as a separate chapter and the consultation outcome is also provided along with the process. Both title and non-titled PAPs along with other interested people were consulted as per ESS 2.

Sl. No.	AIIB ESS2	Acquisition and Requisition of Immovable Property Act, 2017	Identified Gaps	Actions to Bridge the Gaps
5.	Establish a Grievance Redress Mechanism	Section 4 allows the occupant of the land to raise objections in writing. These should be filed with the DC within 15 days of the publication. The DC will then hear the complaints and prepare a report and record of proceedings within 30 days following the expiry of the 15 days given to DPs to file their objections.	Section 4 provision is consistent with AIIB's grievance and redress policy but silent on the project-related grievances during the construction and operation phase in many aspects from labor and community people as well.	AIIB's ESF and ARIPA have some common points in the GRM process. However, the AIIB's ESF needs a more specific GRM process that will focus on project-related Grievance Redress (GRM) including the non-titled holders and the ESIA proposed such process (Two-tier GRM) to meet the gap that has been identified and needs to align as per ESF guideline.
6.	Improve or at least restore the livelihoods of all displaced persons.	The Act 2017 does not require the coverage of the census survey. It only reflects the inventory of losses which is more in physical terms and only includes the names of the owners, etc. This **provision** only deals with the compensation for loss of land, structures, crops, and trees for the legal titleholders.	Provision to assess the impacts on incomes and livelihood from the loss of employment and business, or to restore lost incomes and livelihoods as per ESS 2.	Reassessment is required if there is a loss of income. Specifically, after a designated period, income loss should be re-evaluated within 6 months of relocation time, particularly for non-titled holders (NTH). If income loss is confirmed, appropriate measures must be implemented. If no loss is identified, this should be documented and reported. This process applies to both business owners and non-titled holders and should be included in the Environmental and Social Management Plan (ESMP).
7.	Resettlement Assistance	The Act 2017 does not address these issues.	The services suggested under ESS 2 were not considered in the Act 2017.	Cash compensation is preferred by the 83.6% of PAPs as per the census data and cash compensation has already been provided and it is the most feasible way to address this issue.
8.	Eligibility Criteria	The Act 2017 only considers the legal title holder eligible for compensation.	The Act 2017 has no provision for resettlement assistance and transitional allowances for the restoration of livelihoods of the non-titled (except the sharecroppers for their standing crops) project-affected persons.	Since the NTHs were not initially included, the ESIA and ESDD have now added them as PAPs and suggested actions to meet ESF requirements. The entitlement plan also provides support for non-titled PAPs, covering their structures and compensating for business or income losses, including help for their employees. Additionally, both

Sl. No.	AIIB ESS2	Acquisition and Requisition of Immovable Property Act, 2017	Identified Gaps	Actions to Bridge the Gaps
			Similarly, NTH's structures are also not considered under ARIPA's compensation process.	titled and non-titled owners have been given the requested time for relocation to prevent business losses, as they asked during the consultation.
9.	All compensation should be based on the principle of replacement cost.	The Act 2017 states that the deputy commissioner (DC) determines the amount of compensation by considering: (a) the replacement cost of the property based on the average sale value of the last 12 months preceding the publication of 1st notice of acquisition; (b) the damage to standing crops and trees; (c) damage by severing such property from the other properties of the person occupying the land; (d) adverse effects on other properties, immovable or movable, and/or earnings; and (e) if in consequence of the acquisition of the property, the person interested is likely to be compelled to change his residence or place of business, the reasonable expenses, if any, incidental to such change. In cases of injuries made under subsections (b), (c), (d), and (e), an additional 100 per centum compensation shall be provided.	Act 2017 is largely consistent with AIIB ESS2. However, there are differences in the valuation of land and prices of affected assets, where AIIB prescribes the use of current market rates in the project area. Act 2017 does not ensure replacement cost or restoration of pre-project incomes of the displaced persons.	The current Market Price and titling cost of the land have been assessed and presented in ESIA as per ESF, and a comparison of the land with the DC price to see the differences has been presented after the valuation. Consultations with business owners revealed that the non-permanent structures were built a decade or more ago. Over time, with exposure to weather conditions and use, the value of these structures has decreased. The valuation of structures has been prepared based on PWD schedule rate and incorporated in the budget and entitlement as per the ARIPA 2017 with an additional 100% of the assessed price for structures. The pricing was done for the actual structures and not the depreciated values of these structures. However, market assessment for structure is challenging due to varying regional standards, temporary business structure, diverse material costs, and fluctuating market conditions. Unlike the PWD Bangladesh analysis, which benefits from standardized data and regulatory consistency, other assessments must navigate inconsistent information and local market discrepancies.
10.	Provide relocation assistance to displaced persons.	If DC considers that the structure can easily be transferred, he/she	The Act 2017 does not define additional relocation assistance to displaced persons, other than	The ESMP of ESIA proposed an adequate timeline for relocation as the compensation (includes shifting allowances, right to

Sl. No.	AIIB ESS2	Acquisition and Requisition of Immovable Property Act, 2017	Identified Gaps	Actions to Bridge the Gaps
		will give relocation cost but not cash compensation under law,	the compensation for the direct loss of land and property. Hence, Act 2017 does not comply with AIIB ESS2.	salvage materials, and additional transitional assistance for the loss of business) has already been proposed and given to both titleholders and non-titleholders.
11.	Ensure that displaced persons without titles to land or any recognizable legal rights to land are eligible for resettlement assistance and compensation for loss of non-land assets.	ARIPA 2017 does not cover all the social aspects of the project affected persons. For example: without title or ownership record or informal settler/squatters, occupiers, and informal tenants and leaseholders (without document) and does not ensure replacement value of the property acquired.	The Act 2017 only takes into consideration the legal titleholders and ignores the non-titleholders which is the difference here with ESF.	Resettlement assistance and compensation for loss of nontitle PAPs which has already been proposed in the ESMP of ESIA and also covered in entitlement as well.
12.	Disclose the resettlement plan, including documentation of the consultation in an accessible place and a form and languages understandable to affected persons and other stakeholders.	The act only ensures the initial notification for the acquisition of a particular property to the legal owners.	There are no requirements under the Act, of disclosure of the any documentation or study report, whereas AIIB's ESS2 requires disclosure.	The ESIA, ESDDR and related full documents will have to be disclosed on Client and Banks Web-sites as well as in the project site office.
13.	Design and execute Involuntary Resettlement as part of the Project. Include the full costs of resettlement in the presentation of the Project's costs and benefits. For a Project with significant Involuntary Resettlement impacts, consider implementing the Involuntary Resettlement	The Act 2017 has a provision to include all the costs related to land acquisition and compensation of legal property and assets. However, it does not consider the costs related to other assistance and involuntary resettlement.	The Act 2017 partially meets the requirement of AIIB ESS2 as it only deals with the compensation pertaining to land acquisition.	The ESIA considered non-titled in the entitlement and EMSP as DC's award compensation does not allow them as entitled for any compensation, besides for effective management and implementation the ESMF also provided.

Sl. No.	AIIB ESS2	Acquisition and Requisition of Immovable Property Act, 2017	Identified Gaps	Actions to Bridge the Gaps
	component of the Project as a standalone Project.			
14.	Pay compensation and provide other resettlement entitlements before physical or economic displacement.	The Act 2017 has the provision that all the compensation will be paid before possession of the acquired land by EA.	The Act 2017 meets the requirement of AIIB ESS2.	The act and ESS2 complies full compensation before displacement. DC's award compensation has been taken place which eventually fulfills the ESF requirements. Some of the owners have not been paid due to litigation, and bank mortgage issues, and some were not able to receive as they reside overseas. People were invited formally (notice under section 8) to receive their compensation by providing valid papers.
15.	Monitor and assess resettlement outcomes, and their impacts on the standards of living of displaced persons.	This is not so clearly defined in the Act 2017.	The Act 2017 does not comply with AIIB ESS2.	As there is no provision for RP implementation thus the monitoring and assess resettlement outcomes, and their impacts on the standards of living of displaced persons are not applicable. However, the provision of monitoring is applicable for non-titled PAPs. Income loss should be reassessed after relocation. If income loss is confirmed, appropriate measures must be taken. If no loss is found, this should be documented and reported.
16.	Gender	The Act 2017 has no such provision	AIIB policies pay special attention to gender issues and vulnerable groups in the resettlement processes, particularly the non-titled and the affected poor households.	The policy gaps have been bridged by additional project-specific measures adopted in the ESMP and also baseline have a seprate chapter to cover Gender.
17.	Consultation	The Act 2017 has no such provision	AIIB ESS1 emphasize on Meaningful Consultation with Project-affected people and other stakeholders and facilitate	Meaningful Consultation with Project-affected people and other stakeholders has already been incorporated in the ESIA.

Sl. No.	AIIB ESS2	Acquisition and Requisition of Immovable Property Act, 2017	Identified Gaps	Actions to Bridge the Gaps
			their informed participation in the consultations.	ESDDR will also cover the same to obtain more information.

3.2.10 IFC Performance Standards, 2012 and its Applicability to this Project

The IFC Performance Standards (PS) (January 2012[9]) established by IFC stipulates that the Project shall meet certain requirements throughout the life cycle of an investment by IFC or other relevant financial institutions or commercial banks, which are signatories to the Equator Principles, 2006. A brief description of the Performance standards and its applicability to the proposed project is provided in Table 3-7 below.

Table 3-7: IFC Performance Standards

Performance Standards	Specific Areas	Key Features	Applicability
Performance Standard 1	Assessment and Management of Environmental and Social Risks and Impacts	The PS 1 requires Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of this Project and runs through all subsequent PSs. The social and environmental performance is a continuous process to be initiated by the management and would involve communication between the organization, its workers and local communities directly affected by the Project.	The PS 1 is applicable for the project because it would require carrying out regular assessments of the potential social and environmental risks and impacts and consistently try to mitigate and manage the impacts on an ongoing basis.
Performance Standard 2	Labor and Working Conditions	Economic growth through employment creation and income generation is recognized along with protecting the basic rights of workers. PS 2 is guided by the various conventions of International Labor Organization (ILO) and outlines the minimum requirements of working conditions, protection to the workforce (including issues of child and forced labor) and ensuring occupational health and safety of both its 'employees' as well as 'nonemployees' working through contractors.	PS 2 is applicable for this proposed project because it would be required to conduct its activities in a manner in accordance with the four core labor standards (child labor, forced labor, non-discrimination, and freedom of association and collective bargaining) and address the areas such as working conditions and terms of employment, retrenchment, and occupational health and safety issues.

[9] https://www.ifc.org/en/insights-reports/2012/publications-handbook-pps

Performance Standards	Specific Areas	Key Features	Applicability
Performance Standard 3	Resource Efficiency and Pollution Prevention	PS 3 outline a project level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices	PS3 is applicable for the project because due to the project activities the ambient environmental conditions would be changed. Measurement of ambient conditions and application of technically and financially feasible resources with pollution prevention principles and techniques to avoid or to minimize adverse impacts on environment and human health during the entire project lifecycle would be needed.
Performance Standard 4	Community Health, Safety and Security	PS 4 concentrates on the responsibility that must be undertaken by the client to avoid or minimize the risks and impacts to the community's health, safety and security that may arise from project activities.	PS 4 is required for this project to evaluate risks and impacts to the health and safety of the affected community during the Project life cycle and establish measures to avoid, minimize and reduce risks and impacts from the Project.
Performance Standard 5	Land Acquisition and Involuntary Resettlement	PS 5 require a project to consider various processes and systems to avoid /minimize social and economic impacts related to land acquisition and involuntary resettlement.	PS 5 is required for this project because it involves disruption of economic activities during the project life cycle which are permanent and irreversible in nature. Some impacts on structures are also envisaged within the project boundary.
Performance Standard 6	Biodiversity Conservation and Sustainable Management of Living Natural Resource	PS 6 aims at protecting and conserving biodiversity, maintaining ecosystem services, the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve, is fundamental to sustainable development.	**PS 6 is Applicable.** The study area encompasses the Riverine Habitat of Karnatali River and Turag River, as well as natural drainage canals, and ponds, which collectively support a diverse and abundant fisheries resource.

Performance Standards	Specific Areas	Key Features	Applicability
			A comprehensive survey revealed the presence of 47 fish species across 18 families within the study area, including five endangered species and four vulnerable species. Furthermore, ten species of aquatic macrophytes were identified in the shallow waters of the Karnatali River, floodplains, ponds, and swamps surrounding the proposed project site. Rare sightings of the Ganges River Dolphin have been reported in the Karnatali River during the monsoon and post-monsoon periods, as documented in the Environmental and Social Impact Assessment (ESIA) report. This indicates the presence of this species, which is classified as 'Endangered' according to the IUCN Red List.
Performance Standard 7	Indigenous Peoples	PS 7 acknowledges the possibility of vulnerability of indigenous people owing to their culture, beliefs, institutions and living standards, and that it may further get compromised by one or other project activity throughout the life cycle of the project.	**Not Applicable** This PS delineates the requirement of avoiding / minimizing adverse impacts on indigenous people in a project area, respecting the local culture and customs, fostering good relationship and ensuring that development benefits are provided to improve their standard of living and livelihoods. However, no indigenous people are residing in and around the project area; hence PS 7 is not applicable for the present project.

Performance Standards	Specific Areas	Key Features	Applicability
Performance Standard 8	Cultural Heritage	PS 8 aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. In addition, the requirements of this PS on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.	**Not Applicable** The project site does not have any ancient monuments and/or archaeological site(s), protected. i) If they (antiques/cultural heritage) are found, they need to be relocated as per lenders guidelines ii) Chance find procedures will be incorporated in the ESMP.

3.2.11 WBG Environmental, Health and Safety Guidelines, 2007

WBG has EHS Guidelines that are technical reference documents with general and industry-specific examples of good international industry practice. The guidelines are developed to be used together with the relevant industry sector EHS guidelines that provide guidance to users on EHS issues in specific industries. The guidelines include performance levels and measures that are generally considered achievable in new facilities by existing technology at reasonable costs. When host country regulations and limits differ from the levels and measures presented in the WBG EHS Guidelines, projects should aim to achieve stricter ones. The WBG General EHS Guidelines is organized as presented in Table 3-8.

Table 3-8: World Bank IFC General EHS Guidelines

Main Subject	Topic
Environmental	• Air Emissions and Ambient Air Quality • Energy Conservation • Wastewater and Ambient Water Quality • Water Conservation • Hazardous Materials Management • Waste Management • Noise • Contaminated Land
Occupational Health and Safety	• General Facility Design and Operation • Communication and Training • Physical Hazards • Chemical Hazards • Biological Hazards • Radiological Hazards • Personal Protective Equipment (PPE) • Special Hazard Environments • Monitoring
Community Health and Safety	• Water Quality and Availability • Structural Safety of Project Infrastructure • Life and Fire Safety • Traffic Safety • Transport of Hazardous Materials • Disease Prevention • Emergency Preparedness and Response
Construction and Decommissioning	• Environment • Occupational Health & Safety • Community Health & Safety

3.2.12 Environmental, Health, and Safety Guidelines for Waste Management Facilities, 2007

The EHS Guidelines for Waste Management cover facilities or projects dedicated to the management of municipal solid waste and industrial waste, including waste collection and transport; waste receipt, unloading, processing, and storage; landfill disposal; physico-chemical and biological treatment; and incineration projects. Industry-specific waste management activities applicable, for example, to medical

waste, municipal sewage, cement kilns, and others are covered in the relevant industry-sector EHS Guidelines, as is the minimization and reuse of waste at the source.

EHS guidelines for waste management facilities cover mainly Industry-Specific Impacts and Management, Performance Indicators and Monitoring and References and Additional Sources. Under the industry specific impacts and management, this guideline discussed municipal solid waste comprising MSW incineration; industrial hazardous waste; industrial non-hazardous waste; occupational health and safety; community health and safety.

Measures to Prevent, Minimize and Control for MSW Incineration Facilities

Air Emissions

The following measures are recommended to prevent, minimize, and control air emissions:

- Conduct waste segregation and/or presorting to avoid incineration of wastes that contain metals and metalloids that may volatilize during combustion and be difficult to control through air emission technology (e.g., mercury and arsenic);
- Follow applicable national requirements and internationally recognized standards for incinerator design and operating conditions, mainly rapid quenching of the flue gas after leaving all combustion chambers and before entering any dry particulate matter air pollution control device but also combustion temperature, residence time, and turbulence. Standards for stationary incinerators which include temperature and afterburner exit gas quenching (i.e., rapid temperature reduction) requirements are preferred in order to nearly eliminate dioxins and furans.
- Introduce waste into the incinerator only after the optimum temperature is reached in the final combustion chamber.
- The waste charging system should be interlocked with the temperature monitoring and control system to prevent waste additions if the operating temperature falls below the required limits.
- Minimize the uncontrolled ingress of air into the combustion chamber via waste loading or other routes.
- Optimize furnace and boiler geometry, combustion air injection, and, if used, NOX control devices using flow modeling.
- Implement maintenance and other procedures to minimize planned and unplanned shutdowns.
- Avoid operating conditions in excess of those that are required for efficient destruction of the waste.
- Use a boiler to transfer the flue-gas energy for the production of electricity and/or supply of steam/heat, if practical.
- Use primary (combustion-related) NO_X control measures and/or selective catalytic reduction (SCR) or SNCR systems, depending on the emissions levels required.
- Use flue gas treatment system for control of acid gases, particulate matter, and other air pollutants.
- Minimize formation of dioxins and furans by ensuring that particulate control systems do not operate in the 200 to 400 degrees Celsius temperature range; identifying and controlling incoming waste composition; using primary (combustion-related) controls; using designs and operation conditions that limit the formation of dioxins, furans, and their precursors; and using flue gas controls.

Ash and Other Residuals

Combustion of solid waste generates ash and other material remaining after incineration. Solid wastes may also be generated from treatment of wastewater from flue gas treatment (FGT). The following measures are recommended to prevent, minimize, and control solid waste from incineration:

- Design the furnace to, as far as possible, physically retain the waste within the combustion chamber (e.g. narrow grate bar spacing for grates, rotary or static kilns for appreciably liquid wastes), and use a waste throughput rate that provides sufficient agitation and residence time of the waste in the furnace at sufficiently high temperatures, including any ash burn-out areas, in order to achieve a total organic carbon (TOC) value in the ash residues of below 3 wt percent and typically between 1 and 2 wt percent.
- Manage bottom ash separately from fly ash and other flue gas treatment residues to avoid contamination of the bottom ash for its potential recovery.
- Separate remaining ferrous and non-ferrous metals from bottom ash as far as practicably and economically viable, for their recovery.
- Treat bottom ash on or off-site (e.g., by screening and crushing) to the extent that is required to meet the specifications set for its use or at the receiving treatment or disposal site (e.g., to achieve a leaching level for metals and salts that is in compliance with the local environmental conditions at the place of use);
- Bottom ash and residuals should be managed based on their classification as hazardous or non-hazardous materials. Hazardous ash should be managed and disposed of as hazardous waste. Non-hazardous ash may be disposed of in an MSW landfill or considered for recycling in construction materials.

Water Effluents

Cooling systems generate cooling tower blowdown, which is addressed in the General EHS Guidelines. In addition, flue gas treatment generates wastewater requiring treatment and disposal.

To prevent, minimize, and control water effluents, wastewater from flue gas treatment should be treated as necessary, e.g., using filtration coagulation, precipitation, and filtration to remove heavy metals, and neutralization.

Noise

Principal sources include exhaust fans and resulting in noise from the outlet of the stack; cooling system (for evaporation cooling and especially for air cooling); and turbine generators.

Measures to address noise impacts are addressed in the General EHS Guidelines. Additional recommended measures to prevent, minimize, and control noise from incineration include use of silencers on air coolers and chimneys, as necessary.

Occupational Health and Safety

The most significant occupational health and safety impacts typically associated with workers at waste management facilities occur during the operational phase and include:

Accidents and injuries	Chemical exposure	Exposure to pathogens and vectors

The following procedures are recommended to prevent, minimize, and control accidents and injuries at waste management facilities:

- Provide workers with appropriate protective clothing, gloves, respiratory face masks and slip-resistant shoes for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. For workers near loud equipment, include noise protection. For workers near heavy mobile equipment, buckets, cranes, and at the discharge location for collection trucks, include provision of hard hats.

- Design collection routes to minimize, or possibly eliminate, crossing traffic that is going in the opposite direction.
- Provide two-hand constant-pressure controls for collection vehicles with compaction mechanisms.
- Restrict access to disposal sites such that only safety - trained personnel with protective gear are permitted to high-risk areas.
- Segregate people from operating trucks in recycling and transfer stations.

Dust

Waste processing can generate nuisance and hazardous dust, including organic dust. General mitigation measures for dust are also addressed in the General EHS Guidelines.

Pathogens and Vectors

The following measures are recommended to prevent, minimize, and control pathogens and vectors:

- Provide and require use of suitable personal protective clothing and equipment.
- Provide worker immunization and health monitoring (e.g., for Hepatitis B and tetanus);
- Maintain good housekeeping in waste processing and storage areas.
- Clean and wash with disinfectant the cabins of heavy mobile equipment used at regular intervals.

3.2.13 European Union Pollutant Emission Standard (European Union 2010/75/EU)

The European Union 2010/75/EU is a directive that was adopted by the European Union on November 24, 2010. It is also known as the Industrial Emissions Directive (IED). The aim of the directive is to reduce the impact of industrial activities on the environment and human health by setting common emission limit values for certain pollutants and introducing a permitting system for industrial installations.

The IED applies to a wide range of industrial activities, including energy production, manufacturing, and waste management. It sets emissions limit values for a range of pollutants, including nitrogen oxides, sulfur dioxide, and particulate matter, which are based on the best available techniques (BAT) for each sector. The directive also requires operators of industrial installations to apply for permits that specify the conditions and emissions limits that they must comply with.

The IED also includes provisions on monitoring and reporting of emissions, as well as requirements for public access to information about industrial installations and their emissions. Member states are required to ensure that industrial installations comply with the emission limit values and permit conditions and take appropriate measures if they do not.

The emission inventory has been presented based on the guaranteed emission concentration from equipment. The emission inventory of the power plant is presented in Table 3-9.

Table 3-9: Emission Inventory of Waste to Energy Power Plant

Pollutant	Unit	Emission Concentration (Daily average)
Particulate Matter (PM)	mg/Nm^3	10
Nitrogen Dioxide (NO_2)	mg/Nm^3	200
Sulfur Dioxide (SO_2)	mg/Nm^3	50
Carbon Monoxide (CO)	mg/Nm^3	50
Mercury (Hg)	mg/Nm^3	0.05

Pollutant	Unit	Emission Concentration (Daily average)
Hydrogen Chloride (HCl)	mg/Nm^3	10
Hydrogen Fluoride (HF)	mg/Nm^3	1
Cd+Ti	mg/Nm^3	0.05
Pb+Cr and other heavy metals	mg/Nm^3	0.5
Dioxins and Furans	ng-TEQ/Nm^3	0.1

Source: EU standard DIRECTIVE 2010/75/EU[10]

3.2.14 UK Guideline for Air Emissions

UK Environmental Agency's Air Emission Risk Assessment Guidance

The UK Environmental Agency (EA) provides guidance on air emission risk assessments for industrial activities. The purpose of the guidance is to help operators of industrial facilities assess the risks associated with their emissions and take steps to control them.

The guidance sets out a framework for conducting air emission risk assessments that includes the following steps:

- Identifying the sources of emissions - This involves identifying all the equipment and processes that emit pollutants.
- Characterizing the emissions - This involves quantifying the emissions of each pollutant and identifying any hazardous substances.
- Identifying the receptors - This involves identifying the people, animals, and the environment that may be affected by the emissions.
- Assessing the risk - This involves using modeling tools to assess the risk to human health and the environment posed by the emissions.
- Identifying control measures - This involves identifying measures that can be taken to control emissions and reduce the risk.
- Implementing and monitoring control measures - This involves implementing the identified control measures and monitoring their effectiveness.

The EA guidance also provides specific guidance on how to conduct risk assessments for different types of industrial activities, such as incinerators, waste transfer stations, and industrial combustion plants.

Overall, the guidance is designed to help operators of industrial facilities understand the risks associated with their emissions and take appropriate steps to control them, in order to protect human health and the environment.

UK Environmental Agency Environmental Standard

The UK Environmental Agency (EA) sets environmental standards to protect the environment and human health. These standards apply to a wide range of activities, including industrial processes, waste management, and water and air quality.

Some of the key environmental standards set by the EA include:

[10] https://eur-lex.europa.eu/eli/dir/2010/75/oj

Environmental permits - The EA issues environmental permits to regulate and control activities that have the potential to pollute the environment. Permits set out conditions that the operator must meet in order to minimize the impact of their activities on the environment and human health.

- Waste management standards - The EA sets standards for the handling, storage, and disposal of waste. These standards are designed to ensure that waste is managed in a way that minimizes its impact on the environment and human health.
- Air quality standards - The EA sets standards for air quality, to protect human health and the environment. These standards specify limits on the levels of pollutants such as nitrogen oxides, sulfur dioxide, and particulate matter that can be present in the air.
- Overall, the EA's environmental standards are designed to ensure that activities that have the potential to harm the environment and human health are carried out in a way that minimizes their impact. The EA also monitors compliance with these standards and takes enforcement action when necessary to ensure that they are upheld.

3.2.15 Chinese standard Garbage Bowl (GB) for landfill

Some Chinese standard GB for landfill can be considered for this project.

- Technical Code for Municipal Solid Waste Sanitary Landfill---生活垃圾卫生填埋处理技术规范（国标 GB50869-2013）
- Standard for Pollution Control on the Landfill Site of Municipal Solid Waste---生活垃圾填埋场污染控制标准（国标 GB16889-2008）

According to the requirements of the Technical Code for Municipal Solid Waste Sanitary Landfill (GB 50869-2013): Domestic waste incineration fly ash and medical waste incineration residue meets the conditions specified in the current national standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB16889) after treatment and can enter domestic waste landfill for landfill disposal.

According to the requirements of the Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB16889-2008): WtE fly ash and medical waste incineration residues (including fly ash and sediment) can enter the solid waste landfill for treatment if they meet the following conditions after treatment.

3.3 Categorization of the Project

3.3.1 Project Classification as per DOE, Ministry of Environment, Forest and Climate Change, Bangladesh

Depending upon location, and impact on the environment have been classified in Environmental Conservation Rules (ECR), 2023 into four categories: Green, Yellow, Orange, and Red respectively, to nil, minor, medium, and severe impacts on important environmental components (IECs).

As per the Schedule-1 of the ECR 2023, the corresponding category related to the power plant (e.g., waste Incinerator) fall under Red Category for the following components. The project developer has already obtained SCC from Department Of Environment (DOE) which is given in **Appendix A**.

The transmission line project falls under Orange Category which also required SCC/ECC from DOE, Bangladesh. The project developer has to prepare a separate IEE study to get the DoE clearance.

3.3.2 Project Classification as per Asian Infrastructure Investment Bank (AIIB) Standard

All AIIB-financed projects are required to be screened and categorized to determine the nature and level of the required environmental and social reviews and assessment, type of information disclosure, and stakeholder engagements for the respective project. The project's category is determined by the

category of the project's component that presents the highest environmental or social risk, including direct, indirect, cumulative, and induced impacts, as relevant, in the project area. AIIB assigns each proposed project to one of the four categories as described in Table 3-10 below.

Table 3-10: Screening and Categorization of AIIB Projects

Category		Applicability for the Proposed Project
Category A	A project is categorized as 'Category A' if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse, or unprecedented.	Considering this proposed project's potential negative and positive environmental and social impacts and their management, it is appropriate to fit the Project into Category A under AIIB ESF categorization. This is because most of the impacts are irreversible, cumulative, and not bound to occur in the Project area.
Category B	A project is categorized as 'Category B' when it has a limited number of potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the project area and can be successfully managed using good practice in an operational setting.	Not applicable
Category C	A project is categorized as 'Category C' when it is likely to have minimal or no adverse environmental and social impacts.	Not applicable

Applicability of ESP for Proposed Project

The proposed project entitled 'WTE Power Plant North Dhaka Private Limited' triggers the local environmental and social laws and regulations and also the ESP and ESS of AIIB. Under this project, ESS 1: Environmental and Social Assessment and Management and ESS 2: Involuntary Resettlement are applicable. The ESIA (this study) addresses ESS1 and SIA addresses ESS 2. Standards on Indigenous Peoples (ESS 3) is not triggered by the proposed project. The Bank requires its clients to manage the environmental and social risks and impacts associated with its project in a manner designed to meet the ESP and the applicable ESSs. The present ESIA has been developed in compliance with the ESS 1. The applicability of ESP and ESSs for the proposed project is presented in Table 3-11.

Table 3-11: Applicability of AIIB ESS

Environmental and Social Standards		Applicability	Remarks
ESS1	Environmental and Social Assessment and Management	ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both)	ESS1 is applicable since the proposed project is likely to have negative environmental and social impacts. In addition, it is applicable for the proposed project as the project is required

Environmental and Social Standards		Applicability	Remarks
			to ensure their Environmental and Social assessment and management measures are proportional to project risks and impact.
ESS2	Involuntary Resettlement	ESS2 is applicable if the project is likely to cause Involuntary resettlement	Yes. The project involves disruption of economic activities during the project life cycle which are permanent and irreversible in nature. Some impacts on structures are also envisaged within the project boundary. Given such impacts ESS 2 is triggered.
ESS3	Indigenous Peoples	ESS3 is applicable if indigenous people are present in the project area	No, since no Indigenous people are living in the project area, as defined in the ESP.

However, Due to the nature and scale of this project and applying the ESF of AIIB the project has been classified as a category A project. Category A refers to proposed projects if it is likely to have a number of potentially significant adverse environmental and/or social impacts. In this case, the potential social impacts due to land acquisition of project-affected persons warrant a high-risk categorization.

For this category, the Bank determines the appropriate environmental and social assessment documentation the Client is required to prepare on a case-by-case basis. A full ESIA is required for this project.

4 ANALYSIS OF ALTERNATIVE

The analysis of alternatives in an ESIA study with respect to WtE Project basically involves assessing different technologies, locations and waste management strategies to identify the most environmentally and socially preferrable options ensuring sustainable development while minimizing potential impacts on social and environmental ecosystem of the project footprint and surrounding areas. The analysis of project alternative is a process to identify suitable alternative in place of the existing strategy that would meet the objective and purpose of the project, while avoiding or minimizing negative impacts and enhance project benefits across project life-cycle.

The project has been considered and investigated for several alternatives to reduce potential environment and social impacts. The alternatives assessed were not limited to environment and social aspects, but it can also include the technical aspects of available different options.

The Project has considered alternatives in terms of site location, design and technology options. An analysis of these alternatives has been undertaken for the proposed Project including consideration of a no-Project scenario. The no-go option, or not building the proposed waste-to-energy project, is one that is based on the supposition that the project won't proceed. No environmental or social repercussions would be caused by this choice on the location or the neighborhood. It serves as the standard against which other options are measured and will be taken into account throughout the report.

4.1 No Project Scenario

The no-go alternative assumes that the proposed project will not go ahead, i.e., it is the option of not constructing the proposed waste-to-energy project. This alternative would result in no environmental or social impacts on the site or the local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. The no project option takes the following into consideration:

- Continue current dumping of waste as a method to manage waste for DNCC.
- Cost related to the project activities will be avoided
- Further environmental damage to the proposed area will be avoided.
- Existing public suffering will continue to worsen due to lack of proper waste management system in surrounding of Amin Bazar landfill area.
- The existing landfill will come under more pressure, thereby leading to unhygienic conditions and pollution.
- Electricity generation will remain constant (i.e., no additional energy generation will occur on the proposed site), and the local economy will not be diversified.
- There will be no opportunity for additional employment in an area.

While the “no project scenario” alternative will not result in negative environmental impacts, it will also not result in positive community development or socio-economic benefits. It will also not assist the government in addressing climate change and reaching its set targets for converting waste to energy, nor will it assist in supplying the increasing electricity demand within the country. Therefore, the “no project” option is not recommended.

4.2 Suitability of the Site

Due to land scarcity in the country, seeking an alternative site for establishing the power plant area is difficult. Aside from this, Other than this, the land acquisition is a lengthy and complex process to acquire land for development projects. Additionally,the conceptual project development over alternative sites is quite difficult and cumbersome task as the waste transfer process might create social conflicts and risks for the project. Further more , the scarcity of lands in the city compounded with increasing amount of solid waste, it is crucial to process the MSW to the maximum extent possible to minimize

dumping at the landfill sites. The selection of the project site/location has been carried out based on the following considerations:

Available Land Area: Availability of adequate land for the proposed plant. A total of 31.18 acres (126187.41 m2) of land is required which has been acquired by DNCC.

Existing Land Use: The existing land use within the proposed project boundary is a low-lying fallow land.

Approach Road:. The project site is situated adjacent to the Dhaka-Aricha Highway (N5).. Fuel and equipment can be transported by road using this highway.

The current waste-to-energy project has been proposed as a solution to manage the municipal solid waste generated within the jurisdiction of Dhaka North City Corporation. The existing landfill site designated for the area has reached full capacity and is presently overloaded beyond its intended limits. Considering available land, existing land use and good accessibility for waste transportation route, the proposed site shall be chosen for establishing waste to energy power plant.

To avoid or minimize the impacts resulting from the project's activities, WTE Power Plant North Dhaka Private Limited authority should adopt the appropriate technological design, improvements or adjustments, policy including good site operational practices and applicable ESMP, etc. The overall strategy shall follow the following sequence:

- Impact avoidance or minimization.
- Adequate Compensation where impacts are unavoidable.
- Enhancement Measures-Employment benefits enhancement measures proposed by the consultants.

4.3 Alternative Incineration Technologies

There are four main types of solid waste incinerators:

Presently, a grate-type incinerator is the mainstream equipment abroad, which occupies an absolute advantage; a grate-type incinerator and fluidized bed incinerator are the main equipment in China, and the former has more advantages. These four types of incinerators are briefly introduced and compared below in Table 4-1.

Table 4-1: Comparison of Characteristics of Four Types of Common solid waste incinerators

Item	Mechanical grate furnace	Fluidized bed incinerator	Pyrolysis incinerator	Rotary kiln incinerator
Characteristics of furnace bed and body	Large mechanical grate area and furnace volume	Fixed furnace bed, smaller furnace volume	Vertical fixed grate, 1 ~ 2 combustion chambers	Moving waste by rotating the furnace body
Waste pretreatment	Not required	Required	Required at low calorific values	Not required
The floor area of equipment	Large	Small	Medium	Medium

Item	Mechanical grate furnace	Fluidized bed incinerator	Pyrolysis incinerator	Rotary kiln incinerator
Heat Cauterization of Slag	Easy to reach the standard	Can reach the standard under the condition of continuous ignition support	Not easy to reach the standard	Not easy to reach the standard
Maximum processing scale of a single furnace at present	1200t/d	800t/d	200 t/d	500t/d
Combustion air supply	Easy to adjust	Easier to adjust	Not easy to adjust	Not easy to adjust
Dust content in flue gas	Low	Very high	Low	High
Combustion medium	No carrier	Quartz sand required	No carrier	No carrier
Automatic combustion control	Easy	Not easy	Not easy	Not easy
Operating expenses	Low	Low	High	High
Flue gas treatment	Easy	More difficult	Not easy	Easy
Maintenance workload	Less	More	Less	Less
Comprehensive evaluation	It has strong adaptability to waste, few faults, good treatment performance and environmental protection performance, and low cost	Pretreatment and the failure rate are high, coal incineration is required, and environmental protection is not easy to reach standard.	It is not easy to realize the burnout of waste in the non-melting pyrolysis furnace, the slag thermal burning reduction rate is high, and environmental protection is not easy to reach the standard	It requires high calorific heat (above 2500 kcal/kg) of waste and high operating costs
Applicability of this project	**Applicable**	**Not suitable**	**Not applicable**	**Not applicable**

A mechanical grate waste incinerator has the following characteristics relative to other furnace types:

- It has established and reliable technology. Most large solid waste incineration power plants in developed countries use the mechanical grate furnace type. The large incineration power plants built or under construction in China also mostly use this furnace type.
- It uses the residual heat generated by incineration for power generation, which has certain energy-saving and economic benefits. It has a better CO_2 emission reduction effect than other solid waste treatment facilities.

- It is easy to operate and not easy to cause secondary pollution.
- The incinerator is stable and reliable, the equipment life is long, and the annual operation time exceeds 8000 hours.

The circulating fluidized bed waste incinerator has the advantage of the low loss of ignition, but it has the following more apparent shortcomings:

- According to the research results, its CO2 emission is higher than that of a grate incinerator;
- The operation stability is still insufficient, the frequency of furnace shutdown is high, and the annual operation time is generally 6,000 ~ 7,000h.
- Because the volatile components of waste are mainly burned, fixed carbon combustion accounts for only about 20%, resulting in a high combustion rate, and automatic combustion control (ACC) cannot be well realized.

Based on the above analysis, WtE Power Plant North Dhaka Private Limited selected the mechanical grate furnace as the incinerator for solid waste incineration and power generation projects.

5 ENVIRONMENTAL AND SOCIAL BASELINE

As a part of the environmental and social assessment of the proposed waste-to-energy power plant project, an environmental baseline survey has been carried out in areas surrounding the proposed location. This section includes the existing environmental and social baseline status of the Project area, covering both the natural and social environments. The analysis was completed through the use of a combination of secondary data sources in addition to baseline studies to establish an understanding of the environmental and socio-economic baseline of the Project area. The likely impacts on the environment are based on the actual and foreseeable events/project activities. For the impact assessment, wherever necessary, professional judgment, experience, and knowledge of similar projects will be used. Data for this chapter were collected from:

- Secondary Sources: This included data from Socio-Economic Survey (SES), Census survey,2011, literature reviews, maps and monitoring reports.
- Primary Sources: This included gathering information from field surveys, laboratory analysis, and public consultations in the project area.

The baseline condition of environmental quality in the locality of the project site serves as the basis for the identification, prediction, and evaluation of impacts. The baseline environmental quality is assessed through field studies within the impact zone for various components of the environment, viz. air, noise, water, soil, sediment, socio-economic, etc.

Data was collected from secondary sources for the macro-environmental setting like climate (temperature, rainfall, and humidity), physiography, geology, etc. Firsthand information has been collected to record the micro-environmental features within and adjacent to the project area. The collection of primary information includes extrapolating environmental features on the proposed project design, location, and measurement of socio-cultural features adjoining the proposed project area. Ambient air, noise and water quality, Soil, and Sediment samples were collected in terms of environmental quality to prepare a baseline database. Consultation was another source of information to explain local environmental conditions, impacts, suggestions, etc.

The following section describes the baseline environment into four broad categories:

- **Physical Environment**: Geology, Topology, Land-use, Soils, Meteorology, and Hydrology.
- **Biological Environment:** factors related to life such as habitats, aquatic life, fisheries, terrestrial habitats, flora, and fauna.
- **Environmental Quality:** Air, Water, Noise Quality, Soil, and Sediment;
- **Socio-economic Environment**: Anthropological factors like demography, education, income, livelihoods, health facilities, infrastructure, amenities etc

5.1 Area of Influence (AOI)

The AOI of the project comprises the project site, Transmission line (TL) and the project surrounding area, where the influence of the project activities is anticipated. The areas likely to be affected by the project and its associated activities that include:

- Impact on ambient air quality from vehicle exhaust- 500 meters from the project site. Air pollutants disperse from the project site up to 1 km from the power plant stack and Dust fall- typically up to 500 m from construction activities.
- Noise impact area (defined as the area over which an increase in environmental noise levels due to the project can be detected) - typically 500 m from the power plant center and 100 m from the access road.
- Surface water bodies within 1 km of the project footprint and Groundwater in a 1-2 km radius of the project footprint.

- The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence, and project-related activities (e.g., trampling, water intake/outfall, transportation). This kind of disturbance has been estimated to occur within the project footprint and surrounding areas of about 500 m to 1 km from the activity areas.
- The AOI for social receptors has been defined as a fixed radius extending 5 km from the project footprint, including the area of proposed transmission. This conclusion was arrived at, following preliminary site visits and stakeholder consultations with local communities to demarcate project areas of influence.
- The project activities and facilities that are directly owned, operated or managed by the project proponent (including by contractors) and that are components of the project, such as the main power plant, control room, and transmission line to power grid sub-stations.
- Impacts from unplanned but predictable developments caused by the project that shall occur later or at a related location such as an increased volume in traffic.
- Impacts on biodiversity or on ecosystem services upon which affected communities' livelihoods are dependent.

Further to this, the AOI with respect to the environmental and social resources was considered based on the following reach[11] of impacts:

AIR Quality	• Impact on ambient air quality from vehicle exhaust- 500 meters from the project site • Air pollutants disperse from the project site up to 1 km from the power plant stack • Dust fall- typically up to 500 m from construction activities.
Noise	• Noise impact area (defined as the area over which an increase in environmental noise levels due to the project can be detected) - typically 500 m from the power plant center and 100 m from the access road.
Water	• Surface water bodies within 1 km of the project footprint • Groundwater in a 1-2 km radius of the project footprint
Flora and Fauna (Terrestrial and Aquatic)	• The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence, and project-related activities (e.g., trampling, water intake/outfall, transportation). This kind of disturbance has been estimated to occur within the project footprint and surrounding areas of about 500 m to 1 km from the activity areas.

[11] Distance based on EQMS's experience with similar project- need clarification on this from EQMS.

Based on the above AOI parameters for environmental studies, were limited to a 5 km radius distance from the project site.

Socio-economic/Social

The AOI for social receptors was defined as a 5 km radial zone, determined through reconnaissance site visits and stakeholder consultations with the local community.

5.2 Physical Environment

5.2.1 Meteorology

The climate of Bangladesh is heavily influenced by the Asiatic monsoon. The monsoonal influence results in three distinct seasons:

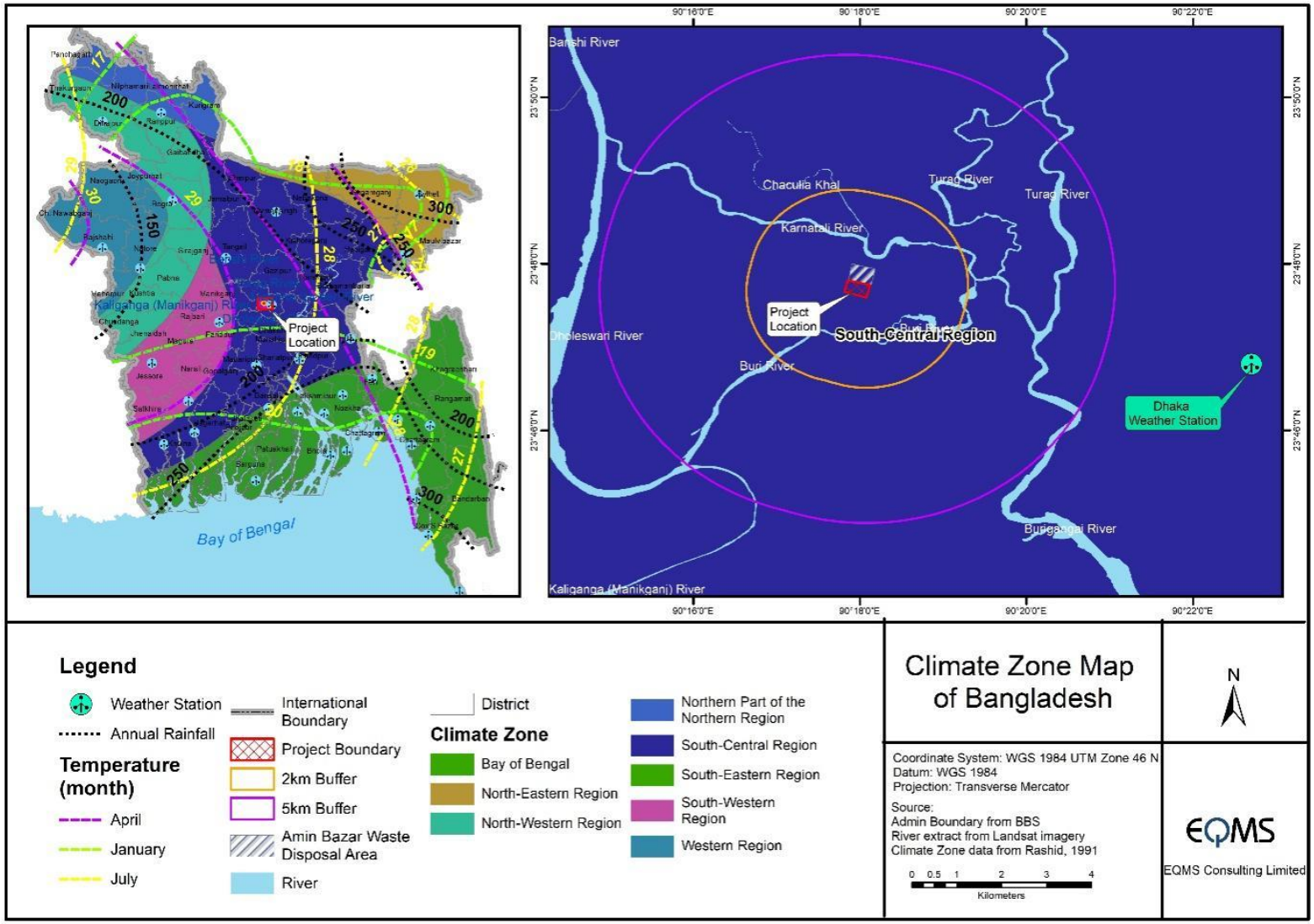
Pre-monsoon hot season (from March to May).

Rainy monsoon season (from June to September).

Cool dry winter season (from October to February).

Bangladesh is in the tropical monsoon region, and its climate is characterized by high temperatures, heavy rainfall, often excessive humidity, and fairly marked seasonal variations. Climate zone of Bangladesh is given in Figure 5-1.

Figure 5-1: Climatic zones in Bangladesh



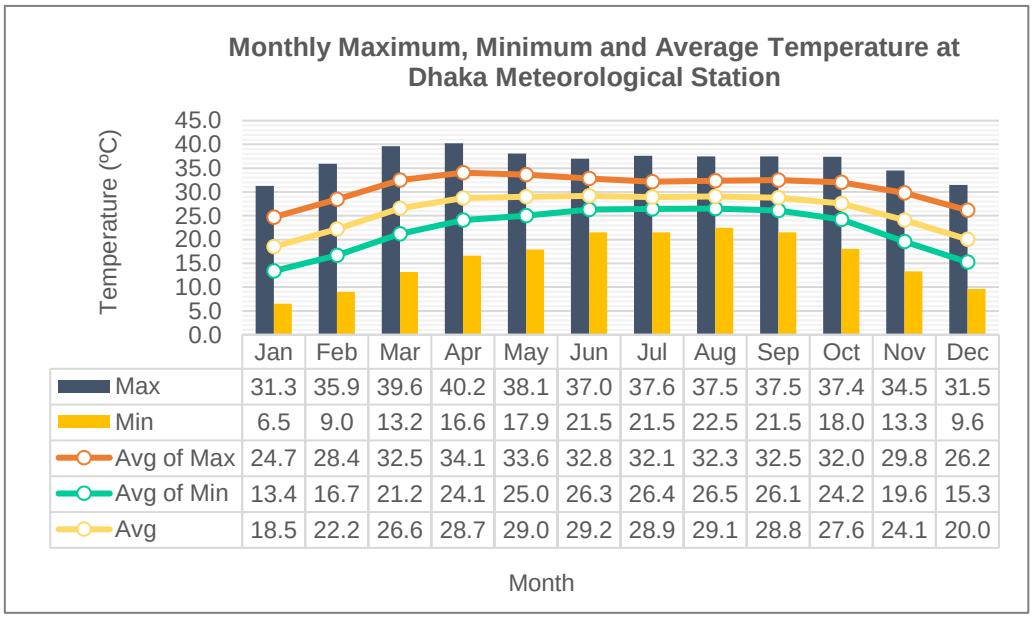
Source: Rashid, Haroun Er, 1991

From a climatological perspective, Bangladesh experiences three distinct seasons: the cool dry season spanning November through February, the pre-monsoon hot season from March through May, and the rainy monsoon season lasting from June through September. January is the coolest month, with average temperatures around 26°C, while April is the warmest, with temperatures ranging from 33°C to 36°C. Most regions receive more than 1,525 mm of annual rainfall, with areas near the hills experiencing as high as 5,080 mm per year. The majority of precipitation occurs during the monsoon months of June to September, with minimal rainfall during the winter period of November to February. Moderate rainfall is also observed in March, April, and October. Climatic sub-regions of Bangladesh are presented in Figure 5-1 and Dhaka District falls in the South-Central zone. The Bangladesh Meteorological Department monitors different climate components in 35 weather stations in Bangladesh. The climatic data for the study area were obtained from the meteorological station located in Dhaka and maintained by the BMD.

5.2.1.1 Temperature

Based on temperature data recorded at Dhaka Meteorological Station for the last 30 years (1992 to 2021), the maximum and minimum ambient temperatures are observed to be ranging from 24.7°C to 34.1°C and 13.4°C to 26.5°C, respectively. The lowest average temperature was in January 2013 (10.4°C). The highest average temperature reached 34.4°C in April 2014. The period from March to October is marked by a continuous increase in temperatures. August is the hottest month of the year with an average maximum and minimum temperature (in August) of 37.5°C and 22.5°C, respectively. From November onwards, both the day and night temperatures decrease, and January is the coldest month, with average monthly maximum and minimum temperatures of 31.3°C and 6.5°C, respectively. The monthly variation of the maximum, minimum, and average temperature at Dhaka Meteorological Station is shown in Figure 5-2.

Figure 5-2: Temperature variation at Dhaka Meteorological Station (1992 to 2021)



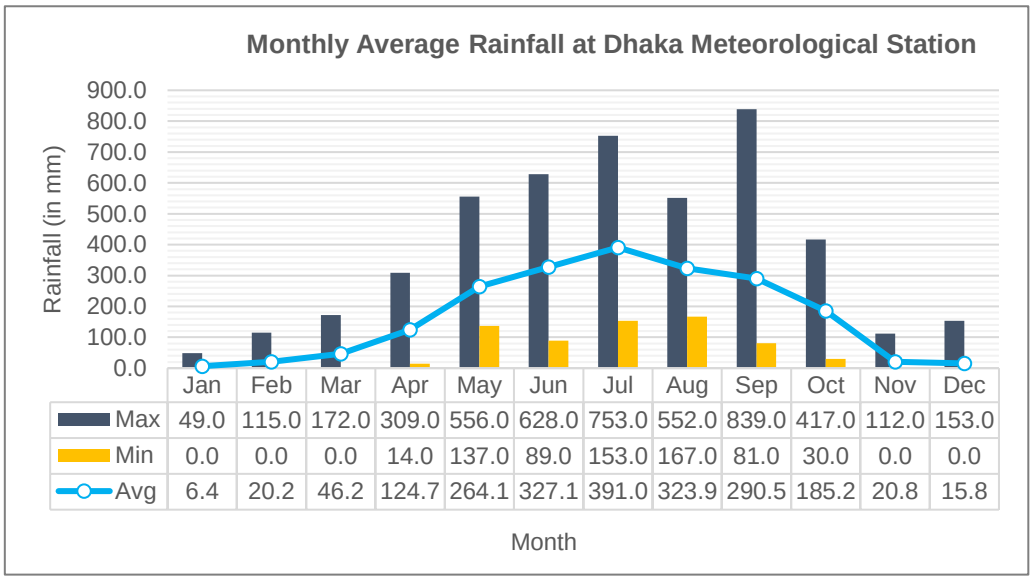
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	31.3	35.9	39.6	40.2	38.1	37.0	37.6	37.5	37.5	37.4	34.5	31.5
Min	6.5	9.0	13.2	16.6	17.9	21.5	21.5	22.5	21.5	18.0	13.3	9.6
Avg of Max	24.7	28.4	32.5	34.1	33.6	32.8	32.1	32.3	32.5	32.0	29.8	26.2
Avg of Min	13.4	16.7	21.2	24.1	25.0	26.3	26.4	26.5	26.1	24.2	19.6	15.3
Avg	18.5	22.2	26.6	28.7	29.0	29.2	28.9	29.1	28.8	27.6	24.1	20.0

Source: Bangladesh Meteorological Department (BMD)

5.2.1.2 Rainfall

The average annual rainfall based on rainfall data recorded at Dhaka Meteorological Station for the last 30 years (1992 to 2021) is 2016.0 mm. Annual rainfall shows considerable variability from year to year. The rainfall also varies considerably within a year (Figure 5-3) with 88.4% of rainfall occurring within the six months from April to October. The highest rainfall is recorded in September 2004 (839.0 mm). An insignificant amount of rainfall has also been recorded in winter (November to February).

Figure 5-3: Average of Total Monthly Rainfall in mm (1992 to 2021) at Dhaka Meteorological Station



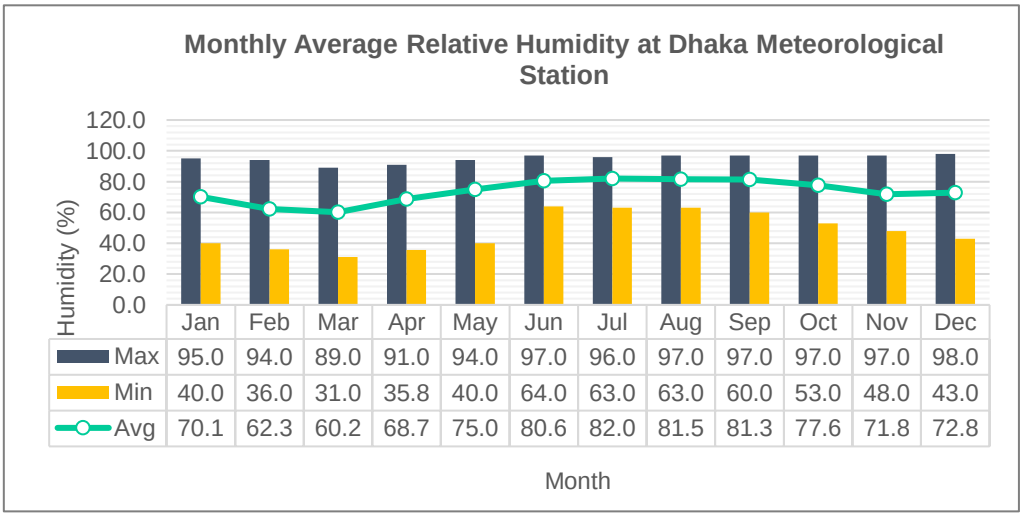
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	49.0	115.0	172.0	309.0	556.0	628.0	753.0	552.0	839.0	417.0	112.0	153.0
Min	0.0	0.0	0.0	14.0	137.0	89.0	153.0	167.0	81.0	30.0	0.0	0.0
Avg	6.4	20.2	46.2	124.7	264.1	327.1	391.0	323.9	290.5	185.2	20.8	15.8

Source: Bangladesh Meteorological Department (BMD)

5.2.1.3 Humidity

Due to the heavy rainfall and proximity to the Bay of Bengal, the humidity levels in Bangladesh remain high. Based on humidity data recorded at Dhaka Meteorological Station for the last 30 years (1992 to 2021), relative humidity in Dhaka Meteorological Station is generally above 68% throughout the year except in February and March. The monthly average relative humidity varies from 60.2% to 82.0% with average humidity at 73.7%. Humidity remains higher in the monsoon (June to September) season and comparatively lower in the winter season. The month of March is the driest with the relative humidity around 60%. The monthly average relative humidity at the Dhaka Meteorological Station is shown in Figure 5-4.

Figure 5-4: Average Monthly Relative Humidity in % (1992 to 2021) at Dhaka Meteorological Station



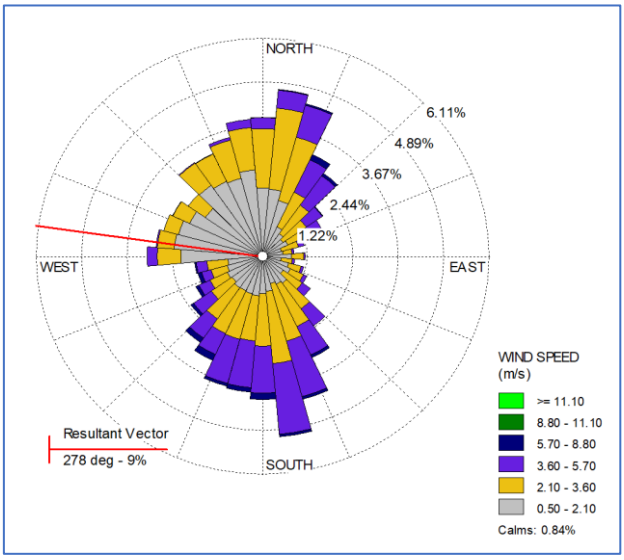
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	95.0	94.0	89.0	91.0	94.0	97.0	96.0	97.0	97.0	97.0	97.0	98.0
Min	40.0	36.0	31.0	35.8	40.0	64.0	63.0	63.0	60.0	53.0	48.0	43.0
Avg	70.1	62.3	60.2	68.7	75.0	80.6	82.0	81.5	81.3	77.6	71.8	72.8

Source: Bangladesh Meteorological Department (BMD)

5.2.1.4 Wind speed and direction

Like the country's wind characteristics, the region is characterized by the southerly wind from the Bay of Bengal during monsoon and northwesterly wind from the Himalayas during winter. As per BMD, the wind direction in Dhaka meteorological station is generally from West-North-West (WNW) to East-Southeast (ESE) direction. Average monthly wind speeds were also higher during March, June, and November with the maximum wind speed of 8.3/s recorded during March. The wind blows from south to north during monsoon. Annual wind direction distribution in (%) is shown in Figure 5-5.

Figure 5-5: Wind Direction Distribution in (%) at Dhaka Meteorological Station

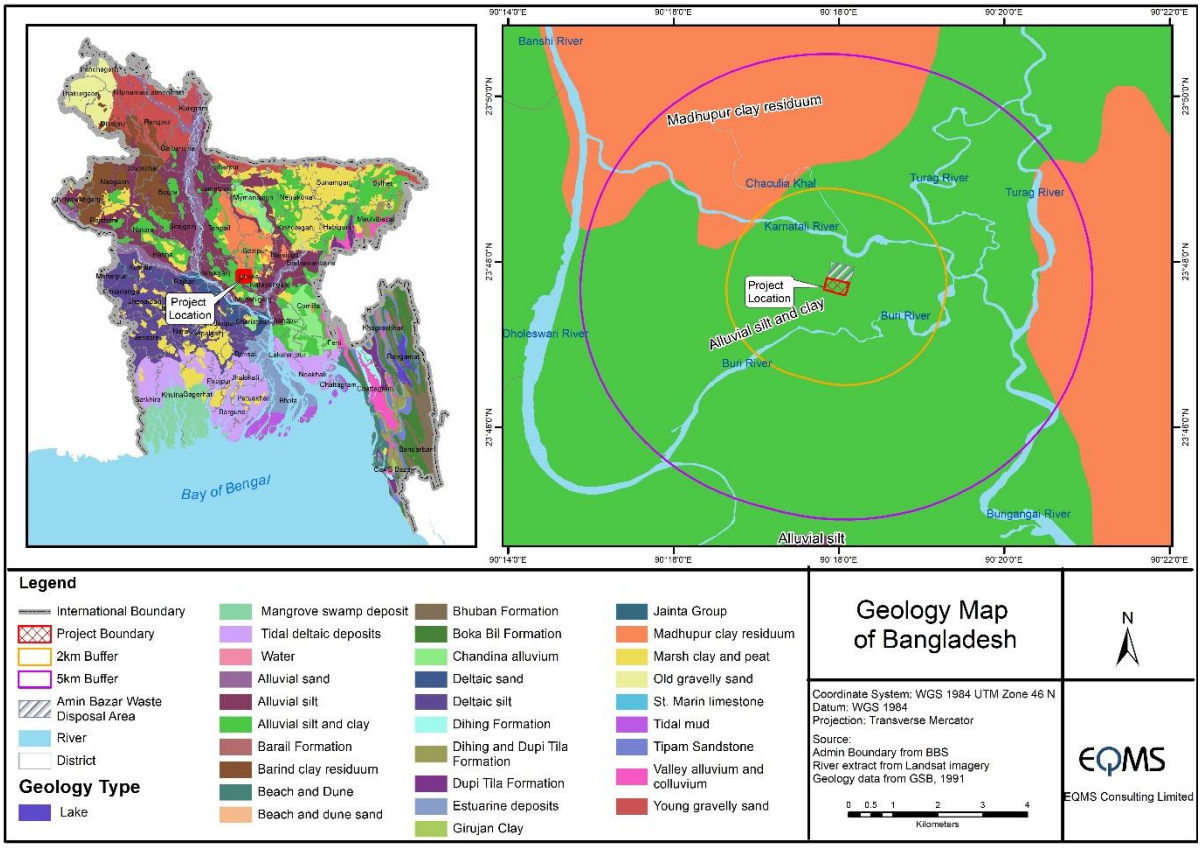


Source: Bangladesh Meteorological Department (BMD)

5.2.2 Geology

The geology profile of Bangladesh is reflective of the country's location, as Bangladesh is a riverine country. The geological evolution of Bangladesh is related to the uplift of the Himalayan mountains and the outbuilding of deltaic landmass by major River systems having their origin in the uplifted Himalayas. This geology is mostly characterized by the rapid subsidence and filling of a basin in which a huge thickness of deltaic sediments was deposited as a mega delta built out and progressed towards the south. The floodplains of the Ganges, the Brahmaputra (Jamuna) and the Meghna Rivers cover approximately 40% of Bangladesh. Geology map of Bangladesh indicating the project area is given in Figure 5-6.

Figure 5-6: Geology map of Bangladesh showing the project area



Source: Geological Survey of Bangladesh, 1991

Geology of the Project Area

The project area covers the geology type named Alluvial silt and clay. The geology of the Project area is shown in Figure 5-6.

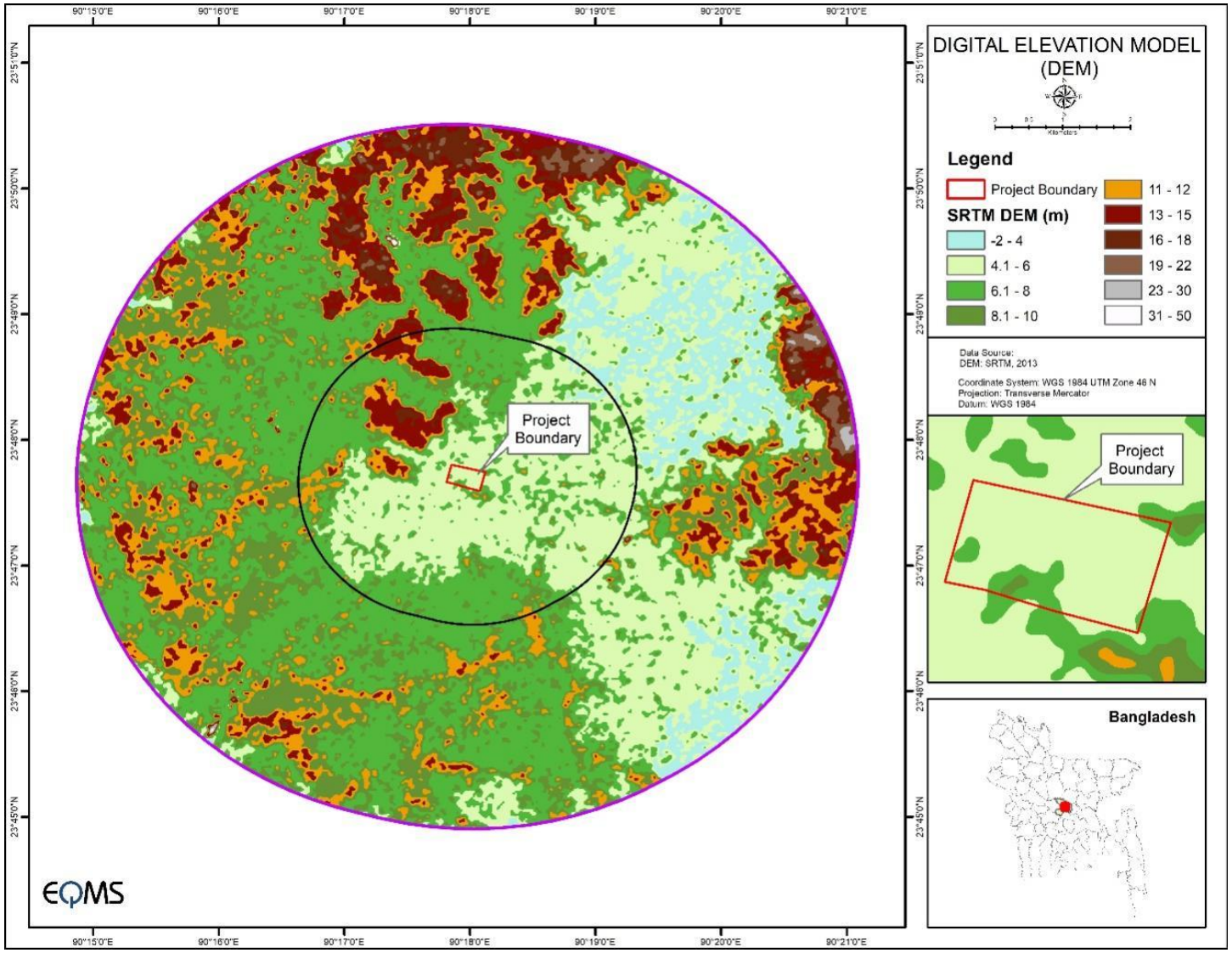
Alluvial silt and clay—Medium to dark-grey silt to clay; color is darker as the number of organic materials increases. Map unit is a combination of alluvial and paludal deposits; includes flood-basin silt, back swamp silty clay, and Organic-rich clay in Sag ponds and large depressions. Some depressions contain peat. Large areas underlain by this unit are dry only a few months of the year; the deeper part of depressions and bills (bhils) contain water throughout the year.

5.2.3 Topology

Elevation of the proposed project boundary: The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m.

Digital Elevation Model for 5km Study Area: According to DEM SRTM, 2013, the minimum and maximum spot height of the project area are 4.1 meters and 8 meters respectively. A digital elevation model (DEM) or 3-D representation of the terrain surface of the 5 km study area is shown with the height range in Figure 5-7. Contours of the study area are generated from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) relief maps. Topo sheets were not available for the study area and therefore all the relevant information was extracted from the Shuttle Radar Topography Mission (SRTM) DEM only. All the processing was done with the ARC GIS 10.1 software. The contour map derived from DEM shows that the topography of the 5 km study area is predominantly a high terrain with maximum elevation in the western part on the bank of the project area. The highest elevation levels are 50 m whereas the lowest is -2 m.

Figure 5-7: DEM of the project study area



Data Source: DEM, SRTM, 2013

5.2.4 Physiography

According to the Physiography of Bangladesh, the proposed project study area falls under the physiographic unit of “Madhupur Tract”.

Madhupur Tract Another Pleistocene upland block in the Bengal Basin is located in the central part of Bangladesh comprising greater Dhaka and Mymensingh districts, between the courses of the Old Brahmaputra and the Jamuna rivers. Towards the south, this physiographic sub-region extends as far as Dhaka, the capital of the country. Madhupur Tract measures about 4,105 sq km. Comparable to the Barind Tract, the area belongs to a Pleistocene terrace consisting mainly of red-colored and mottled clays. It is characterized by plateau-like hillocks varying in height from 9 to 18.5m, and a dendritic drainage pattern, typical of all Pleistocene terraces in Bangladesh. The valleys, mostly flat, are cultivated. The Madhupur jungle contains Shal trees (Shorea robusta), the hardwood which is second to teak in value. The physiography of the proposed bridge area is given in Figure 5-8.

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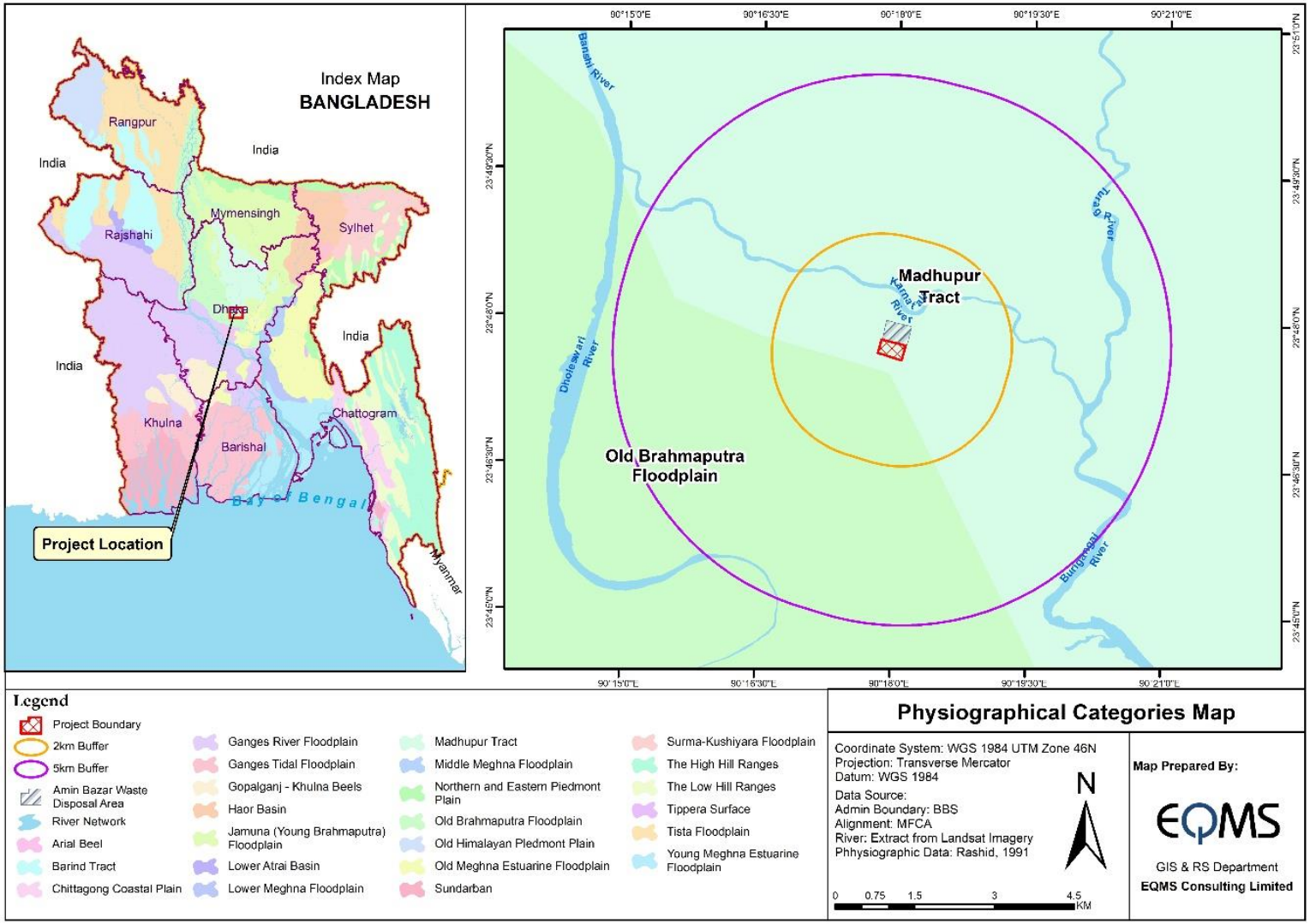
Figure 5-8: Physiography Map of Bangladesh Showing the Project Area



Source: Soil Resource Development Institute (SRDI), 1997; Rashid 1991, Reimann, 1933

5.2.5 Geomorphology

The proposed project study area falls under the geomorphic unit- “Flood Plains”.

Flood Plains- The flood plains of the Ganges, the Atrai, the Brahmaputra-Jamuna, the Old Brahmaputra, and the Meghna rivers cover approximately 40% of Bangladesh. The elevation of the major part of the floodplain ranges from 3 to 5 meters. The floodplain covers the central, north, and northeastern parts of the country. The Brahmaputra-Jamuna Flood Plain is located between the Barind and Madhupur Tracts. The elevation of this surface is 29 m in the north and about 6 m in the south. In 1887, a remarkable change in the course of the Brahmaputra took place. In that year, the river shifted from a course around the eastern edge to the western side of the Madhupur Tract and changed from a meandering river to a braided river. The Old Brahmaputra degenerated into a small seasonal channel and rarely spills over the previously built-up levees. The Ganges Flood Plain extends from the western border of the country, south of the Barind Tract, as far east where it merges with the Jamuna Flood Plain. The Meghna Flood Plain merges with the southern part of the Old Brahmaputra Flood Plain in the northwest and with the Sylhet Depression in the north. Landform of the floodplain is characterized by natural levees distributed in a mottled pattern which forms shallow depressions and small ridges. The maximum height of the levees is 30 m above sea level. There are numerous small depressions (beels/haors) in the flood plain. The level of the rivers gently slopes towards these depressions. Silty clay, clay, and sandy silt with local peat beds are the major constituents of the floodplain area. The geomorphology of the proposed bridge area is given in Figure 5-9.

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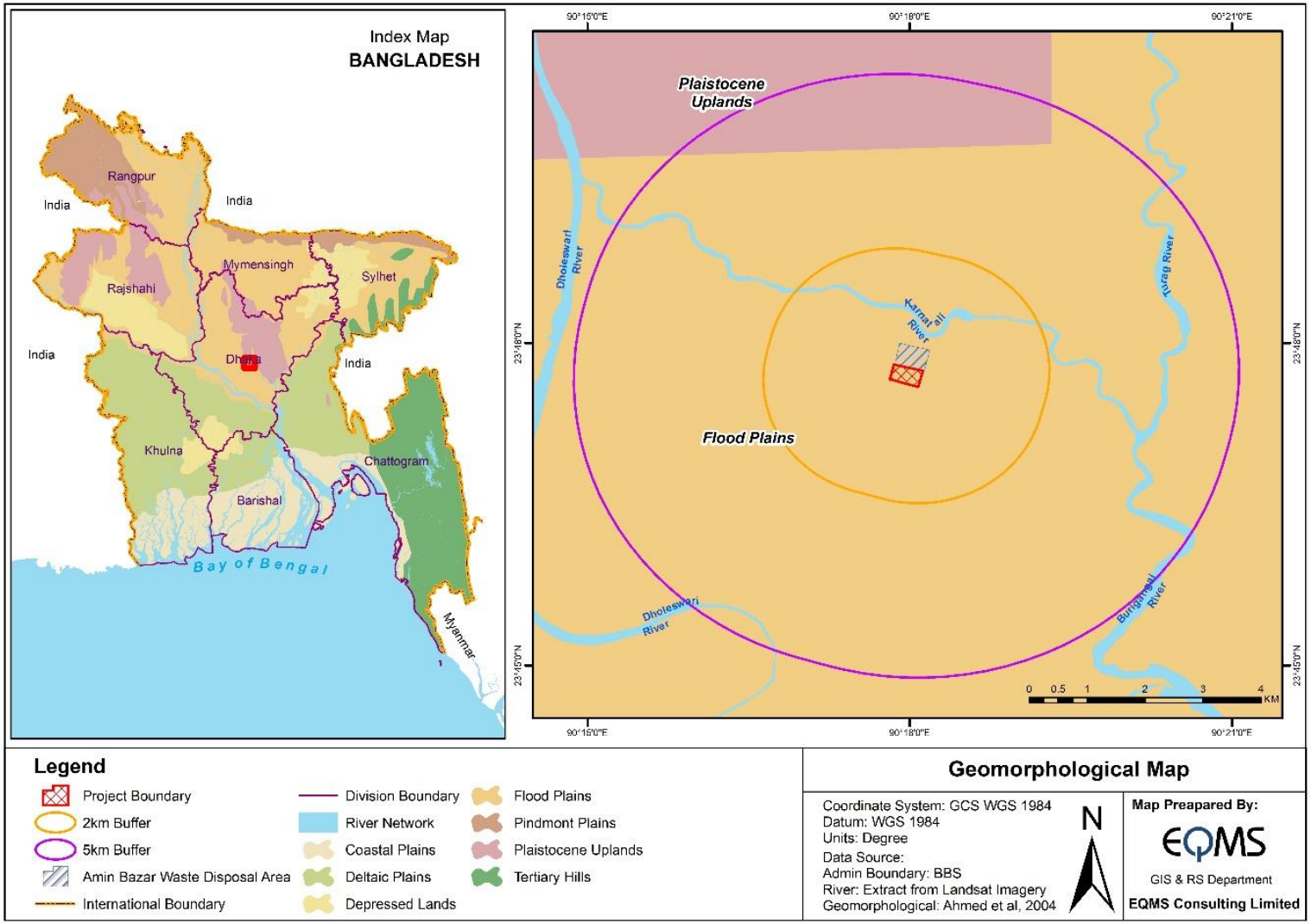
Figure 5-9: Geomorphology Map of Bangladesh Showing the Project Area



Source: Ahmed et al., 2004

5.2.5.1 Soil Texture

A major part of Bangladesh is on the delta formed by the three major rivers Brahmaputra, Ganges, and Meghna. Bangladesh soil map with the project site is shown in Figure 5-10.

. Jamuna Karatoya Bengali and Lakhya Floodplain are the soil types of the project area. Non-calcareous Alluvium Similar to calcareous alluvium, except they are non-calcareous in soil profiles. These soils occupy extensive areas on the active Tista and Brahmaputra-Jamuna floodplains. They are sandy or silty, grey, or olive, neutral to slightly alkaline. Most of these soils have been included as Eutric Fluvisols.

Jamuna Karatoya Bengali Floodplain

- Formed by the deposition of sediments from the Jamuna, Karatoya, and Bengali rivers.
- Typically sandy or silty in texture.
- Grey or olive in color.
- Neutral to slightly alkaline pH.

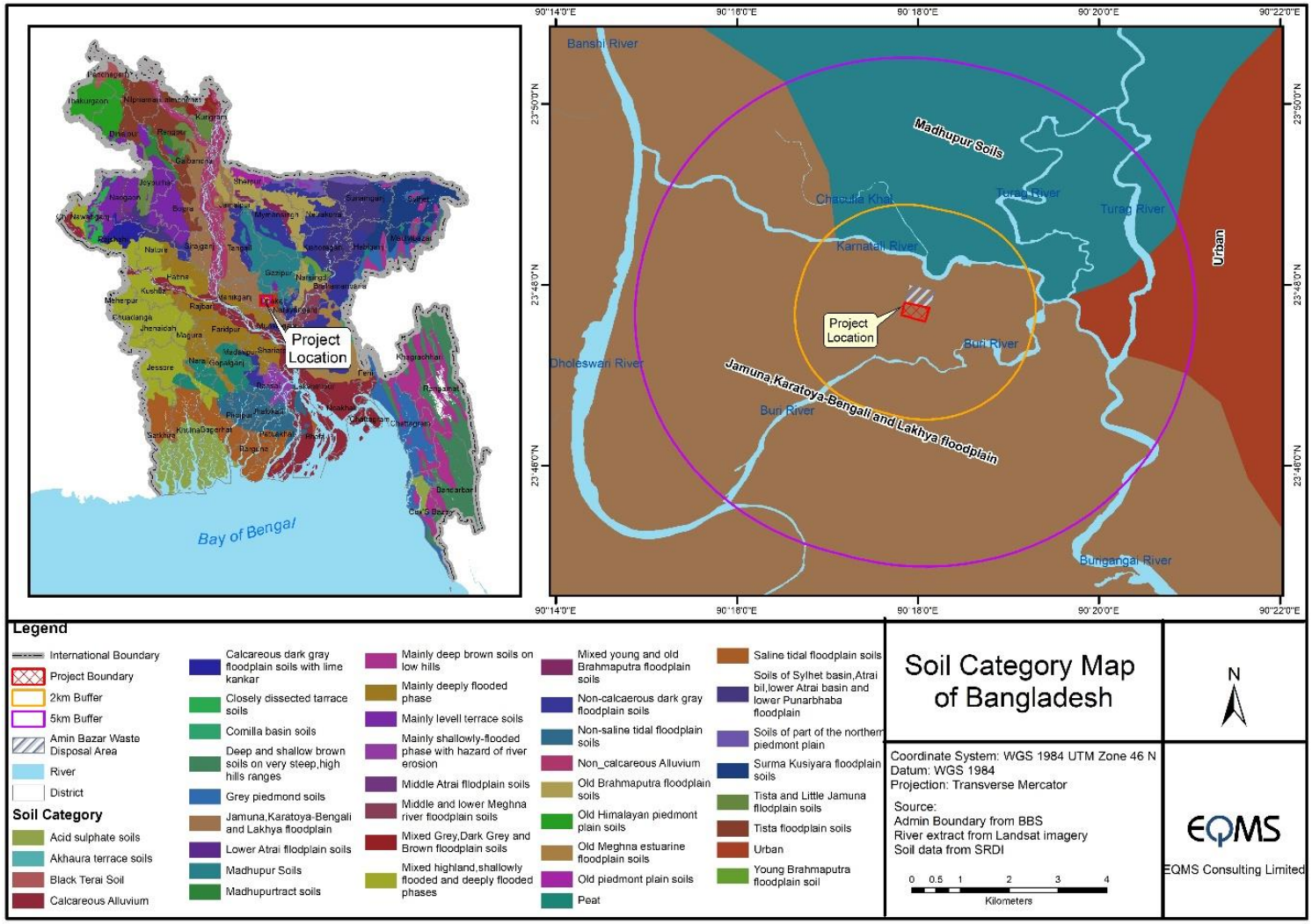
Lakhya Floodplain

- Formed by the deposition of sediments from the Lakhya river.
- Similar in texture and color to the Jamuna Karatoya Bengali Floodplain.
- Also neutral to slightly alkaline in pH.

Non-calcareous Alluvium

- Similar to calcareous alluvium, but lacking calcium carbonate in the soil profile.
- Covers extensive areas on the active floodplains of the Tista and Brahmaputra-Jamuna rivers.
- Sandy or silty in texture, grey or olive in color.
- Neutral to slightly alkaline pH.
- Classified as Eutric Fluvisols, a type of soil formed in floodplains with high fine particle content and neutral to slightly alkaline pH.

Figure 5-10: Soil map of Bangladesh showing the project area



Source: Soil Resource Development Institute (SRDI)

5.2.5.2 Land use

The proposed project area is nonagricultural land (fallow land). Land use/cover inventories are an essential component in land resource evaluation and environmental studies due to the changing nature of land use patterns. The land use study for the proposed project and its 5 km buffer was undertaken with the following objectives:

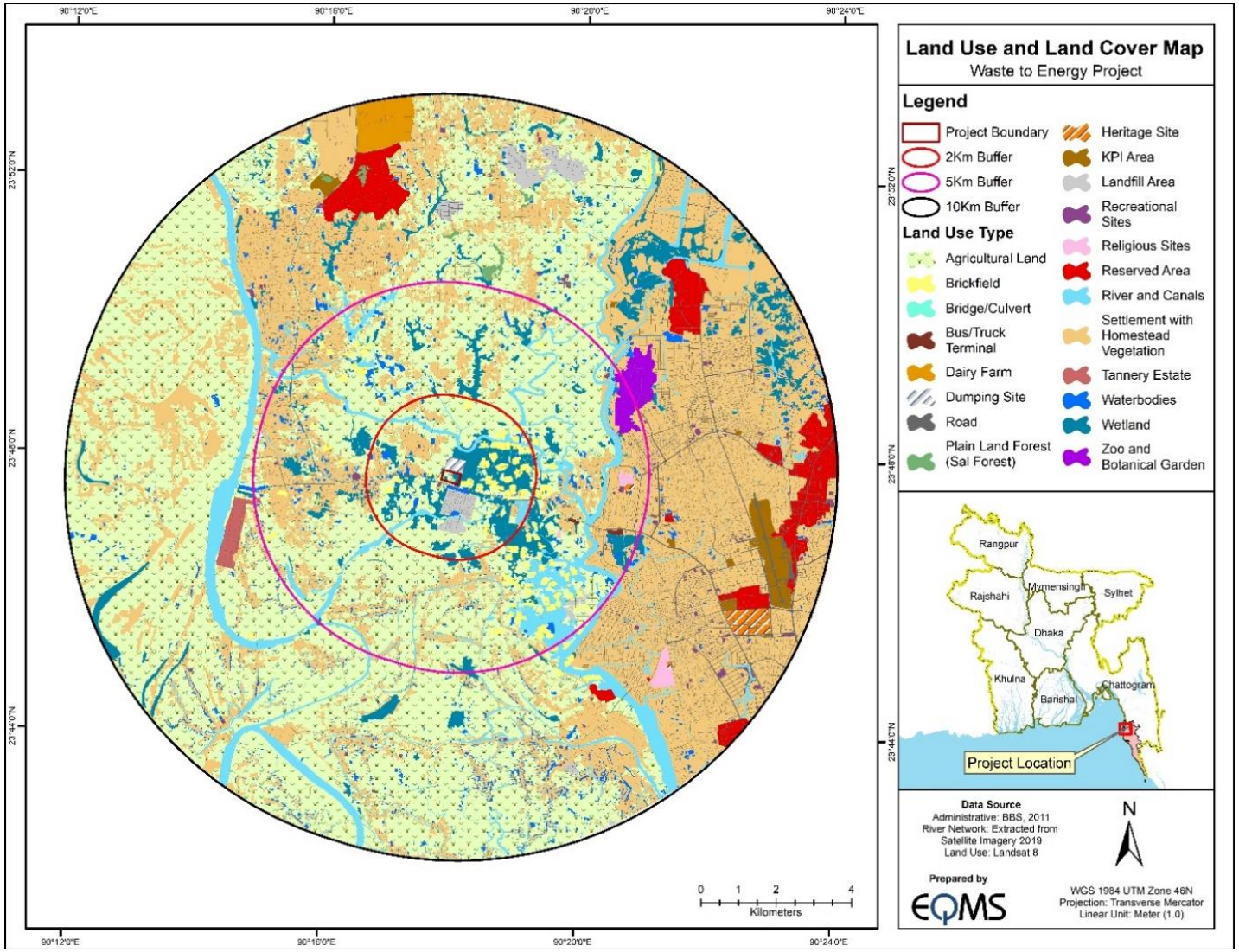
- To study the land use/cover in the 5 km radius areas of the proposed project site and provide inputs for environmental planning of the proposed project by analyzing the existing land use/land cover scenario.
- To establish the existing baseline scenario using a GIS database for incorporation of thematic information on the different physical features including Built-up, Open Land, Vegetation, Waterbodies, etc.

The evaluation of the existing environmental status of the study area was considered 5 km. Table 5-1 shows the existing land use composition around 5 km of the project study area. The evaluation of the existing land use pattern of the study area was considered 5 km where Agricultural land dominates the landscape, constituting 51.012% of the total area, followed by settlement areas with homestead vegetation at 21.838%. Notably, significant portions of land are allocated to rivers and canals (8.092%), wetlands (8.569%), and water bodies (2.697%), indicating the presence of natural features crucial for ecological balance. Other land use categories include brickfields (3.198%), roads (2.151%), and recreational sites (0.183%), contributing to infrastructure and leisure activities. Relatively smaller areas are dedicated to cultural sites, religious sites, and zoo and botanical gardens, highlighting cultural and recreational amenities. Dumping sites and landfill areas represent essential facilities for waste management, while bus/truck terminals facilitate transportation logistics. The data underscores a diverse landscape with a mix of natural, agricultural, residential, and infrastructure elements, emphasizing the need for balanced development and sustainable land management practices to preserve ecological integrity and meet societal needs. Table 5-13 gives the Land use/Land cover map showing the land use pattern within 5 km of the study area.

Table 5-1: Existing Land Use Composition around 5 km of the Project Area

Land Use Type	Area in Acres	Percentage
Agricultural Land	10851.050	51.012
Brickfield	680.335	3.198
Bridge/Culvert	1.256	0.006
Bus/Truck Terminal	18.876	0.089
Dumping Site	41.866	0.197
Cultural Site	10.503	0.049
Landfill Area	209.932	0.987
Recreational Sites	39.004	0.183
Religious Sites	43.815	0.206
River and Canals	1721.268	8.092
Road	457.479	2.151
Settlement with Homestead Vegetation	4645.163	21.838
Tannery Estate	4.489	0.021
Waterbodies	573.630	2.697
Wetland	1822.694	8.569
Zoo and Botanical Garden	150.082	0.706
Total	**21271.44076**	**100**

Figure 5-11: Land use map of the Study Area



Source: Google earth image analysis

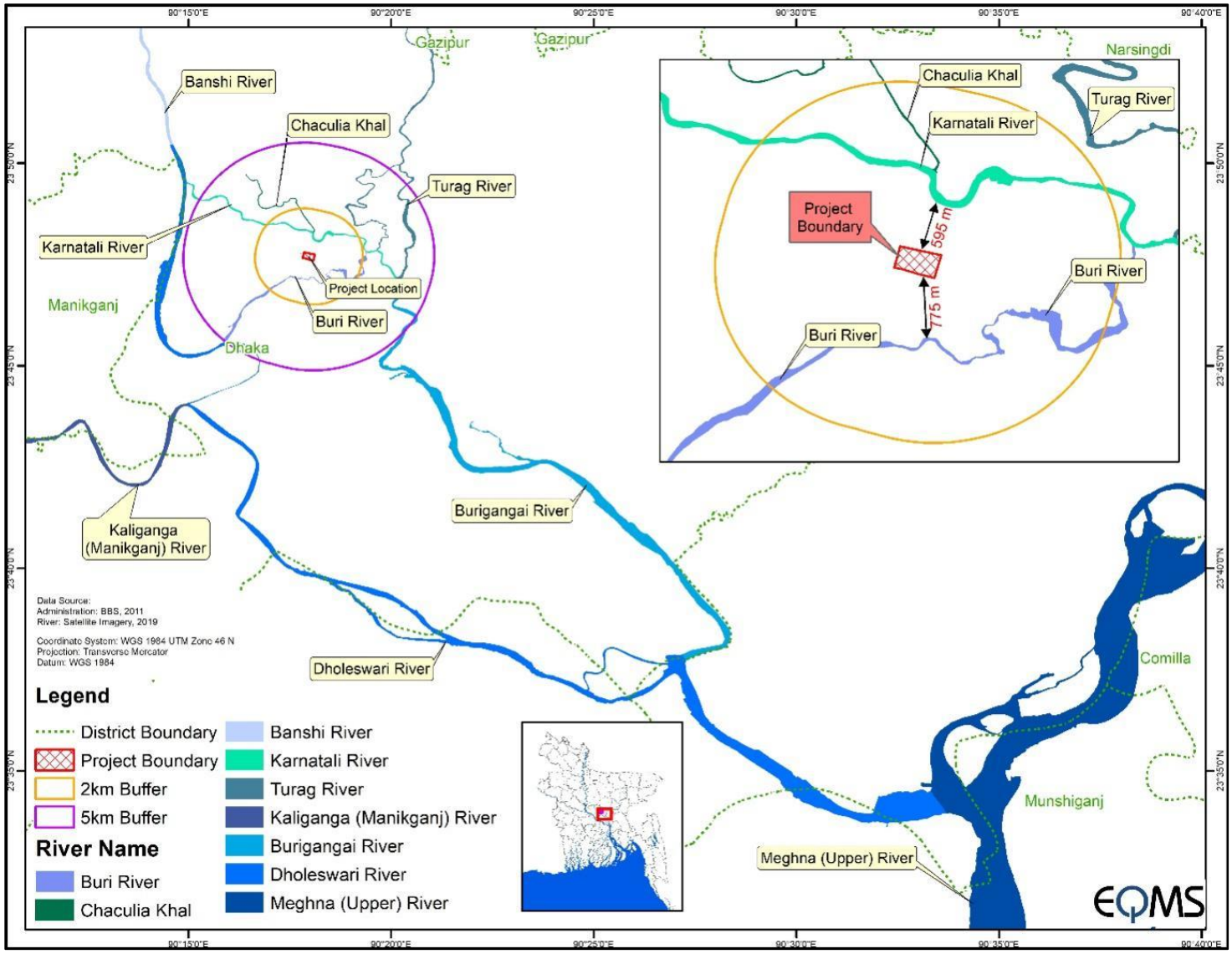
5.2.6 Hydrology & Natural Drainage System

The Karnatali, Buri, and Turag are the major rivers that flow through Amin Bazar and are close to the project area. The Karnatali River about 600m north of the proposed plant site has a large water volume, with a minimum monthly water supply of 0.48m^3/s and a minimum water level of 0.86m (which can meet the water demand of the project), which can also be considered as the water source of this project. Figure 5-12 shows major rivers and water bodies around the project area.

Dhaka's drainage system is a complex network of natural and man-made channels essential for managing the city's substantial rainfall runoff. It comprises 40 khals, with Dhaka West having 13 canals totaling over 31 kilometers and Dhaka East with 27 canals spanning about 60 kilometers. These canals, connected to surrounding rivers like the Buriganga, Sitalakkhya, Balu, and Turag, drain approximately 80% of the city's area. The system also includes numerous water storage areas such as lakes and low-lying lands, which act as retention zones to mitigate flooding.

The Turag River flows in a southerly direction through Amin Bazar, originating in the north and eventually joining the Buriganga River to the south of Dhaka. Its catchment area, estimated to be around 40-50 square kilometers, includes areas to the north and northwest of Dhaka, collecting rainfall runoff and drainage from a significant portion of the greater Dhaka region. The Karnatali River and Turag River are connected through a network of canals and drainage channels in Dhaka, with the Karnatali River flowing into the Turag River, which eventually joins the Buriganga River. This connection enables the effective drainage of rainfall runoff and excess water from the city, as the rivers work together to manage water flow and prevent waterlogging and flooding in the city.

Figure 5-12: Hydrology map around the project area

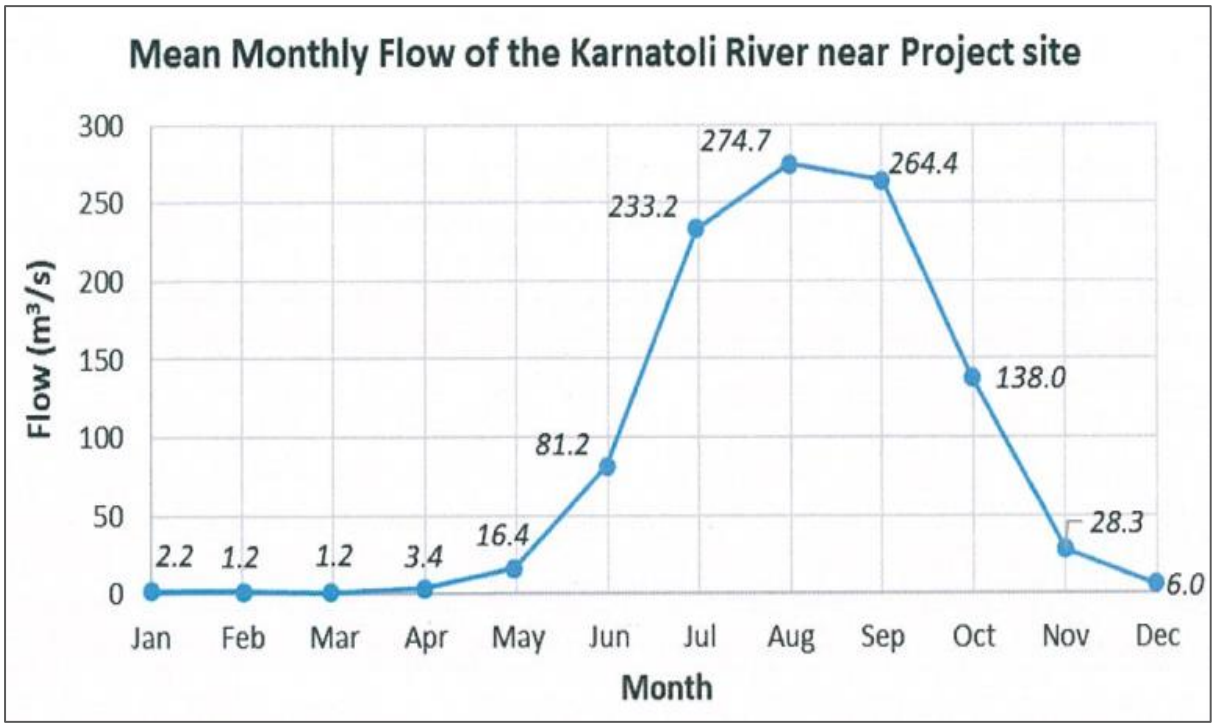


5.2.7 Surface Water Availability Assessment

The Karnatali River was identified as the proximate surface water sources, and their water availability was assessed through flow modeling and environmental flow requirements during both the dry and monsoon seasons. The surface water availability for this river was expressed in terms of monthly average and dependable flows. The Weibull formula was employed for the estimation of dependable flow for each month.

Based on the last 30-years data analysis, mean monthly flow ranges 1.2 – 3.4 m^3/s from January to April, 16.4 – 81.2 m^3/s from May to June, 233.2-138.0 m^3/s from July to October and 28.3 – 6.0 m^3/s November to December. Monsoon season environmental flow has been found to be minimum 59,040 m^3/hr. and in the dry season flow rates have been found to be minimum 4,320 m^3/hr., which meets the requirement of both environmental and industrial water usage of the study area.

Figure 5-13: Mean Monthly Flow of the Karnatali River near Project Site



The monthly average flow of the Karnatali River has presented in the Figure 5-13. Based on the water demand of the Waste-to-Energy (WtE) project, only 8% (of total water flow 4,320 m^3/hr) of the environmental flow will be abstracted from the surface water sources during worse month (February and March) of dry season, thus no significant impact on the flow of the river. However, enhancing storage capacity from monsoon season, continuous monitoring of the water quality and flow rates, adaptive and conservation measurements will bring sustainable management of the water resource systems of the WtE project in the study area.

5.2.8 Ground Water Availability Assessment

Some groundwater monitoring stations have been studied for the WtE project. The borewells were located near the project site area. Last 10-years borewell data have been studied to understand the groundwater level fluctuation of the study area. Long term hydrographs showed a gradual declination of groundwater levels near the study area.

The groundwater borewell station (ID: GT 2648010) was located near the study area (referred to previous groundwater assessment by CEGIS, March 2022). Based on the borewell data study, groundwater levels have been found to be a decline trend. Groundwater levels have declined up to 7m

from the base year 2013 to 2020. A significant lowering of groundwater level was also noticed towards the project area as shown in the Figure 5-15.

Figure 5-14: WTE Project Area and the Nearby Groundwater well locations for examination

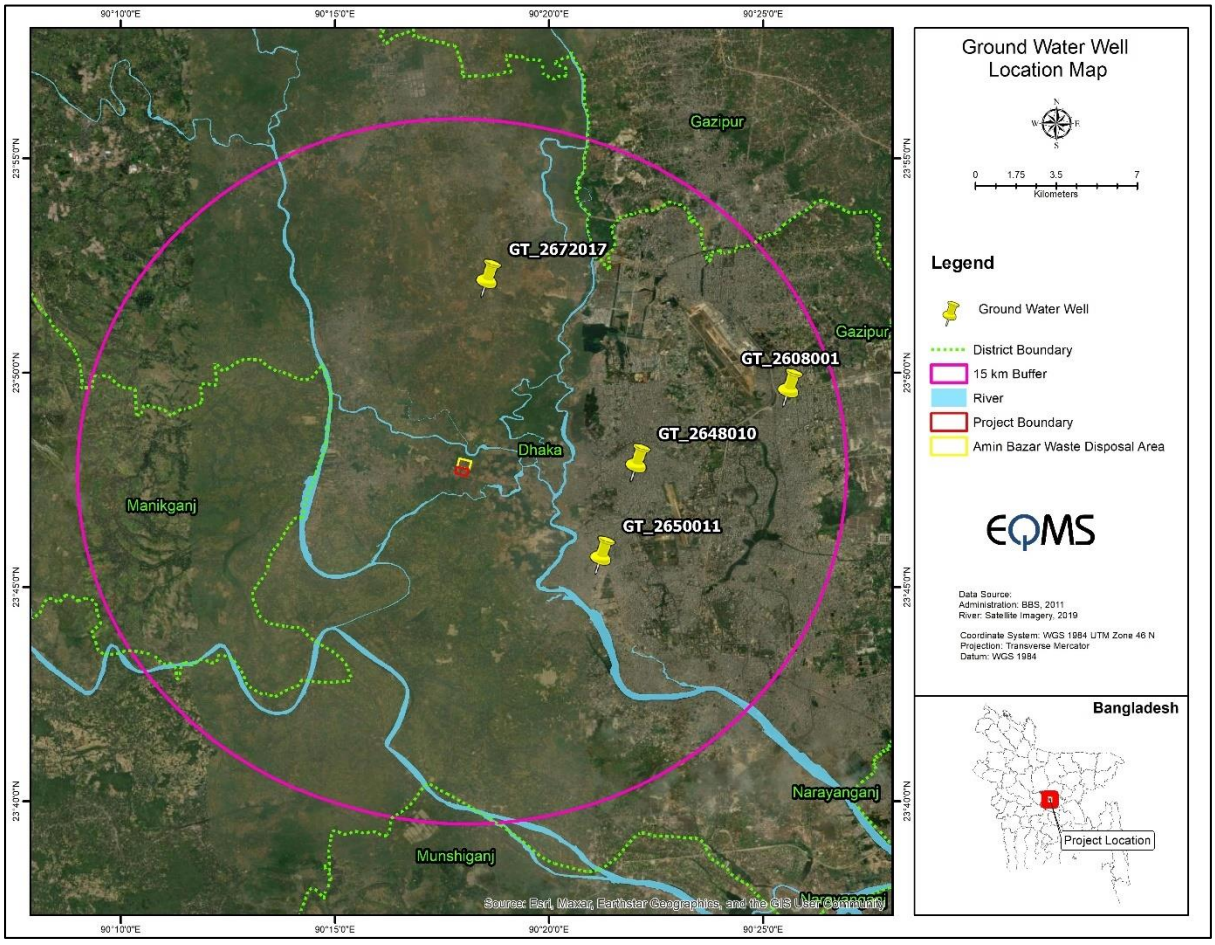
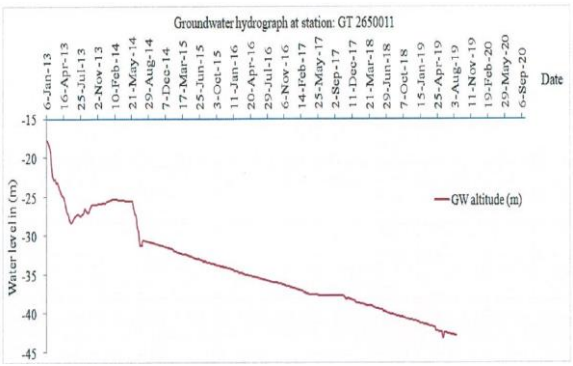
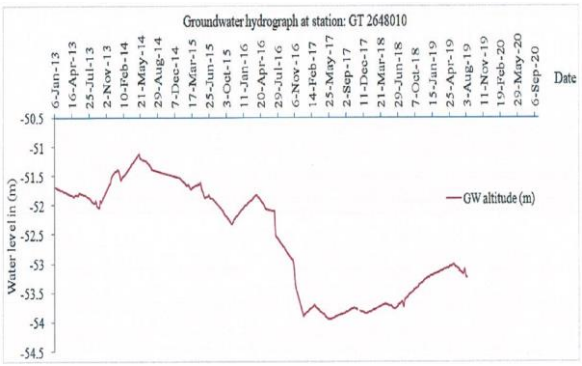
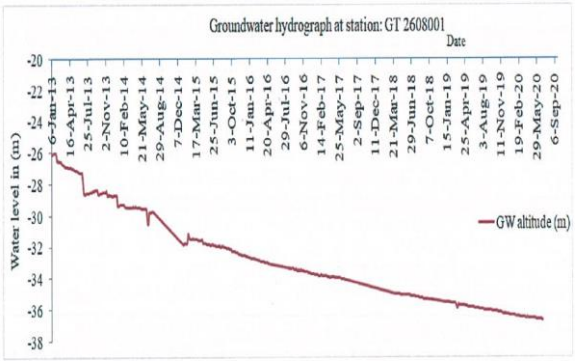
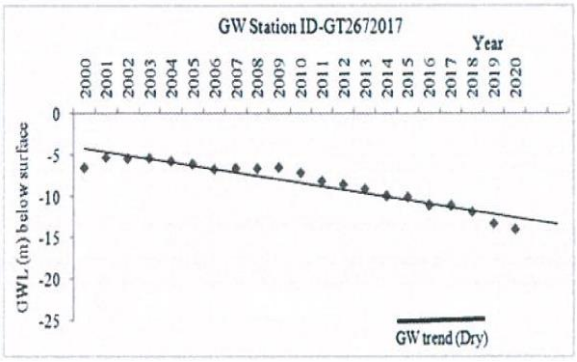


Figure 5-15: Declining groundwater hydrograph at different well site locations



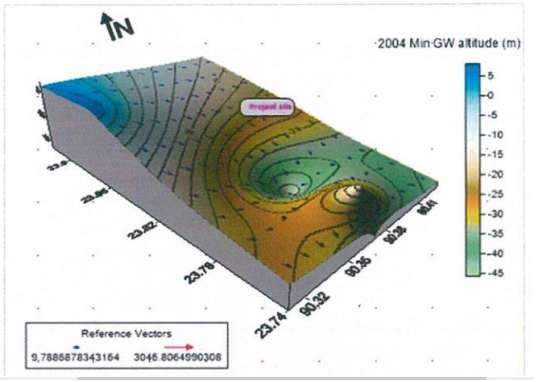




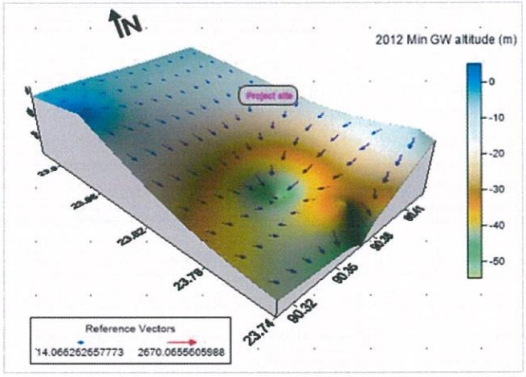


Based on some observations, sustainable groundwater yield has been found to be 568 m3/day (maximum allowable drawdown 1m at T= 1,350), and 2,840 m3/day (maximum allowable drawdown 5m at T= 1,350).

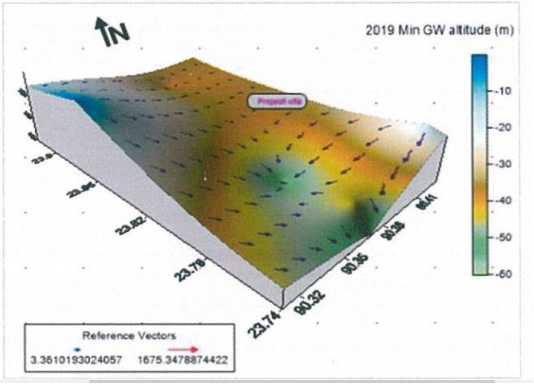
Groundwater fluctuation varies near the project area according to the study (CEGIS, 2022). From 2004 to 2012 and 2019, where a significant lowering of the groundwater levels has been found for the project area as shown in the below figure.



Groundwater level lowering in 2004



Groundwater level lowering in 2012



Groundwater level lowering in 2019

Groundwater Recharge and Impacts

The isotopic analysis of groundwater flow within the study area revealed that the groundwater is hydraulically connected to the base flow of the Dhaleshwari River, located approximately 14 kilometers upstream from the Waste-to-Energy (WtE) project area. Furthermore, the analysis indicated that the groundwater within the project area is being recharged from the base flow of the Dhaleshwari River. Annual groundwater recharge has been found 250-300mm/year which is not sufficient for any heavy

industry abstraction-recharge ratio, thus imply on the groundwater impacts on the nearby societal and environmental demands.

Recommendations

- Direct hydrogeologic investigations have been recommended to understand the present groundwater actual conditions in terms of water quality and specific yielding capacity at different pressure levels.
- As the groundwater level has been curtailed, artificial and natural groundwater recharge zone connected to the project area's aquifer have been recommended. Further detailed study and periodic monitoring has also been recommended.

5.3 Natural Disasters

5.3.1 Earthquake and seismic activity

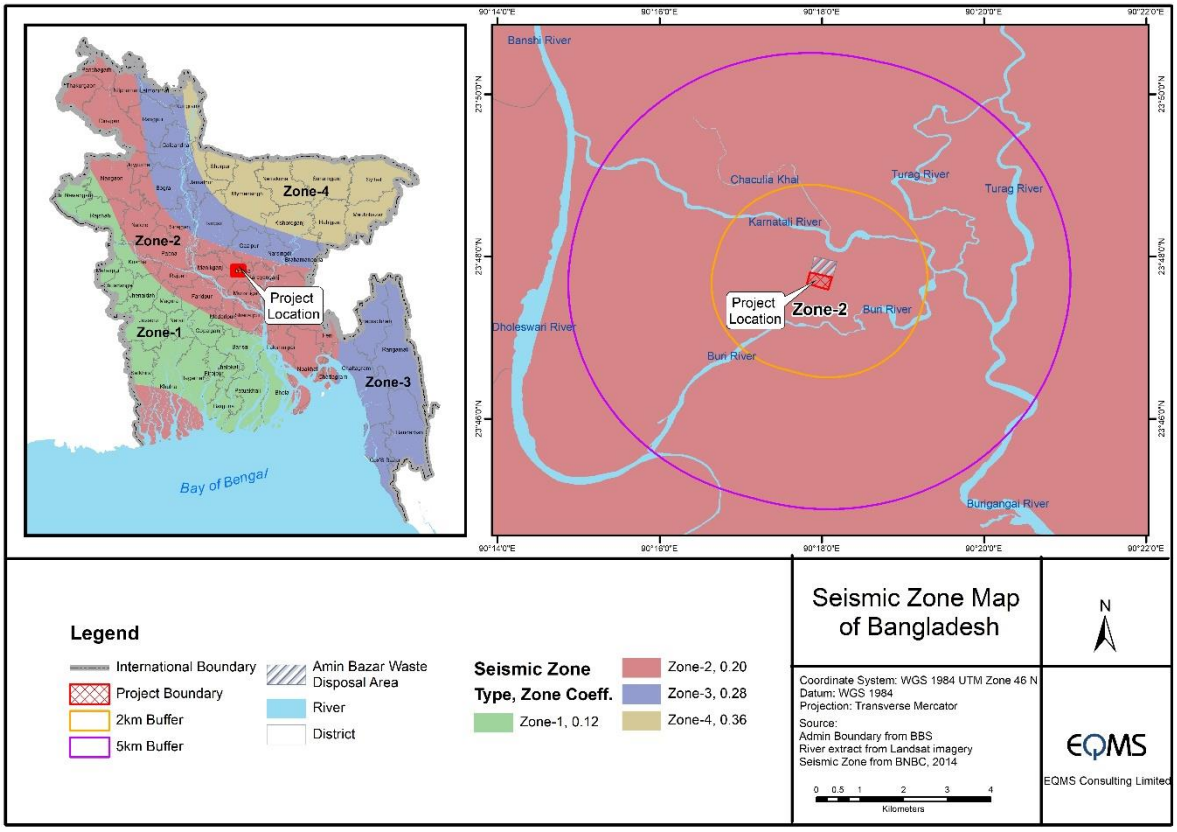
Bangladesh can be affected by moderate to strong earthquake events due to its proximity to the collision boundary of the Northeast moving Indian plate and Eurasian Plate. Strong historical earthquakes with magnitude greater than 7.0 have affected parts of Bangladesh in the last 150 years, some of them had their epicenters within the country. The seismic distribution in Bangladesh is shown in Figure 5-16. As per the Seismic Zoning Map of Bangladesh, the county is divided into four seismic zones. Description of seismic zones of Bangladesh is given in Table 5-2.

Table 5-2: Description of Seismic Zones of Bangladesh

Seismic Zone	Location	Seismic Intensity	Seismic Zone Coefficient, Z
1	Southwestern part including Barisal, Khulna, Jessore, Rajshahi	Low	0.12
2	Lower Central and Northwestern part including Noakhali, Dhaka, Pabna, Dinajpur, as well as Southwestern corner including Sundarbans	Moderate	0.20
3	Upper Central and Northwestern part including Brahmanbaria, Sirajganj, Rangpur	Severe	0.28
4	Northeastern part including Sylhet, Mymensingh, Kurigram	Very Severe	0.36

Source: Bangladesh National Building Code (BNBC), 2020

Figure 5-16: Map showing Seismic Zoning map of Bangladesh with project area



Data source: Bangladesh National Building Code (BNBC), 2020

The Project site falls in the Zone–II area, with a basic seismic coefficient of 0.5g and at low risk of earthquakes. No major earthquake has been reported in the project area in recent years or in the recent past.

Earthquakes in Bangladesh are frequent and often cause damage. The earthquakes occur due to a convergent boundary between the Indian Plate and the Eurasian Plate.

Table 5-3: Historical List of Major Earthquake in Bangladesh

Date	Region	Mag.	Deaths	Injuries	Comments
2023-12-02	Chittagong	5.5 M_w	0	200+	Minor damage
2021-11-26	Chittagong	6.2 M_w	0	5	Slight damage
2012-03-18	Dhaka	4.5 M_w	0	0	
2010-09-10	Chittagong	5.1 M_w	0	0	Slight damage
2008-07-26	Dhaka	4.8 M_w	0	25	
2007-11-07	Chittagong	5.5 M_w	0	10	Minor damage
2003-07-27		5.5 mb	0	0	Additional damage
		4.3 mb	0	0	Additional damage
2003-07-26		5.7 M_w	2	25	Moderate damage
2002-06-20	Rangpur	4.5 M_w	0	55	Minor damage
2001-12-19	Dhaka	4.5 M_w	0	100	Minor damage
1999-07-22	Maheshkhali Island	5.2 M_w	6	200+	Moderate damage

Date	Region	Mag.	Deaths	Injuries	Comments
1997-11-21	Chittagong	6.1 M_w	23	200	Minor damage
1989-06-12	Khulna	5.8 M_w	1	100	Minor damage
1988-02-06	Sylhet	5.9 M_w	2	100	Moderate damage
1918-07-08	Kishoreganj	7.2 M_w	0	0	Some damage

Source: Live8[12]

5.3.2 Cyclone and Storm Surges

Devastating cyclones hit the coastal areas of Bangladesh almost every year usually accompanied by high-speed winds, sometimes reaching 250 km/hr. or more and 3-10m high waves, causing extensive damage to life, property, and livestock. Because of the funnel-shaped coast, Bangladesh repeatedly becomes the landing ground of cyclones formed in the Bay of Bengal. The project area is not prone to cyclones. These cyclones occur in two seasons, April-May, and October-November – i.e., before and after the monsoon.

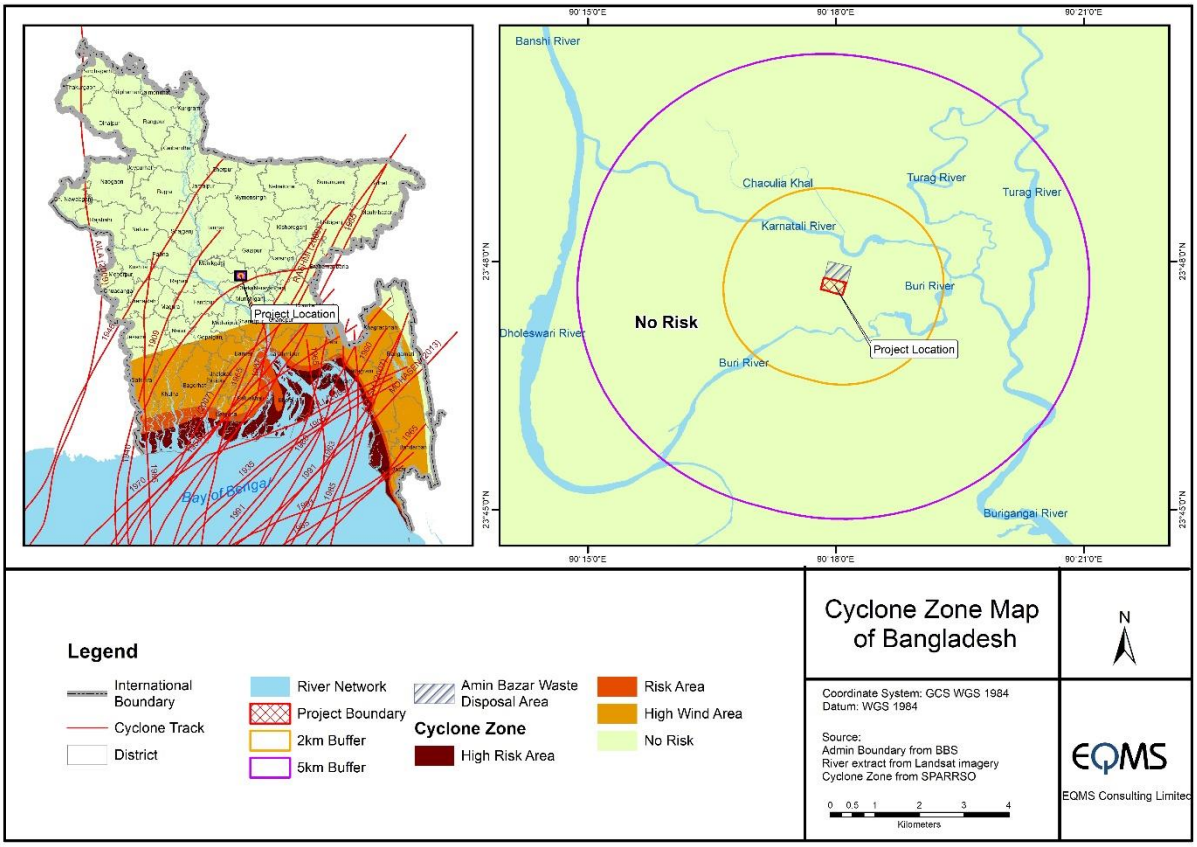
Cyclones in Bangladesh are presently classified according to their intensity and the following nomenclature is in use:

- Depression (winds up to 62 km/hr.).
- Cyclonic storm (winds from 63 to 87 km/hr.).
- Severe cyclonic storm (winds from 88 to 118 km/hr.); and
- Very severe cyclonic storm of hurricane intensity (winds above 118 km/hr.).

Cyclone-affected areas in Bangladesh has been shown in Figure 5-17. The project area lies under no risk of the cyclone area of Bangladesh.

[12] https://live8.bmd.gov.bd/p/Historical-Cyclones/

Figure 5-17: Map showing cyclonic storm tracks of Bangladesh with project area



Source: Bangladesh Meteorological Department (BMD)

Table 5-4: Historical List of Major Cyclone in Bangladesh

Date	Cyclone Information
13–15 August 1974	A cyclonic storm hit Khulna. Maximum wind speed reached 80.5 km/h. Casualty:600 people.
24–28 November 1974	A cyclone struck the coastal areas near Cox's Bazar and Chittagong, including the offshore islands. Maximum wind speed reached 161 km/h. The storm surge was up to 2.8–5.2 m. Casualty: 200 people, 1000 cattle. Damages: 2,300 houses destroyed.
9–12 May 1975:	A strong cyclone pummeled Bhola, Cox's Bazar and Khulna. Maximum wind speed was 96.5 to 112.6 km/h. Casualty: 5 people.
9–12 May 1977	Khulna, Noakhali, Patuakhali, Barisal, Chittagong and offshore islands were hit by a cyclone. Maximum wind speed was up to 112.63 km/h.
14–15 October 1983	A strong cyclone hit the coastal islands and chars near Chittagong and Noakhali. Maximum wind speed reached 122 km/h: Casualty: 43 people. 6 fishing boats and a trawler lost, more than 150 fishermen and 100 fishing boats went missing Damages: 20% of the aman rice crops in the affected regions were destroyed.
5–9 November 1983	A cyclone hit Chittagong, Cox's Bazar coast near Kutubdia, St Martin's Island, Teknaf, Ukhia, Moipong, Sonadia, Barisal, Patuakhali and Noakhali. The maximum wind speed reached 136 km/h. The storm surge was 1.52 m. Casualty:300 fishermen with 50 boats missing. Damages:2,000 houses destroyed.
24–25 May 1985	A severe cyclone hit Chittagong, Cox's Bazar, Noakhali and coastal islands (Sandwip, Hatiya, and Urirchar). Maximum wind speed at Chittagong was 154 km/h, at Sandwip was 140 km/h, at Cox's Bazar was 100 km/h. The storm

Date	Cyclone Information
	surge reached a height of 3.0–4.6 m. Casualty:11,069 people, 135,033 cattle. Damages: 94,379 houses and 74 km of road, and embankments destroyed.
8–9 November 1986	A severe cyclonic storm hit the coastal island and chars near Chittagong, Barisal, Patuakhali and Noakhali. Maximum windspeed was 110 km/h at Chittagong and 90 km/h at Khulna. Casualty: 14 people. Damages: 972 km2 of paddy fields were inundated; Schools, mosques, warehouses, hospitals, houses and buildings were destroyed at Amtali upazila in Barguna District.
24–30 November 1988	A severe cyclonic storm Cyclone 04B struck Jessore, Kushtia, Faridpur and coastal islands of Barisal and Khulna. The maximum windspeed was 162 km/h. The storm was accompanied by a storm surge of 4.5 m at Mongla Port. Casualty: 5,708 people, and numerous wild animals at The Sundarbans (deer 15,000, royal Bengal tiger 9), cattle 65,000. Total damage to crops reached Taka 9.41 billion.
18 December 1990	The remnant tropical depression of Severe Cyclonic Storm BOB 09/04B made landfall on 18 December near Cox's Bazar, however, there were no reports of any impact in association with the system.[10][11]
29–30 April 1991	The 1991 Bangladesh cyclone hit Bangladesh late 29 April night. The storm originated in the Indian Ocean and reached the Bay of Bengal coast after 20 days. The diameter of the storm was close to 600 km. The maximum wind speed (observed at Sandwip) reached 225 km/h. At other places, the maximum wind speed was reported as follows: Chittagong 160 km/h, Khepupara (Kalapara) 180 km/h, Kutubdia 180 km/h, Cox's Bazar 185 km/h, and Bhola 178 km/h. (The NOAA-11 satellite estimated the maximum wind speed to be about 240 km/h at 1.38 pm on 29 April). The storm made landfall near the coast north of Chittagong port during the night of the 29 April. The maximum storm surge height reached about 5 to 8 m. Casualty: 150,000 people, 70,000 cattle. Damages: loss of property was estimated at about Tk 60 billion.
31 May-2 June 1991	A cyclone hit the coastal islands and chars near Patuakhali, Barisal, Noakhali and Chittagong. Maximum wind speed reached 110 km/h. The storm surge was 1.9 m.
29 April-3 May 1994	A severe cyclonic storm hit the coastal islands near Cox's Bazar. Maximum windspeed reached 210 km/h. Casualty: 400 people, 8,000 cattle.
21–25 November 1995	A severe cyclonic storm hit the coastal islands near Cox's Bazar. The maximum wind speed was up to 210 km/h. Casualty: 650 people, 17,000 cattle.
16–19 May 1997	May 1997 Bangladesh cyclone hit the coastal islands and chars near Chittagong, Cox's Bazar, Noakhali and Bhola districts. The maximum wind speed was 225 km/hour, and the storm surge reached 3.05 metres. Casualty: 126 people.
25–27 September 1997	A severe cyclonic storm hit coastal islands near Chittagong, Cox's Bazar, Noakhali and Bhola. It had wind speeds of up to 150 km/hour, and a storm surge of 1.83 to 3.05 metres.
16–20 May 1998	A severe cyclonic storm with windspeed of 150 km/hour struck coastal islands near Chittagong, Cox's Bazar, and Noakhali. The storm surge was from 1.83 to 2.44 metres.
19–22 November 1998	A cyclonic storm, with wind speeds up to 90 km/hour, and a storm surge of 1.22 to 2.44 metres hit coastal islands and sand shoals near Khulna, Barisal, and Patuakhali.
14–15 May 2007	Cyclone Akash struck about 115 km south of Chittagong with wind speeds up to 120 km/hour. 14 people were killed and damages amounted to US$982 million.
15 November 2007	cyclone Sidr with wind speeds up to 260 km/hour, made landfall on southern Bangladesh, causing over 3,500 deaths and severe damage.[12]

Date	Cyclone Information
26–27 October 2008	Cyclone Rashmi made landfall on the Bangladesh coast late on 26 October with wind speeds up to 85 km/hour, 15 people were killed and thousands of homes were also damaged.
19–21 April 2009	Cyclone Bijli attacked weakly in Bangladesh and not so severe damages were recorded except some houses and crop fields losses.
27–29 May 2009	A severe Cyclone Aila attacked offshore 15 districts of south-western part of Bangladesh with wind speeds up to 120 km/hour; about 150 persons killed, 2 lac houses and 3 lac acres of cultivated land and crops losses.
16–17 May 2013	Cyclone Viyaru, formerly known as Cyclonic Storm Mahasen, hit near Chittagong with wind speeds up to 85 km/hour. 17 people died, and nearly 1.3 million were affected across the country. Losses to crops exceeded US$35.3 million.
29 July 2015	Cyclone Komen with wind speeds up to 75 km/hour, Komen made landfall near Chittagong. About 510,000 houses in the country were damaged or destroyed, and many residents lost their source of income as 667,221 acres (270,000 ha) of crop fields were damaged. The floods killed 132 people, of which at least 39 were directly related to Komen.
21 May 2016	Cyclone Roanu made landfall near Chittagong killing 26 people in Bangladesh. It has wind speeds up to 100 km/hour. Around 40,000 homesteads and business houses were damaged. Food storage, seasonal crops were damaged. Livestock, including fish and shrimp firms were swept away.
20 August 2016	The remnants of Tropical Storm Dianmu affected Bangladesh, no damage or death were reported.
29–31 May 2017	Cyclone Mora with wind speeds up to 110 km/hour, made landfall near Chittagong. A total of 500,000 people managed to move out of coastal areas before the storm made landfall on 31 May. A multitude of tropical cyclone warnings and watches were issued for much of southern Bangladesh and the districts of Northeast India. Strong winds and storm surge battered buildings and destroyed farmlands across Chittagong, Cox's Bazar, and Rangamati, with at least 20,000 houses damaged in refugee camps for Rohingya Muslims displaced by conflict in neighbouring Myanmar. As of 31 May, eighteen people were reported to be killed across Bangladesh, mostly due to falling trees and drowning.
4 May 2019	Cyclone Fani moved into Bangladesh after making landfall in Odisha. It killed 17 people in ten districts of Bangladesh. It destroyed about 63,000 ha (160,000 acres) of farmland in 35 districts of the country, the agricultural loss were at ৳385 million (US$4.6 million). Total damage in Bangladesh were up to ৳5.36 billion (US$63.6 million).
9 November 2019	Cyclones Matmo and Bulbul made landfall near West Bengal, and crossed into Bangladesh. It caused severe flooding and storm surge in the country, with approximately 72,000 metric tons of crops being lost, with a total value of Tk 2.6 billion (US$31 million).
20 May 2020	Cyclone Amphan moved into Bangladesh after making landfall in nearby West Bengal.
26 May 2021	Cyclone Yaas hit Bangladesh after causing a lot of damages and destructions in India. Before hitting, strong tidal waves damaged many coastal structures, dames and jetties.[13]
24 October 2022	Cyclone Sitrang made landfall near Bhola killing 35 people in Bangladesh. It had wind speeds up to 85 km/hour.

Source: Bangladesh Meteorological Department[13]

[13] https://live8.bmd.gov.bd/p/Historical-Cyclones/https://en.wikipedia.org/wiki/List_of_Bangladesh_tropical_cyclones

5.3.3 Floods

Flood is an annual phenomenon in Bangladesh. Normally, the most severe flood occurs in Bangladesh during July and August. Regular river floods (during monsoon season) affect 20% of the country, which may increase up to 67% in extreme years like the 1998 flood. The country has a long history of destructive flooding that has had very adverse impacts on lives and property. In the 19th century, six major floods were recorded: 1842, 1858, 1871, 1875, 1885 and 1892. Eighteen major floods occurred in the 20th century. Those of 1951, 1987, 1988 and 1998 were of catastrophic consequence. More recent floods include 2004 and 2010. Floods also occurred in 2015 and 2017.

The catastrophic floods of 1987 occurred throughout July and August and affected 57,300 square kilometers (22,100 sq mi) of land, (about 40% of the total area of the country) and was estimated as a once in 30–70-year event. The seriously affected regions were on the western side of the Brahmaputra, the area below the confluence of the Ganges and the Brahmaputra and considerable areas north of Khulna.

The flood of 1988, which was also of catastrophic consequence, occurred throughout August and September. The waters inundated about 82,000 square kilometers (32,000 sq mi) of land, (about 60% of the area) and its return period was estimated at 50–100 years. Rainfall together with synchronization of very high flows of the three major rivers of the country in only three days aggravated the flood. Dhaka, the capital of Bangladesh, was severely affected. The flood lasted 15 to 20 days.

In 1998, over 75% of the total area of the country was flooded, including half of Dhaka.[7] It was similar to the catastrophic flood of 1988, in terms of the extent of the flooding. A combination of heavy rainfall within and outside the country and synchronization of peak flows of the major rivers contributed to the flood. The 2004 flood was very similar to the 1988 and 1998 floods with two thirds of the country under water.[14]

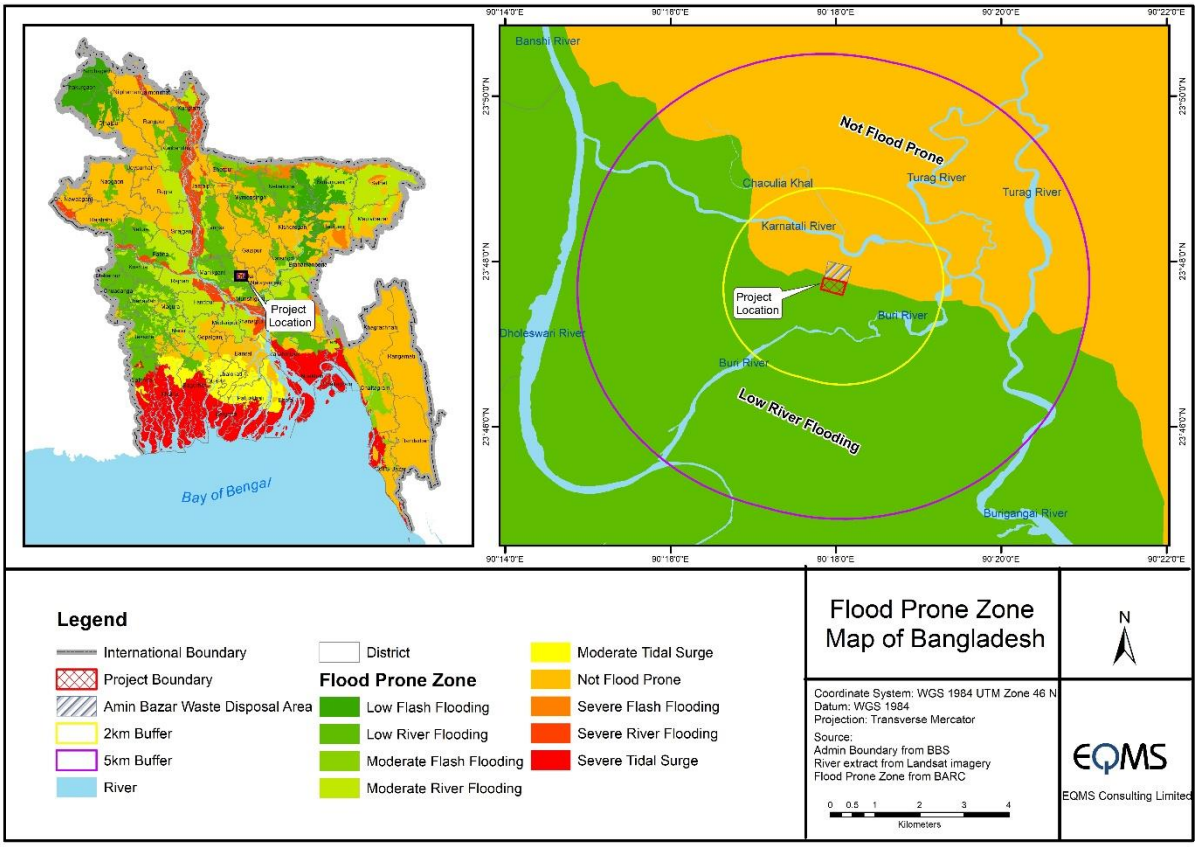
There are four types of floods in Bangladesh:

- Monsoon floods along major rivers during the monsoon rains (June-September).
- Flash floods caused by overflowing of hilly rivers of eastern and northern Bangladesh (Normally during April-May and September-November).
- Rain floods are caused by drainage congestion during heavy rains.
- Coastal floods caused by storm surges.

The largest area of the proposed project site belongs to not flood-prone area. Figure 4-12 shows the flood-affected areas of Bangladesh with project area. The project site is situated in a low river flooding area. Discussion with the local people it became evident that the lower area beside the highway becomes inundated for short periods sometimes in the rainy season. As per Bangladesh Agriculture research council study, the project site lies in low river flooding area.

[14] http://ffwc.gov.bd/

Figure 5-18: Flood Map of Bangladesh with project area



Data Source: BARC

5.3.4 Salinity Intrusion

The proposed project site is located in the North-western area of Bangladesh and the salinity intrusion effect is not present in the project area.

5.3.5 Landslide

The proposed project site is located in the floodplain of the Karnatali River. There is no hilly area close to the project site. As a result, landslides are not expected in the proposed project site.

5.4 Environmental Monitoring

5.4.1 Air Quality

The objective of the ambient air quality monitoring program was to establish the baseline ambient air quality in the study area. Air quality monitoring has been done during both the dry (April-May 2022) and wet seasons (July-August 2022) to observe the seasonal variation of ambient air quality in the study area.

5.4.1.1 Selection of Sampling Locations

The ambient air quality monitoring locations were based on the following aspects of the field survey plan developed before the fieldwork.

- The meteorological conditions of the area are based on information from the BMD observatory at Dhaka station.
- Topography of the study area.
- Location of sensitive receptors such as significant settlements.

5.4.1.2 Air Quality Monitoring Location

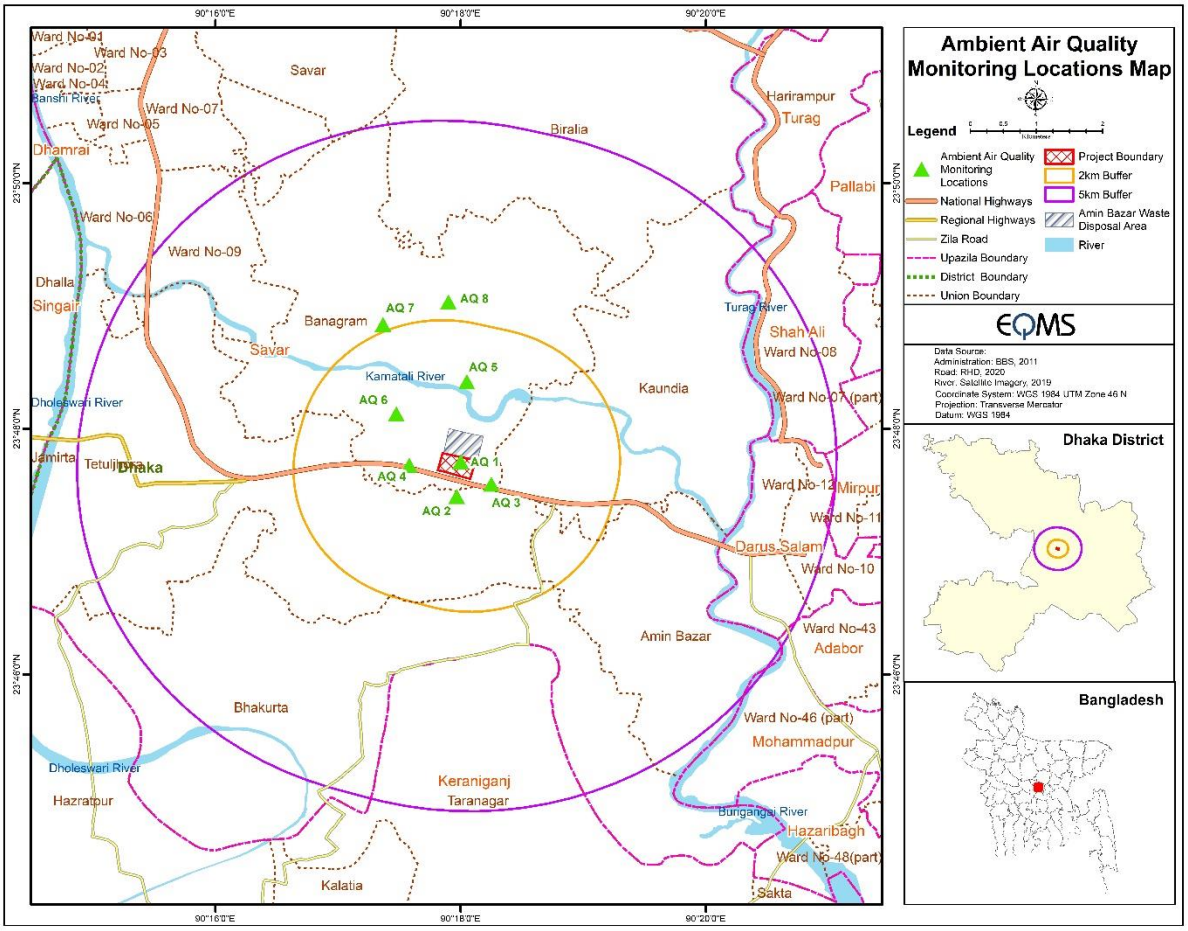
The EQMS team has searched air pollution sources around the project site. There are some brick kilns around the project site. These brick kilns can disperse SO_x in the area. Generally, air pollution sources in the study area consist of road dust, industry, brick kilns, black smoke from diesel engine vehicles, wind-blown dust from Amin Bazar waste landfill and agricultural lands, domestic heating, and cooking. EQMS has determined eight air quality monitoring locations around the project site based on prevailing wind direction and the importance of the receptors. The dry and wet season ambient air quality of the study area is monitored at eight (8) locations from April to May 2022 and July to September 2022, respectively. Location details and points of Ambient Air quality sampling are depicted in Table 5-5 and Figure 5-19, respectively.

Table 5-5: Ambient Air Quality Sampling Locations

SL	Monitoring Locations	Monitoring ID	Monitoring Date & Duration		Distance from the plant (meter)	Coordinates
			Dry season	Wet Season		
1	Project Site, Bongaon, Savar, Dhaka	AQ1	Six weeks (11 April 2022 to 25 May 2022)	Six weeks (26 July 2022 to 7 September 2022)	Project site	23°47'42.30"N 90°17'59.77"E
2	Modhumoti Model Housing, Bongaon, Savar, Dhaka	AQ2			323	23°47'27.20"N 90°17'57.86"E
3	Raj filling station, Bongaon, Savar, Dhaka	AQ3			312	23°47'33.33"N 90°18'14.79"E
4	Baliapur, Bongaon, Savar, Dhaka	AQ4			409	23°47'42.25"N 90°17'34.92"E
5	Beraid lake city, Bongaon, Savar, Dhaka	AQ5			1151	23°48'22.48"N 90°18'3.06"E
6	Nagar Konda, Savar, Dhaka	AQ6			892	23°48'7.61"N 90°17'27.89"E
7	Beraid Gandaria, Savar, Dhaka	AQ7			1930	23°48'43.49"N 90°17'19.32"E
8	Chakullia Bongaon, Savar, Dhaka	AQ8			2320	23°49'3.02"N 90°17'53.20"E

Source: Field Survey by EQMS, April-May and July-September 2022

Figure 5-19: Ambient Air Quality Monitoring Location



Source: Field Survey by EQMS, 2022

Photographs taken during air quality monitoring are shown in **Figure 5-20**.

Figure 5-20: Photographs of Ambient Air Quality Monitoring

	
AQ1	AQ2

	
AQ3	AQ4
	
AQ5	AQ6
	
AQ7	AQ8

Source: Field Survey by EQMS Team, April to May and July to September 2022

5.4.1.3 Methodology

The ambient air quality was monitored at eight (08) locations. Each location was monitored for six weeks. The collected air quality data has been calculated as a six-week average for each monitored location. Air Quality Monitoring (AQM)-09 Air Quality Monitoring System machine was used to collect ambient air quality monitoring data, including Oxides of Nitrogen (NOx), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), and Particulate Matter (PM_{10} and $PM_{2.5}$). Sampling and analysis of ambient air quality were conducted by following the USEPA recommendation. The air quality monitoring device records one reading every minute and stores it automatically in memory, which is later retrievable. Monitoring and analysis of ambient air quality were conducted by referring to the USEPA recommendation.

Table 5-6: Particular air quality and weather monitoring system

Parameter	Machine	Methods of Testing	Sensors
$PM_{2.5}$	AQM-09	On-Site Recording	Light Scattering Technique
PM_{10}	AQM-09	On-Site Recording	Light Scattering Technique
Nitrogen di oxide	AQM-09	On-Site Recording	High Sensitivity Electrochemical
Sulfur dioxide (SO_2)	AQM-09	On-Site Recording	High Sensitivity Electrochemical
Carbon monoxide (CO)	AQM-09	On-Site Recording	High Sensitivity Electrochemical

As per the national and international standards, CO was monitored for 8 hours to compare with the standard. The standard duration for PM_{10}, $PM_{2.5}$, SO_2, NO_2 is 24-hour data**.** A conversion equation was used to convert the data from a specific time to the expected time. Many agencies (e.g., New York State Dept. of Environmental Conservation, California Office of Environmental Health Hazards Assessment, USEPA, Ontario Ministry of Environment) used a conversion process by applying Pasqual's (1961) air mass dispersion tables defining six air mass stability classes (Table 5-7) and a set of meteorological conditions (Table 5-8). Using the simple power law, Schroeder and Jugloff (2012) described the steps for converting eight-hour readings to 24-hour/annual values. The stability classes (Table 5-7) are related to average wind speed, daytime solar radiation, and night-time cloud cover (Table 5-8); refining these relationships was also developed by Pasquill.

Table 5-7: Pasquill-Gifford Air Dispersion Stability Classes and Associated Dispersion Exponents[15]

Stability Class	P	Definition
A	0.5	Very Unstable
B	0.5	Unstable
C	0.333	Slightly Unstable
D	0.2	Neutral
E	0.167	Slightly Stable
F	0.167	Stable

Table 5-8: Meteorological conditions define the P-G Stability Classes

Surface Wind Speed	Day Time Incoming Solar Radiation	Nighttime Cloud Cover	Surface Wind Speed	Day Time Incoming Solar Radiation	Nighttime Cloud Cover
m/s	Strong	Moderate	Slight	>50%	<50%
<2	A	A-B	B	E	F
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D

[15] Julie Schroeder and Denis Jugloff (2012), Interpretation of 24-hour sampling data: Development of 24-hour ambient air quality criteria and their use in Ontario, Human Toxicology & Air Standards Section, Standards Development Branch, Ontario Ministry of the Environment, Toronto, ON, Canada

Surface Wind Speed	Day Time Incoming Solar Radiation	Nighttime Cloud Cover	Surface Wind Speed	Day Time Incoming Solar Radiation	Nighttime Cloud Cover
m/s	Strong	Moderate	Slight	>50%	<50%

Weather data was not recorded during the monitoring period. So, from the Bangladesh context, the annual average wind speed in the Dhaka area is about <2 m/s. Considering the wind speed, from Table 5-8 (1st row as the average wind speed in all the area is <2 m/s), the project stability class was calculated as 0.39 (see below):

$$P = \frac{0.5+0.5+0.167}{3}$$

= 0.389 ≈ 0.39

The value of the exponential factor is calculated based on the stability class of the study area (Table 5-7). The wind speed and stability classes of the study area are A, B, E, and F. Hence, the P value will be the average of the respected P values of these stability classes. This suggests a somewhat unstable air mass, resulting in considerable dilution of an eight-hour sample spread over 24 hours. To provide 24-hour averages for the five parameters, the following power-law equation, as defined in Schroeder and Jugloff 2012 was applied:

$$C_{long} = C_{short} (t_{short}/t_{long})^{p}$$

Where,

C_{long} = Expected output in a specific time
C_{short} = Outcome during Monitoring Period
t_{short} = Specific time period during monitoring (in minutes)
t_{long} = Expected time period (in minutes)
p = Exponential factor where the value is 0.39

5.4.1.4 Ambient Air Quality Monitoring Results

Ambient air quality monitoring test results of the dry and wet season have been given in Table 5-9.

Table 5-9: Summary results of ambient air quality testing in Dry and Wet season

Monitoring Code	CO	NO_2	PM_{10}	$PM_{2.5}$	SO_2	O_3
	(mg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
AQ1 (Dry Season)	1.12	82.24	95.33	37.51	57.07	36.25
AQ1 (Wet Season)	0.59	36.35	47.68	22.33	42.93	31.94
AQ2 (Dry Season)	0.43	58.17	61.84	22.62	50.83	35.87
AQ2 (Wet Season)	0.34	34.46	37.50	22.95	33.52	27.51
AQ3 (Dry Season)	0.62	70.35	147.11	34.40	62.42	38.22
AQ3 (Wet Season)	0.43	40.48	54.93	24.06	44.71	30.79
AQ4 (Dry Season)	0.70	92.02	93.18	48.92	52.02	36.14
AQ4 (Wet Season)	1.07	54.32	69.37	37.56	69.94	32.89
AQ5 (Dry Season)	0.59	63.46	64.57	38.80	39.40	34.97
AQ5 (Wet Season)	0.68	47.54	40.58	26.24	40.15	32.65
AQ6 (Dry Season)	0.48	57.87	65.23	24.98	52.83	36.05
AQ6 (Wet Season)	0.32	28.76	55.11	21.66	43.62	31.38
AQ7 (Dry Season)	0.44	53.13	58.84	23.19	50.65	33.54
AQ7 (Wet Season)	0.16	30.18	48.00	20.70	39.44	29.39
AQ8 (Dry Season)	0.42	52.83	58.27	22.06	51.64	33.53
AQ8 (Wet Season)	0.16	26.63	48.47	17.39	34.90	27.21
Duration (Hours)	8	24	24	24	24	8
Weather	Sunny					
Bangladesh Standard[16]	5	80	150	65	80	100
WHO Standard[17]	10	25	45	15	40	100

Source: Laboratory Analysis by EQMS Laboratory, 2022

[16] Air Pollution (Control) Rules, 2022

[17] WHO Ambient Air Quality Guideline Values (2021), which are also being referred in the World Bank and IFC's General EHS Guidelines

5.4.1.4.1 Dry Season

Air quality monitoring was conducted in the dry season to understand the seasonal variation of ambient air quality in the project areas. To understand the seasonal variation of ambient air quality in the project areas Dry and Wet season air quality was measured. Table 5-9 shows the summary findings of air quality measurement in the winter season. The study found that the concentration level of PM_{10} and $PM_{2.5}$ remains within the standard limits of Air Pollution (Control) Rules, 2022 in all study locations. But the PM_{10} and $PM_{2.5}$ concentration has exceeded the WHO Ambient Air Quality Guideline Values (2021) at all the locations. The average concentration of PM_{10} in all locations varies from 58.27 µg/m^3 to 147.11 µg/m^3, in AQ8 and AQ3 locations, respectively. In the case of the average concentration of fine particulate matter ($PM_{2.5}$), the value ranges from 22.06 µg/m^3 in AQ8 to 48.92 µg/m^3 in AQ4. Although no values of the concentration of $PM_{2.5}$ in any location did not exceed the standard limit of Bangladesh, it exceeded the WHO standard at all the locations. The concentration of PM_{10} and $PM_{2.5}$ is comparatively moderate in the monitoring locations situated in urban or semi-urban areas compared to rural locations.

The concentration of SO_2 was found within the standard limit of Air Pollution (Control) Rules, 2022 in all monitoring locations. But it exceeded the WHO standard in all the locations except for the AQ5 location. The concentration of NO_2 varies from 52.83 (µg/m^3) to 82.24 (µg/m^3). The study found that the concentration level of NO_2 remains within the Air Pollution (Control) Rules, 2022 standard limit at all the locations except for the AQ1 location and exceeded the WHO standard at all locations. The concentration of CO was found within the standards of both Air Pollution (Control) Rules, 2022 and WHO. The highest concentration of NO_2, SO_2, CO, and O_3 were found in AQ1 (82.24 µg/m^3), AQ3 (62.42 µg/m^3), AQ1 (1.12 mg/m^3), and AQ3 (38.22 µg/m^3) respectively. On the other hand, the lowest concentrations of NO_2, SO_2, CO, and O_3 are found in AQ8 (52.83 µg/m^3), AQ5 (39.40 µg/m^3), AQ8 (0.42 mg/m^3), and AQ8 (33.53 µg/m^3) respectively.

5.4.1.4.2 Wet Season

A second-round air quality monitoring was conducted in the wet season to understand the seasonal variation of ambient air quality in the project areas. Table 5-9 shows the summary findings of the baseline monitoring of ambient air quality during the wet season. The study found that the average concentration of PM_{10} in every location varies from 37.50 to 69.37 µg/m^3, which remains within the standard of Air Pollution (Control) Rules, 2022 at all the locations but exceeded the WHO standard at all the maximum locations except for the AQ2 and AQ5. The lowest concentration is found in the AQ2 location, while the highest concentration is detected in the AQ4 location. In the case of fine particulate matter ($PM_{2.5}$), the average concentration varies from 17.39 µg/m^3 in AQ8 to 37.56 µg/m^3 in AQ4. The study found that all the $PM_{2.5}$ concentration is within the national standard of Air Pollution (Control) Rules, 2022, and exceeded the WHO standard for all the locations. The main sources of particulate matter in study areas include vehicular emission, traffic movements, burning of solid waste in open spaces, unpaved road surfaces, and brickfields.

In addition to particulate matter, the concentration of gaseous substances, e.g., NO_2, SO_2, CO, and O_3 have also been measured during baseline monitoring of ambient air quality. The concentration of SO_2 was found within the standard limit of Air Pollution (Control) Rules, 2022 in all monitoring locations. But it exceeded the WHO standard in most of the locations except for the AQ2, AQ7, and AQ8 locations. The concentration of NO_2 varies from 26.63 (µg/m^3) to 54.32 (µg/m^3). The study found that the concentration level of NO_2 remains within the Air Pollution (Control) Rules, 2022 standard limit at all locations but exceeded the WHO standard at all locations. Moreover, the results suggest that the level of CO, and O_3 did not exceed the national and WHO standard level in any location.

The highest concentration of NO_2, SO_2, CO, and O_3 were found in AQ4 (54.32 µg/m^3), AQ4 (69.94 µg/m^3), AQ4 (1.07 mg/m^3), and AQ4 (32.89 µg/m^3) respectively. On the other hand, the lowest concentrations of NO_2, SO_2, CO, and O3 are found in AQ8 (26.63 µg/m^3), AQ2 (33.52 µg/m^3), AQ7 & AQ8 (0.1 mg/m^3), and AQ8 (27.21 µg/m^3) respectively.

5.4.1.4.3 Comparison Between Air Quality in Dry and Wet Seasons

Ambient air quality has been monitored in two seasons to get a better understanding of the baseline environmental conditions of project areas as the weather pattern influences the level of air quality. Figure 5-21 shows a graphical presentation of the comparison between the concentration of PM_{10} and $PM_{2.5}$ in the dry and wet seasons. The analysis found that the concentration of PM_{10} decreased in the wet season than the dry season. The highest amount of PM_{10} has found in AQ3 (147.11 µg/m^3) in the dry season, which decreased to 54.93 µg/m^3 in the wet season. On the other hand, the lowest concentration of PM_{10} in the dry season was found at 58.27 µg/m^3 at AQ8 which decreased to 48.47 in the wet season. In the case of $PM_{2.5}$, the highest concentration was found at 48.92 µg/m^3 in AQ4, which decreased in the wet season to 37.56 µg/m^3. On the other hand, the minimum concentration of $PM_{2.5}$ has found 22.06 µg/m^3 in the dry season at the AQ8 location, which decreased to 17.39 µg/m^3 in the wet season. The concentration of $PM_{2.5}$ in the AQ2 location has slightly increased compared to the wet season value. The AQ2 monitoring location is surrounded by a dense vegetation cover, so the outside activities have a very minimal impact on air quality for that location.

Figure 5-21: Comparison between the concentration of PM_{10} & $PM_{2.5}$ in the dry and wet season

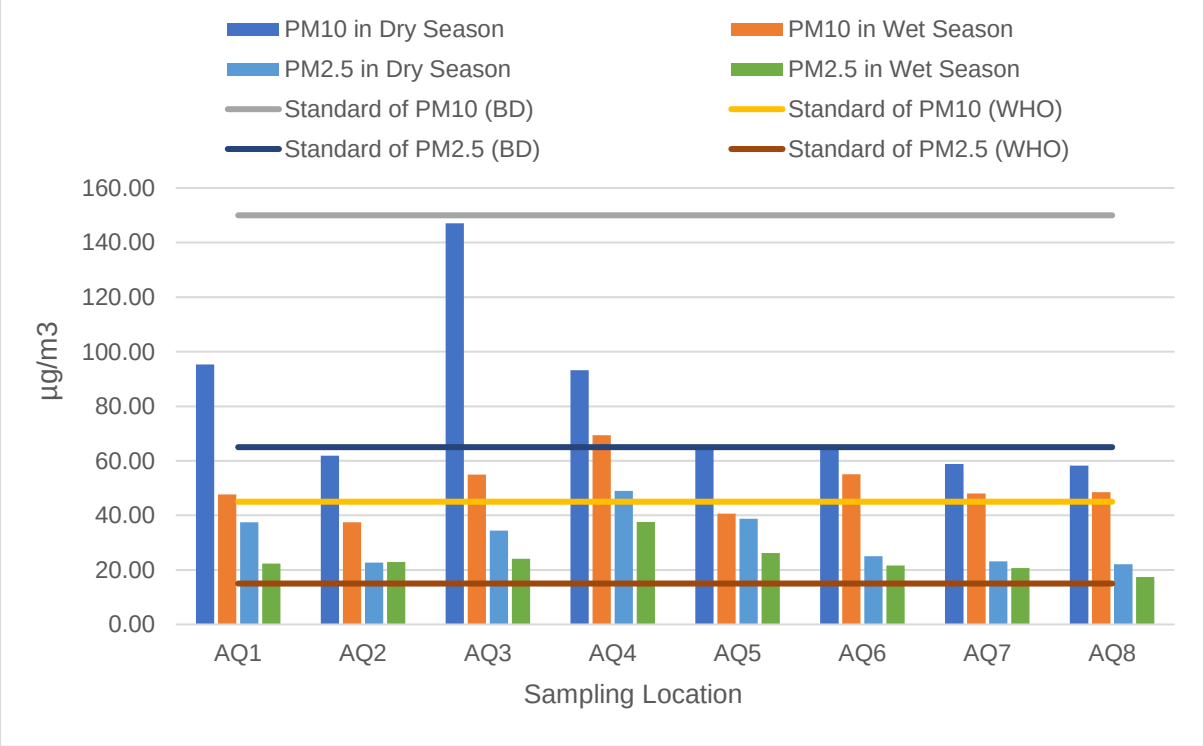


Figure 5-22 shows the comparison between the concentration of NO_2 in the dry and wet seasons. The study found that, unlike the concentration of particulate matter, the concentration of NO_2 in the wet season has decreased in all locations, compared to the concentration in the dry season. The highest NO_2 concentration was found at 92.02 µg/m^3 in the AQ4 location, which decreased (54.32 µg/m^3) in the wet season. According to the result Table 5-9, the concentration of NO_2 decreased in the wet season compared to the dry season for all the locations.

Figure 5-22: Comparison between the concentration of NO_2 in the dry and wet seasons

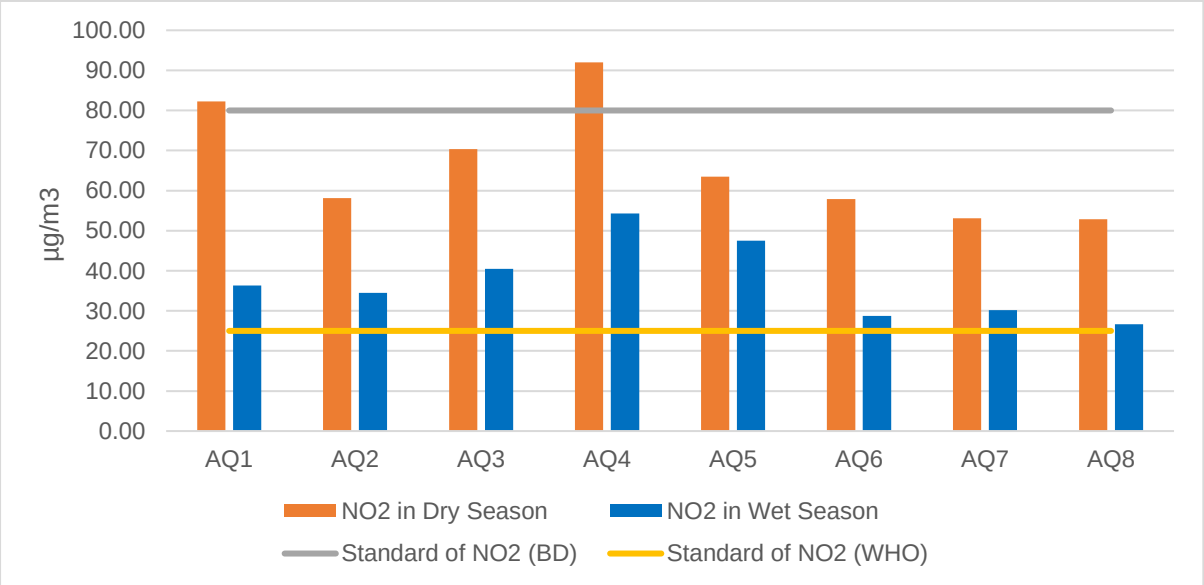


Figure 5-23 shows the comparison between the concentration of SO_2 in the dry and wet seasons in all locations. The findings reveal that except for the AQ4 location all the air quality monitoring location's values have decreased in the wet season compared to the dry season. AQ4 location is beside the Dhaka-Aricha highway and many brick kilns are situated around the monitoring location. During the monitoring period in the wet season, most of the brick field was in operation. So, it might be the reason for exceedance compared to the dry season.

Figure 5-23: Comparison between the concentration of SO_2 in the dry and wet seasons

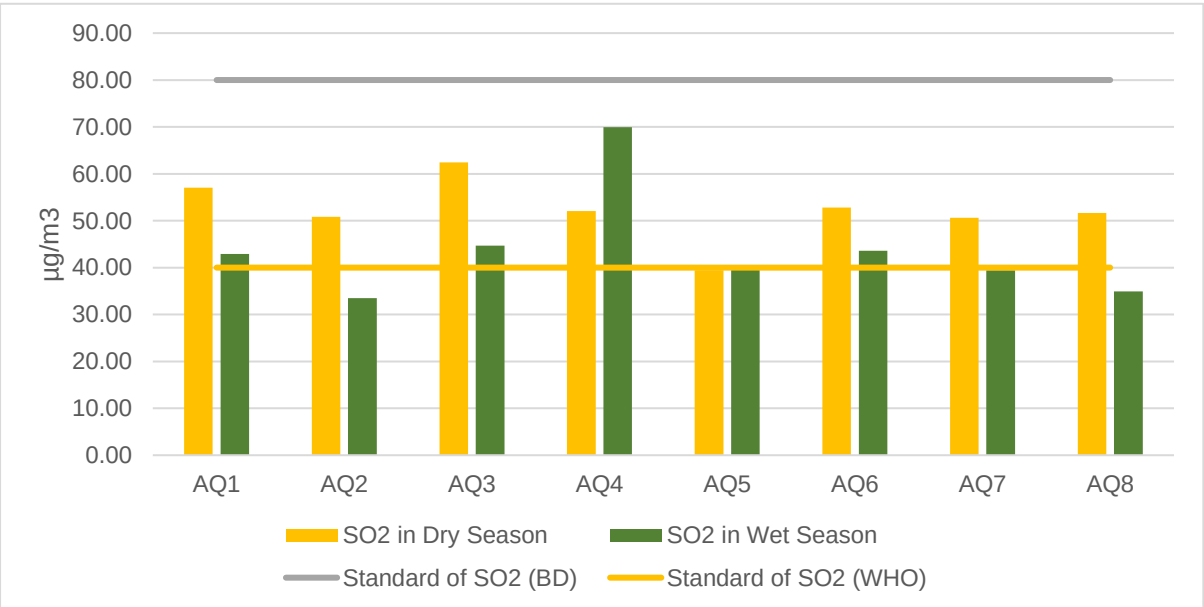


Figure 5-24 shows the comparison between the concentration of CO in the dry and wet seasons in all monitoring stations. The concentration of CO in the wet season has increased in AQ4 and AQ5 locations compared to the dry season CO concentration, while it has decreased in the other six stations. In short, unlike the concentration of particulate matter, the concentration of gaseous substances showed a mixed variation in both seasons.

Figure 5-24: Comparison between the concentration of CO in the dry and wet season

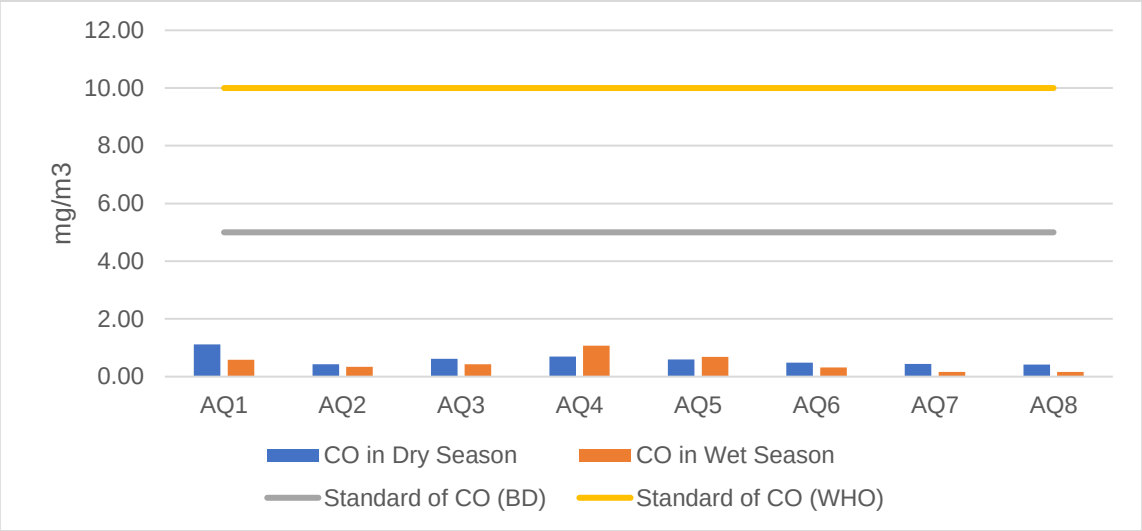
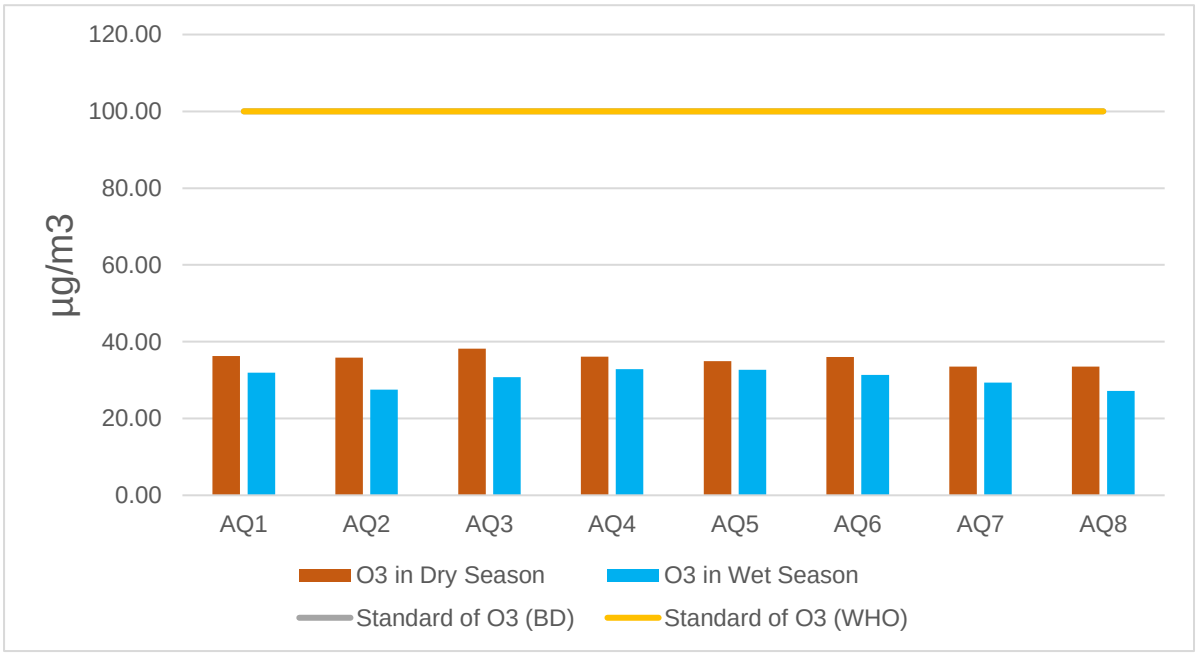


Figure 5-25 shows the comparison between the concentration of O_3 in the dry and wet seasons in all monitoring stations. The concentration of O_3 in the wet season has decreased in all the locations compared to the dry season O_3 concentration. In short, unlike the concentration of particulate matter, the concentration of gaseous substances showed a mixed variation in both seasons.

Figure 5-25: Comparison between the concentration of O_3 in the dry and wet seasons



5.4.2 Water Quality

The EQMS team has observed various water sources around the project site. The river Karnatali is about 600 m away from the project site. This water body remains almost dry in the winter season. The EQMS team has collected four ground and four surface water samples as representative water sources covering dry and wet seasons in the study area.

Firstly, one liter of water sample was taken into an air-tightened plastic bottle without any air bubbles. This bottle was preserved for laboratory testing. Then, another sample was taken from the exact location for onsite testing. Finally, the preserved and air-tightened sample bottle was sent for laboratory

testing. Some parameters, e.g., temperature, pH, and Dissolved Oxygen (DO), were tested onsite as their values may change in a different environment other than the sampling point. On the other hand, other parameters, e.g., Color, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), Turbidity, Total Coliforms, Arsenic, Oil, and Grease, etc. have been tested in EQMS laboratory.

The samples were analyzed per the standard procedure/method given in Standard Method for Examination of Water and Wastewater Edition 20, published by American Pharmacists Association (APHA). Water quality parameters are checked against Environment Conservation Rules (ECR), 2023-Schedule 2 (a), and ECR-Schedule-3 (b). Details of the analysis method are presented in **Table 5-10.**

Table 5-10: Methods of Water Analysis

SL	Parameter	Method	Protocol
1.	Temperature (˚C)	Digital thermometer	-
2.	Turbidity	Turbidity meter	APHA., 2130 B
3.	Total Dissolved Solids (mg/l)	Digital TDS meter	
4.	Conductivity (µmhos/cm)	Conductivity meter	APHA., 2510 B
5.	Dissolved Oxygen (mg/l)	Digital Dissolved Oxygen (DO) meter	
6.	pH	Digital pH meter	APHA., 4500 H+ B
7.	Salinity	Digital Salinity Meter	APHA., 2520 B
8.	Chemical Oxygen Demand (COD)	Closed Reflux Method (CRM)	APHA., 5210 B
9.	Iron (Fe) (mg/l)	Atomic Absorption Spectroscopy (AAS)	APHA 3113 B
10.	Cadmium (Cd) (mg/l)	AAS	APHA-3500-Cd (B)
11.	Arsenic (As) (mg/l)	AAS	APHA 3500(B)
12.	Manganese (Mn)	AAS	APHA 3113 B
13.	Nitrogen (Nitrate)	AAS	APHA.,4110 B
14.	Nitrogen (Nitrite)	UVS	APHA.,4110 B
15.	Phosphate	UVS	APHA 4500-P.C
16.	Total Suspended Solid	Gravity Multi-meter	-
17.	Oil & Grease	Purge Trap Gas Chromatography (GC)	APHA., 5220 B
18.	Biochemical Oxygen Demand (BOD)	5 days incubation	APHA., 5210 B

Surface water quality was compared with the standards for Inland Surface Water, Environment Conservation Rules (ECR), 2023-Schedule 2(a). In contrast, the groundwater was compared with the Drinking Water Standard ECR-Schedule-2(b), 2023, and the WHO Guidelines.

5.4.2.1 Surface Water Quality

The surface water sampling was collected from 100 m upstream and downstream of Karnatali river close to the project area. During the dry season, two surface water samples were collected (SW1 & SW2) in April 2022. Wet season (Monsoon) surface water samples (SW1 and SW2) were collected in August 2022. Details of surface water sampling locations are depicted in Table 5-11.

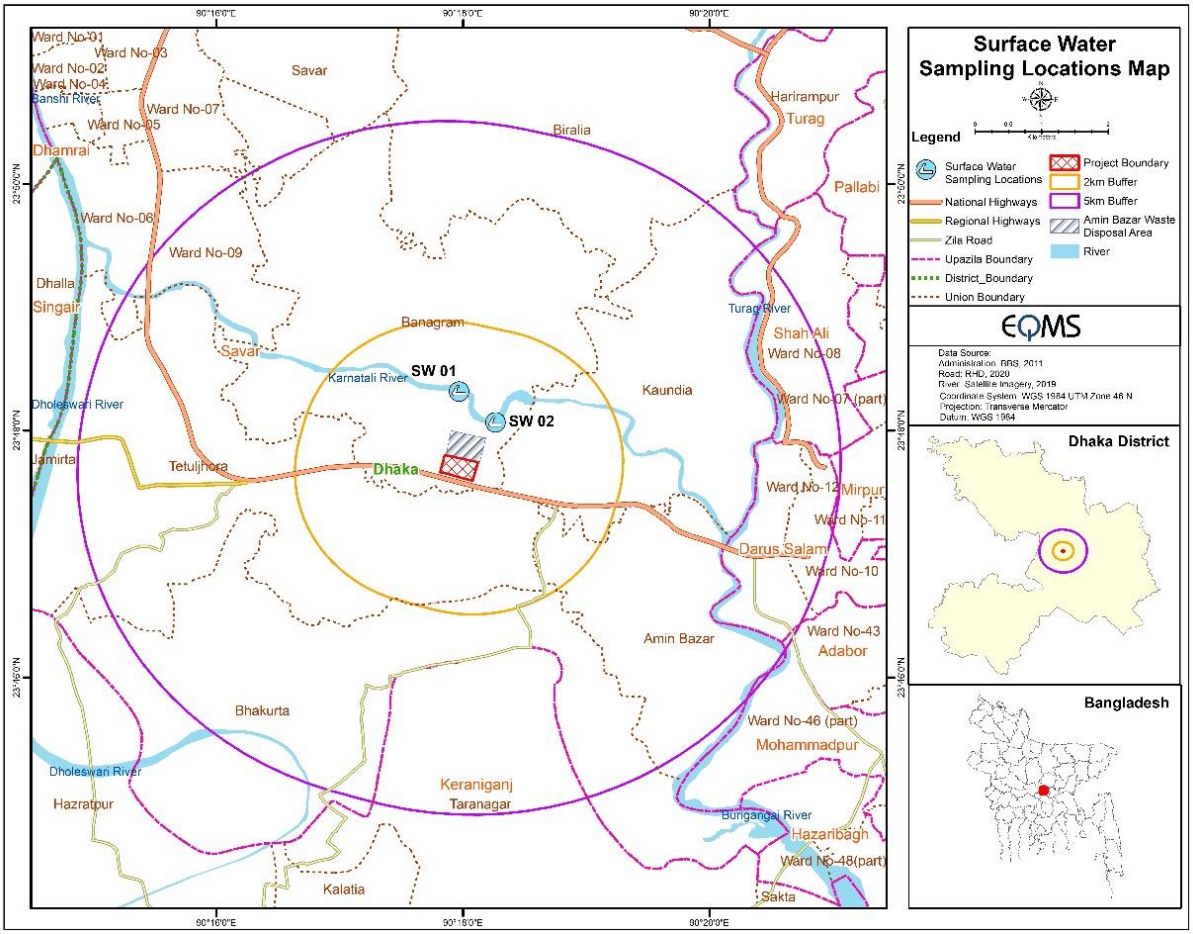
Table 5-11: Details of Surface Water Sampling Locations

SL.	Sampling Location	Code	Sampling Date		Geographical Location	Type of Source
			Dry season	Wet season		
1.	Upstream of Karnatali River	SW1	12 April 2022	16 August 2022	23°48'18.97"N 90°17'58.07"E	River Water
2.	Downstream of Karnatali River	SW2	12 April 2022	16 August 2022	23°48'3.99"N 90°18'15.83"E	River Water

Source: Field Survey by EQMS Team, April and August 2022

Sampling locations of surface water collection are shown in Figure 5-26.

Figure 5-26: Surface Water sampling location



Source: EQMS, April and August 2022

Photographs taken during the surface water sampling are shown in Figure 5-27.

Figure 5-27: Photographs were taken during surface water sampling

	
SW1 (Dry)	SW2 (Dry)
	
SW1 (Wet)	SW2 (Wet)

Source: Field Survey by EQMS Team, April and August 2022

Results Analysis

Analytical results from the surface water sampling test are presented in Table 5-12.

Table 5-12: Surface Water Quality Testing Results in Wet and Dry Season

Parameters	Unit	Concentration Present				Bangladesh Standard[18] (ECR-2023: Schedule 2(A)-1)					
		SW1 (Dry)	SW1 (Wet)	SW2 (Dry)	SW2 (Wet)	a	b	c	d	e	f
DO	mg/L	5.3	6.0	4.9	6.4	≥ 6	≥ 5	≥ 5	≥ 5	≥ 1	-
BOD	mg/L	5.5	0.9	6.5	0.8	≤ 2	≤ 3	≤ 3	≤ 6	12	≤ 12
Temperature	(^{0}C)	21.8	22.1	22	22.0	-	-	-	-	-	-
Electric Conductivity (EC)	µS/cm	1580	180	1390	170	-	-	-	-	-	-
Turbidity	NTU	27.6	5.7	29.1	5.5	-	-	-	-	-	-
pH		7.91	7.87	7.81	7.39	6.5-8.5	6.5-8.5	6.0-9.0	6.0-9.0	6.5-8.5	6.5-8.5
TDS	mg/L	790	90	690	80	1000	1000	1000	1000	1000	1000
Salinity	ppt	0.82	0.07	0.69	0.07	-	-	-	-	-	-
Iron	mg/L	0.41	0.02	0.37	0.03	-	-	-	-	-	-
Arsenic	mg/L	0.01	0.00	0.01	0.00	-	-	-	-	-	-
Phosphate	mg/L	1.2	1.2	1.8	1.0	0.1	0.5	0.5	0.5	-	2.0
Zinc	mg/L	0.06	0.02	0.08	0.01	-	-	-	-	-	-
Chromium	mg/L	0.02	0.00	0.03	0.01	0.02	0.2	0.02	0.05	0.1	0.1
Nitrate	mg/L	25.5	1.7	21.5	1.6	7.0	7.0	7.0	7.0	-	5.0
Magnesium	mg/L	16	12	14	10	-	-	-	-	-	-
Aluminum	mg/L	0.08	0.00	0.06	0.00	-	-	-	-	-	-
Coper	mg/L	0.81	0.01	0.78	0.01	-	-	-	-	-	-
COD	mg/L	58	11	68	0.8	10	10	25	50	100	100

[18] Bangladesh Environment Conservation Rules, 2023- Schedule 3 (Standards for Inland Surface Water).

Parameters	Unit	Concentration Present				Bangladesh Standard[18] (ECR-2023: Schedule 2(A)-1)					
		SW1 (Dry)	SW1 (Wet)	SW2 (Dry)	SW2 (Wet)	a	b	c	d	e	f
Hardness (as CaCO3)	mg/L	108	78	108	13	-	-	-	-	-	-
Ammonia	mg/L	0.35	0.48	0.41	84	-	-	-	-	-	-
Ammonium	mg/L	0.39	0.47	0.48	0.47	0.1	0.3	0.3	0.3	2.7	1.5
Color	PCU	190	37	187	39	-	-	-	-	-	-
TSS	mg/L	56	128	57	110	-	-	-	-	-	-
Oil and Grease	mg/L	15.71	11.42	17.42	11.24	-	-	-	-	-	-

Source: Laboratory Analysis by EQMS Laboratory, 2022

Note: a = Source of drinking water for supply only after disinfecting; b = Water usable for recreational activity; c = Source of drinking water for supply after conventional treatment; d = Water usable by fisheries; e = Water usable by various process and cooling industries; f = Water usable by irrigation

The analyzed results for surface water were compared to Bangladesh Standards (ECR, 2023). Most of the surface water parameters are not yet standardized in ECR, 2023. The surface water samples' testing results are presented in Table 5-12**.** The results found that most parameters comply with the national standard, while some parameters don't comply with the standard limits. Some of the water quality parameters are discussed below.

pH

The acceptable range of pH set by the DoE is between 6.5 and 8.5. This is the range, which indicates adequate protection to the life of freshwater fish and bottom dwelling invertebrates. The pH ranges from 7.81 to 7.91 in the dry season and 7.39 to 7.87 in the wet season. The test result found that the pH of the surface water is within the acceptable limit of Bangladesh standards.

DO

Dissolved oxygen (DO) is one of the most important indicators of water quality. It is essential for the survival of fish and other aquatic organisms. Oxygen is also introduced into the water as a byproduct of aquatic plant photosynthesis. When dissolved oxygen becomes too low, fish and other aquatic organisms cannot survive. Decrease in DO values below the critical level of 3 mg/L causes death of most fishes and other aerobic aquatic organisms. The dissolved oxygen for surface water ranges from 4.9 to 5.3 mg/l in the dry season and 6.0 to 6.4 mg/l in the wet season, DO in the dry season is below the Bangladesh Standard but in the wet season, it is within the national standard. The lower concentration of DO indicates a higher amount of organic waste materials present in the water body.

Turbidity

Turbidity is a measure of the cloudiness of water, which represents the degree to which the water loses its transparency due to the presence of suspended particulates. Turbidity ranges between 27.6 to 29.1 NTU in the dry season and 5.5 to 5.7 in the wet season.

Total hardness

During the dry season, the total hardness recorded in the surface water samples collected at locations SW1 and SW2 are 108 mg/l at both sites., During the wet season total hardness ranged from 13 to 78.

Biological Oxygen Demand $(BOD)_5$

BOD is another important parameter, representing the amount of oxygen needed to break down the organic matter in water. Biochemical Oxygen Demand varies from 5.5 to 6.5 mg/l in the dry season and 0.8 to 0.9 in the wet season. BOD in the dry season exceeds the national standard but it meets the national standard in the wet season. Higher BOD indicates more oxygen was required, which is less for oxygen-demanding species to feed on and signifies lower water quality. Inversely, low BOD means less oxygen is being removed from the water. Runoff carrying wastes from streets and sidewalks; nutrients from fertilizers; leaves, grass, and paper from residential areas, are all contributors to increase oxygen demand.

Chemical Oxygen Demand (COD)

COD value in all four samples had been found in the range of 58-68 mg/L in dry season, while 0.8 to 11 mg/L in wet season. There is no stipulated standard for COD in Bangladesh. Higher COD levels mean a greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen (DO) levels. A reduction in DO can lead to anaerobic conditions, which is deleterious to higher aquatic life forms.

Total Dissolved Solids (TDS)

The standard for inland surface water for Total Dissolved Solids is 1000mg/L. Total Dissolved Solids for surface water vary from 690 to 790 mg/l in the dry season and 80 to 90 in the wet season. The

maximum TDS value in the samples is 790 mg/l at the SW1 location during the dry season. Test results showed that the TDS value for all the locations was found within the national standard.

Oil & Grease

Oil and grease cause ecological damage to aquatic organisms and plants. This leads to decrease dissolved oxygen levels in the water. Oil and grease can also interfere with biological life in surface waters and create unsightly films. Oil & grease for surface water ranges from 15.71 to 17.42 mg/l in the dry season and 11.24 to 11.42 mg/l in the wet season.

Chromium

Chromium for surface water ranges from 0.02 to 0.03 mg/l during the dry season monitoring and 0.00 to 0.01 mg/l in the wet season.

Some other physical and chemical properties of water, e.g., Chemical Oxygen Demand, Temperature, Electric Conductivity (EC), Salinity, Iron, Arsenic, Phosphate, Zinc, Nitrate, Magnesium, Aluminum, copper, Ammonia, Ammonium, Color, and Total Suspended Solid (TSS), have been tested for which no national standard is established.

5.4.2.2 Ground Water Quality

The water sampling and analysis were undertaken to understand the overall baseline water quality of the groundwater in the study area. Groundwater samples were taken from representative selected groundwater sources representing different parts of the study area.

The groundwater sampling locations were selected to obtain a representative water sample from various study areas. During the dry season, two groundwater samples were collected (GW1 & GW2) in April 2022. Wet season groundwater samples (GW1 and GW2) were collected in August 2022. Table 5-13 represents the sampling location of groundwater in and around the project site.

Table 5-13: Details of Ground Water Sampling Locations

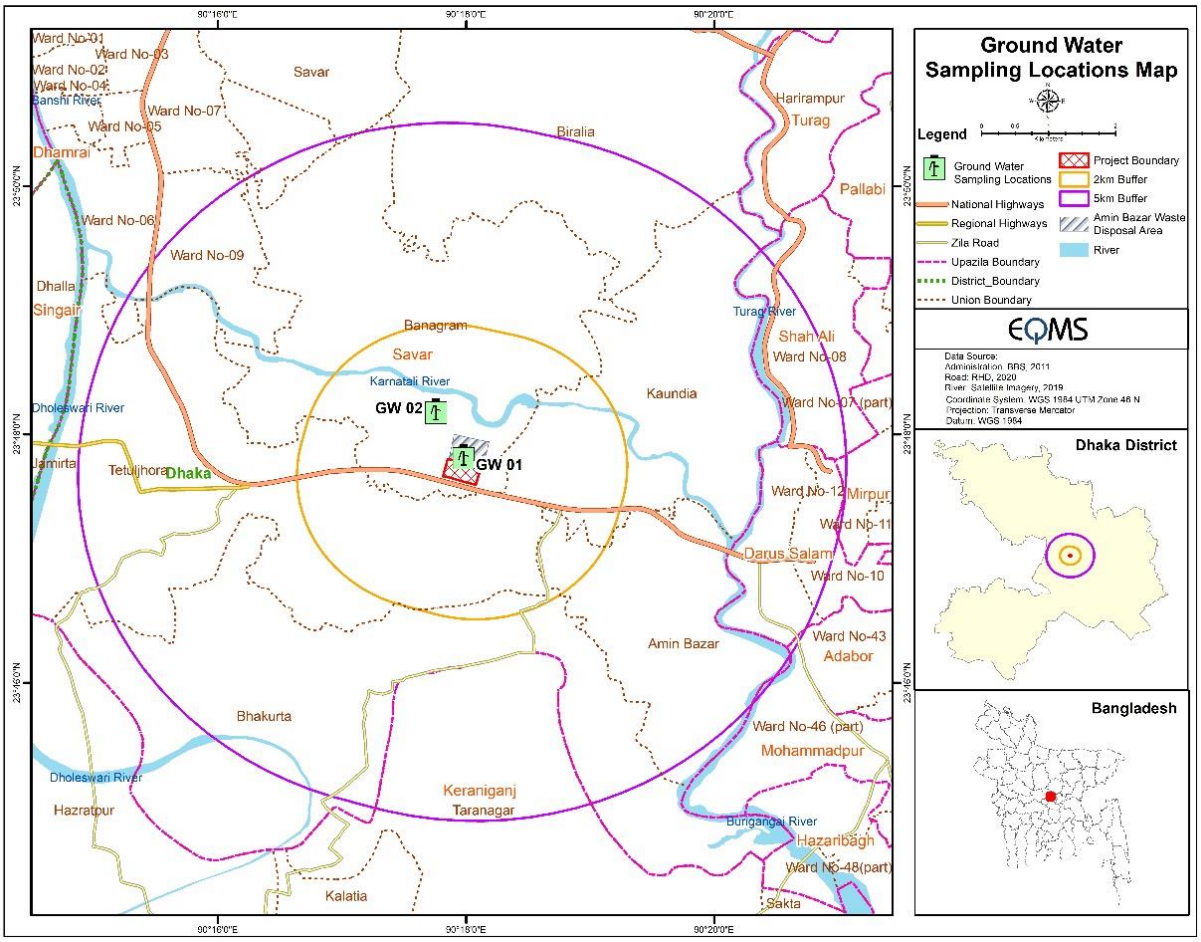
SL.	Sampling Location	Code	Sampling Date		Geographical Location
			Dry season	Wet season	
1.	Project Site, Bongaon, Savar, Dhaka	GW1	12 April 2022	16 August 2022	23°47'48.52"N 90°17'58.80"E
2.	Konda Majhipara, Bongaon, Savar, Dhaka	GW2	12 April 2022	16 August 2022	23°48'10.50"N 90°17'45.37"E

Source: EQMS ESIA Study Team, April, and August 2022

Sampling locations of groundwater are shown in Figure 5-28. Primary monitoring of ground water quality was conducted at 2 locations during each of the monitoring period to understand the existing condition of groundwater and assess probable impacts of the proposed project activities on the sub surface aquifers. The basis of selecting ground water sampling location was primarily guided by the slope of the area, understanding of local ground water flow regime, understanding of use of ground water in the study area and availability of tube well/borewell for ground water abstraction. Groundwater sample GW1 has been taken from the project site to know the existing status of groundwater quality and later it will be compared during construction and operation phase groundwater monitoring results. The project site was selected for GW1 as all the facilities will be installed here and that might affect the groundwater quality. For this reason, this area has been selected to monitor the existing ground water condition.

The second groundwater GW2 sample has been collected from nearest residential area for assessing the present condition of groundwater quality and will be compared with construction and operation phase monitored data to identify any impacts due to project interventions.

Figure 5-28: Groundwater Sampling Location



Source: EQMS, April and August 2022

Photographs captured during groundwater sampling are shown in Figure 5-29.

Figure 5-29: Photographs were taken during groundwater sampling

	
GW1 (Dry)	GW2 (Dry)

	
GW1 (Wet)	GW2 (Wet)

Source: Field survey by EQMS team, 2022

Analytical results from the groundwater sample test are presented in Table 5-14.

Table 5-14: Ground Water Quality Analysis Result

SL	Parameter	Unit	GW1 (Dry)	GW1 (Wet)	GW2 (Dry)	GW2 (Wet)	Bangladesh Standard[19]	WHO[20]
1.	Temperature	^{o}C	22.0	22.0	21.9	22.1	20-30	-
2.	Electric Conductivity (EC)	µS/cm	290	270	420	420	--	(2,000 by EPA)
3.	Turbidity	NTU	0.05	0.01	0.08	0.02	5.0	
4.	pH	-	6.81	8.04	6.78	7.64	6.5 – 8.5	6.5 – 8.5
5.	TDS	ppm	140	130	210	210	1000	1500
6.	DO	mg/L	6.0	6.0	6.1	6.0	--	-
7.	Salinity	ppt	0.12	0.12	0.19	0.17	--	-
8.	Iron	mg/L	0.00	0.01	0.00	0.00	0.3 – 1.0	0.3
9.	Fluoride	ppm	0.8	1.0	0.9	0.8	1.0	
10.	Arsenic	mg/L	0.00	0.00	0.00	0.00	0.05	
11.	Total Coliform	n/100 ml	0	0	0	0	0	-
12.	Faecal Coliform	n/100 ml	0	0	0	0	0	-
13.	Chloride	mg/L	16	23	15	19	250[a]	

[19] Ministry of Environment, Forest, and Climate Change. (1997). Bangladesh Environment Conservation Rules, 2023 (Schedule-2 (b)). The People's Republic of Bangladesh.

[20]WHO Standards for Ground Water Quality

SL	Parameter	Unit	GW1 (Dry)	GW1 (Wet)	GW2 (Dry)	GW2 (Wet)	Bangladesh Standard[19]	WHO[20]
14.	Total Alkalinity	mg/L	245	253	185	163	--	--
15.	Total Hardness	mg/L	85	81	70	73	500	

Source: Laboratory Analysis, EQMS laboratory, 2022

The analyzed results for groundwater were compared to the Bangladesh Standards (ECR, 2023) and WHO guidelines. The groundwater analysis for both the dry season and wet season reveals that all the parameters are within the standard value of ECR, 2023, and WHO guidelines. Considering the result of the Groundwater testing, it can be assumed that the groundwater quality is satisfactory for drinking in the study area.

5.4.3 Ambient Noise Quality

The objective of monitoring the ambient noise level was to establish the baseline ambient noise level in the project area.

The residence places around the project site is a quitter. Noise levels besides the highway were higher due to the high frequency of heavy vehicles. No heavy industries are within 2 km of the project site, which creates high noise. Noise generated from the proposed power plant during construction and operation should be compared with the present baseline noise level to know the impact of the power plant on the ambient environment. Noise levels were recorded as sound pressure levels with the help of a digital sound level meter. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations. These locations were chosen to record representative data all over the project site. The noise sampling locations have been selected considering the potential sources of construction activities and the nearest receptors. Important receptors in and around the project site like residential area, educational institutions were considered. The selected locations are fallen in different categories as per DOE/IFC such as industrial, residential, commercial, mixed and silent area. The sound level is recorded as A-weighted equivalent continuous sound pressure level values using A-weighting filters in the noise measuring instrument.

Details of noise level measurement sampling locations are depicted in Table 5-15.

Table 5-15: Details of Noise Level Measurement Sampling Locations

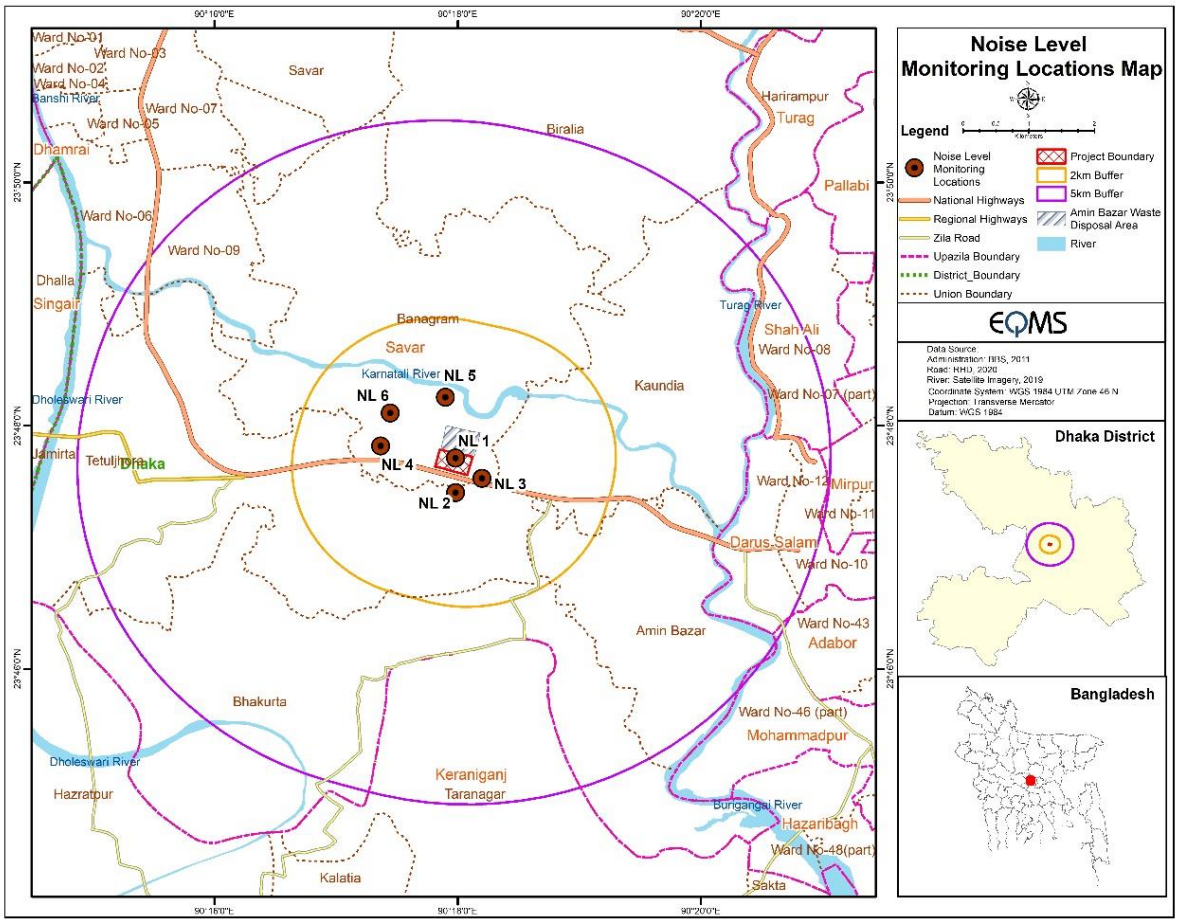
SL.	Code	Location	Monitoring Date	Monitoring Duration	Geographic location	Location setting (DOE/IFC)
1.	NL1	Project Site, Bongaon, Savar, Dhaka	10.04.22-11.04.22	24 hours	23°47'43.09"N 90°17'58.95"E	Industrial
2.	NL2	Modhumoti Model Housing, Bongaon, Savar	11.04.22-12.04.22	24 hours	23°47'26.31"N 90°18'0.15"E	Residential area
3.	NL3	Raj filling station, Bongaon, Savar	12.04.22-13.04.22	24 hours	23°47'33.84"N 90°18'12.02"E	Mixed/Commercial area
4.	NL4	Baliapur Uttarpara Jame Masjid, Bongaon, Savar	13.04.22-14.04.22	24 hours	23°47'49.86"N 90°17'21.44"E	Mixed/Commercial area

SL.	Code	Location	Monitoring Date	Monitoring Duration	Geographic location	Location setting (DOE/IFC)
5.	NL5	Nagar Konda Road, Bongaon, Savar	14.04.22-15.04.22	24 hours	23°48'14.26"N 90°17'54.17"E	Residential area
6.	NL6	Konda High School and College, Konda, Savar	15.04.22-16.04.22	24 hours	23°48'6.28"N 90°17'26.74"E	Silent area

Source: EQMS Field Survey, April 2022

The geographical locations of Noise monitoring are shown in Figure 5-30.

Figure 5-30: Noise Level Monitoring Location



Source: EQMS Field Survey, April 2022

Photographs captured during noise monitoring in and around the project site are shown in Figure 5-31.

Figure 5-31: Photographs were taken during Noise level measurement

	
NL1	NL2
	
NL3	NL 4
	
NL 5	NL 6

Source: Field Survey by EQMS Team, April 2022

Noise Level Monitoring Results

Ambient noise level monitoring results are given in the following Table 5-16.

Table 5-16: Noise Level Parameter in and around the Proposed Site

Location	Noise level (dB(A))[21]						Bangladesh Standard (dB(A))[22]		IFC EHS Guideline (2007)[23]		Location setting (DOE/IFC)
	Leq (day)	L_{max}	L_{min}	Leq (night)	L_{max}	L_{min}	Day	Night	Day	Night	
NL1	66.8	84.4	35.9	57.5	78.3	35.5	75	70	70	70	Industrial
NL2	54.8	76.6	34.6	43.1	59.9	33.2	55	45	55	45	Residential area
NL3	67.3	89.3	34.3	64.6	85.1	35.5	60	50	70	70	Mixed/Commercial area
NL4	76.9	97.1	46.6	72.8	96.6	42.2	60	50	70	70	Mixed/Commercial area
NL5	55.1	76.3	40.2	44.6	53.7	33.4	55	45	55	45	Residential area
NL6	51.5	67.4	37.2	43.2	55.32	34.7	50	40	55	45	Silent area

Note: Grey color indicates exceedance of national noise level standard of Noise Pollution (Control) Rules, 2006

Source: EQMS Field Survey, April 2022

Ambient daytime noise level (Leq_{day}) was recorded in the range of 51.5 to 76.9 dB(A). In contrast, the study area's ambient nighttime noise levels (Leq_{night}) varied from 43.1 to 72.8 dB(A). Maximum noise levels (L_{max}) for daytime at the monitoring locations were recorded in the range of 67.4 to 97.1 dB(A), and the minimum noise levels (L_{min}) for daytime at the monitoring locations were recorded in the range of 34.3 to 46.6 dB(A). Maximum noise levels (L_{max}) for nighttime at the monitoring locations were recorded in the range of 53.7 to 96.6 dB(A), and the minimum noise levels (L_{min}) for nighttime at the monitoring locations were recorded in the range of 33.2 to 42.2 dB(A).

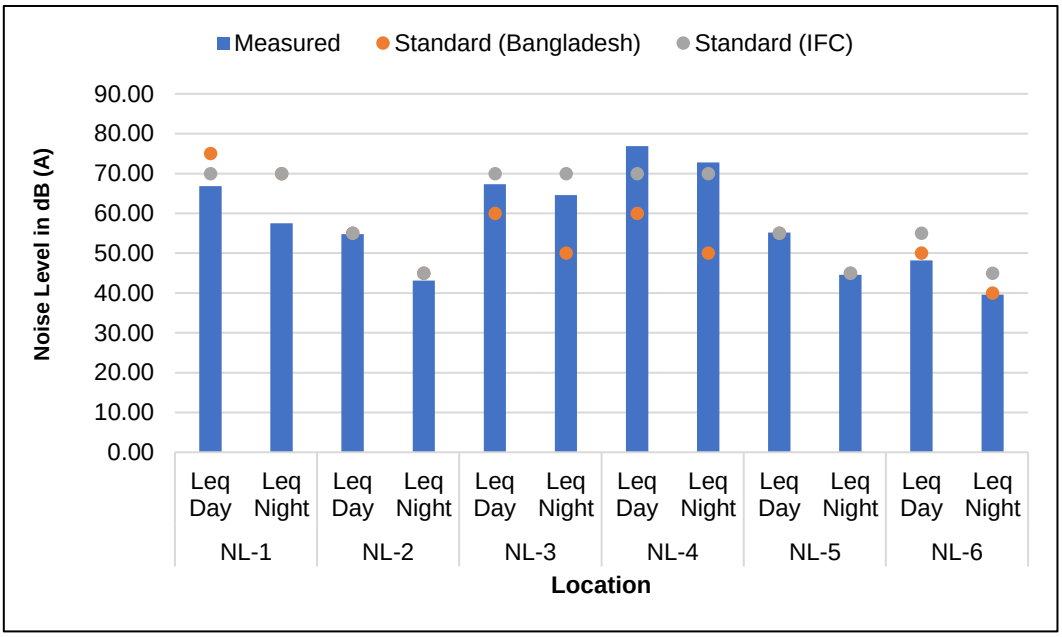
During the daytime, the noise level ranged from a high of 76.9 dB(A) at NL4 to a low of 51.5 dB(A) at NL6. Visual representations of noise levels at each monitoring location are illustrated in the graph in Figure 5-32.

[21] A-weighted decibel, abbreviated dB(A), is an expression of the relative loudness of sounds in air as perceived by the human ear. In the A-weighted system, the decibel values of sounds at low frequencies are reduced, as the ear is less sensitive to low audio frequencies, especially below 1000 Hz, than to high audio frequencies.

[22] Ministry of Environment, Forest, and Climate Change. (2006). Noise Pollution (Control) Rules, 2006 (S.R.O. No. 212-Law/2006). The People's Republic of Bangladesh.

[23] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999

Figure 5-32: Graphical representation of noise level at the monitoring points



On the other hand, the highest noise level at nighttime was recorded at 72.8 dB(A) at NL4, and the lowest was 43.1 dB(A) at NL2 during the monitoring period. According to the Noise level measurement result, the noise level for NL3 exceeded the Bangladesh standard on both day and nighttime. According to IFC guidelines, the NL3 result is within the standard for both day and nighttime. And the noise level for NL4 exceeded the Bangladesh and IFC standards on both day and nighttime. It is because the location of Noise level measurement in NL3 and NL4 is beside the Dhaka-Aricha highway and thousands of vehicles pass through the highway. Therefore, it might be the significant reason for the exceedance of Noise level.

5.4.4 Soil and Sediment Quality

Sampling Method and Locations

Soil and sediment quality is a measure of the condition of soil relative to the requirements of one or more biotic species and or to any human need or purpose. According to the United States Department of Agriculture Natural Resources Conservation Service, "Soil and sediment quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation." The European Commission's Joint Research Centre proposed a definition, stating that "Soil quality is an account of the soil's ability to provide ecosystem and social services through its capacities to perform its functions under changing conditions. Soil quality reflects how well soil performs the functions of maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, nutrient cycling, and providing support for plants and other structures.

The soil and sediment sampling strategy were designed to assess the existing soil and sediment quality over the project area. Each location used a composite sampling technique for soil and sediment sampling.

A total of four (4) soil samples were collected from two locations covering two seasons (dry and wet). Similarly, A total of four (4) sediment samples were collected from two locations covering both dry and wet seasons. Soil and Sediment sampling were done during April and August 2022 to cover the dry and wet seasons, respectively. Details of soil and sediment sampling locations are depicted in Table 5-17.

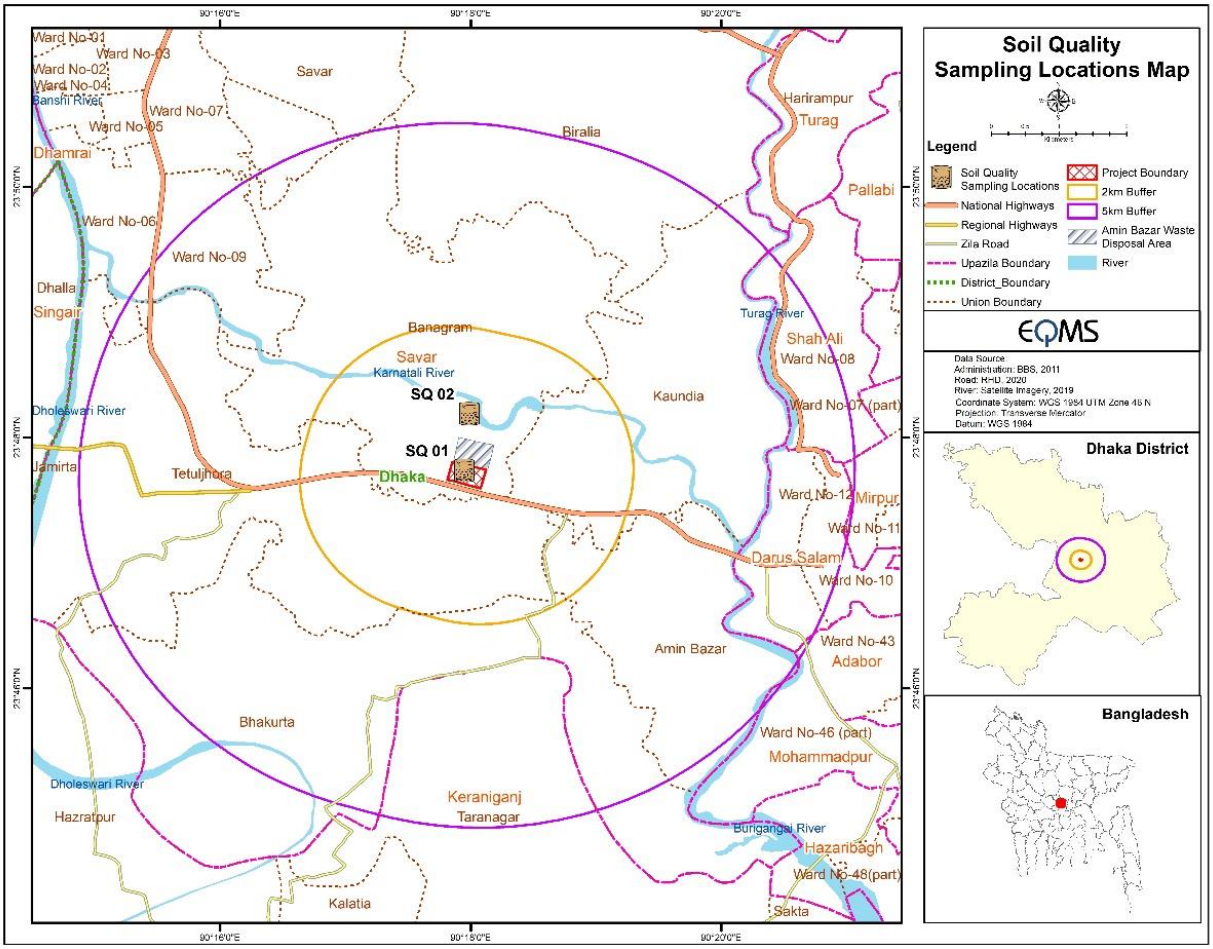
Table 5-17: Details of Soil & Sediment Sampling Locations

SL.	Sampling Location	Code	Monitoring data		Type	Geographical Location
			Dry season	Wet season		
1.	Project Site, Bongaon, Savar, Dhaka	SQ1	12 April 2022	16 August 2022	Soil	23°47'44.29"N 90°17'56.84"E
2.	Nagar Konda Road, Bongaon, Savar, Dhaka	SQ2	12 April 2022	16 August 2022	Soil	23°48'11.43"N 90°17'59.30"E
3.	Upstream of Karnatali River	Sed1	12 April 2022	16 August 2022	Sediment	23°48'20.53"N 90°17'50.59"E
4.	Downstream of Karnatali River	Sed2	12 April 2022	16 August 2022	Sediment	23°48'10.45"N 90°18'19.84"E

Source Field Survey by EQMS, April and August 2022

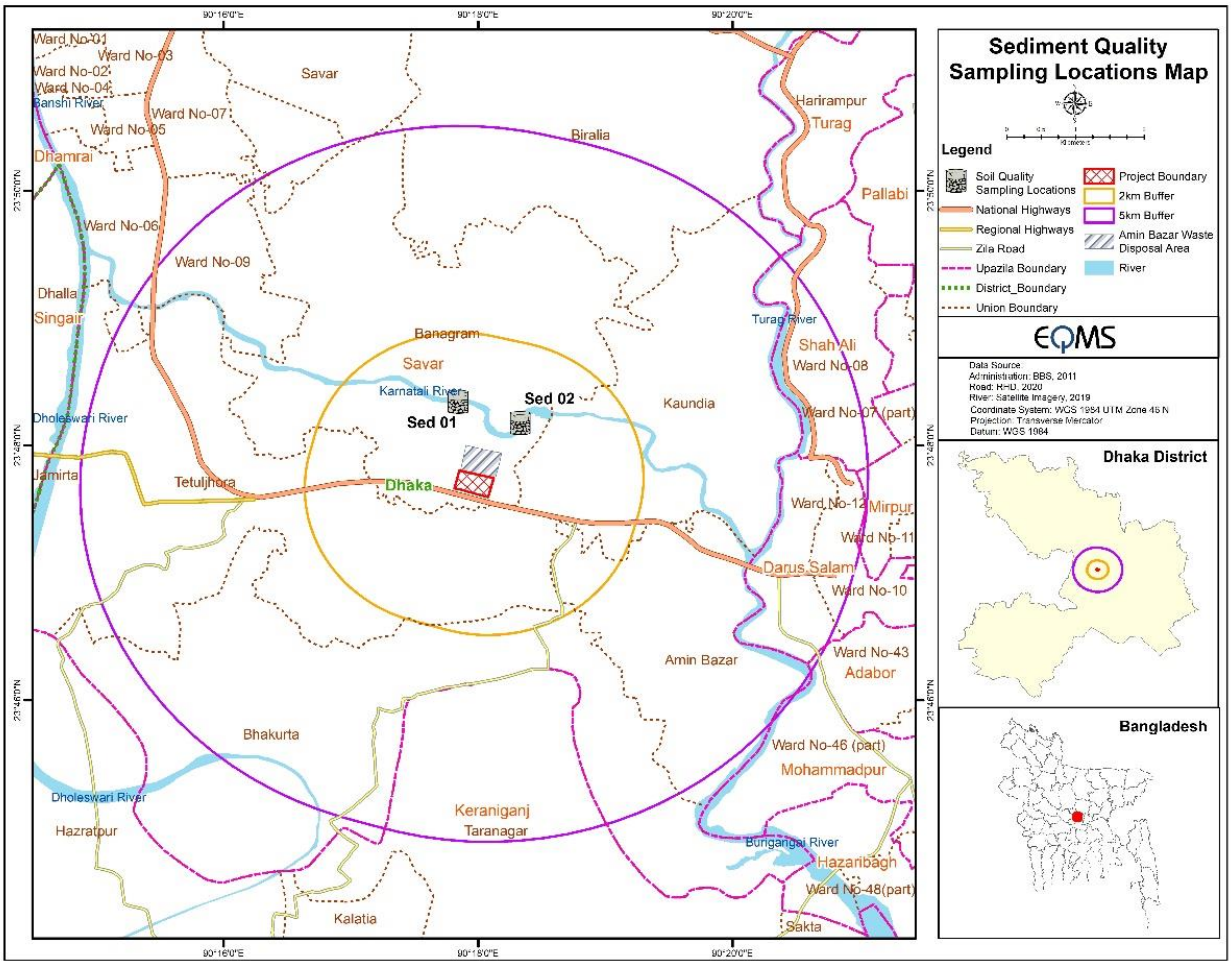
Soil and sediment sampling location maps are given in Figure 5-33 and Figure 5-34, respectively.

Figure 5-33: Soil Sampling Location



Source: EQMS Field Survey, April and August 2022

Figure 5-34: Sediment Sampling Location



Source: EQMS Field Survey, April and August 2022

Soil samples were collected using tools from a depth of 45 cm from the topsoil surface in both dry and wet seasons. At each location, soil samples were collected from three spots and homogenized. The homogenized samples were collected following the quartering technique and then packed in polyethylene plastic jars and sealed. The sealed samples were sent to the laboratory for analysis.

Photographs taken during soil and sediment collection are shown in Figure 5-35 and Figure 5-36, respectively.

Figure 5-35: Photographs were taken during the Soil collection

SQ1 (Dry)

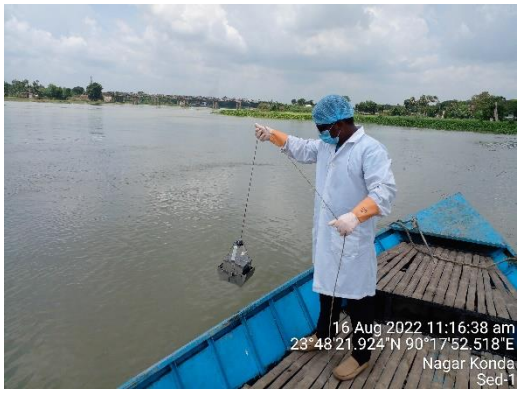
SQ2 (Dry)

	
SQ1 (Wet)	SQ2 (Wet)

Source: Field Survey by EQMS Team, April and August 2022

Sediment samples were collected from the Karnatali River using the Ekman dredger in both the dry season and wet season. At each location, sediment samples were collected from two spots and homogenized. Care was taken to minimize the surface disturbance to the sediments. The homogenized samples were then packed in polyethylene plastic bags, sealed, and sent to the laboratory for analysis.

Figure 5-36: Photographs were taken during the Sediment collection

	
SedQ1 (Dry)	SedQ2 (Dry)
	
SedQ1 (Wet)	SedQ2 (Wet)

Source: Field Survey by EQMS Team, April and August 2022

Analysis Results and Discussions

The analysis results of physicochemical parameters of soil and sediment samples are presented in Table 5-18 and Table 5-19, respectively.

Table 5-18: Soil Quality Analysis Result

SL.	Testing Specification		Method	Unit	SQ1 (Dry)	SQ1 (Wet)	SQ2 (Dry)	SQ2 (Wet)
1.	Texture		Marchel triangle using sand, silt, and clay %.	--	Sandy Loam	Silt Loam	Sandy Loam	Silt Loam
2.	Particle Size Distribution	Sand	Hydrometer Method	%	63.6%	17.3%	57.97%	19.3%
		Slit			26.3%	57.1%	27.19%	55.4%
		Clay			10.1%	25.6%	14.84%	25.3%
3.	Salinity		Salinity measure from soil-saturated paste extract. Salinity measuring meter HACH, USA	ppt	2.41	3.87	2.53	3.76
4.	pH		Benchtop pH meter Metrohm 906, Switzerland	-	7.27	7.38	7.19	7.21
5.	Cation Exchange Capacity		Soil leaching column method	Meq/100g soil	6.78	12.31	57.43	11.23
6.	Nitrogen (Total)		Kjeldahl nitrogen digestion and distillation method	%	0.219	0.113	0.224	0.102
7.	Potassium		Flame Photometer	ppm	2288	3125	2189	2876
8.	Magnesium		Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	ppm	4170	2748	4051	2568
9.	Sodium		Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	ppm	294.4	441	287.19	401
10	Phosphorus		Vanadomolybdophosphoric acid colorimetric method using UV-Visible Spectrophotometer	ppm	1580	894	1560	786
11	Iron		Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	%	1.785	3.66	1.491	3.45
12	Chromium		Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	ppm	37.825	21.31	29.91	19.84
13	Cadmium		Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	ppm	0.223	0.210	0.197	0.202

Source: Laboratory Analysis by Bangladesh Council of Scientific and Industrial Research (BCSIR) Laboratory, 2022

Soil pH is critical in absorbing and utilizing essential trace elements required for healthy plant growth. The ideal pH range varies for plants; however, most plants favor a mildly acidic growing environment of around 5.8 to 6.2. Most plants will endure pH environments ranging from pH 5.0 to 7.0.

It has been observed that the texture of the soil is primarily sandy loam in the study area. The pH of the soil ranged from 7.19 to 7.27 for the dry season and 7.21 to 7.38, indicating that the soil is moderate to slightly alkaline.

The phosphorus values for dry and wet season ranges from 1560 to 1580 ppm and 786 to 894 ppm, respectively. The potassium value ranges from 2189 to 2288 ppm for the dry season and 2876 ppm to 3125 ppm for the wet season. The magnesium values have varied from 4051 to 4170 ppm and 2568 ppm to 2748 ppm for both dry and wet seasons respectively. The iron concentrations for the dry season were observed to be ranging from 1.491% to 1.785% and 3.45% to 3.66% for the wet season. The dry season Chromium concentrations range from 29.91 to 37.82 ppm, whereas 19.48 ppm to 21.31 ppm for the wet season. The salinity present in the soil of the study area is observed in the ranges from 2.41 to 2.53 ppt for the dry season and 3.76 ppt to 3.87 ppt for the wet season. Total nitrogen and sodium concentration during the dry season ranged between 0.219 to 0.224 % and 287.19 to 294.4%. The wet season Total nitrogen and sodium concentration vary from 0.102% to 0.113% and 401 ppm to 441 ppm, separately. The Environmental Conservation Rules (ECR), 2023 has no soil quality standard.

Table 5-19: Sediment Quality Analysis Results

SL.	Testing Specification	Method	Unit	SedQ1 (Dry)	SedQ1 (Wet)	SedQ2 (Dry)	SedQ2 (Wet)
2.	pH	Benchtop pH meter Metrohm 906, Switzerland	-	7.51	7.48	7.47	7.23
3.	Nitrogen (Total)	Kjeldahl method, (Nitrogen Digestion and Distillation Apparatus, VELP, Italy)	%	0.1287	0.101	0.101	0.102
4.	Potassium	Flame Photometer, (Jenway, UK)	ppm	3432	4433	3086	4132
5.	Calcium	Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	ppm	1674	2241	1661	1942
6.	Magnesium	Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	ppm	8249	6832	8769	6144
7.	Sodium	Flame Photometer, (Jenway, UK)	ppm	472.5	378	441.81	306
8.	Phosphorus	Vanadomolybdophosphoric acid colorimetric method using UV-Visible Spectrophotometer	ppm	695	715	671	689
9.	Iron	Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	%	3.249	3.964	3.153	3.023
10.	Zinc (Zn)	AAS	ppm	126	109	120	93
11.	Cadmium	Flame Atomic Absorption Spectrometry (AA 7000, Shimadzu, Japan)	ppm	1.423	0.849	1.132	0.826

Source: Laboratory Analysis by Bangladesh Council of Scientific and Industrial Research (BCSIR) Laboratory, 2022

Analysis Results and Discussions

It has been observed that the texture of the sediment is mostly silt loam in the study area. The pH of the sediment ranged from 7.47 to 7.51 for the dry season and 7.23 to 7.48 for the wet season, indicating that the sediment is moderate to slightly alkaline.

The phosphorus values for dry and wet seasons ranged from 671 to 695 ppm and 689 to 715 ppm, respectively. The potassium value ranged from 3086 to 3432 ppm and 4132 to 4433 ppm, respectively for dry and wet seasons. The magnesium values have varied for dry and wet seasons from 8249 to 8769 ppm and 6144 ppm to 6832 ppm, respectively. The iron concentrations were observed to be ranging from 3.153% to 3.249% ppm for the dry season and on the other hand, the wet season data ranges from 3.023 ppm to 3.964 ppm. Total nitrogen, calcium, and sodium concentration for the dry season range between 0101 to 0.1287%, 1661 to 1674 ppm, and 441.81 to 472.5 ppm; and for the wet season it varies from 0.101% to 0.102%, 1942 ppm to 2241 ppm, 306 ppm to 378 ppm. The analysis reveals that these sediments are moderate to slightly alkaline with acceptable potassium, iron, and magnesium content and less to medium phosphorous ranges. The Environmental Conservation Rules (ECR), 2023 has no sediment quality standard.

5.5 Biological Environment

5.5.1 Introduction

Industrialization is one of the main drivers of ecological, environmental, and socio-economical change worldwide[24]. It is a central component of land transformation processes and fundamental changes in land use and landscape pattern around the globe, especially in developing countries. This provision is fully applicable to the adjacent areas of Karnatali River of Savar Upazila Dhaka, located in one of the densely populated regions of Bangladesh, facing today the complexity of the socio-economic and ecological issues.

Despite not being completely natural, the habitats and ecosystems of the Karnatali River, Turag River, and adjacent area have a high value in terms of their rich biodiversity in its diverse ecological habitats. The study area for the ecological survey includes a buffer area from the estimated center of the proposed project location. Land use of the buffer area includes rivers, grasslands, fallow lands, wetlands, gardens, agricultural lands, and woodlands including a scattered plantation.

5.5.2 Bio-ecological Zones of the Study Area

Bio-geographically, Bangladesh is situated in the Oriental Region lying at the transitional point between the Indo-Himalayan and Indo-Chinese sub-region. In the context of physiographic and biological diversity, IUCN has classified Bangladesh into Twenty-Five (25) Bio-Ecological Zones[25].

The study area has fallen under the Bio-ecological Zone of '3. Madhupur Sal Tract' and '4c. Brahmaputra Jamuna Floodplain' (Figure 5-37). Details on these bio-ecological zones are presented in Table 5-20.

Table 5-20: Typical Characteristics of Bio-ecological Zones of AOI

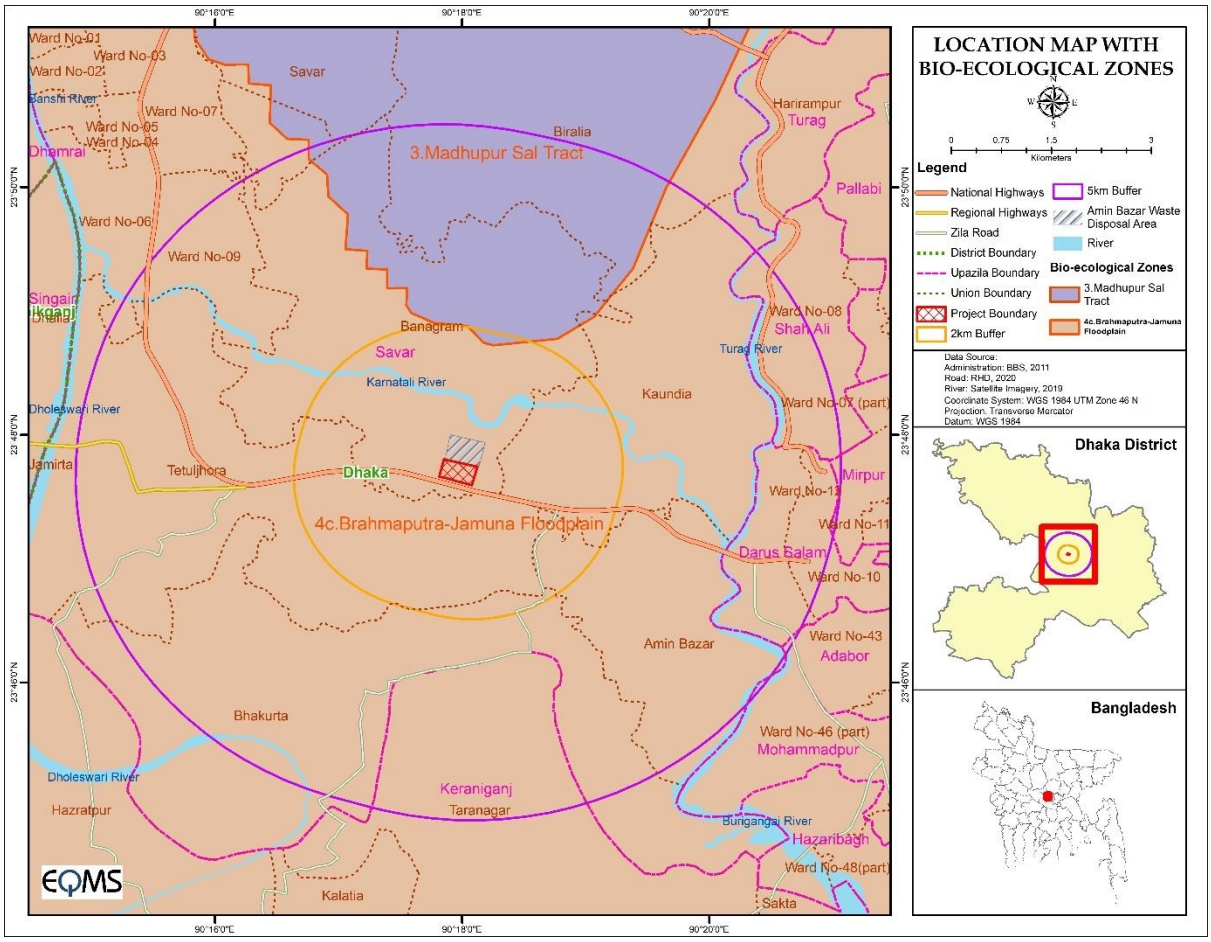
3. Madhupur Sal Tract		
Floral diversity	Trees	Sal (*Shorea robusta*), Ban chalta (*Lagerstroemia parviflora*), Chitrika/neul (*Bursera serrata*), Ban karpash (*Thespesia lampus*), Bhela (*Semicarpus anacardium*), Bhela (*Semicarpur anacardium*)
	Herbs	Shamdalam *(Elephantopus scaber),* Shothi *(Curcuma zedoaria), Borreria hispida*
	Shrubs	Kamela (*Mallotus philippensis*), Kestoma/Keura (*Glochidion multiloculare*), Assar (Grewia microcos), Mankanta (Randia dumetorum)
	Climbers	Kamkui/ kantakui (*Bridelia retusa*), Goalia lata (*Spatholobus roxburghii*), Ban ritha/Kuchui (*Acacia concim*), Anantamul (*Hemidesmus indicus*)
	Orchids	Pink nodding orchid (*Geodorum densiflorum*)
Faunal Diversity	Mammals	Capped langur (*Trachypithecus pileatus*), Wild boar (*Sus scrofa*), Asiatic brush-tailed porcupine (*Atherurus macrourus*), jackel (*Canis aureus*), Jungle cat (*Felis chaus*)
	Birds	Indian pitta (*Pitta brachyura*), Oriental dollarbird (*Eurystomus orientalis*), Blue-tailed bee-eater (*Merops philippinus*), Dusky eagle-owl (*Bubo coromandus*), Green-billed malkoha (*Phaenicophaeus tristis*), Lesser

[24] Freitas, E.V.D., M.D.M. Veloso, and W.S. Araújo. 2020. Urbanization alters the composition, but not the diversity and structure of Neotropical savanna woody plant communities. Folia Geobotanica 55: 95–108

[25] Nishat, A., S.M.I. Huq, S.P. Barua, A.H.M.A. Reza and A.S.M. Khan. 2002. Bio-ecological Zones of Bangladesh. The World Conservation Union (IUCN), Dhaka, Bangladesh. 141 pp

		coucal (*Centropus bengalensis*), Yellow-footed green pigeon (*Treron phoenicopterus*)
	Reptiles	Indian black turtle (*Melanochelys trijuga*), Monocled cobra (*Naja kaouthia*), Cantor's kukri snake (*Oligodon cyclurus*)
	Amphibians	Banded bullfrog (*Kaloula pulchra*), Ornate narrow-mouthed frog (*Microhyla ornata*), Red microhylid (*Microhyla rubra*), Taipeh frog (*Rana taipehensis*), Balloon frog (*Uperodon globulosus*)
4c. Brahmaputra Jamuna Floodplain		
Floral diversity	Trees	Kanthal (*Artocarpus heterophyllus*), Aam (*Mangifera indica*), Rendi koroi/Rain tree (*Samanea saman*)
	Herbs and Shrubs	Danda kalash (*Leucus aspera*), Bhant (*Clerodendrum viscosum*), Assam lata (*Mikania scandens*), Motkila (*Glycosmis arborea*)
	Trees Near water	Pitali (*Trewia nudiflora*), Koroj (*Pongania pinnata*), Jarul (*Lagerstroemia speciosa*), Debdaru (*Polyalthia longifolia*)
	Aquatic Plants	Kachuripana (*Eichhornia crassipes*), Shada shapla (*Nymphaea nouchali*), Keshordam (*Ludwigia adscendens*)
Faunal diversity	Mammals	Rhesus macaque (*Macaca mulatta*), Three-striped palm squirrel (*Funambulus palmarum*), Jackal (*Canis aureus*), Hispid hare (*Caprolagus hispidus*), Small Indian civet (*Viverricula indica*)
	Birds	Jerdon's baza (*Aviceda jerdoni*), Black-necked stork (*Ephippiorhynchus asiaticus*), Asian openbill (*Anastomus oscitans*), River lapwing (*Vanellus duvaucelii*), Pheasant-tailed jacana (*Hydrophasianus chirurgus*)
	Reptiles	Yellow monitor (*Varanus flavescens*), Bengal monitor (*Varanus bengalensis*), Common vine snake (*Ahaetulla nasutus*)
	Amphibians	Tree frog (*Polypedates leucomystax*), Cricket frog (*Limnonectes limnocharis*)

Figure 5-37: Bio-ecological Zones of the Study Area



Source: Atlas of Bio-ecological Zones of Bangladesh, IUCN, 2002

5.5.3 Ecosystems within the Study Area

A comprehensive biodiversity baseline survey was conducted in May and August 2022 considering the project area of influence to be 5 km from the project site during the ESIA. In this study, a total of 44 floral species under 23 families, 40 bird species under 23 families, four species of amphibians under two families, eight species of reptiles under six families and five mammal species under four families were recorded during the study period. None of the recorded flora and fauna species are under threatened categories according to IUCN Bangladesh, 2015. A total of ten aquatic macrophyte species were recorded from the shallow water of the Karnatali River, floodplains, ponds, and swamps around the proposed project AOI.

Based on the secondary information, point count survey and boat-based transect survey were used for recording the occurrence and identifying the habitats of Ganges River Dolphin (*Platanista gangetica*) around the project AOI across the Karnatali River. The study area included the river stretches of 10 km, with 5 km downstream and 5 km upstream from the proposed project site. During the study period, no aquatic mammals were seen at the project site or AOI.

A comprehensive preliminary environmental review was conducted for the proposed project site location. This review confirmed that there are no designated Important Bird Areas (IBAs) or Key Biodiversity Areas (KBAs) situated in very close proximity to the site. The nearest KBA is the National Botanical Garden, located 4.8 km northwest of the project site. Due to this distance, the proposed project activities are expected to have almost no negative impact on this KBA.

Additionally, the review did not find any endangered or vulnerable plant or animal species that have been observed or recorded within the project area in recent times. The area is characterized by common, widely-distributed species. The overall ecological sensitivity of the site is considered low, and there are no unique ecosystems present that would require special conservation measures. Based on these findings from the preliminary review, it has been determined that biodiversity assessment is not necessary for this proposed project.In addition, all kinds of potential biodiversity impacts of the plant and other AFs have been identified and assessed under section 6.2.2.9 and 6.2.3.8.

The ecosystems within the study area are as follows: Terrestrial ecosystems and Aquatic ecosystems.

5.5.3.1 Terrestrial Ecosystem

The ecological setting is mostly settled with typical homestead vegetation, agricultural lands, roadside vegetation, Grassland, and fallow land. The study area is concealed by lush green foliage of a wide variety of trees, thickets of bamboo and banana plants, and others.

5.5.3.1.1 Habitat

Homestead Vegetation: A characteristic feature of the homestead landscape is the presence of a variety of plant and fruit trees. Common homestead vegetation was recorded near villages and settlements that give a green panoramic view. Common species include Coconut (*Cocos nucifera*), Jackfruit (*Artocarpus heterophyllus*) Mango (*Mangifera indica*), Guava (*Psidium guajava*), Papaya (*Carica papaya*), Neem (*Azadirachta indica*), Lemon (*Citrus spp.)*, Java Plum (*Syzygium cumini*), Supari (*Areca catechu*), Banana (*Musa sapientum*), Koroi (*Samanea saman*), etc. This vegetation offers numerous urban wildlife species such as birds, herpetofauna, and mammals around the project AOI.

Agricultural lands: The project AOI is characterized by agricultural land. Various farming methods were observed inside the AOI**.** Mono-cropping of paddies is the most prevalent farming approach. The main crops grown around the proposed project area include paddy, peanut, onion, garlic, chili, and other vegetables such as Potato, Brinjal, Cucumber, Bitter gourd, Snake Gourd, Bottle ground, Pumpkin, Water pumpkin, Hyacinth bean, etc. Tree species observed near the agricultural lands are Olive (*Elaeocarpus serratus*) Java Plum (*Syzygium cumini*), Coconut (*Cocos nucifera*), Mango (*Mangifera indica*), Date palm (*Phoenix sylvestris*), etc.

Roadside Vegetation: The major roadside vegetation consists of Acacia (*Acacia auriculiformis*), Raintree (*Samanea saman*), Custard apple (*Annona reticulata*) Indian rosewood (*Dalbergia sissoo*), Bot (*Ficus benghalensis*), Mahogony (*Swietenia mahagoni*), Eucalyptus (*Eucalyptus citriodora*), etc. This vegetation is an additional habitat for many birds and small mammal species.

Grassland and Fallow Land: Fallow land is an uncultivated highland near the settlement that is often utilized for plantation. Grassland and fallow land provide a habitat for a multitude of grassbird species. The major plant species of these sites are Akshmoni (*Acacia auriculiformis*), Eucalyptus (*Eucalyptus camaldulensis*), Coconut (*Cocos nucifera*), and Mahagony (*Swietenia mahagoni*). Besides, Durba grass (*Cynodon dactylon*) Para grass (*Brachiara mutica*), and Ruzi grass (*Brachiaria ruziziensis*)) are dominant herb species in the grassland habitat.

Figure 5-38: A Photo plate of Different Types of Terrestrial Habitats

Agricultural Land

Roadside vegetation

Homestead vegetation

Grassland and Fallow Land

Source: EQMS Field Survey, May 2022

5.5.3.1.2 Terrestrial Flora

The quadrat sampling method has been used for assessing the vegetation structure in and around the project area. A total of five quadrates were sampled for phytosociological assessment. Floral species composition was assessed from the field based primary survey data of five quadrats laid in the AOI. The sampling plot size (quadrat) was 10m x 10m for trees, 5m x 5m for shrubs and 1m x 1m for herbs. The Quadrates study sites have been provided in the Table 5-21 and locations of the quadrats are shown in Figure 5-39. A sample photo plate of the quadrat Survey is given in Figure 5-40.

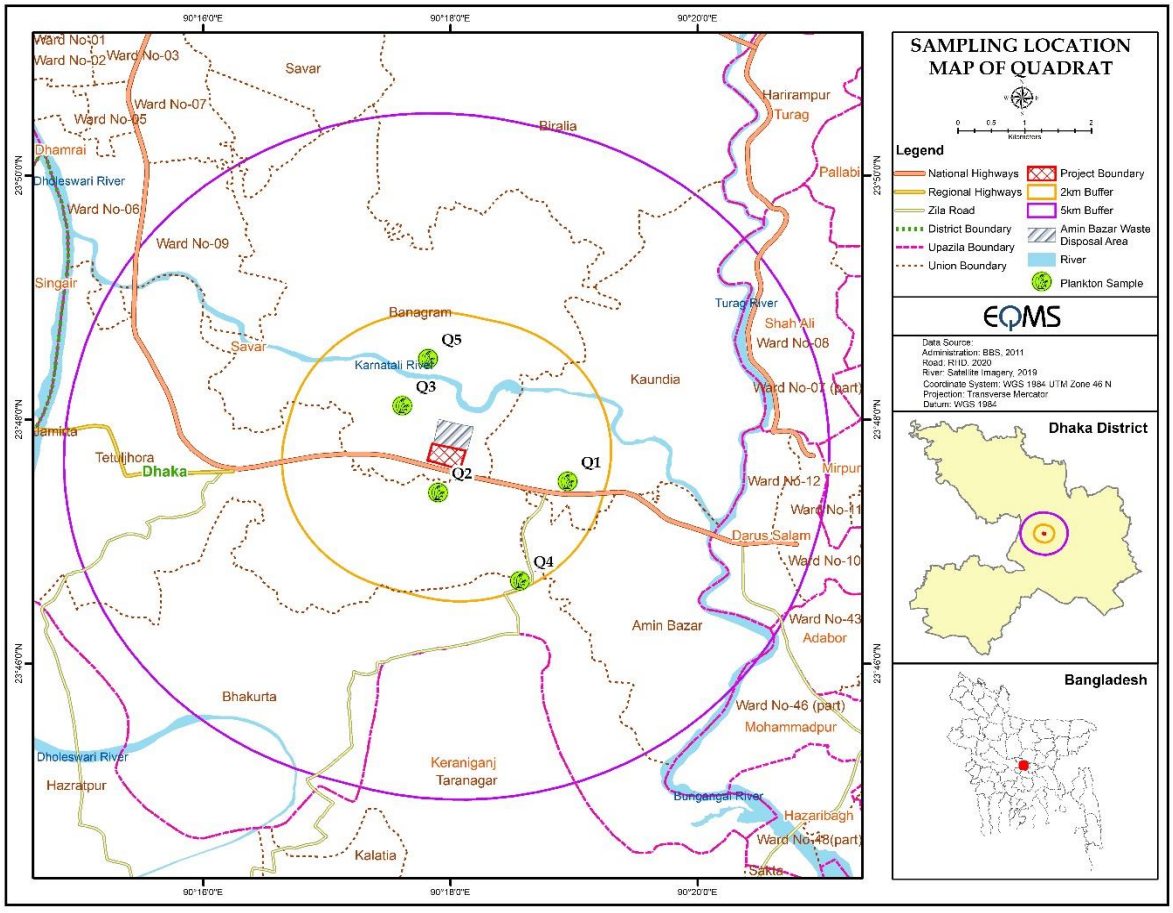
Table 5-21: Description of the Quadrat Sampling

Location Code	Location/ Nearest Village	Latitude	Longitude	Habitat Type
Q1	Uttar Kaundia	23°47’29.55” N	90°18’56.85” E	Roadside Vegetation
Q2	Near Rajmohol Resort, Modhumoti Model Town	23°47’24.13” N	90°17’54.03” E	Mixed vegetation

Q3	Nagar Konda	23°48’6.78” N	90°17’36.60” E	Homestead vegetation
Q4	Near Mograkanda North Para	23°46'40.68"N	90°18'33.79"E	Mixed vegetation
Q5	Beraid Gandaria	23°48'29.87"N	90°17'49.09"E	Homestead garden

Source: EQMS Field Survey, May 2022

Figure 5-39: Sampling Location Map of Quadrat Survey



Source: EQMS Field Survey, May 2022

Figure 5-40: A sample Photo Plate of Quadrat Survey

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Sample quadrate plots for the floral survey</td></tr>
<tr><td> 
</td><td>  </td></tr>
<tr><td>Observation of vegetation type</td><td>Species wise data collection in sample quadrat</td></tr>
</table>

Source: EQMS Field Survey, May 2022

Floral Species Composition

Floral species composition was evaluated employing primary survey data from five (5) quadrats planted in the AOI. The terrestrial flora covers most of the vegetation in the study area. A total of 44 species under 23 families of floral species were enumerated during the field survey from the five (5) quadrat samples. The highest number of floral species (7 species) were recorded under the Fabaceae family and the second-highest number of species (6 species) were under Moraceae. Major tree species observed in and around the project AOI area were Kathal (Artocarpus heterophyllus), Mango (*Mangifera indica*), Chalta (*Dillenia indica*) Jam (*Syzygium cumini*), Mahogoni (*Swietenia mahagoni*), Coconut (*Cocos nucifera*), Shishu (*Dalbergia sissoo*) etc.

Species Diversity Index

Shannon Diversity index (H) is used tool characterize species diversity for different quadrats. Highest value of Shannon diversity index (H) was found for Quadrat Q1 (1.633) at Uttar Kaundia followed by Quadrat Q5 (1.231) at Beraid Gandaria and the lowest value was found for Quadrat Q3 (1.075) at Nagar Konda. The value of Evenness (E) is highest in Quadrat Q1 followed by Quadrat Q5. The highest species richness (6) was recorded in Quadrat Q1, and the greatest number of individuals (22) were recorded in Quadrat Q4. Biodiversity indices of different Quadrats has been presented in Table 5-22.

Table 5-22: Biodiversity indices of different Quadrats

Parameter	Quadrat 1 (Q1)	Quadrat 2 (Q2)	Quadrat 3 (Q3)	Quadrat 4 (Q4)	Quadrat 5 (Q5)
Shannon-Wiener Diversity Index(H)	1.633	1.171	1.075	1.097	1.231
Evenness (E)	0.911	0.845	0.776	0.791	0.888
Species Richness (S)	6	4	4	4	4
Total Abundance	12	14	12	22	13

Source: EQMS Field Survey, May 2022

5.5.3.1.3 Terrestrial Fauna

The total faunal biodiversity of the study area is divided into three major classes such as Avifauna, Herpetofauna (Amphibians & Reptiles), and Mammals.

5.5.3.1.3.1 Avifauna

The transect method was applied to know the status of the avian fauna in the study area and record the bird species. The avifauna was also identified visually by hearing their calls and recorded in the data sheet.

A total of 40 species under 23 families have been found within the study area. The highest number of birds that dominated the study area are belonging to the family Alcedinidae and Ardeidae (06 species). In addition, Columbidae, Corvidae, and Sturnidae are the second dominated family (03 species). Homestead forests, grassland and bush, and some aquatic habitats of this area have supported the wild birds for feeding and roosting ground. All the bird species found in this are the least concern (LC) both locally and globally according to IUCN red list.

5.5.3.1.3.2 Herpetofauna (Amphibians & Reptiles)

Visual encounter surveys were conducted for herpetofauna fauna over a wider area. These surveys generally comprised walking through various habitats.

A total of four (4) species of amphibians belonging to two (2) families and eight (8) species of reptiles belonging to six (6) families were listed from the project area based on primary and secondary data. Among the recorded amphibian species, the highest number of amphibians (3 species) dominated in the study area belonging to the family Dicroglossidae. On the other hand, the highest number of reptilian species (3 species) were recorded under the Colubridae family and the rest of them have only single species. A checklist of herpetofaunal species recorded in the AOI has been presented in **Appendix H-3**.

All the amphibian species are included in the Bangladesh Wildlife (Conservation and Security) Act, 2012 in Schedule-II which protects them from hunting, killing, and capturing. On the other hand, two (2) Near Threatened (NT) reptile species such as Bengal Monitor Lizard (*Varanus bengalensis*) and Spectacled Cobra (*Naja naja*) were found in the study area.

5.5.3.1.3.3 Mammals

A visual Encounter Survey was followed for observing and counting the wild mammalian species. Mammals that were reported observed in the project area are the Common mongoose (*Herpestes edwardsii*), Common Indian field mouse (*Mus booduga*), Indian Fruit Bat (*Pteropus giganteus*), Common House Rat (*Rattus rattus*) and Irrawaddy Squirrel (*Callosciurus pygerythrus*). All the mammalian species found in the project AOI are Least Concern (LC) both locally and globally according to IUCN Red List. A checklist of mammalian species has been provided in **Appendix H-4**.

5.5.3.2 Inland Aquatic Ecosystem

5.5.3.2.1 Habitat

Aquatic ecosystem within the AOI comprises the Riverine Habitat of Karnatali River and Turag River, some natural drainage canals, floodplain area, beels and ponds. Different types of aquatic habitats within the AOI have been presented in Figure 5-41.

Figure 5-41: A Photo plate of Different Types of Aquatic Habitats

Seasonal Floodplain area

Canal | Karnatali River

Source: EQMS Field Survey, May 2022

5.5.3.2.2 Fish Production and Effort

The study area has rivers, floodplains, canals, and various small ponds. The area has rich and diverse fisheries. According to the consultation with the Senior Upazila fisheries officer, the total fish production of the Savar Upazila is 3,433.989 metric tons (MT). Out of the total fish production, 1,166.501 metric tons (MT) is produced from Capture fisheries and 1,775.228 MT is produced from culture fisheries. There are 2254 fishermen are involved in capture fisheries and 1378 fish farmers are involved in fish farming. A glimpse of general information on fisheries resources is provided in Table 5-23.

Table 5-23: General information of fisheries resources of Savar Upazila (2019-2020)

Capture Fisheries	
Major Capture Species	Rui, Catla, Mrigal, Shol, Taki, Gojar, Aair, Puti, Tengra, Baim, Gulsha, Bacha, Shrimp, etc.

Major Capture Indigenous Species	Rui, Catla, Mrigal, Shol, Taki, Gojar, Aair, Puti, Tengra, Baim, Gulsha, Bacha, etc.
Average Production (kg/ha)	1,166.501
Total Capture Area (ha)	342.86
Culture Fisheries	
Major Culture Species	Rui, Catla, Mrigal, Silver Carp, Bighead, Pangas, Monosex Telapia, Koi, Thai Punti etc.
Major Culture Indigenous Species	Rui, Catla, Mrigal, Koi
Average Production (kg/ha)	1,775.228
Total Capture Area (ha)	342.86

Source: Senior Upazila Fisheries Office, Savar, May 2022

The study team also conducted FGD and consultation with fishermen, local people, fish farmers, and fish market surveys to understand the fishing efforts of the study area. As the rivers have not much tidal influence, the fishermen capture fish in the Karnatali and Turag Rivers during the daytime. The average fishing is 4-5 hours a day and some catch fish twice a day.

5.5.3.2.3 Fishing Craft and Gears

Fishing crafts are the device that is used to catch and transportation fish. Only non-mechanized boats were observed for fishing around the study area during the study period and in a boat, 2-3 fishermen catch fish in a group. Fishing gear is any form of equipment, implement, tool or mechanical device used to catch, collect, or harvest. According to the consultation with fishermen, local fish sellers, and visual observation, different types of fishing gear of two categories (active and passive gear) were observed to harvest fish in the study area. Dominant gears are Ber Jal, Poa Jal, Dacon Jal, Jhaki Jal, Dharma Jal, Current Jal, Moiya Jal, Ber Jal, Thella Jal, BairJal, Chandi bair Jal, Chai Jal, Borshi, etc. The highest numbers of fish species are found in Ber Jal, and the lowest number of fish species are found in Box Chai Jal.

5.5.3.2.4 Fish Migration

Migration is an instinct and facilitating act in the fulfilment of bio-physiological urges in animals. Fishes are no exception and constitute one of the distant migrating groups in the aquatic sphere. For some fish species migration is intra-environmental, limited to a shorter range of distance while for others trans-environmental migration extends from a few hundred to thousands of kilometers. Karnatali River plays a great role in fish migration. Fishes pass from Dhaleshawri to Turag and Buriganga through Karnatali River. During the monsoon fresh water comes from upstream along with fish. Fish move to the floodplains for breeding. Only this time fishermen can catch fish from the river and most of the fish are small. The fish use the floodplains as a nursery, breeding, and feeding ground and move to the other rivers before the beginning of the dry season. Fishes like Tengra, Rui, Catla, Shol, Taki, Pungus, Gulsha Tengra, Shing, Magur, Koi, Puti, etc are very common in these floodplain areas.

5.5.3.2.5 Fish Inventory

The fish survey was carried out based on direct observation through boat-to-boat fish survey, FGD (Focus Group Discussion) with the Fishermen and fish market survey, interviewing local community people and fishermen, conducting KII with Senior Upazila Fisheries Officer of Savar Upazila of Dhaka and secondary information for fish species in the proposed project area.

Fisheries resources of the study area are rich and diversified. A total of Forty-seven (47) species of fish and Six (6) species of Prawn and shrimps were recorded. Most of the fish found in the study area were culture species. Among captured fisheries resources, beels and the floodplain attain the maximum

habitat area in the Savar Upazila. The abundant fish species found in the study area were Indian major carp (*Labeo rohita*, *Catla catla*), Kachki (*Corica soborna*), Tilapia (*Oreochromis niloticus*).

The recorded Forty-seven (47) fish species are covered under Eighteen (18) families. The highest number of fish species belong to the family Cyprinidae. In addition, six (6) species of Prawns and shrimps under two (2) families were recorded. Among the recorded fish species, five (05) Endangered species (*Mastacembelus armatus, Clupisoma garua*, *Botia Dario*, *Channa marulius*, *Chitala chitala*) and four vulnerable species (*Monopterus cuchia*, *Sperata aor*, *Gudusia chapra*, *Labeo boggut*) were enlisted.

5.5.3.2.6 Aquatic Macrophytes

Aquatic macrophytes are defined as emergent, floating-leaved or submerged macroscopic plant species with distinct roots and shoots. In the shallow water of the Karnatali River, floodplains, ponds, and swamps around the proposed project site, various hydrophytes and floating ferns grow in abundance. Tall grasses present a picturesque site near the bank of Karnatali River and the floodplain areas. A total Ten (10) aquatic macrophyte species were recorded around the proposed project AOI. A photo plate of Aquatic Macrophytes is presented in Figure 5-42 and a checklist of Aquatic Macrophytes in the study area is presented in Figure 5-42.

Figure 5-42: Aquatic Macrophyte of the study area

Kasari (*Actinoscirpus grossus*)

Kochuripana (*Eichhornia crassipes*)

Helenchaa (*Enhydra fluctuant*)

Shapla (*Nymphaea nouchali*)

Source: EQMS Field Survey, May 2022

5.5.3.2.7 Aquatic Mammals (Ganges River Dolphin)

The Ganges River Dolphin ("shusuk" in Bangla), *Platanista gangetica* is a freshwater dolphin species distributed throughout the Ganges-Brahmaputra-Meghna River systems in Bangladesh. According to the IUCN Red List of Bangladesh 2015, The Ganges River Dolphin is listed as Vulnerable (VU) but Global IUCN Red List of Threatened species (version: 2022-2) listed it as Endangered (EN). This species is placed on the First Schedule of Bangladesh Wildlife (Conservation & Security) Act, 2012.

The study area of Karnatali River is connected with the Turag and Buriganga Rivers. Studies conducted in 2003-2004 for Buriganga River (Southern part) and in 2012-2013 for Buriganga River (Northern part) found the density of dolphins per kilometer to be 0.25 (Alam and Sarkar, 2012[26]) and 0.38 (Alam *et al.*, 2015[27]), respectively.

In 2009, Khan (2016)[28] reported that several dolphins were sighted near Shoalmachi in the river Turag and at Jhaochar, a kilometre downstream in the river Buriganga. He reported that boatmen spotted some of the dolphins near Amin Bazar Bridge with bore marks of white patches on their back which could be due to suffering from fungal infection due to exposure to pollution.

Research conducted in 2012 to 2013 by Baki *et al.* (2017)[29] indicates that the stretch of the Turag River near Aminbazar and Birulia (Site 1,5,6 in Figure 5-44) is a notable habitat for these dolphins. Studies indicate that this stretch of the river is crucial for dolphin abundance, with sightings being more frequent during the wet season from August to November and sightings vary significantly by season due to changes in water levels and pollution. During the dry season, sightings decrease as dolphins move to other areas with better water quality. The highest encounter rate observed was 0.49 dolphins per kilometer in October 2013. The study area map has been presented in Figure 5-44. Some photos of dolphins observed in November 2013 near Amin Bazar Bridge site in the Buriganga River, Dhaka are shown in Figure 5-43.

Figure 5-43: View of the Platanista gangetica gangetica (Roxburgh, 1801) sightings near Amin Bazar Bridge site in the Buriganga River, Dhaka, Bangladesh in November 2013

[26] Alam, S. M. I., & Sarker, N. J. (2012). Status and distribution of the gangetic dolphin, platanista gangetica gangetica (roxburgh, 1801) in river Buriganga During 2003-2004 and its conservation. *Bangladesh Journal of Zoology*, *40*(1), 21-31.

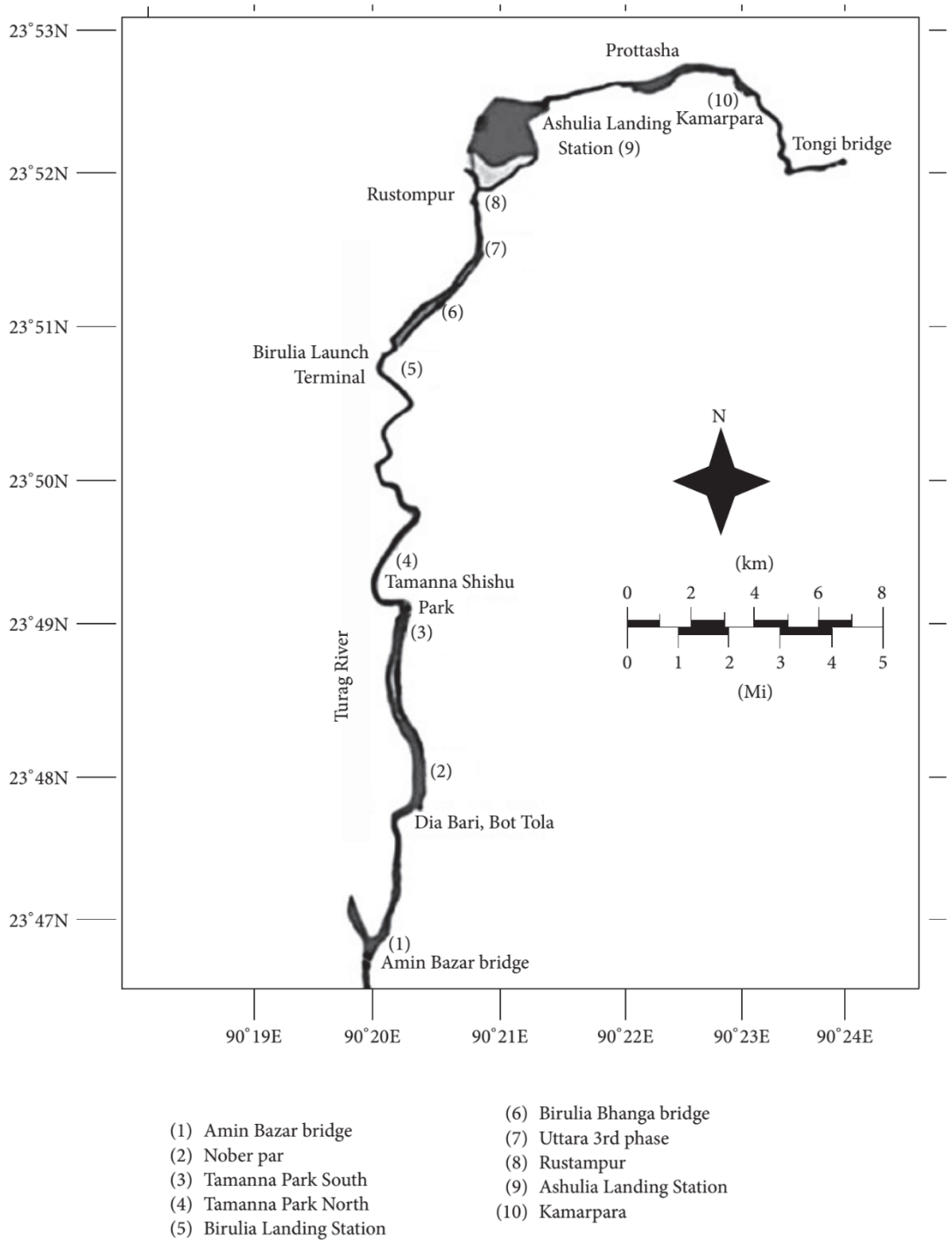
[27] Alam, S. M. I., Hossain, M. M., Baki, M. A., & Bhouiyan, N. A. (2015). Status of ganges dolphin, Platanista gangetica gangetica (Roxburgh, 1801) in the river Buriganga, Dhaka. *Bangladesh Journal of Zoology*, *43*(1), 109-120.

[28] Khan, M. A. (2009). Gangetic dolphins return. Retrieved from https://www.thedailystar.net/news-detail-107621 on 05.06.2024

[29] Baki, M. A., Bhouiyan, N. A., Islam, M. S., Alam, S. M. I., Shil, S., & Hossain, M. M. (2017). Present status of Ganges river dolphins Platanista gangetica gangetica (Roxburgh, 1801) in the Turag river, Dhaka, Bangladesh. *International Journal of Zoology*, *2017*.

Source: Hossain *et al.*, 2016[30]

Figure 5-44: Map of the Dolphin Surveys Sites in Turag River studied in 2012-2013 by Baki *et al.* (2017)



Source: Baki et al. (2017)

[30] Hossain, M.M., Alam, S.M.I., Baki, M.A. and Bhouiyan, N.A. (2016), Ganges River Dolphin. Bull Ecol Soc Am, 97: 183-187. https://doi.org/10.1002/bes2.1227

During the ESIA, point count survey and boat-based transect survey were used for monitoring the Ganges River Dolphin (*Platanista gangetica*) around the project impact areas across river (Karnatali River). The study area includes river stretches of 10 km, with 5 km downstream and 5 km upstream from the proposed project area (3-4 August 2022).

During the study period, no aquatic mammals were seen at the project site or AOI. Consultation of local people and fishermen revealed that they rarely observe Ganges River Dolphin (*Platanista gangetica*) in the Karnatali River (adjacent to the Bongao bridge) during monsoon and post-monsoon (Bengali month: Ashsin-Kartik) period. Also, consultation with the Senior Upazila Fisheries Officer, Savar Upazila confirmed the rare presence of Ganges River Dolphin in Bongao Bridge and adjacent areas.

5.5.3.2.8 Aquatic Invertebrates (Plankton & Macrobenthos)

Phytoplankton and Zooplankton was collected by plankton net (No. 20 silk bottling cloth, mesh size: 45 µm for phytoplankton and No. 25 silk bottling cloth, mesh size: 75 µm for Zooplankton) from three specific points at predefined three (3) sample collection points (Table 5-24 and Figure 5-45). After collection, they were preserved in 3% formalin and a few drops of Glycerin. After adding preservatives, they were brought to the laboratory for species identification and numerical abundance.

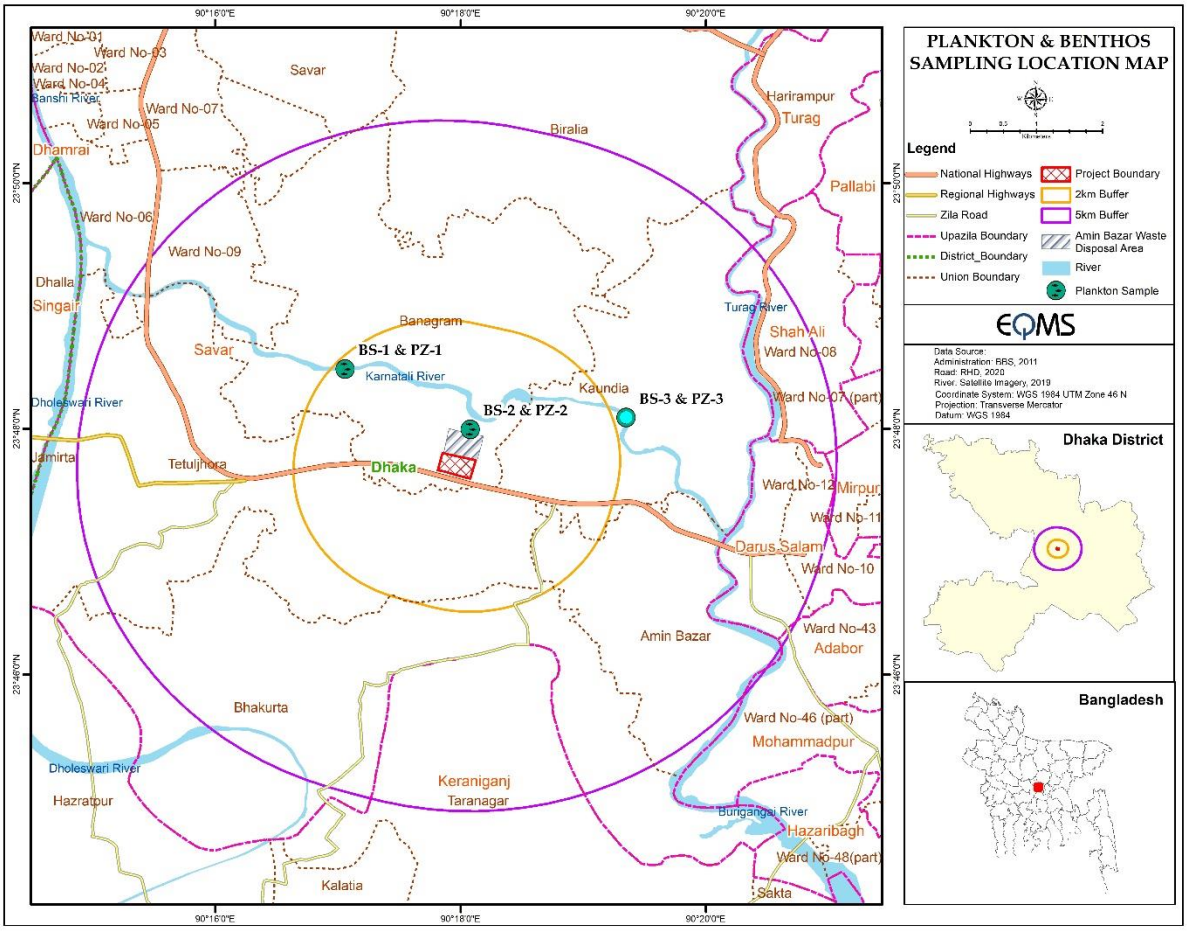
Macrobenthos samples were collected by Ekman bottom grab sampler from predefined three (3) selected points of proposed project AOI (Table 5-24 and Figure 5-45)**,** and sediment from the sampler was taken into plastic bucket and mixed with water. Then the mixed water passed through a 0.5 mm mesh-sized hand-sieve to remove the waste particles, and the separated benthos with other residue were preserved in labeled plastic containers with 10% buffered formalin and transferred to the laboratory for further analysis. Organisms were sorted and enumerated under major taxa. An electric microscope was also used to identify benthos.

Table 5-24: Sampling Points for Plankton and Macrobenthos survey

Sl.	Location	Distance and direction from the Project area	Plankton Sample Code	Benthos Sample Code	GPS coordinates
1	Upstream	Approximately 1200-meters north-west side from the Proposed project site	PZ1	BS-1	23°48'21.01"N 90°17'45.84"E
2	Project adjacent area	Approximately 500-meters north of the proposed project site	PZ2	BS-2	23°47'59.39"N 90°18'4.62"E
3	Downstream	Approximately 1200-meters north-east of the Proposed project site	PZ3	BS-3	23°48'14.95"N 90°18'24.15"E

Source: EQMS Field Survey, May 2022

Figure 5-45: A Map Showing Plankton and Benthos Sampling Locations



Source: EQMS Field Survey, May 2022

5.5.3.2.8.1 Phytoplankton

Dry Season: A total of six (06) species of phytoplankton were identified by sample analysis from predefined three sample collection locations during Dry season field visit in May 2022. The phytoplankton in the study area was represented by four groups and the dominant phytoplankton group was the Bacillariophyta but in the case of species, *Chlorella* sp. was dominant under Chlorophyta.

Wet Season: A total of seven (07) species of phytoplankton under three groups were identified by sample analysis from predefined three sample collection locations during the wet season field visit in August 2022. and Bacillariophyceae is the dominant group but *Microcystis* sp. under Cyanophyceae is the dominant species.

Species composition and numbers of phytoplankton per liter have been presented in Table 5-25.

Table 5-25: Phytoplankton found in the study area

Sl.	Season	Class	Species	Number (individuals/L)		
				PB1	PB2	PB3
1.	Dry Season (May 2022)	Bacillariophyceae	*Fragilaria* sp.	2	1	0
2.			*Nitzschia* sp.	4	0	3
3.			*Navicula* sp.	0	0	3
4.		Euglenophyceae	*Euglena* sp.	5	3	0

Sl.	Season	Class	Species	Number (individuals/L)		
				PB1	PB2	PB3
5.		Chlorophyceae	*Chlorella sp.*.	8	3	4
6.		Cyanophyceae	*Anabaena* sp.	2	0	3
1.	Wet Season (August 2022)	Bacillariophyceae	*Melosira* sp.	1	2	1
2.			*Synedra* sp.	1	1	2
3.			*Nitzschia* sp.	2	4	1
4.			*Navicula* sp.	2	0	0
5.		Chlorophyceae	*Chlorella* sp..	3	2	0
6.		Cyanophyceae	*Anabaena* sp.	1	1	0
7.			*Microcystis* sp.	6	0	1

Source: EQMS Field Survey, May 2022, and August 2022

5.5.3.2.8.2 Zooplankton

Dry season: A total of four (04) species of zooplankton were identified by sample analysis. Two species of Branchiopoda *(Daphnia* sp., *Moina* sp.), One species of Monogononta (*Brachionus* sp.), and One species of Copepoda (*Diaptomus* sp.) were found. *Diaptomus* sp. and *Moina* sp. were the highest abundant zooplankton species.

Wet season: Three (03) species of zooplankton were identified by sample analysis during wet season field visit in August 2022. One species of Copepoda (*Cyclops* sp.), Eurotatoria (*Asplanchna* sp.), and Branchiopoda (*Bosmina* sp.). Among them, *Bosmina* sp. was the highest abundant species.

The species composition and the number of zooplankton per liter have been presented in Table 5-26.

Table 5-26: Zooplankton found in the study area

Sl.	Season	Class	Species	Number (individuals/L)		
				PB1	PB2	PB3
1.	Dry Season (May 2022)	Copepoda	*Diaptomus* sp.	1	2	4
2.		Monogononta	*Brachionus* sp.	3	2	2
3.		Branchiopoda	*Daphnia* sp.	1	2	0
4.			*Moina* sp.	2	4	1
1.	Wet season (August 2022)	Copepods	*Cyclops* sp.	0	2	0
2.		Eurotatoria	*Asplanchna* sp.	0	2	1
3.		Branchiopoda	*Bosmina* sp.	3	0	1

Source: EQMS Field Survey, May 2022, and August 2022

5.5.3.2.8.3 Macrobenthos

Dry season: A total of six (6) species were identified from four sampling locations. These species belong to Polychaeta, Gastropoda, and Bivalvia. One Species of Polychaeta (*Nereis lamellosa*) two species of Gastropoda (*Bellamya bengalensis*, and *Indoplanorbis exustus*), and three species of Bivalvia (*Lamellidens marginalis*, *Lamellidens jenkinsianus*, and *Parreysia corrugata*). Benthos abundance varied between 755 to 88 individuals per square meter (individuals/m2) in the present study.

Wet season: Four (04) species were identified belongs to Polychaeta, Clitellata, Insecta and Gastropoda. One Species of Polychaeta (*Nereis lamellosa*), Clitellata (*Tubifex* sp.), Insecta (*Chironomus* sp.), and Gastropoda (*Melanoides* sp.) were identified in wet season field visit (August 2022). Macrobenthos abundance varied between 533 to 44 individuals per square meter (individuals/m2). *Nereis lamellosa* was the highest abundant benthos species.

Macrobenthos species composition and number of individuals per square meter have been presented in Table 5-27.

Table 5-27: Macrobenthos organisms identified in the study area

Sl.	Season	Class	Species	Number (Individuals/m^2)		
				BS1	BS2	BS3
1.	Dry Season (May 2022)	Polychaeta	*Nereis lamellosa*	755	355	222
2.		Gastropoda	*Bellamya bengalensis*	177	0	0
3.			*Indoplanorbis exustus*	88	0	0
4.		Bivalvia	*Lamellidens marginalis*	133	0	133
5.			*Lamellidens jenkinsianus*	0	0	88
6.			*Parreysia corrugata*	0	177	0
1.	Wet season (August 2022)	Polychaeta	*Nereis lamellosa*	533	488	355
2.		Clitellata	*Tubifex* sp.	88	0	0
3.		Insecta	*Chironomus* sp.	0	222	0
4.		Gastropoda	*Melanoides* sp.	0	0	44

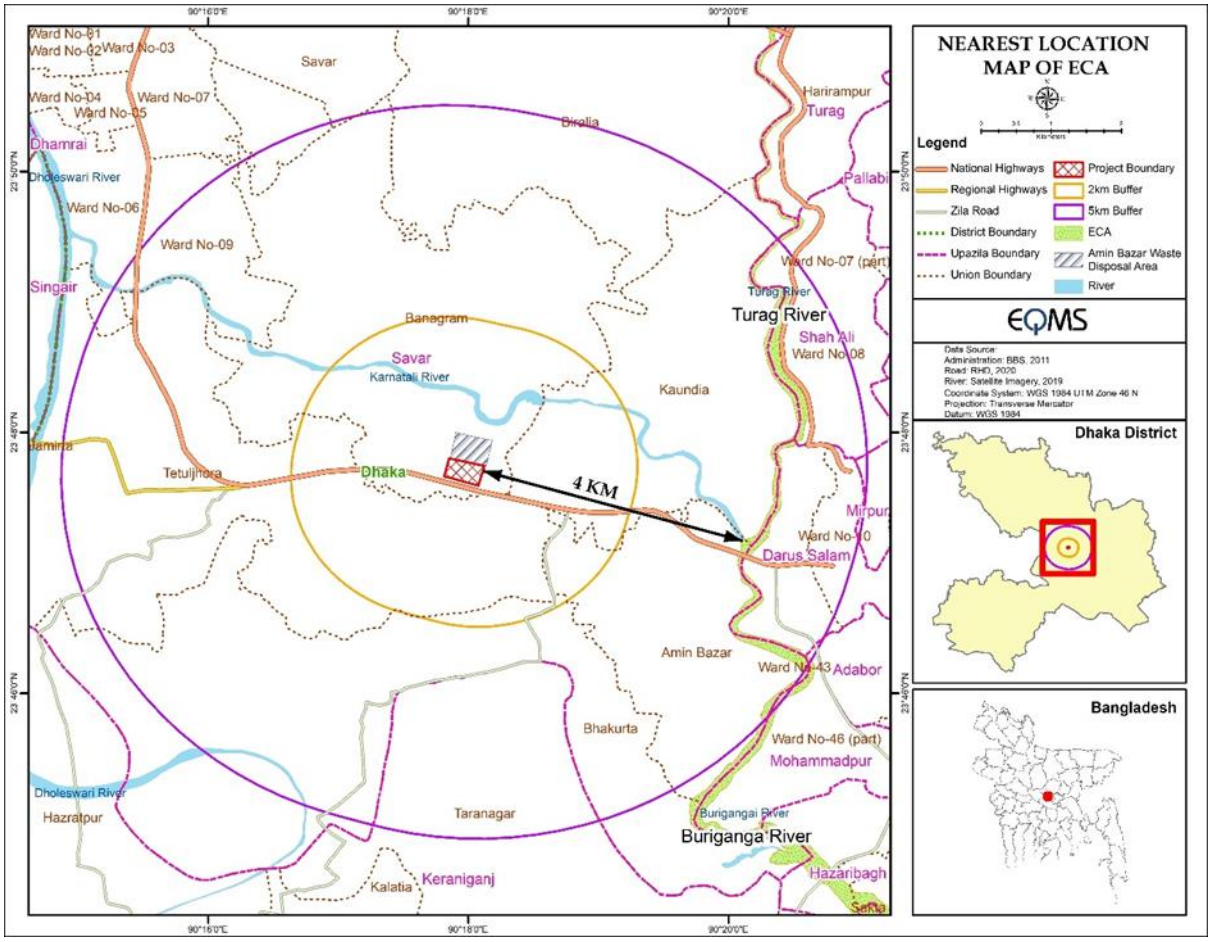
Source: EQMS Field Survey, May 2022, and August 2022

5.5.4 Biodiversity-sensitive areas

5.5.4.1 Ecologically Critical Area (ECAs)

The proposed project buffer area holds an ECA namely **Turag River** (Figure 5-46). According to the Department of Environment, the Turag River has been declared an Ecologically Critical Area (AAQ) in 2009. Turag River is located on the North-Eastern side of the project area at approximately 4 km aerial distance.

Figure 5-46: Location Map of Nearest ECA from Project AOI



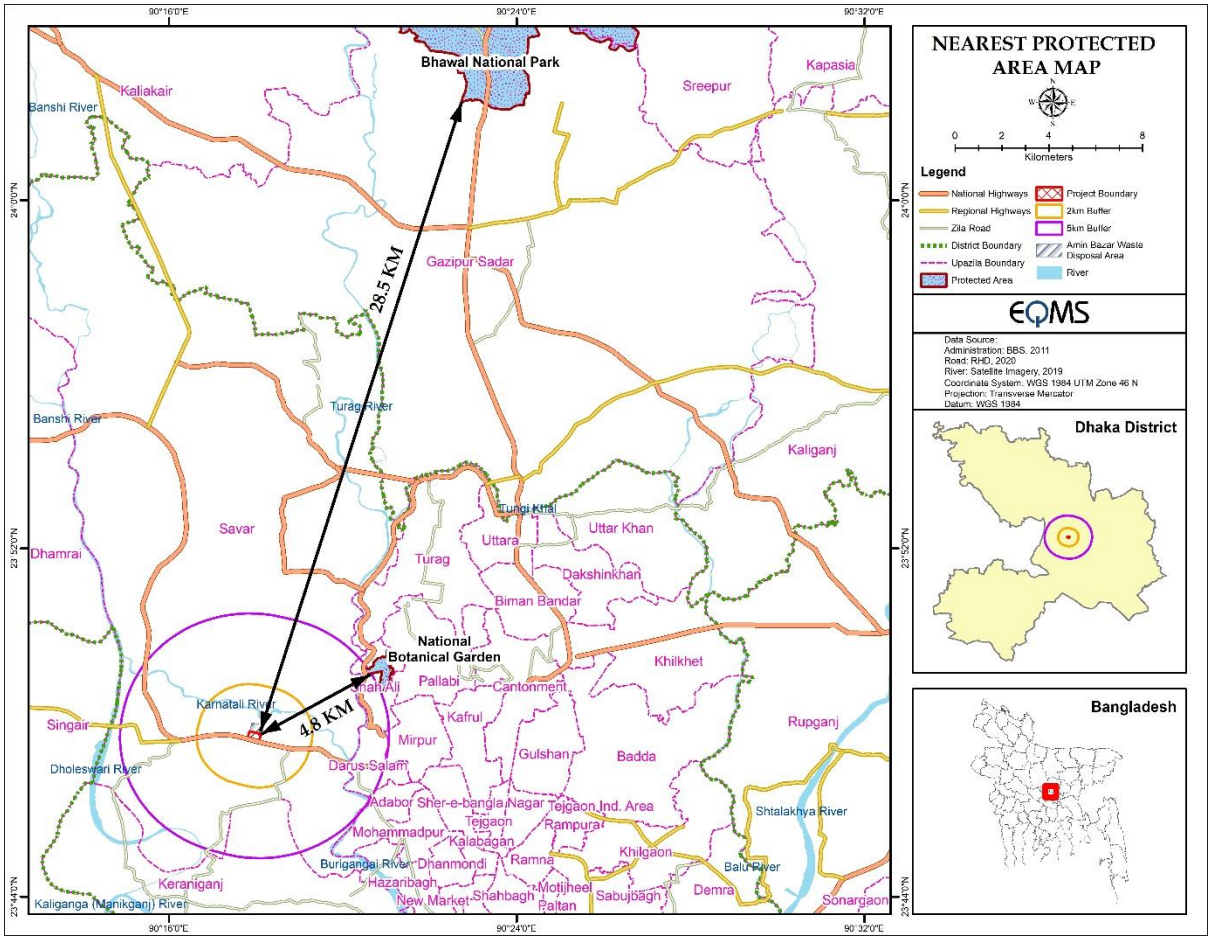
Source: Department of Environment, GoB

5.5.4.2 Protected area (PAs)

Protected areas (PA) are generally declared and designated by the government of the country, and these areas receive protection by the Countries' laws because of their recognized natural, ecological, or cultural values. The Bangladesh Wildlife (Conservation and Security) Act, 2012 defines and designates several "Protected Areas," i.e., Wildlife Sanctuary, National Park, Safari Park, Ecopark, Botanical Garden, Wild Animal Breeding Centre, Special Biodiversity Conservation Area, National Heritage, Memorial Tree, Sacred Tree and Kunjaban. There are 61 (Sixty-one) PAs in total, according to the Forest Department (31 October 2022) of Bangladesh and 51 (Fifty-one) of them are managed by them.

The proposed project AOI holds an PA and the nearest PA from the project site is the **National Botanical Garden, Mirpur, Dhaka** which is approximately at an aerial distance of 4.8 km North-East. The map of the PAs is shown in Figure 5-47.

Figure 5-47: Protected Area Map



Source: Forest Department, GoB, 28 December 2022

5.5.4.2.1 National Botanical Garden, Mirpur, Dhaka

The National Botanical Garden in Mirpur, Dhaka, established in 1961, is one of Bangladesh's largest and most significant botanical gardens, covering an area of 84 hectares. The garden boasts a diverse collection of over 56,000 plants representing approximately 1,500 species, including rare and endangered varieties. These plants are arranged in thematic sections such as the cactus house, orchid house, rose garden, and palm collection, each showcasing different types of flora and their ecological significance. The garden's extensive plant collection and thematic displays provide valuable resources for botanical studies, conservation efforts, and public education.

Scenic lakes and water bodies enhance the beauty of the National Botanical Garden, creating a tranquil environment that attracts various bird species and making it a popular spot for bird watching and photography. Well-maintained walkways and trails meander through the garden, allowing visitors to explore its diverse landscapes and enjoy leisurely walks, jogging, or nature observation. The garden also offers ample picnic spots and open spaces for families and groups to relax and unwind, making it a favored recreational destination in Dhaka.

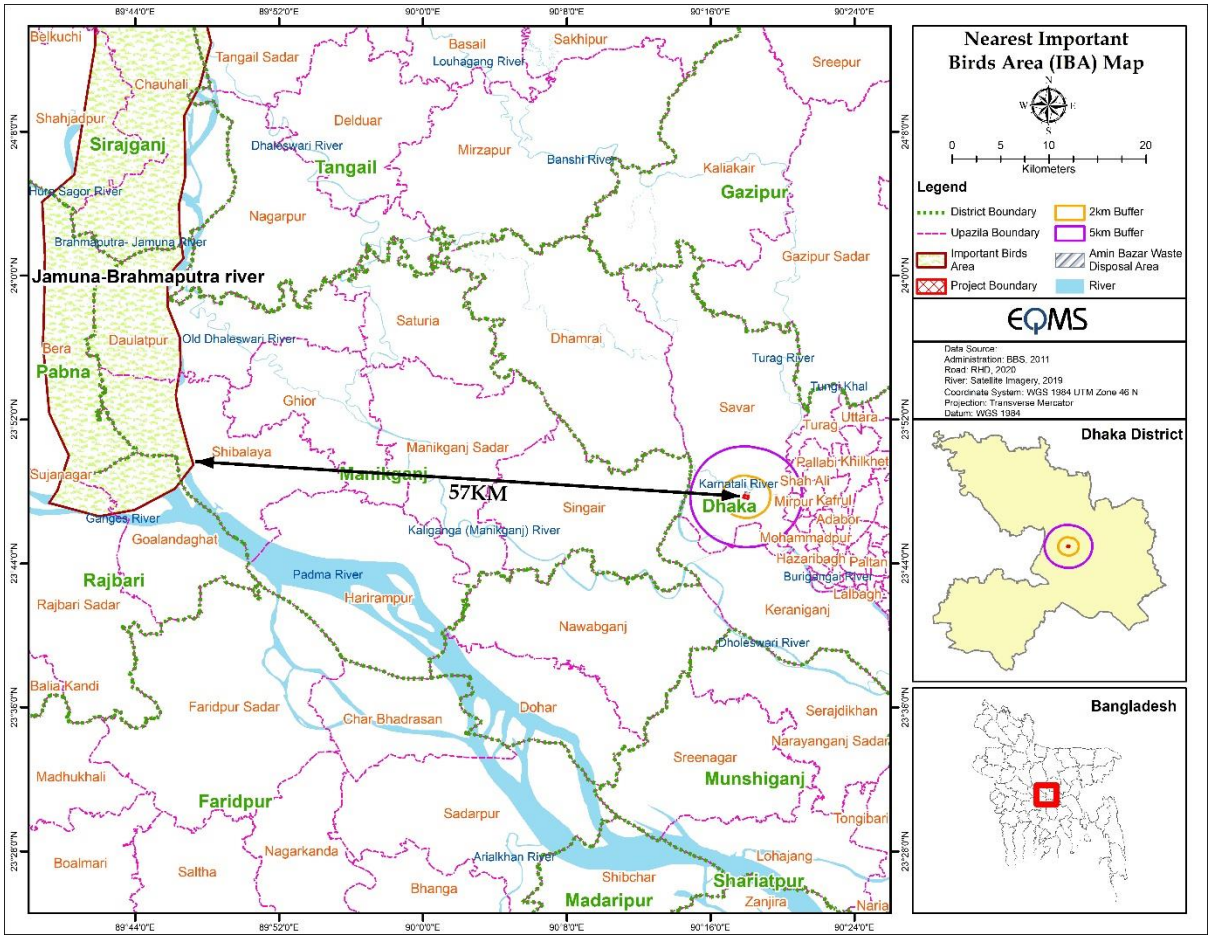
In addition to its role in recreation and education, the National Botanical Garden is a hub for botanical research and conservation. It collaborates with national and international organizations to study plant taxonomy, ecology, and conservation, maintaining a herbarium and a seed bank to support its efforts. Educational programs, guided tours, workshops, seminars, and exhibitions are regularly organized to raise awareness about plant conservation and promote environmental education among students, researchers, and the general public.

The garden also hosts various cultural and social events, such as flower shows and plant fairs, which draw a wide range of visitors and provide opportunities for the local community to engage with nature and celebrate the beauty of plants. Accessible by public transport and equipped with ample parking facilities, the National Botanical Garden serves as a cherished green space in Dhaka, offering a perfect blend of natural beauty, scientific research, and recreational opportunities.

5.5.4.3 Important Bird & Biodiversity Areas (IBAs)

According to BirdLife International (2022)[31], there are twenty (20) IBAs in Bangladesh. Although **there is no IBA in the project AOI**. The nearest IBA is the **Jamuna-Brahmaputra River** is at an aerial distance of 57 km west (Figure 5-48).

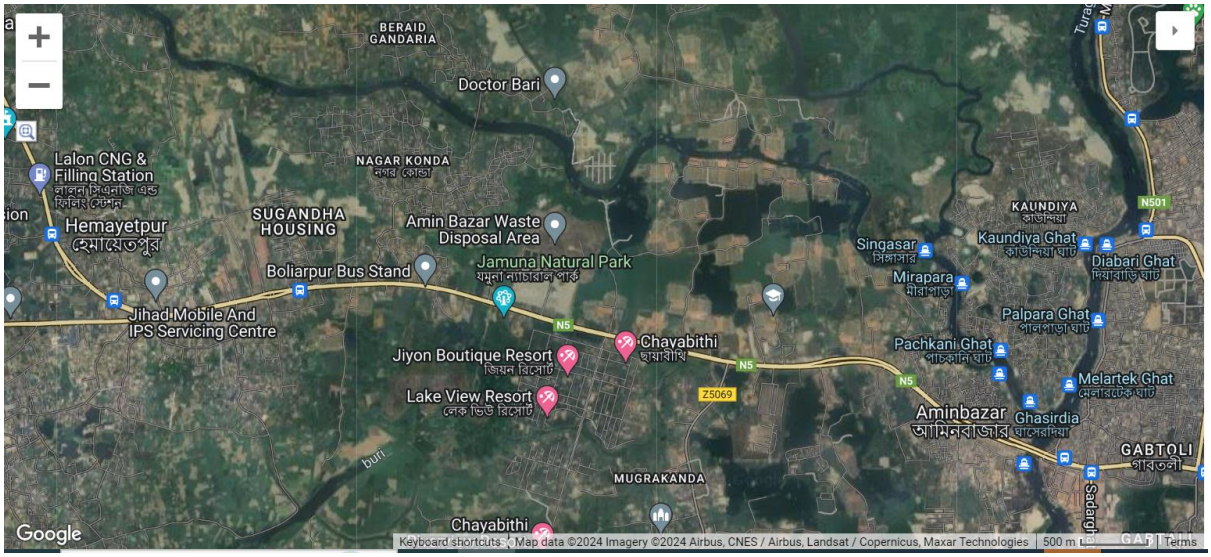
Figure 5-48: Important Bird & Biodiversity Areas Map



Source: BirdLife International (2022)

[31] BirdLife Data Zone. (n.d.). BirdLife International. Retrieved December 28, 2022, from http://datazone.birdlife.org/country/bangladesh/ibas

Figure 5-49: Important Bird & Biodiversity Areas Map; ebird



Source: ebird[32]

5.6 Cultural Heritage

This section provides an overview of presence of any cultural heritage sites within the defined area of influence. The site assessment and stakeholder consultations have confirmed the absence of any cultural or heritage sites in and around the project. Hence, national and any international act or regulations are not applicable in this project context.

5.7 Socio-Economic Conditions

This section offers a comprehensive overview of the administrative setup of the district, the demographic landscape focusing project impacted villagers, social dynamics covering the social groups, vulnerable groups and the livelihood pattern of the of the affected community. Moreover, the land use patterns in the project area, the availability of social and physical infrastructure associated with education, health and sanitation facilities and related connectivity. The entire study was based on the review of available secondary information and on-site consultations with relevant stakeholders conducted by the ESIA consultant during the site visit. Given the study area's unique characteristics, the ensuing discussion was primarily focused on the target villages with pertinent comparisons drawn to the respective Mouza, Parishad and Union where appropriate. The enumerators visited house to house and collected information from the affected household head or his/her senior proxy available during the survey., impacted business entities and structure owners. Data collection methods including FGD, KII, PCM and structured questionnaires were employed to gather primary data

5.7.1 Methodology

In order to carry out a detailed analysis of the Socio-Economic data to present a backdrop to the project footprint area, this ESIA collected and analyzed secondary and primary data. Using data from two sources allows for robust analysis and allows for accurate identification of the extent of risks and impacts. This chapter initially discusses the various approaches and samples used in this study to assess the baseline socio-economic condition. Subsequently, in order to obtain a macro level view information collated from secondary sources is presented. Finally, primary data collected through surveys, consultation and interviews are presented. The socio-economic baseline has been developed on the basis of integrating existing quantitative data with some additional qualitative assessments that

[32] https://ebird.org/hotspots, Amin bazar

were undertaken through primary data collection. To obtain data from household level the team follows the list found in joint verification provided by DC and for the secondary data study team used National Housing and Census data published by BBS 2011. In particular, the key components of the methodology included followings:

5.7.1.1 Survey of Landowner

A socio-Economic survey was carried out among 146 landowners out of 242, including 5 commercial structure owners whose land/ commercial structure had been purchased. The rest of the landowners were not found at the address given against their name and property assessment by relevant (Dhaka) Land Acquisition Department at the site during the survey. The survey was carried out to understand the socio-economic condition of the landowners, the land purchase process, any agitation during land acquisition process,and the disbursement of compensation to affected landowners.The Socio-Economic Survey was conducted in August 2022 by the social expert of EQMS. Photographs taken during the socio-economic survey are presented below.

Figure 5-50: Photographs captured during the socio-economic survey

5.7.1.2 Survey of Non-title holder (Land Dependent)

The site assessment has revealed a significant reliance on Land both in terms of rented land being used for business purposes and the utilization of the encroached land to operate small shops at the project area. A total of 5 land dependents were identified during the survey. In order to gauge the potential impact of this land dependency on livelihoods, a socio-economic survey was conducted among these 5 project affected peoples (PAPs).

5.7.1.3 Key Informant Interview

Meetings with key informants like the Union Chairman and Union Member of Bangoan Union of Savar Upazila were undertaken to assess the actual market price of the land parcel, land price negotiation process, land registration process, and any agitation at the community level during the land acquisition activity.

Figure 5-51: Meeting with Chairman, Bangoan Union Parishad and Members

5.7.1.4 Focus Group Discussion and Community Consultation

Focus group discussion and community consultation was conducted involving landowners, the Kunda Jame Masjid Committee, Temple Committee, Bongaon Primary School, land dependents, woman groups, and youth groups. to assess any potential impact on their existing activities, their perspective about the proposed project, expectations associated with the project and also capture the socio-economic condition of the study area. Photographs of FGD and Community Consultation are presented in **Appendix-D-3**.

5.7.2 Administrative Boundary

The study area comes under Baliarpur of Bangoan Union of Savar Upazila of Dhaka district. The name of mouza is “Baliarpur” which is under Savar Upazila of Dhaka district and situated beside the Dhaka-Aricha highway. The project site is in the Savar Upazila of Dhaka District. Savar Upazila (Dhaka district) area 280.12 sq km, located between 23°44' and 24°02' north latitudes and in between 90°11' and 90°22' east longitudes. It is bounded by Kaliakair and Gazipur Sadar Upazilas on the north, Keraniganj Upazila on the south, mohammadpur, adabar, darus salam, shah ali, pallabi and turag thana on the east, Dhamrai and Singair Upazila on the west. Savar is the second biggest Upazila of Dhaka Zila in respect of area. It is a part of the Dhaka Statistical Metropolitan area (SMA).

5.7.3 Project Affected Households

According to land related data (ownership information from joint verification list provided from DC) from the respective land acquisition department, it was identified that a total of 242 households will be affected due to the land acquisition of the proposed project as per the list (joint verification) provided by DC. Out of the total, 55 HHs are not traceable due to a mismatch of residence addresses given by the LA department. 41 landowners have refused to talk and give any data about their households. The EQMS site team made the efforts of reaching out to these stakeholders on their personal phones as well with the help of the village head and nearby residents. However, despite all hurdles, 146 HHs were surveyed through a structured questionnaire. The following table illustrates the number of HH and identified PAPs and HH size with the sex ratio of the surveyed people. A sample copy of the joint verification list is incorporated in **Appendix E-9**.

According the 2011 census data from the Bangladesh Bureau of Statistics (BBS), the total population of the Union was recorded at 33,627, with 607 individuals surveyed. Among them, 242 households were identified as landowners during the joint verification process, The total number of households in the Union stood at 7,813, with an average household size of 4.2, which exceeds the average household size of Project Affected Persons (PAPs), which is 4.15.

Table 5-28: Distribution of HH and population

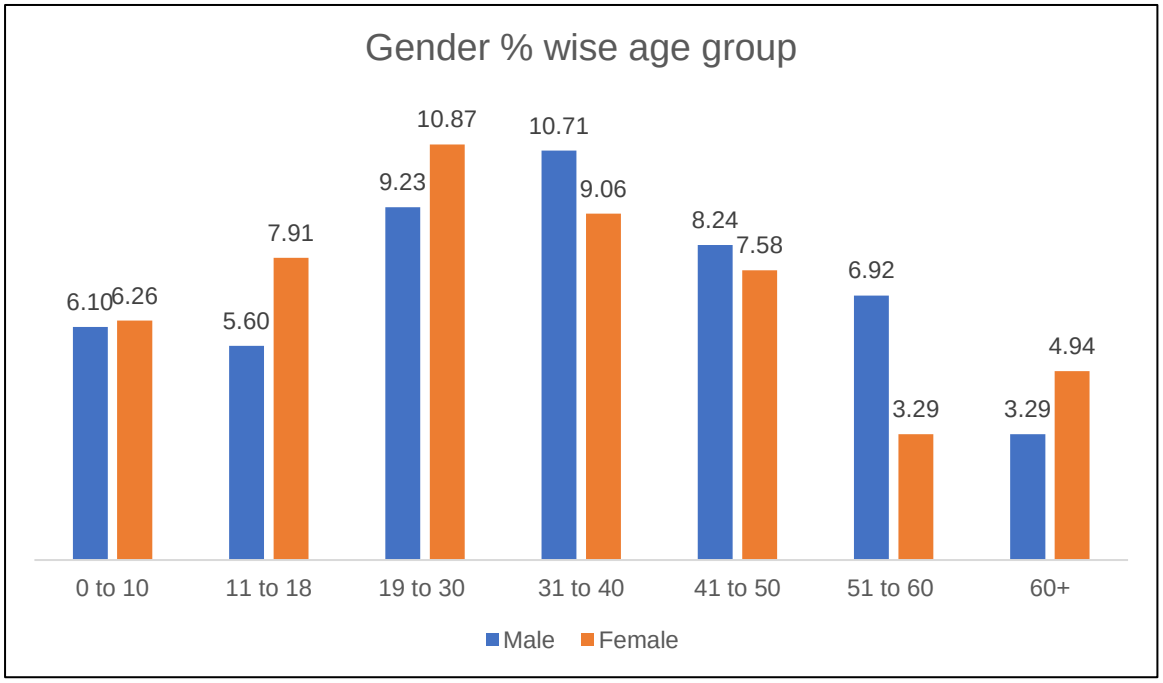
No of Households	Population			Sex ration	HH size
	Male	Female	Total		
146	304	303	607	100.33:100	4.15

Source: EQMS’s Socio-economic survey August 2022

5.7.4 Age Structure

Figure 5-52 shows the distribution of the population in the project area on the basis of age composition. Out of the total project impacted households, 50.08% represents male and rest 49.92% represents female population. The table also highlights that the highest section of the population constitutes the age category of 19 to 30 years (20.10%) where the female (10.87%) group is higher than the male (9.32%) group. The second highest category is 31 to 40 years (19.77%). In most age groups, the number of males is higher than that of females.

Figure 5-52: Gender % wise age group among PAPs



Source: EQMS's Socio-economic survey August 2022

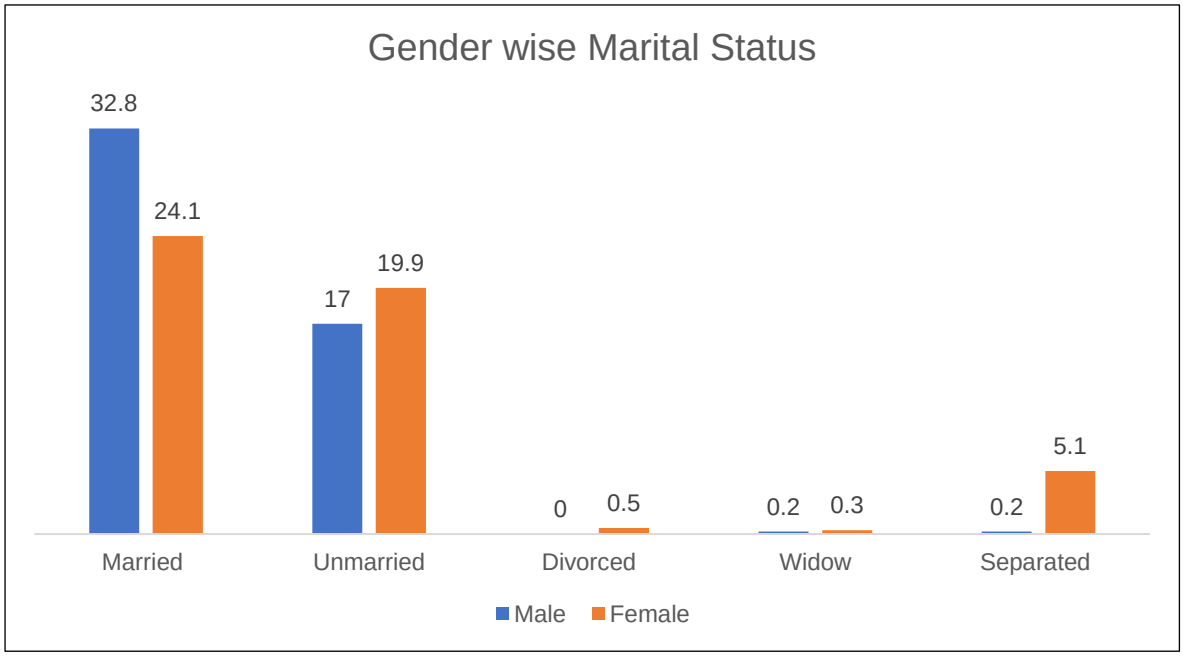
5.7.5 Religious Affiliation

As per the census data of BBS, 2011 people from the different religious background in Bongaon union is 31229 from Muslim community, 2389 from Hindu community, 2 Christian and 7 Buddhist. The survey data indicates that out of the total respondents, there are 30 Hindus and 575 Muslims identified which reflects maximum representation of Muslim people amongst impacted households.

5.7.6 Marital Status

As per the census data of BBS, 2011 the total married among male is 60.5 and female is 69.7 percent. Unmarried among male is 38.8 and among female is 21.9 percent. Figure 5-53 shows the marital status of the total population in the Project area. It is found that the rate of married people is higher than that of unmarried people. In the married category, the rate of married males (32.8%) is higher than that of females (24.1%). The percentage of separated and divorced category males is minimal (0%) compared to the rest of the categories.

Figure 5-53: Gender-wise Marital Status (%) of PAPs



Source: EQMS's Socio-economic survey August 2022

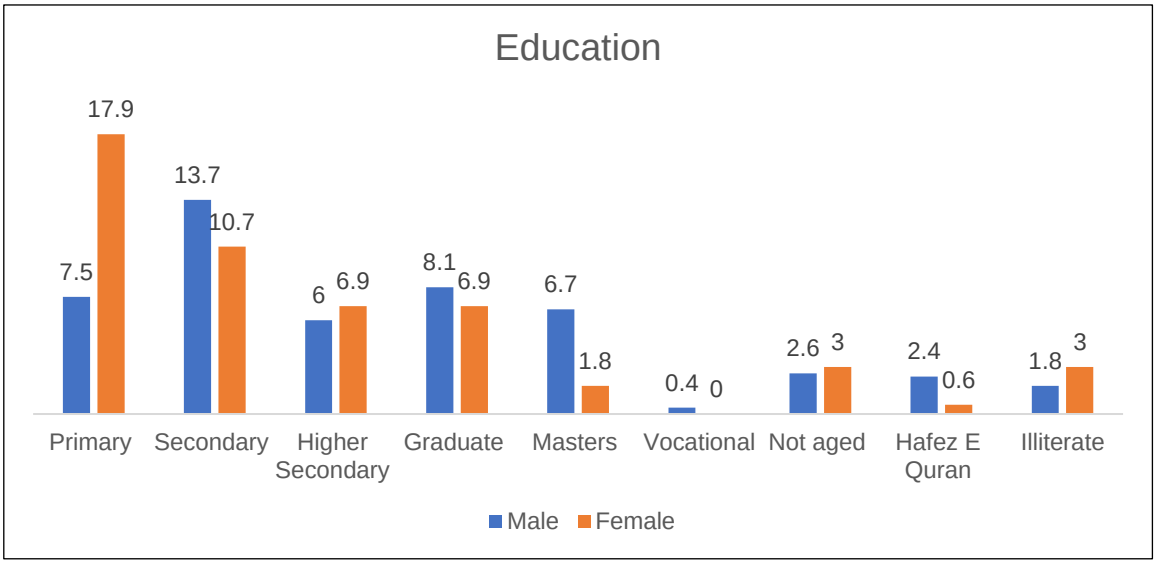
5.7.7 Education

As per the census data of BBS, 2011 literacy rate of the union stands at 51.7% where literacy rate among male is 54.8% and female is 48.3% of total population of the union. However, the BBS data doesn't include educational attainment levels.

Socio-economic survey findings of the Project area show, that the higher concentration of literate primary (25.4%) and secondary levels – class six to ten (24.4%) %) including Secondary School Certificate (SSC) or equivalent (12.9%). Approximately, (14.9% of) the population have completed Higher Secondary School Certificate (HSC) or equivalent and the same percentage (14.9%) have graduated or achieved higher education.. Males have higher percentage than females across all levels, except at the primary and higher secondary levels.

Among the study population, about 5.6% of the population consists of children under five years old who are not attending school. However, the illiteracy rate in the Project area is significantly low, with only 48% having never attended school. In Bangladesh, 29.62% of the population aged seven years and above (Household Integrated Economic Survey (HIES)-2016) are found illiterate. Figure 5-54 illustrates the educational status of the project affected people in a gender-segregated manner.

Figure 5-54: Educational status of the PAPs



Source: EQMS's Socio-economic survey August 2022

5.7.8 Occupation of the Households

As per the census data of BBS, 2011 the employment landscape in the union is predominantly driven by agriculture with 2140 males and 57 females engaged in this sector. The second largest sector is services, with1273 males and 291 females employed.and in industry sector, there are 318 males, and 128 females involved. Additionally, 3565 females are engaged in household work.

As per the socio-economic survey, out of total of 607 family members residing in 146 households, various occupational distributions area observed within the project area. The highest number of individuals (150 females) are identified as housewives, while 148 people area categorized as not working due to age or physical barriers, reflecting their unemployment status. Among earning members, predominant occupations include small and medium-scale business (28.62%), private service (7.08%), and agriculture (2.80%), primarily held by male. Another remarkable occupation are transport worker (1.48%). A few female members (12) are engaged with business, but the number is highest working women among other occupational groups. About 2.64% of male earners also work abroad and they send remittances in their households, but no female earners work abroad. Most of the female members are housewives (24.71%) and engaged with household chores. Some 12.69% of family members are students in different grades and about 24.38% are unemployed. Table 5-29 illustrates the occupational pattern of the PAPs by their gender.

Table 5-29: Gender-wise occupational pattern

Main Occupation	Male No	%	Female No	%	Total No	%
Agriculture	17	2.80	0	0.00	17	2.80
Private Job	32	5.27	11	1.81	43	7.08
Livestock	3	0.49	0	0.00	3	0.49
Business	101	16.64	12	1.98	113	18.62
Govt. Job	5	0.82	1	0.16	6	0.99
Electrician	5	0.82	0	0.00	5	0.82
Foreign Employment	16	2.64	0	0.00	16	2.64

Main Occupation	Male No	%	Female No	%	Total No	%
Mechanic	8	1.32	0	0.00	8	1.32
Housewife	0	0.00	150	24.71	150	24.71
Driver	9	1.48	0	0.00	9	1.48
Teacher	1	0.16	1	0.16	2	0.33
Wage Labor	3	0.49	0	0.00	3	0.49
Rent Collection	3	0.49	1	0.16	4	0.66
Professional (Architect, Engineer, Doctor, etc.)	3	0.49	0	0.00	3	0.49
No occupation	57	9.39	91	14.99	148	24.38
Student	35	5.77	42	6.92	77	12.69
Total	**298**	**49.09**	**309**	**50.91**	**607**	**100.00**

Source: EQMS's Socio-economic survey August 2022

5.7.9 Income and Expenditure

5.7.9.1 Monthly Income from primary occupation of Household Head's

The data reveals that large proportion of household heads (54.1%) earn between 5000 and 30000 BDT, (21.91%) falls into the income (31000 to 50000 BDT per month), and about 32.19% of households earn above 50000 BDT per month, reflecting a substantial upper-income segment. In addition, 17.81% Household Heads have more than 1 lakh taka income per month. Following Table 5-30 shows the range of income of 146 household heads from their primary occupation.

Table 5-30: Income range of Household Head

Amount of income range	No	%
5000 to 10000	27	18.49
11000 to 20000	25	17.12
21000 to 30000	27	18.49
31000 to 40000	11	7.53
41000 to 50000	9	6.16
50000 to 1 lakh	21	14.38
More than 1 lakh	26	17.81
Total	**146**	**100.00**

Source: EQMS's Socio-economic survey August 2022

5.7.9.2 Monthly Income from secondary occupation of Household Head's

The socio-economic survey reveals a common practice among households where individuals engaged in agricultural activities also pursue secondary occupations. It was also noted that majority of the agricultural households in project villages, are engaged in livestock rearing as supplementary income activity. The analysis of the data also indicates that 9 out of 17 household heads involved in agriculture

derive income from cattle rearing and selling milk. On average, each household sells 3 -5 liters of milk daily at a price of 80 BDT per liter, translating to approximately 8000 BDT per month.

5.7.9.3 Monthly Income of Other Family Members

Socio-economic survey data shows that apart from 146 Household Head, there are numerous numbers of people from the family members who are involved with income generating activities. From the gender segregated occupational data in Table 5-31 we found that, there are 26 women from surveyed household who is involved in income generating activities. From those 26 women, 11 are involved in private sector job with average monthly income 20500 BDT, 12 women involved in business with average monthly income 40000 BDT, 1 woman involved in govt. job, 1 teaching and 1 rent collection with monthly income 22000 BDT, 25000 BDT and 32000 BDT respectively.

Apart from the women those who are involved in income, there are 60 men are found from the surveyed household those who are involved in income generating activities in different sector. Following Table 5-31 illustrates professional involvement from other family members in income generating activities with monthly average income.

Table 5-31: Involvement with income from family members and amount of income

SL	Income generating activities	No. of person involved	Average Monthly income (each) BDT
1.	Agriculture	2	10000
2.	Private Job	7	23000
3.	Business	24	28000
4.	Govt. Job	1	30000
5.	Electrician	2	12000
6.	Remittance	16	30000
7.	Mechanic	2	15000
8.	Driver	3	12000
9.	Professional	3	100000

Source: EQMS's Socio-economic survey August 2022

5.7.9.4 Monthly Households Income

The household income of the surveyed populations reveals that the majority of households 54 (36.99%) fall within the income range of BDT 25,001 to BDT 30,000. The next most common income range is BDT 30,001 to BDT 40,000, with 34 (23.29%) households. As income increases, the frequency of households decreases. 10.27% of households earn between BDT 100,001 to BDT 200,000. Notably, there are fewer households earning higher incomes. Only 4 (2.74%) of households have an income is more than 500,000. A detail of household's income from the primary and secondary sources is given in below Table 5-32.

Table 5-32: Monthly Household Income

Range	Monthly Income	
	No.	%
Lowest to 25,000	0	0.00
25,001 to 30,000	54	36.99
30,001 to 40,000	34	23.29
40,001 to 50,000	8	5.48
50,001 to 60,000	9	6.16

Range	Monthly Income	
	No.	%
60,001 to 70,000	2	1.37
70,001 to 80,000	7	4.79
80,001 to 90,000	2	1.37
90,001 to 100,000	4	2.74
100,001 to 200,000	15	10.27
200,001 to 300,000	3	2.05
300,001 to 400,000	3	2.05
400,001 to 500,000	1	0.68
Above 500,001	4	2.74
Total	146	100.00

5.7.9.5 Monthly Household Expenditure

Survey data shows that for food consumption the highest range of expenditure of the households of PAPs is BDT. 5000-10000 (46.58%); for electricity, water, gas, telephone & transport purpose the highest range of expenditure of the households of project areas is BDT. < 5000 (78.08%); and for education, healthcare, clothing & entertainment purpose the highest range of expenditure is BDT. < 5000 which is 70.55%. Table 5-33 shows the monthly household expenditure of the households of project-affected people.

Table 5-33: Monthly household expenditure

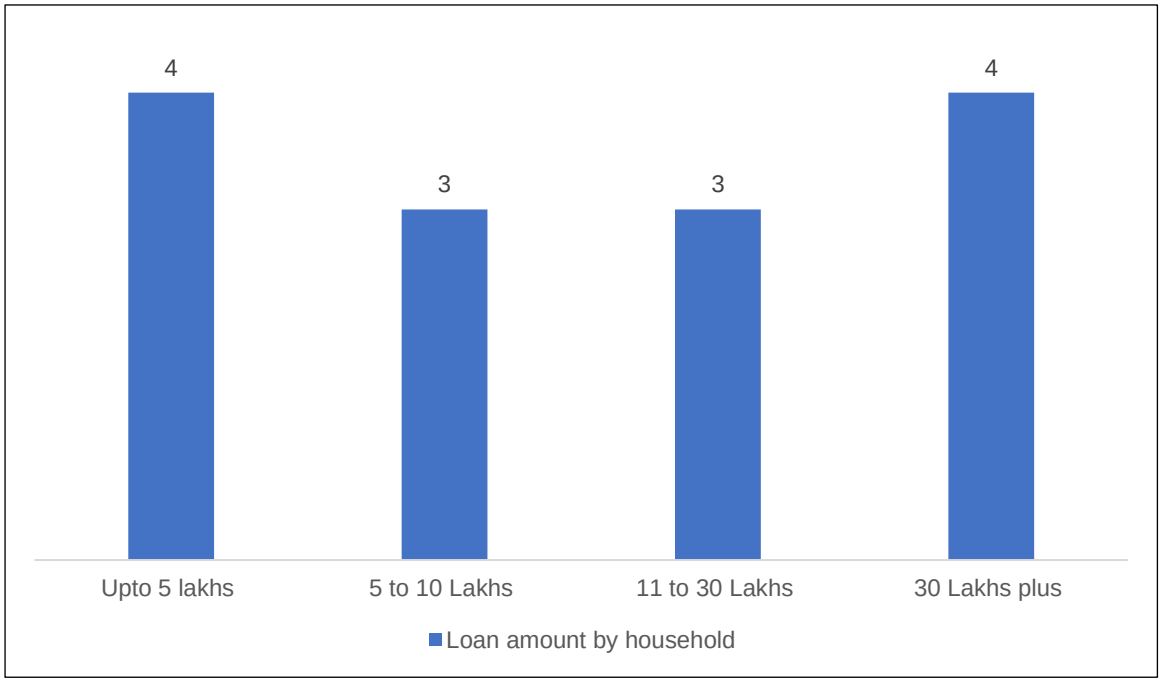
Expenditure	<Tk 5000	Tk 5000 – Tk 10,000	Tk 10,000 –Tk 15,000	Tk 15,000 –Tk 20,000	Tk 20,000 –Tk 25,000	>Tk 25,000	Total
Food consumption	3	68	43	18	8	6	**146**
%	2.05	46.58	29.45	12.33	5.48	4.11	**100.00**
Electricity, gas, transport, telephone	114	24	2	2	2	2	**146**
%	78.08	16.44	1.37	1.37	1.37	1.37	**100.00**
Education, Healthcare, Clothing & Entertainment	103	28	6	2	3	4	**492**
%	70.55	19.18	4.11	1.37	2.05	2.74	**100.00**

Source: EQMS's Socio-economic survey August 2022

5.7.10 Involvement with Loan

Survey data shows that 14 households are involved with a loan from Banks and NGOs. They also have a regular transaction in the bank and have savings and current accounts active in the respective bank. Figure 5-55 illustrates the loan involvement of the HHs, where the highest amount of loan takers is 4 and the lowest amount of loan takers is also 4 HHs. Among the 14 HHs, only 2 of them took a loan from NGOs and they are repaying their debt. Most of them used the loan for the expansion of their business.

Figure 5-55: Loan involvement by Households



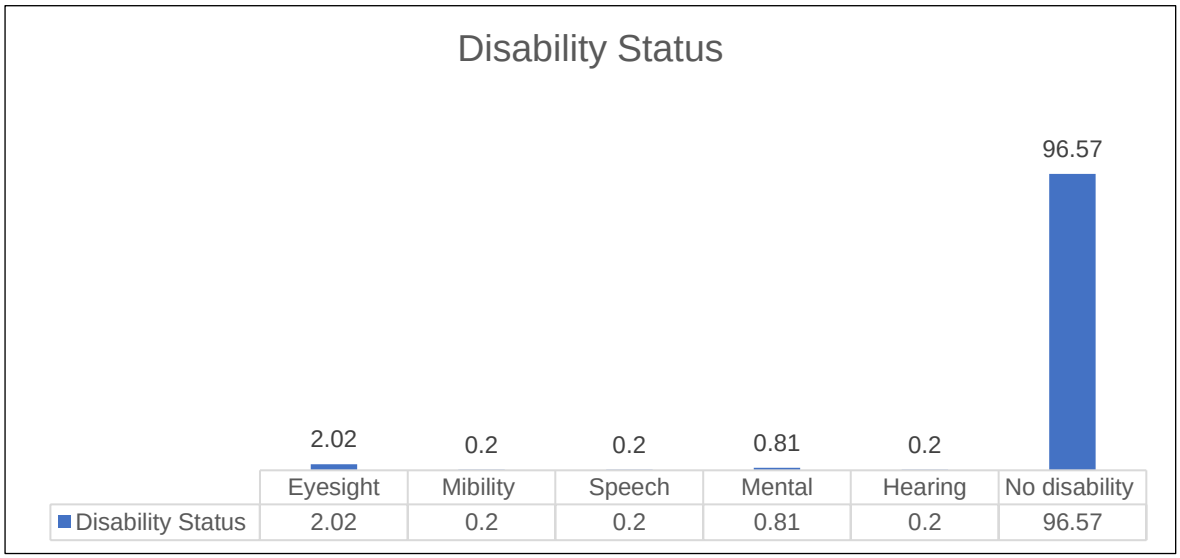
Source: EQMS's Socio-economic survey August 2022

5.7.11 Disability

As per the census data of BBS, 2011 about 1.1% of total population from the union have found having disabilities in different form. 0.1% with speech related disability, 0.3% with vision and 0.1% with hearing related disability while 0.3% with physical, 0.2% with metal and 0.1% with autism.

From the socio-economic data, it was found that total of 21 persons are listed under disability and most of them (10) have eyesight problems. 586 of people have no disability sign. No indigenous population was identified during the census. Figure 5-56 shows the percentage of people with disabilities among the PAPs. The higher number (96.57%) is with no disability.

Figure 5-56: Disability status of PAPs



Source: EQMS's Socio-economic survey August 2022

5.7.12 Accessibility

The social economic survey revealed that the surveyed population have easy access to different facilities such as schools, hospitals, hat-Bazar (local market), etc. Most of the respondents have reported that their nearby market is within 1 km while community clinics providing primary health care services are also within the same distance. Specialized hospitals for advanced care are situated within 5-10 km radius facilitated by good road connectivity. Moreover, both primary and secondary level educational facilities are available within the village, also within a 1 km distance.

5.7.12.1 Access to Basic Amenities

5.7.12.1.1 Access to Electricity

The survey found that people have 100% grid connection from the local grid supplier. Some have Instant Power Supply (IPS) facilities in their household as a backup of load shading. No household has been found during the socio-economic survey that has no electricity connection. As per the BBS data it was found that 92% of households had access to electricity at that time of survey.

5.7.12.1.1.1 Access to household Electricity

Currently, people are using prepaid card system electricity billing facilities within their households and commercial space. 64% of household pay taka between 100 to 1000 for consumption of electricity every month, while 27% of households pay taka between 1100 to 2000 and 5% of households pays between 2100 to 5000 and rest 4% of housholds pays more than 5000-taka per month against electricity bills..

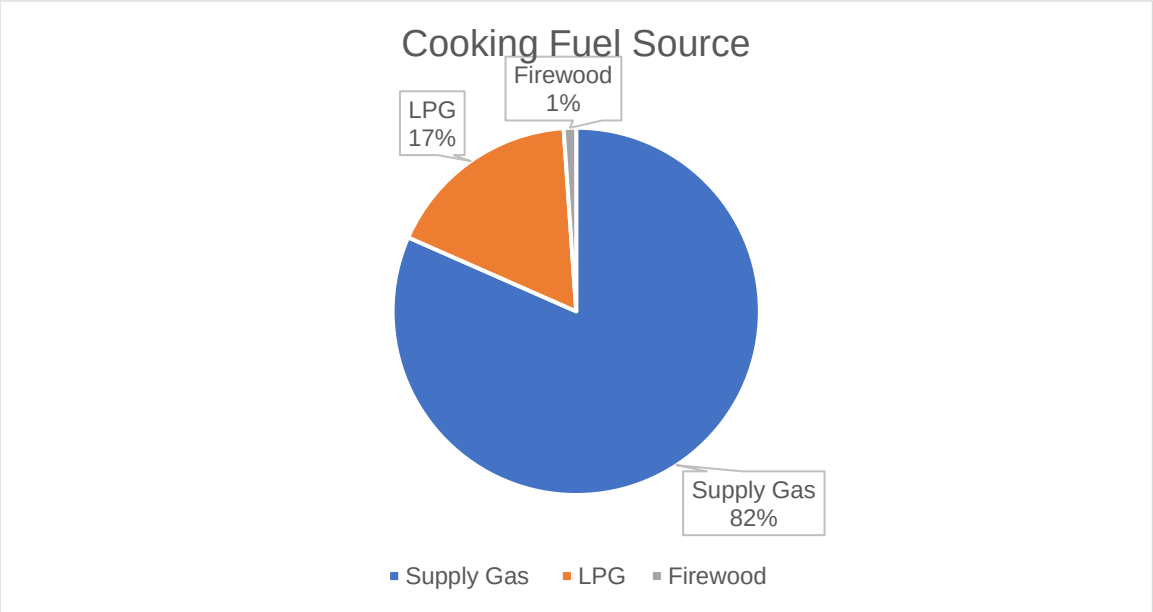
5.7.12.1.2 Access to Drinking water

The surveyed population has reported the water from tubewel/borewelll is being used for drinking and other domestic purposes. Among them, 91% households have access to deep tube well/borewell facility whereas 9% use tube well facility. The survey has highlighted that majority of the households in project villages have access to their own drinking water facilities.

5.7.12.1.3 Access to Cooking fuel

The survey found three primary sources of cooking fuel among the respondents. The predominant choice is supplied gas, followed by usage of Liquified Petoleum Gas (LPG). A small fraction of respondents utilize firewood for cooking purposes. The following Figure 5-57 chart illustrates the scenario of the usage of cooking fuel among the PAPs.

Figure 5-57: Source of Cooking fuel



Source: EQMS's Socio-economic survey August 2022

5.7.12.1.4 Access to Sanitation

As per the census data of BBS, 2011 Households (HHs) with sanitary water sealed facilities account for 56.8%, while those with sanitary non-water sealed facilities constitute 32.7%, 9% have access to non-sanitary toilet and 1.5% lack any toilet facilities.

As per the socio-economic survey data, among the surveyed population, all individuals have access to sanitary latrines. Among them, 78% use water-sealed sanitary latrines and 22% use non-water-sealed sanitary latrines. No respondents reported having non-sanitary latrines or lacking toilet facilities.

5.7.12.1.5 Access to Mobile Network and Internet

Survey data shows that 100% of surveyed people have access to mobile networks and all the respondents have access to mobile phones. Out of total surveyed individuals, 50.68% individuals are using mobile net, 10.96% individuals using broadband connectivity, and 38.36% individuals do not use any internet facility. Respondents who are using the internet from different service providers and non-user of internet facility are presented in Table 5-34.

Table 5-34: Internet users among PAPs

Mobile Internet No.	%	Broadband No.	%	No User No.	%
74	50.68	16	10.96	56	38.36

Source: EQMS's Socio-economic survey August 2022

5.7.12.1.6 Access to Health Facilities

People in project villagers, have easy access to community clinics for primary-level health care facility., located close to their residences. Local pharmacies and traditional medicine are frequently relied on as primary sources of healthcare services. In case of health emergencies and critical conditions beyond local treatment, most individuals travel to specialized hospital within a 10 km radius to avail specialized health care facilities with doctors' consultation, facilitated by easily accessible road connectivity and improved transportation network

5.7.13 Project related knowledge and expectations

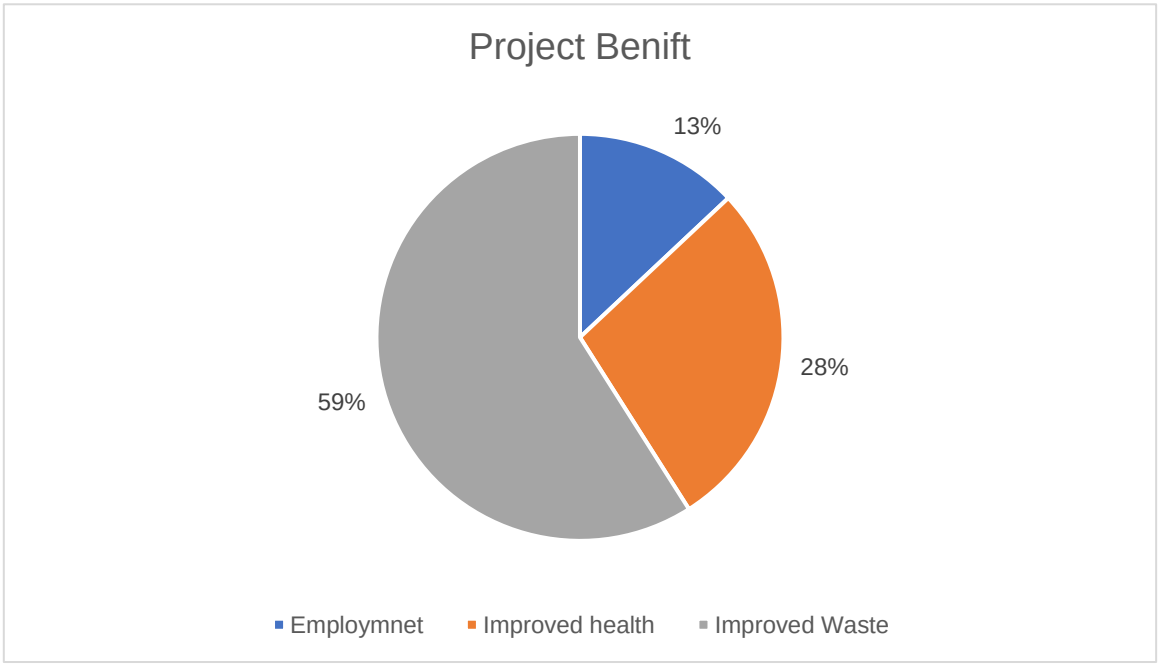
5.7.13.1 Project knowledge

People were asked during the survey regarding their consciousness and knowledge about the proposed project. Out of 146 HHs, 115 HHs have answered positively having their knowledge and consciousness about the project. 25 of them have limited knowledge about the project and the remaining 6 of them have no idea about the project. Most of the people have heard about the project from the surveyor of the DC office and DNCC, some of them heard it first from their local leaders and elders of the community.

5.7.13.2 Project Benefit

Survey data indicates that people respond positively when asked about the economic benefits that this project will bring to their locality and their lives. Nearly 99% of respondents expressed optimism about the manifold benefits they anticipate form this project Figure 5-58 shows that 59% of the surveyed population believe that this project will improve the existing waste management system, while 28% of them believe this project will improve their health status as a whole and 13% of them expressed their opinion associated with potential employment opportunity due to the project activity.

Figure 5-58: Project Benefit Response



Source: EQMS's Socio-economic survey August 2022

5.7.14 Preference of Compensation

During the socioeconomic survey, people were asked about their preference associated with compensation against their acquired land. Survey data indicates that the majority of respondents (83.6%) have preferred cash compensation and very few respondents have stated their preference with an additional payment for agricultural loss of their acquired land Additionally, 2.7% of respondents have stated that, they could not grow any crops on their land due to uncontrolled waste from landfill area and requested for additional compensation.

5.7.15 Compensation Utilization

Respondents were asked about their utilization of compensation amount with data indicated that, 48% intend to invest in or start a new business, 12% plan to purchase new land and 24% aim to save funds as a deposit and 16% plan to allocate it towards loan repayment and family purposes.

5.7.16 Skill Improvement

Among the surveyed people, most of them have agreed to improve their skills for socio-economic benefit were asked to give their opinion regarding their preference for skill-based training. Based on their opinion mostly the following categories were found that have been chosen by the PAPs in support of trade-wise skill development training program. Though some of them said nothing about their preference in undergoing the proposed skill-enhancement Program. Table 5-35 illustrates the list of choice made by respondents as their area of skill enhancement program.

Table 5-35 Skill Choice list by the respondents

Skill Choice	No of Person
Computer-Based Training (Graphics and Photoshop)	11
Driving	5
Tailoring	8
Cooking/Bakery	4
Technical/Mechanical	7
Livestock	4
Agro based training	8
Total	**47**

Source: EQMS's Socio-economic survey August 2022

5.7.17 Persons Associated with the Land

Shaymoli Transport and NR Travels along with their associated facilities of transport workshop, repairing and maintenance shop, cow farm, and water treatment plant (Shaymoli Drinking Water) have employees working there. Survey data shows that person associated with the land more than 801 people. As the relocation process was very smooth and in a nearby place, none of the employees have been affected by the land acquisition from employment perspective. Both of the owners stated that they purchased new land to shift all the associated facilities and relevant things from the acquired land.

Income related information from both Shaymoli and NR Travels was not covered under the study due to the vastness of the business as they stated they have not associated only with the transport and water business rather more than 20 food items and some other business also combinedly taken care of under the same umbrella. Besides, company policy does not comply with sharing such data with anyone. Even if the authority wants to make an effort, there will be confusion as the business is not related to one place and the capital is not separated for the business running in the acquired land. Even after attempting several times by study team member, they could not reach in physical appearance of the depot owners, as they denied not to share any information about the business. However, it was understood from the several attempt made to obtain such information that none of the owners will

disclose any information like business turnover and any financial information with the consultant of study team.

Shaymoli Transport

Though, the bus depot[33] were established in some leased land of Roads and Highways and in the purchased land combinedly. Once the acquisition process is done, they can still run their business in their leased land which is nearly half of their existing bus depot before acquisition. The bus depot owner has built new permanent structure and secured site with boundary wall which was lacked earlier in the old place and part of the old place (leased part) is also using for office and bus depot purposes. Consultation with the depot manager has been taken place as they stated, they are now in a better position with newly built structure and facilities as some of the previous structures were ragged and cranky. No employment loss has been encountered due to the land acquisition and relocation of the depot. Employees are working in the new and old depot area, as the owner has purchased new land just opposite the previous depot. The following table shows the number of employees working in Shaymoli Transport service and Shaymoli Drinking Water and photographs of old and new depots.

Shaymoli Transport-Associated persons		
CNG (Fuel pump used by the depot for fueling their buses)	**Bus repair, maintenance**	**Water Plant (Drinking Water)**
55	**450**	**85**

Photographs of Shaymoli Transport's Old and New Depot

Old Storage Area

Old Reparing Shed

[33] A base of transport resting and accommodating for running administrative function and maintenance of vehicles with repairing facilities within it.

	
New Storage area	New Reparing Shed
	
New Bus Depot area	Old Bus Depot area

Shaymoli Drinking Water

An automated drinking water bottling factory owned by the same owner of Shaymoli Transport has also been relocated due to the land acquisition. As per the consultation with the plant in charge of Shaymoli Drinking Water, they were given their desire time which they claimed during the consultation for the smooth shifting and relocation of water plant. During the shifting time no employees were dismissed, and their salary disbursement was regular. The whole engineering team was busy with shifting machines to assist the assigned farm to do the task. Delivery personnel and other staff were engaged in the food sector (another business run by the owner). The water plant has been shifted as per the given timeline and started operating since March 2024 after a few days of test run. The current location has better ground water quality than the previous one and the bad smell of landfill no longer exists in the new place stated by the plant head and quality manager during the consultation. Following Figure 5-59 shows the status of water plant both old and new form.

Figure 5-59 Photographs of Old and New Water Plant (Shaymoli Drinking Water)

	
Old Water Plant Mechine area	Old Husky Mechine area
	
New Water Plant Mechine area	Husky Machine area in New Plant
	
Stored Water after production at new plant	Production ongoing at new palnt

NR Travels

The current status of the relocation and shifting to the new place is completed within the required given time by DNCC. The new site is just opposite of their current location and their status of relocation in the new place is better than previous condition in terms of structure, security, and connectivity with the highways. Employees are working without any loss of employment and the given timeline for shifting assists them for a smooth run of the operation of their daily work. Even in the consultation with lenders E&S expert during their mission it was also confirmed by the depot manager from bus company that they have not eliminated anyone from the job due to acquisition and shift of location to another place. It was also evident that the current location is just the opposite of the previous location and better facilities in newly built structures made the working conditions better.

Cow Farm

The previous cow farm which was a part of NR Travels within the depot area also been shifted to new depot area. Conversation with the farm in charge has been taken place at both new and old farm in 2022 and 2024 to obtain information of any employment loss due to the acquisition and shifting at new location. No dismissal of employees occurred for this relocation and new place is quite better in terms of previous place stated by the farm manger. Cow health is far better in new places with no odor from landfill and sufficient fresh air and light. Even in the pick summer no fan is required at the new place. Treatment cost for cows has been decreased at new places where in previous place it was often that veterinary personnel visited.

Table 5-36 shows the number of people associated with the land who are working there on a regular basis. The process of their relocation has been done and some photographs of old and new place with structures is presented Figure 5-60 below.

Table 5-36: Details of the persons associated with the land of NR Travels and Cow Farm

Person associated with NR Travels and Cow Farm		
Official	**Bus repair, maintenance**	**Cow Farm**
20	180	11

Figure 5-60: Old and New Photographs of Transport and Cow firm

New Cow farm

Old Cow firm

	
Old Depot area	New Depot area
	
Entrance of New Site with fencing	Ongoing works at Newly purchased Location

5.7.18 Information on five title-holder business

Site visit, socio-economic survey, joint verification survey from Deputy Commissioner office has ensured that the acquired land area has five ongoing business within it which has already been relocated from the land that has been acquired. However, the location of the business is comprised of some leased land from the Roads and Highways Department and privately owned land of the owners. After acquisition and hand over of the land to the project authority, each of the businesses running their business within the leased land and shifted rest of the part just opposite side of the road within the given flexible time they asked.

The number (5) item in the table refers to a situation where two pucca rooms out of three were demolished because they fell within the project's boundary. The remaining rooms continue to function as it did previously. Additionally, a dilapidated tin shed, which stored a kitchen and various scarp materials, was also demolished. At the new location where the owner relocated, new structure made of tin were constructed for a kitchen and storage purposes Furthermore, the owner acquired a shipping container to serve as an alternative space for seating and an office The shed was also relocated from its original site to the new location. Both the depot and the repairing workshop owners are currently operating their businesses simultaneously at both the old and the newly purchased locations, benefiting from improved facilities and infrastructure.

Table 5-37 Information of Five Titled Business

Sl.	Name of the Owner	Name of Business	Type of Business
1.	Ramesh Ghosh	Shaymoli Paribahan	Bus Depot and Repairing Workshop
2.		Shaymoli Drinking Water	Water Plant
3.	Ramendranath Ghosh	Shaymoli N.R. Paribahan	Bus Depot and Repairing Workshop
4.		N/A	Cow Farm
5.	Ekhlas Uddin	Jessore Engineering	Bus Repairing Workshop

Figure 5-61 Photographs of Old and New Conditions of the Business Structures

Old Shed Before Acquisition

New Shed at new place After Acquisition

Old Kitchen and Storage area

New Kitchen and Storage are

Old Office Before Demolishing

One office room remain after demolishing

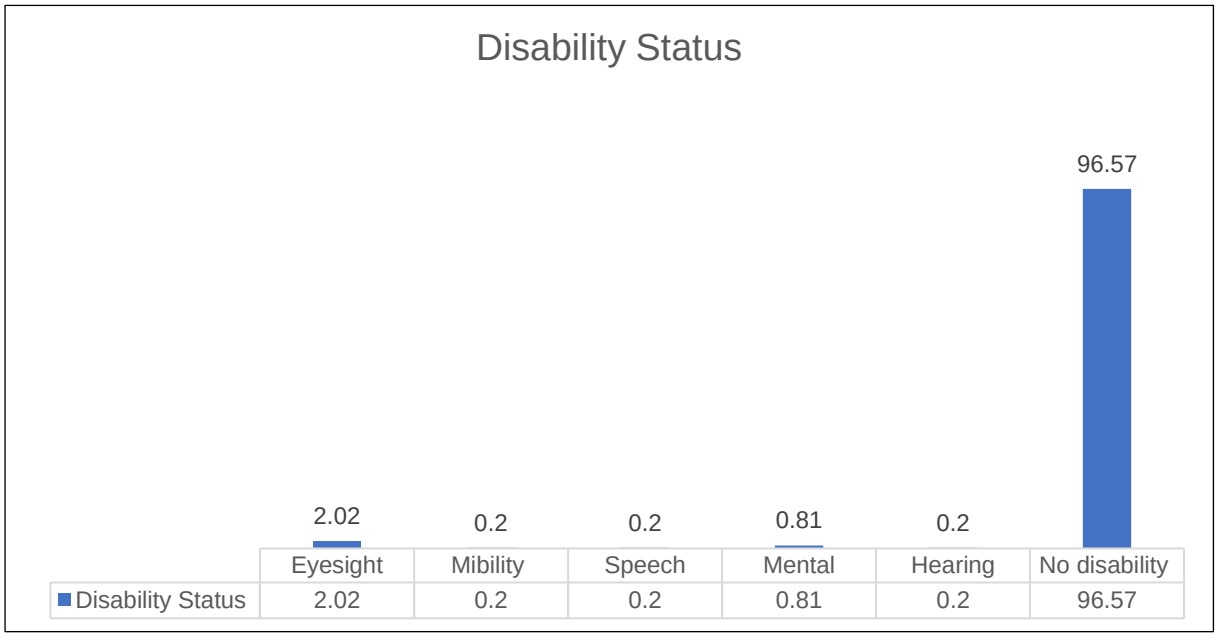
	
Newly establish office	Ongoing business at leased area (old)

5.8 Vulnerability Assessment

In this report, vulnerability can be defined as the lack or inability of a PAP to avail themselves of the benefit/benefits of a project because of their state of vulnerability, incorporating -gender, physical, economic, social, or educational component. The PAP Compensation Agreement will outline which households or individuals are considered vulnerable and detail the compensation or specific assistance they are entitled to disability.

It was found that a total of 21 individuals area categorized as disabled with the majority (10) experiencing issues related to eyesight. Approximately 96.6% of the population shows no signs of disability. The census conducted during the elaboration of the RP, did not identify presence of any indigenous population. Figure 5-61 displays the percentage of people with disabilities among the PAPs, where the larger proportion (96.57%) shows no disability. No household heads were identified as disabled, rather the data represents the overall population status from the survey

Figure 5-62: Disability status of PAPs



Source: EQMS Field Survey, August 2022

5.8.1 Income Below Poverty Line

In Bangladesh, similar to many other countries, the poverty threshold is set at USD 1.9 (177 BDT) per person per day. Families earning below this amount per person daily, which translates to approximately USD 256.5 (23854 BDT) per month for an average household size of 4.5, are deemed vulnerable. Without proper mitigation measures during project implementation, these households are at risk of their economic conditions deteriorating further.

Survey data reveals that the lowest monthly income for 54 households (36.99%) falls between BDT 25001 and 30000, with no households found to have a monthly income below the poverty threshold.

5.8.2 The Elderly

The analysis indicates that 7.8% of the total population affected by the project is over 60+ years old and are considered as vulnerable based on their age category. The details of elderly is reflected in Table 5-39.

Table 5-38: Number of Elderly

Male	Female	Total	% Of total PAPs
16	23	39	7.8%

Source: EQMS Field Survey, August 2022

5.8.3 The Women Headed Household

According to socio economic survey, no women headed household was found amongst surveyed population.

5.9 Socio-economic conditions of non-title holders

This section provides an understanding of the socio-economic conditions of the non-titled holder (5) found within the project boundary.

5.9.1 Demographic Profile

Non-titleholders are those who have no legal rights on the land, but they are using the land for their economic and social benefits. The non-titleholders of this project are mainly small-scale business owners who are running their business (shop/tea stall) within the project footprint. Demographic profile of the non-titleholders is presented in the Table 5-39

Table 5-39: demographic profile of (non-titleholder)

No of Households	Population			Sex ration	HH size
	Male	Female	Total		
5	12	13	25	100.33:100	5.15

Source: EQMS Field Survey, August 2022

5.9.2 Other socio-economic indicators of the Non-titled Household

The socio-economic survey reveals that among non-titled population a total of 10 individuals are married while 15 are unmarried with no widows or divorced individuals found. From the religious perspective, 1 Hindu household comprising 4 members are identified while remaining 4 families totaling 21 individuals were from Muslim communities. Following Table 5-40 illustrates the socio-economic indicators of the people.

Table 5-40: Other socio-economic conditions of the HH (non-titleholder)

Item	Male	Female	Total
Marital Status (Married)	5	5	10
Marital Status (Unmarried)	7	8	15
Total	**12**	**13**	**25**
Involve with income	5	0	5
Occupation (Business)	5	0	5
Occupation (Housewife)	0	5	5
Occupation (student)	3	5	8
No Occupation	4	3	7
Involvement with Loan	2	0	2
Disability	0	0	0
Access to Electricity	12	13	25

Other than shared information about non-titled holders, the education status of those non-titled holders ranges from secondary to no education at all, with a reflection of higher educational profile among females, constituting 60% educated from primary to higher secondary levels compared to 40% of males. None of the females were involved in income-generating activities other than household chores. All households have access to tube well/borewell water for drinking, with sanitary non-water sealed toilet facilities. The primary expenses at the household level are food consumption and house rent, with 3 out of 5 households using firewood and only 2 using LPG as cooking fuel

5.9.3 Income from the Business

During the individual consultation with each of the respondents doing business as a non-titled holder, their income level (tentative, they couldn't figure out the exact amount) has been assessed which is presented in the Table 5-41.

Table 5-41: Income level of non-title holder

SL	Business Type	Tentative Income in BDT per month
1.	Tea stall	25000
2.	Small Restaurant	35000
3.	Tea stall	22000
4.	Tea stall	20000

5.	Primary medicine and mobile banking and recharge shop	15000

5.9.4 Status of Employees

Status of employees working under non-titled holder is found to be mainly on monthly basis, but some of the employees avail their payment either on weekly or daily basis based on their needs. Among 5 shop owners, only 4 shop owners have employees on temporary basis, because none of the employees stays more than two or three months. Status of the payment and number of employees in each shop is presented in the Table 5-42

Table 5-42: Number of employees and their status

SL	Business Type	Employee 1 Salary BDT per month	Employee 2 Salary BDT per month
1.	Tea stall	10000	N/A
2.	Small Restaurant	12000	8000
3.	Tea stall	8000	N/A
4.	Tea stall	8000	N/A

5.9.5 Vulnerability of Non-titles Holder

As per the vulnerability assessment criteria (i.e. disability, income below poverty line, women headed household) three of the household from non-titleholders were found vulnerable based on their income level relative to the defined poverty line (1.9 USD [177 BDT] per person per day). Separately, the vulnerability issue can be addressed under proposed LIA/LRP for identified non-titled vulnerable individuals aligning with AIIB's ESS guidelines and the process adopted for compliance needs to be verified under proposed Environment and Social Due Diligence exercise.

In Bangladesh, similar to many other countries, the poverty threshold is set at USD 1.9 (177 BDT) per person per day. Families earning below this amount per person daily, which translates to approximately USD 256.5 (23854 BDT) per month for an average household size of 4.5, are deemed vulnerable. Without proper mitigation measures during project implementation, these households are at risk of their economic conditions deteriorating further. The study found that 3 out of 5 households are under vulnerable conditions in terms of income.

5.9.6 Information on Five Non-Titled Business Owners

The land acquisition for this project will impact directly on the five small scale businesses owner those who are not legally titled to the land. Though, as per the ESF guidelines, detailed assessment should be given and proper compensation to restore their livelihood better or similar position should be ensured. An assessment has been given detailing their business, income, socioeconomic conditions etc. in the baseline section. However, the study team found that five of the non-titled business owners have been evicted from their place of business due to site clearance. Three of them are still doing business just beside the previous location of which one of them rebuild his structure with his own money just to continue the business and rest of the two have not built any structure rather continuing business in open place. Two of the five owners were shifted just beside the newly purchased land of Shaymoli and Shaymoli N.R. which is opposite side of the Dhaka-Aricha highway, they also rebuilt their structure with own fund. None of the non-title business owners were given any compensation or relocation

assistance. Following Table 5-43 shows the details of five non-title business owners and the Figure 5-63 shows the current and old conditions of business structures.

Table 5-43: Information of Five Non-title Business

Sl.	Name of Owner	Type of Business Running	Employees associated
1.	Provash Ghosh	Tea Stall	1
2.	Abul Kalam	Small Restaurant	2
3.	Abdul Kuddus	Tea stall	1
4.	Moin Uddin	Tea stall	1
5.	Md Mahabub	Mobile Recharge and Mobile Banking	N/A

Figure 5-63: Photographs of Old and New Conditions of the Structures of Non-title Business

Old Structure Provash Ghosh

New Structure of Provash Ghosh

Old Structure of Md Mahabub

New Structure of Md Mahabub

	
Old Structure of Abul Kalam	Old Structure of Abdul Kuddus
	
Old Structure of Moin Uddin	New Structure of Abdul Kuddus

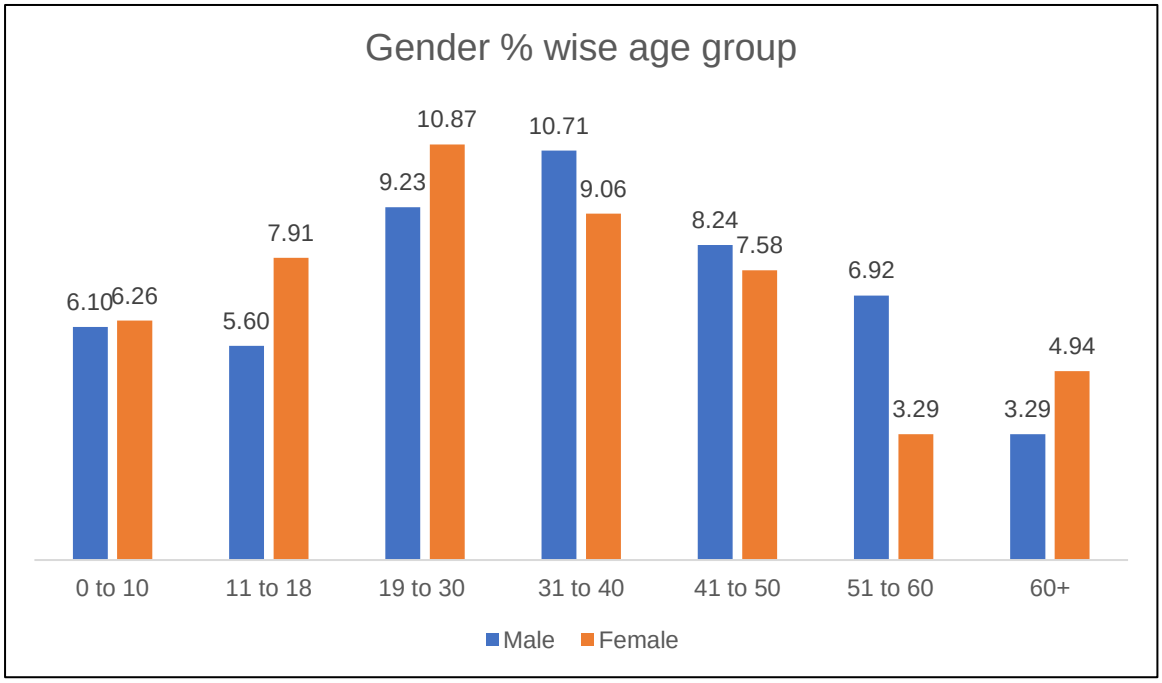
5.10 Gender Analysis

Bangladesh has made remarkable progress in the last 20 years in improving the lives of women and girls. Government of Bangladesh has made strides in addressing gender inequality – such as introducing gender-sensitive budgets for 40 ministries and establishing affirmative actions to increase women's participation in political and workforce leadership – barriers to overcoming inequality still exist. Government of Bangladesh has made a commitment to take the necessary measures to eliminate discrimination against women in all forms. The Articles 10, 19, 28 of constitution of Bangladesh have granted the rights of women to work in al professions.

5.10.1 Gender wise age Group

The socio-economic data shows that the surveyed population slightly lower in number from women group. The age group data shows that the women group from age group in 0-10 years, 11-18 years, 19-30 years and 60+ are higher in number than the men. Figure 5-64 illustrates the gender segregated population by their age group.

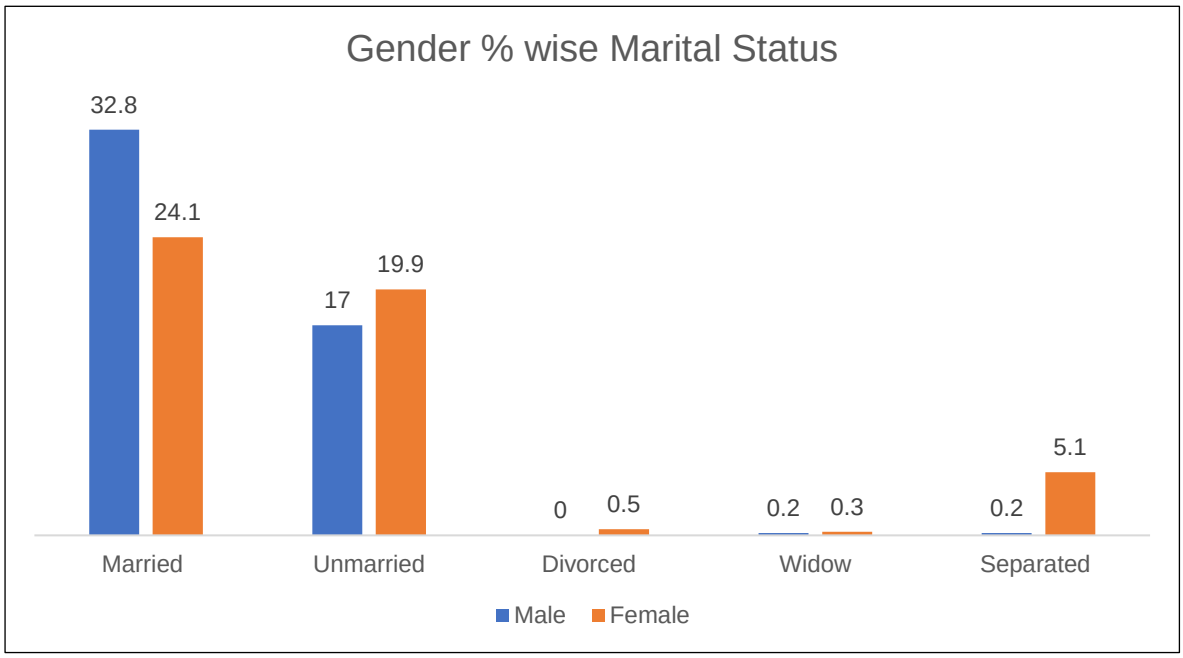
Figure 5-64 Gender wise age group of PAPs



5.10.2 Gender wise Marital status of PAPs

The socio-economic data shows that unmarried women are higher in number than men which is 19.9% while men are 17%. Percentage of women are also higher than men in divorced, widow and separated category. Figure 5-65 shows the gender segregated marital status of PAPs.

Figure 5-65 Gender wise Marital status

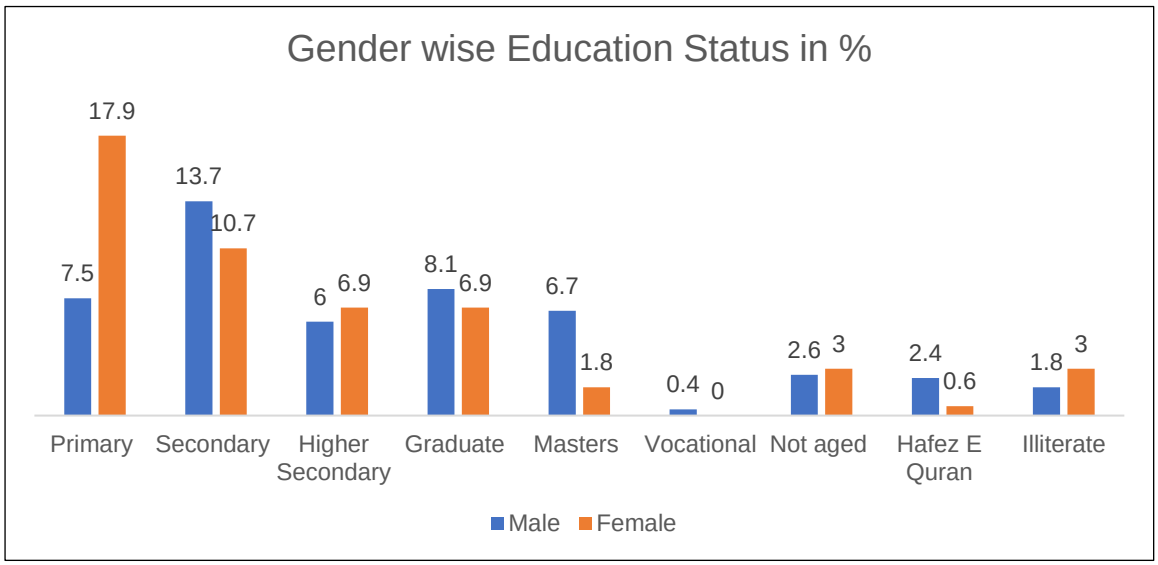


5.10.3 Geder wise Educational Status

The socio-economic survey found that the educational attainment is higher among women than men in Primary (17.9%) and Secondary (6.9%) level, also the rate of illiteracy is also higher among women

which is 3% while the men are only 1.8% among the PAPs. Figure 5-66 illustrates the gender segregated data of educational attainment among PAPs.

Figure 5-66 Gender wise Education status of PAPs



During the socio-economic survey, people were asked about the land holding pattern and ownership of women in the project area. Survey data shows that women have land ownership in the project area, and they owned that land hereditarily. For land-related decisions in the family, 98.5% (298 person) said no involvement or power of decision making while only 1.5% said there is decision-making authority and power of women in the family regarding land and other issues. No female was identified during the survey who was involved in cultivation within the project area. Among the landowners those who are women are all of them found solvent from both husband and paternal side.

The AIIB project has always focused on gender equality and women's development. ESS1 clearly poses the need to identify any adverse gender risks and impacts and develop mitigation measures to reduce these risks and impacts based on gender factors. This includes optimizing project design, promoting equal opportunities, and empowering women in socio-economic aspects. An analysis of gender differences was conducted in the areas of participation in decision making, economic participation, and development capabilities. The following factors were recognized from the qualitative and quantitative data.

- Women are less aware or lower understanding of the project compared to men.
- Women are less involved in income generating activity than men.
- For land-related decisions in the family, 98.5% (298 person) said no involvement or power of decision making while only 1.5% said there is decision-making authority and power of women in the family regarding land and other issues.

However, study founds women those who are vulnerable in terms of socio-economic status from waste pickers. The list of waste pickers provided by the DNCC has shown 9 women were involved in waste picking in the land fill site of total 20 waste pickers. Every one of them are from poor and low-income community, where some of them are only earning member of the family having disable children and elderly husband. Having no sanitation and resting place within the land fill site also make them vulnerable in terms of hygiene issues. Nine of them are from the age between 30 to 55. Few of them use safety boots while collecting waste materials while most of them use regular slippers. None of the women are attended school after primary level, and every one of them get married in their early age (12-16).

Providing Employment Opportunities for Women and Increasing Economic Income during the project construction process, it is expected positions for women, such as laborers with low technical requirements, cleaners, traffic maintenance workers, and cooks for the construction team. These positions can be offered to the women with vulnerability and low income from waste pickers ensuring that increase their economic income through that involvement. The employment opportunity may help them to get rid from the hazardous work they are currently involved in raag picking in the landfill.

5.10.4 Gender wise Land ownership

The socio-economic survey found that the women those who have ownership in the acquired land are 91 where the total landowners are 242 which indicates that nearly 38% women have ownership of total landowners. Women have the ownership of land hereditarily, mostly from patriarchal property and some have found share from spouse. The ownership status of land indicates women have equally been treated along with men in terms of property distribution which indicates good societal condition there.

6 IMPACT ASSESSMENT AND MITIGATION MEASURES

Assessment of potential impacts is based on activities that will be involved in the implementation of the project, the nature and extent of the proposed activities, and the present environmental setting of the project area.

6.1 Impact Assessment Methodology

The impact assessment has involved the prediction, evaluation, and mitigation of impacts. The main ESIA steps are summarized below and comprise of:

- Potential Impact Prediction: determination of what could potentially happen to resources/ receptors as a consequence of the Project and its associated activities.
- Impact Evaluation: Assessment of the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value, and/or importance of the affected resource/receptor.
- Mitigation and Enhancement Measures: Identification of appropriate and justified measures to mitigate adverse impacts and enhance positive impacts.
- Residual impact evaluation: Evaluation of the significance of impacts assuming effective implementation of mitigation and enhancement measures.

6.1.1 Potential Impact Prediction

Prediction of environmental impacts is the most important component in the impact assessment study as it provides quantitative information on likely environmental impacts from a project well in advance. The diverse range of potential impacts considered in the impact assessment process typically results in a wide range of prediction methods being used, including quantitative, semi-quantitative, and qualitative techniques.

6.1.2 Impact Evaluation

Once the identification of potential impacts is completed, each potential impact is described in terms of its various relevant characteristics (e.g., nature, extent, duration, intensity/ severity, irreplaceable loss of resources, and probability).

6.1.2.1 Nature of Impacts

The nature of impact is an assessment of the type of effect the activity is likely to have on the surrounding affected environment. The description includes what is being affected and its magnitude. The nature of the impact will be classified as positive or negative and direct, indirect, and induced.

Direct	Potential/possible Impacts will be generated directly from the project activities and its associated facilities, which are directly linked with the project. (e.g., discharge of untreated wastewater from construction camps into a nearby water body may lead to a decline in water quality).
Indirect	Potential/possible Impacts will be generated from secondary sources which are induced by the project activities. (e.g., impacts of air emissions such as CO_2 on climate change, NO_X may lead to acid rains, VOC may lead to low-level atmospheric ozone when combined with NO_X in the presence of sunlight).
Induced	Potential/possible Impacts will be generated (which are not part of the Project) due to the effect/consequence/outcome of the Project (e.g., an influx of camp followers resulting from the importation of a large project workforce).

6.1.2.2 Extent and Location of Impacts

Extent and location indicate the spatial area that may be affected by the proposed project activities or its associated facilities (Table 6-1).

Table 6-1: Geographical Extent of Impacts

Extent	Description
Project Site	Potential/possible impacts' area only at or within the project site/project boundary.
Local	Potential/possible impacts' area is not only limited to the site, but also its immediate surrounding areas/receptors.
Regional	Potential/possible impacts' area extends to the immediate surrounding areas along with adjacent areas.
National	Potential/possible impacts' area considered at a national level.
Trans-Boundary	• Impact considered not only within the national level but also within the neighboring country. • Impact considered a global level.

6.1.2.3 Duration of Impacts

Duration measures the lifetime/existence/continuation of the impact (Table 6-2).

Table 6-2: Duration of Impacts

Duration	Description
Short Term	Potential/possible impact duration is a very limited time or length of construction/decommissioning period.
Medium Term	Potential/possible impact duration will continue after the construction period but stop/discontinue/cease within a tenure of 10 years.
Long Term	Potential/possible impact duration will continue for more than 10 years or the entire operational life of the project.
Permanent – Mitigated	Potential/possible impact will remain after the operational life of a project but appropriate mitigation measures reduce the impact.
Permanent – No Mitigation	• Potential/possible impact will remain after the operational life of the project. • No mitigation measures will reduce the impact after implementation.

6.1.2.4 Intensity/severity of Impacts

Intensity/severity is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts (Table 6-3).

Table 6-3: Intensity of Impacts

Intensity	Description
Insignificant	Changes due to potential/possible impact are minor, not visible/noticeable, natural functioning of the environment not affected.
Low	• Natural functioning of the environment is minimally affected. • Natural, cultural, and social functions and processes can be reversed to their original state if mitigation measure is taken.

Intensity	Description
Medium	• Environment remarkably distorted/disturbed/impacted, still functions, if in a modified way. • Negative impacts cannot be fully reversed.
High	• Cultural and social functions and processes distorted/disturbed/impacted. • Potentially ceasing to Environmental function temporarily. • Negative impacts cannot be fully reversed.
Very High	• Natural, cultural, and social functions and processes permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected. • Negative impacts cannot be reversed.

6.1.2.5 Potential for Irreplaceable Loss of Resources

Potential for Irreplaceable Loss of Resources is the degree to which the project will cause a loss of irreplaceable resources (Table 6-4).

Table 6-4: Potential for Irreplaceable Loss of Resources

Potential for Irreplaceable Loss of Resources	Description
Low	No irreplaceable/unique resources will be impacted.
Medium	Irreplaceable/unique resources can be replaced, with mitigation measures/efforts and will be replaced after a certain period of time.
High	Potential/possible Impact replaces a particular/vulnerable resource.

6.1.2.6 Probability

Probability is the likelihood or the chances that the impacts will occur (Table 6-5).

Table 6-5: Probability of Impacts

Probability	Description
Unlikely	Under normal conditions, no potential/possible Impact expected.
Low	The probability of the impact occurring is low due to its design or historic experience.
Medium	There is a distinct probability of the impact occurring.
High	It is most likely that the impact will occur.
Definite	The impact will occur regardless of any prevention measures.

6.1.2.7 Magnitude

The magnitude is calculated as extent + duration + intensity + potential impact on irreplaceable resources.

Magnitude essentially describes the intensity of the change that has the potential to occur in the resource/receptor as a result of the potential impact. The magnitude designations themselves are universally consistent, but the definitions for these designations vary depending on the resource/receptor.

In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the EIA to indicate that the project has the potential to result in a potential positive impact, without characterizing the exact degree of positive change that may occur.

6.1.2.8 Significance

The significance will be rated by multiplying the consequence of the impact and the probability of occurrence (i.e., Magnitude × Probability = Significance).

Table 6-6: Significance of Issues (Based on Environmental Parameters)

Significance	Description
Positive Impact	Potential/possible impacts that have a beneficial impact on affected media
Very low	No action is required.
Low	• Impacts are within the acceptable range. • Potential/possible impacts such as localized or short-term effects on habitat, species, or environmental media.
Medium-Low	• Impacts are within the acceptable range but should be mitigated to lower significance levels wherever possible. • Potential/possible impacts such as localized, long-term degradation of sensitive habitat or widespread, short-term impacts on habitat, species, or environmental media.
Medium-High	• Potential/possible impacts are significant and require attention. • mitigation is required to reduce the negative impacts to acceptable levels. • Potential/possible impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species, or environmental media.
High	• Impacts are of great importance, mitigation is crucial. • Potential impacts such as significant, widespread, and persistent changes in habitat, species, or environmental media. • Potential impacts such as persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.
Very High	• Impacts are unacceptable. • Potential impacts such as loss of a significant portion of a valued species or loss of effective ecosystem function on a landscape scale.

Potential social impacts are inherently variable because community response to a potential impact, perceptions of existing and changing conditions, and the degrees of vulnerability are all heavily dependent on local conditions and the human factor. The significance of designations for potential social impacts taken into consideration social science expertise and previous experience in Bangladesh regarding the relationships between individuals, communities, government agencies, NGOs, special interest groups, and different industries.

Table 6-7: Potential Social Impact Significance

Significance	Definition
Positive Impact	Potential/possible impacts that have a beneficial impact on affected stakeholders.
Very Low	Potential/possible impacts that are practically indistinguishable from the social baseline, with little to no potential impacts to or concerns from affected external stakeholders.

Significance	Definition
Low	Potential/possible impacts that are short-term nuisance or inconvenience; potentially affected external stakeholders concerned but likely able to adapt with relative ease.
Medium-Low	Potential/possible impacts such as localized or short-term effects; potentially affected stakeholders concerned but likely able to adapt with relative ease.
Medium-High	Potential/possible impacts such as local-to-regional (sub-national) or medium-term effects; potentially affected stakeholders concerned and raise the issue as a high priority but may be able to adapt with some targeted support or assistance.
High	Potential/possible impacts such as local-to-national or long-term effects; potentially affected stakeholders concerned and raised as a high priority; may not be able to adapt without targeted support or assistance to maintain a pre-impact livelihood.
Very High	Potential/possible impacts such as local-to-global or irreversible long-term effects; potentially affected stakeholders concerned raise the issue as a high priority and are likely, not able to adapt without targeted support or assistance.

To determine potential public health impacts, the assessment team considers the public which has the potential to be exposed to various aspects and potential impacts of the project, whether it is a permanent resident with continuous exposure or periodic exposure to a fisherman transiting through the project area. The significance of determinations for potential public health impacts take into consideration local and regional public health expertise and previous experience in Bangladesh regarding the relationships between individuals, communities, health care providers, government agencies, NGOs, and different industries.

Table 6-8: Potential Public Health Impact Significance

Significance	Definition
Positive Impact	Potential/possible impacts that have a beneficial impact on the affected stakeholder.
Very low	No impact to the public.
Low	Potential/possible illness or adverse effect with limited or no impacts on the ability to function and medical treatment is limited or not necessary.
Medium-Low	Potential/possible illness or adverse effects with mild to moderate functional impairment requiring medical treatment or management.
Medium-high	Potential/possible serious illness or severe adverse health effects requiring a high level of medical treatment or management.
High	Potential/possible serious illness or chronic exposure of a few resulting in life-shortening effects.
Very High	Potential/possible serious illness or chronic exposure of many resulting in life-shortening effects.

6.1.3 Mitigation and Enhancement Measures

Once the significance of an impact has been characterized, the next step is to evaluate what mitigation and enhancement measures are defensible. These are commonly incorporated into the project as commitments. Mitigation is aimed at preventing, minimizing or managing significant negative impacts

to as low as reasonably practicable and optimizing and maximizing any potential benefits of the project, where applicable.

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated project activities) and then to address the resultant effect on the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude.

6.2 Impact Identification

The potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the project have been considered with respect to their potential to interact with environmental and social resources or receptors.

The interaction matrix enables a methodical identification of the potential interactions each project activity may have on the range of resources/receptors within the area of influence i.e., the study area of the project. The interaction matrix for the project activities and likely impacted resources/receptors are presented in Table 6-9.

Table 6-9: Impact Identification Matrix for the Proposed Project

Project Activities/Aspect	Potential Impacts																																
	Physical Resources													Biological Resources				Socio-economic Resources										Health and Safety					
	Air Quality	z	Noise	Vibration	Surface water resource	Surface water quality	Groundwater resource	Groundwater quality	Soil resources	Sediment quality	Land use	Drainage pattern	Visual/Aesthetics	Terrestrial flora	Terrestrial fauna	Aquatic flora	Aquatic fauna	Demographic (incl. Physical displacement)	Economy and Employment	Social and cultural structure	Land & livelihood loss/ Economic displacement	Infrastructure and service	Cultural resources	Education and skills	Agriculture/cash crops	Occupational health and safety	Public transportation	Communicable/non-communicable disease	Vector-borne disease	Sexually transmitted disease	Community Health & Safety	Vulnerable groups
Pre-Construction																																	
Land Purchase/ Acquisition for power plant/TL/Ash yard																																	
Site Clearing, Earthmoving, Land Filling, and Leveling																																	
Construction Phase																																	
Construction of Access Road																																	
Building construction including temporary structures																																	
Mechanical and Electrical Activities																																	
Operation of Construction Equipment and Machinery																																	
Water pump station & pipeline construction																																	
Ash yard establishment																																	
Construction Material Storage, handling, and disposal of waste																																	
Generation of sewage and discharge																																	
Transmission tower installation and stringing of wire																																	
Transportation of manpower, equipment & materials																																	
Fuel and Chemical Storage and Handling																																	
Sourcing of construction water and domestic water																																	
Washing of vehicles and equipment																																	
Operation Phase																																	
Collection and transportation of waste																																	
Operation of Boiler, Turbine, and Generators																																	
Enterprises and individuals involved in waste chain																																	
Waste entering the plant																																	
Waste incineration																																	
Operation of Cooling System																																	
Water demand (Surface and groundwater intake)																																	
Wastewater from plant operation																																	
Transportation, storage, and use of chemicals																																	
Maintenance (cleaning, oil change, lubrication, etc.)																																	
Waste generation (Fly ash, Bottom ash, Slug, etc.)																																	

Project Activities/Aspect	Potential Impacts																																
	Physical Resources													Biological Resources				Socio-economic Resources									Health and Safety							
	Air Quality	z	Noise	Vibration	Surface water resource	Surface water quality	Groundwater resource	Groundwater quality	Soil resources	Sediment quality	Land use	Drainage pattern	Visual/Aesthetics	Terrestrial flora	Terrestrial fauna	Aquatic flora	Aquatic fauna	Demographic (incl. Physical displacement)	Economy and Employment	Social and cultural structure	Land & livelihood loss/ Economic displacement	Infrastructure and service	Cultural resources	Education and skills	Agriculture/cash crops	Occupational health and safety	Public transportation	Communicable/non-communicable disease	Vector-borne disease	Sexually transmitted disease	Community Health & Safety	Vulnerable groups
Domestic waste or domestic use of water																																	
Job Facilities																																	

	Represents “no” interactions are reasonably expected;
	Represents interactions reasonably possible but none of the outcomes will lead to significant impact impacts;
	Represents interactions reasonably possible with one of the outcomes leading to potential significant impacts.

6.2.1 Positive Impact or Beneficial Effects

A Waste to Energy (WtE) project can have several positive impacts comprising reducing landfill waste, mitigating greenhouse gas emissions, promoting environment-friendly sustainable management of municipal solid waste, reducing foul odour from the landfill site and ultimately generation of electricity. Additionally, it can create job opportunities amongst locals, improving socio-economic and environmental condition of the project area and contributing to development of local economy. Furthermore, the community consultation has revealed community's perspective focusing on potential job opportunity for locals, meeting local energy requirements, improved environment leading to reduced incidences of environmental hazards, dour control and enhancing the aesthetic development of the project area.

Hence, this Waste-to-Energy (WtE) project is considered as one of the most economical and environment-friendly solutions for tackling the problem of municipal waste. This will reduce air, water and soil contamination and odor also. This will improve the quality of life of society and will provide safe & hygienic surroundings.

The following areas have been identified that potentials for positive impacts:

Electricity Generation

The main positive impacts due to this project can be considered as generating electricity by incinerating waste that could reduce the burden of the existing waste management system of DNCC. The implementation of this project can better achieve the sustainable development of solid waste disposal in Dhaka City, realizing "reduced, resourceful and harmless solid waste".

Employment Generation

Employment generation will be a significant contribution to the project, especially considering the employment scenario in the project area during the construction phase. The project is expected to employ at least about 2320 people during the construction phase and 280 people for the operations phase through contractors. Waste pickers will be recruited at the plant as per the needs. The potential impacts due to the employment generation are considered to be positive.

Enhancement of Local Economy

During the operation period, people from various parts of the country as well as globally will be employed for long days. During this time all kinds of commodities relevant to the livelihoods of workers and engineers will be supplied from the local community. As a result, local business opportunities and the enhancement of the economy will create a positive impact for the community.

Opportunity for local transporters

The project operation will require a number of transportation services including regular requirements for commuting short-term visitors and industrial provisioning of a range of materials. Hence, this would create business opportunities for local transporters.

Community Benefits

The electricity produced from the power plants is supplied to the distribution grid and GoB decides on the areas to which the power generated is to be supplied. There will be an increase in the local government's efforts to electricity settlements in view of the demand from the local community. The local community will also expect an increase in development activities associated with WTE Power Plant North Dhaka Private Limited's social responsibility commitments.

Reducing Community Health risk

Currently People living close to the landfills may suffer from pneumonia, bronchial and skin diseases from the huge amounts of waste dumped there, as reported by the FGD respondents. Nearby dwellers also suffer from regular headaches, stomach problems, and a loss of appetite due to the foul smell.

Farmers working near the landfill face many injuries, with rashes occurring commonly after submerging their feet in contaminated rivers or agricultural fields. They can't dip their body in the water as it causes deep rashes on the skin. Mosquito breeding is higher within and around the landfills and contributes to the spread of various vector-borne diseases among nearby dwellers. The nearby people of the landfill can't even stay properly inside the house due to the disturbance of flies and mosquitoes.

Above mentioned community health risk of the existing landfill will be reduced after completing the project.

Reducing Odors

Odors in landfill gas are caused primarily by hydrogen sulfide and ammonia, which are produced during the breakdown of waste material. The emission of a foul stench from the landfills is a huge problem for the landfill workers and adjacent households. The nearby dwellers' lives have become unbearable due to the landfill's emitted odor. This also negatively affects those walking or traveling along the highway/roads beside the landfills and contaminates the air. The odors from the existing landfill will be reduced after the completion of the project.

Reducing impacts on water quality

The leachate and the waste mixing with the groundwater adversely affect the surrounding water bodies, killing the fish population and hampering fishermen's livelihoods. The river (Turag, nearby Amin Bazar) has become ruined by waste entering it. The leachate treatment plant does not fully reduce leachate percolation into the nearby waterbodies, making them polluted and unsuitable for fish cultivation. Thus, many farmers and fishermen have been forced to switch livelihoods. The impact on water quality due to the current landfill will be lessened by the proposed project.

Reducing impacts on Soil Quality

Dwellers beside the Aminbazar landfill cannot cultivate crops due to the soil and groundwater contamination caused by leachate permeation and waste dumping. Many agricultural lands are located around 200–300 m radius from the dumping zone of the Aminbazar landfill which is a highly risky zone. Furthermore, especially during the monsoon, the waste becomes clogged in the farmland, causing soil infertility. The proposed project will reduce the impacts on the soil quality of the surrounding area.

6.2.2 Impacts during Pre-Construction and Construction Phase

Alongside the project benefits, there will be potential negative environmental impacts at the three phases of the project cycle. The proceeding sections discuss each of these phases' impacts on the environmental and social.

6.2.2.1 Impacts on Land Use

The proposed site is located on the south of the Amin Bazar landfill site, on the west side of North Dhaka, about 17 km from the Dhaka city center and is situated at Bongaon Union under Savar Upazila of Dhaka District. The proposed land requirement for WTE Power Plant North Dhaka Private Limited is 31.18 acres (126187.41 m^2) including incineration plant land and new access roads. The existing land use of the proposed power plant is mostly fallow low-lying land. No major tree species are present within the project boundary. No permanent water bodies and hills have been found in the project area. This project will not fill any pond, canal, and waterbodies during site development. No hill cutting is required due to project development. The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about 850,000 cubic meters. The sand will be sourced from Padma River, Meghna River and Brahmputra Jamuna River. The existing project site land will be developed through filling, levelling, and grading, prior to start the construction activities. Land development activities will change the existing landform and land use of the project site but might not the surrounding area. The land use pattern of the project site will be changed from fallow low-lying land to industrial

category. The impacts on landform due to the site development activities are assessed to be **Medium-High**.

Impact	Impacts on landform due to site development				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Inside of the project boundary				
Frequency	Limited to pre-construction stage				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider **Medium-high**				

Mitigation Measures

- Land development will be confined within the project boundary, and special care needs to be taken as the earth filling material cannot move to the adjacent land.
- Avoidance of productive land and far from the nearest settlement area is preferable.
- Avoidance of encroachment of waterbodies is preferable.
- Complete the landfill and soil compaction as soon as possible before starting the construction activities for the power Plant.
- Landfilling and site development activities can be continued during dry season only to avoid drainage congestion/waterlogging in the project site and its surrounding area.
- Adequate storm water drainage plan should be ensured by the project proponent during the pre-construction stage of the proposed project.
- Tree/Vegetation clearance should be reduced as much as possible.
- Greenbelt development as early as possible after completion of the construction activities immediately.
- Proponent should take tree plantation program whereas possible in the project boundary or along the roadside or any vacant forest land with collaboration of forest department.
- Parking of vehicles and stockpiling of materials/excavated earth should be done in systematic way to avoid the damaging of aesthetics of the site; and
- Regular monitoring of the drainage condition and waterlogging situation in the project area.

The impact of landform will have medium intensity with project site extent for a short-term duration which will result in an overall medium-high impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.2 Impact on Air Quality

During the preconstruction and construction of the power plant facilities (including the main building, auxiliary area, water treatment area, ash & slag comprehensive treatment area, water intake and drainage pipeline and transmission line), the activity would involve excavation for the land development, movement of transporting vehicles carrying the construction materials, etc. All these activities would give rise to the emission of dust particles thereby affecting air quality marginally at the site which will be transitory in nature. The major sources of impacts on ambient air quality are given below:

Pre-construction Stage:

- Site Cleaning (Removal of vegetation/trees)
- Landfilling, levelling, excavation, and compaction

Construction Stage:

- Exhaust emission from the movement of equipment by trucks, and other heavy loaders.
- Operation of diesel generators and other diesel-based construction machinery.
- Earthworks, Including excavation, and soil stripping.
- Site clearance including removal of topsoil.
- Construction sites generate dust from construction materials, waste, loose earth, moving excavated material, and transporting wastes on vehicles.
- Heavy machinery causes air pollution.
- Loading and unloading construction materials.
- Handling and mixing cement.
- Concreting works, including operation of concrete batching plant.

6.2.2.2.1 Dust from Construction Activities

Particulate matter will be the predominant pollutant affecting the ambient air quality during the pre-construction and development phase of the proposed power plant project. Gaseous emission from the operation of machinery, equipment's, and vehicles will impact on ambient air quality. During site cleaning, land filling, site establishment, earthwork and transportation activities in dry condition significant dust will be generated. The nearest settlement (Nandonik Housing Society) is located 200 m south to the project boundary. The particulate matter that would be released into the air could reduce visibility. During land development, nearby settlements close to the project site and access road may experience impacts from dust generation. However, these impacts are, , reversible and of short duration, confined within the project boundary and occur primarily during the pre-construction and development stage.

The possible sources of dust generation activities and exhaust emission during the construction phase are as follows:

- Excavation of soil to construct building and equipment foundations.
- Pile driving for the equipment foundation.
- Movement of construction equipment by vehicle.
- Loading and unloading of materials.
- Dust generated from stockpiles of materials, waste, loose earth, handling and moving excavated material and transporting wastes on vehicles.
- Concrete works, including the operation of the concrete batching plant.
- Exhaust emission from the movement of heavy equipment by heavy loaders, trucks,
- Operation of diesel generators and other diesel-based construction machinery.

Dust generated from many of these activities will increase the particulate matter levels in ambient air. Most of the construction activities mentioned above have the potential to generate dust. The extent of impacts from dust will depend on the exact location of these activities and on the weather conditions; stronger winds and dry conditions will enhance the transfer of dust, while damp or wet conditions will

reduce this impact. Construction dust dispersion is expected to be localized due to the relatively high mass of the dust particles, which will tend to confine the most significant dust impacts to the area within 200 m of the source. The potential for dust emissions during the wet season will be small, due to the moistening of any dust by rainfall. As the dust is expected to settle within 200 m, the main receptors would be workers on site and neighbouring settlements. The nearest settlement (Nandonik Housing Society) is located 200 m south of the project boundary. Bongaon Village about 500m away from the proposed plant. Settlements are surrounded by thick homestead plantations which will act as a barrier reducing the magnitude of any dust impacts. The significance of the impacts is assessed to be **Medium-Low**.

Impact	*Dust from Site Development and Construction Activities*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Settlement within the 500 m of the project boundary				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures for dust control

- The EPC contractor should develop and implement a Construction Environment Management Plan (with reference to the management of air quality during the construction phase) once detailed information relating to the construction methodology and the schedule is available (prior to commencement).
- EPC contractor should consider minimization of groundworks when high winds are present;
- The EPC contractor should undertake land grading, improvement or moving of materials during periods of low winds.
- Sand and other materials will be stored in specifically designated areas and will be properly stored at the site and will be water-sprayed or covered.
- Implementation of regular watering and sprinkling dust suppression regime, during the dry season.
- The concrete batching plant will be located within the protected site to keep it away from sensitive receptor/s.
- Stockpiles will be maintained at the site only, which is a fenced area. No stockpiles will be maintained outside, and the maximum possible distance between the stockpiles and receptors will be maintained.
- Material transport will be totally enclosed with impervious sheeting, and wheel washing will be carried out at the site.

- Waste from construction will not be burned.
- The movement of construction vehicles will be minimized, and a 20 km/hr speed limit will be enforced around the construction site.
- The Ambient Air quality monitoring should be carried out by the contractor following the National Air Pollution Control Rules 2022 (Schedule-1: Standards for Ambient Air Quality).and
- Lorries and trucks engines should be turned off while waiting on site to minimise the exhaust emissions.

The impact of dust control will have high intensity with local extent for a short-term duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.2.2 Exhaust Emissions

Different equipment, burge and vehicle will be used for land cleaning, dredge material transportation, filling, levelling, land development activities and transportation purpose. The equipment and vehicles will generate gaseous substances (NOx, SO_2) which will contribute to deteriorate the ambient air condition during the preconstruction stage.

Construction vehicles and other construction equipment will generate exhaust emissions. Heavy equipment such as bulldozers, excavators, dump trucks, and compactors will be used onsite. Emissions from this equipment and from diesel generator sets used to generate power will cause impacts on ambient air quality. Construction vehicles and equipment engine exhaust emissions include CO, $PM_{2.5}$, PM_{10}, and NO_2. It is not anticipated that large volumes of exhaust emissions will be generated during the construction phase of the power plant and transmission line as well. Impacts from vehicle emissions decrease rapidly with increasing distance from the source. The main receptors would be workers on site and neighbouring settlement. The distance between the project site boundary and the closest residential dwelling is 200m to the southern boundary of the project site. Moreover, the consequences will not be significant as the settlement is not located adjacent to the project boundary. The impacts on ambient air quality during construction phase is assessed to be **Medium-Low**.

Impact	*Exhaust Emission*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Settlement within the 500 m of the project boundary					
Frequency	Limited to preconstruction and construction phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures for Exhaust Emissions

Exhaust emissions will be minimized by following mitigation measures:

- Exhaust vent of DG set will be kept at proper height to ensure quick dispersion of gaseous emissions.
- Low Sulphur diesel (S<O.5%) will be used in diesel-powered equipment in collaboration with best management practices.
- All diesel-powered equipment will be regularly maintained, and idling time reduced to minimize emissions.
- Vehicle/equipment air emissions will be controlled by good practice procedures (such as turning off equipment when not in use).
- Vehicle/equipment exhausts observed emitting significant black smoke in their exhausts will be serviced/ replaced.
- Periodic checking of vehicles and construction machinery to ensure compliance to emissions standard following the National Motor Vehicles Standard (Schedule-2: Standards for emission from motor vehicles, APCR, 2022);

The implementation of good site practices, such as the regular maintenance of vehicles and equipment, using cleaner fuels, and switching of vehicles when not in use will be used to reduce exhaust emissions from the operation of diesel-powered construction equipment and therefore minimize adverse air quality impacts. The impact of exhaust emission will have low intensity with local extent for a short-term duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.2.3 Offensive Odor

The implementation of this project involves several types of construction works that may generate substances with bad odors. For example, land preparation and clearing work, sewage from mobile and stationary toilets, solid waste, slurry, etc. Offensive odors from preconstruction and construction activities, arising from materials like asphalt, solvents, and heavy machinery emissions, can adversely affect nearby residents' health and well-being. Issues such as headaches, respiratory problems, and increased stress are common. These odors also contribute to air pollution, harming local wildlife and vegetation. The presence of unpleasant smells can deter outdoor activities, reduce the area's aesthetic and recreational value, and impact local economies. Moreover, odor from the existing landfill site can create trouble for the workers and staff during preconstruction and construction period of this project. However, considering the possibility of producing such a bad odor and its public exposure level, the impact seemed less significant. The impact due to the offensive odor is assessed to be **Medium Low**.

Impact	*Offensive Odor*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Settlement within the 500 m of the project boundary				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High

Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

- A brief odor management plan shall be developed that outlines the strategies to be used to minimize or eliminate odors during the construction period.
- The EPC contractor should ensure mask to the workers and community to reduce odor effect.
- A community liaison team shall be established to communicate with local residents about the project, including any odors that may arise during construction.
- The sewage sludge generated from stationary toilets in offices, workers' accommodations, and construction yards should be managed with sanitary pit and shall not be released in open environment.
- Odor-neutralizing agents shall be used to minimize the release of odors during land preparation and clearing work.
- Solid waste and slurry should be covered and disposed of properly to minimize odors.
- Adequate ventilation and air filtration systems shall be installed in enclosed spaces, such as mobile and stationary toilets and other work areas, to minimize the buildup of odors.

The impact of offensive odor will have low intensity with local extent for a short-term duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.3 Impact on Noise and Vibration

6.2.2.3.1 Impacts from Noise Emissions

Noise and vibration are very common outcomes of any development project. Noise can lead to annoyance due to interference with communication or disturbance to receptors involved in leisure activities, as well as sleep disturbance[34]. It is expected that, due to the nature of this project, this project will also produce noise during the construction phase. The potential sources of noise during the construction phase of the Project include equipment, machinery, and transportation used for the construction activities. The heavy equipment used for construction activities will be the major source of the noise. This will include piling and preparing concrete foundations for plants and buildings. Transportation of construction materials to the stockyard for the associated transmission line may cause negligible noise pollution. The traffic volume will be increased during the construction phase due to the transportation of equipment, construction materials, and workers on the access road which will be the source of noise to the closest receptor. In general, noise is attenuated over distance from the source due to the dissipation of sound energy through the atmosphere.

Noise Impact within the Project Site

Noise-sensitive receptors within the project site are staff and workers in the proposed waste-to-energy power plant and associated facilities. About 2320 people will be working throughout the construction phase. There is potential for disturbance to habitations in the proximity of the construction site. The general noise levels during construction phase such as due to the working of heavy earth moving

[34] World Health Organization. (1999). *Guidelines for Community Noise*. https://apps.who.int/iris/handle/10665/66217

equipment and machinery installation may sometimes go up to 90 dB(A) at the work sites in the daytime. Different phases of construction activities at the project site are scheduled to take place for about 24 months. The workers, in general, are likely to be exposed to an equivalent noise level of 80-90 dB(A) in 8 hours shift.

Noise is also one of the aspects which may cause hearing impacts on workers associated with construction activities and communities in the immediate vicinity, especially during early morning and nighttime construction work activities.

Noise impact to the E&S sensitive receptors

The equipment and machinery will produce cumulative noise depending on source type and number, weather condition, distances and duration of the working period. If a single equipment will produce 90 dB (A) within 1m, it would be reduced gradually to its movement.

The produced noise will traverse to the adjacent communities from the sources. The closest receptors are residential area named Nagar Konda- 550m and Baliarpur Village-800 meters and Nandonic Housing Society- about 200 meters from the project site. The nearest School and mosque are located between 880 m to 1500 m away from the construction work site. Moreover, fauna within and around the project site also is considered sensitive receptor. The nearest settlement (Nandonik Housing Society) is located 200 m south from project site and Bongaon village adjacent to the North-western boundary which is about 500m away from the project site. Construction traffic is expected to be generated throughout the entire construction period; however, the volume and type of traffic generated will depend on construction activities being conducted, which will vary during the construction period.

Considering the closest receptor to the project site and staff and workers during construction phase, the impact due to noise generation has been considered **Medium-Low**.

Impact	*Impact on noise level during the construction period*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Settlement within the 500 m of the project boundary				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures due to Noise within the Project Site

The following mitigation measures will be implemented to minimize potential noise impacts within the project site during the construction phase:

- The EPC contractor should develop and implement a Construction Environment Management Plan (with reference to the management of air quality during the construction phase) once

detailed information relating to the construction methodology and the schedule is available (prior to commencement);

- Normal working hours of the contractor will be between 06:00 and 21:00 hours from Saturday to Thursday. If work needs to be undertaken outside these hours, it should be limited to activities that do not exceed the noise criteria at nearby noise sensitive receptors.
- The machinery and vehicles should be equipped with mufflers, silencers, foam, rubber, and other sound soundproofing materials, whatever is necessary, to reduce operation noise; the diesel generators should be covered with a canopy.
- Only well-maintained equipment will be operated on-site.
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts, and replacing worn-out components should be conducted.
- Machinery and construction plants that may be in intermittent use (e.g., trucks) shall be shut down or throttled down during non-work periods.
- The EPC contractor should conduct regular inspection and spot checks of all noise generating equipment.
- Construction vehicles and machinery will be well maintained and not kept idling when not in use.
- Mobile noise sources such as cranes and earth moving equipment shall be routed in such a way that there is minimum disturbance to receptors.
- Low-noise equipment shall be used as far as practicable.
- The amount of equipment operating simultaneously shall be reduced as far as practicable.
- The EPC contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work.
- The personnel involved in high noise-generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels.
- The contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work (this is a requirement of Occupational Safety and Health Administration (OSHA) 2007);
- Maintain the vehicle speed (20 km/hr) limit on the access road along with placing of speed limit signages in designated loctaions.
-
- All loud and sudden noises will be avoided wherever possible and fixed noise sources shall be located at least 50m away from the site boundary.
- Temporary noise barriers shall be provided surrounding the high noise generating construction equipment.
- Stone breaking machine should be confined within a temporary shed so that noise pollution could be kept minimum.
- Periodic checking of vehicles to ensure compliance to sound standard following the National Motor Vehicles Standard (Standards for sound originating from motor vehicles or mechanized vessels, Noise Pollution Control Rules, 2006); and
- The Noise level monitoring should be carried out by the contractor following the Noise Pollution (control) rules 2006).

Mitigation Measures for E&S sensitive receptors outside of the project boundary

The following mitigation measures will be implemented to minimize potential noise impacts to the E&S sensitive receptors that are outside the project site during construction phase:

- Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby National Skills Registry (NSRs) as far as practicable.

- Noisy plants (such as breakers and rollers) shall be located as far away from receptors as practicable.
- Only limited construction activities shall be carried out during night-time.
- Restrict the nighttime vehicle movement through the access road.
- Maintain the vehicle speed (20 km/hr.) limit on the access road.
- Temporary noise barriers shall be provided surrounding the high noise-generating construction equipment.

The impact of noise will have low intensity with local extent for a short-term duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.3.2 Impacts from Vibration

The construction activities using heavy machinery during soil compacting and rolling, lifting cranes, etc. will generate moderate to high vibration. Ground-borne vibration will likely be generated during the installation of driven piles and other construction equipment during the construction period.

In general, vibration propagated through the ground during earthworks is attenuated within a short distance from the source. Formulae from empirical studies generally consider approximately 110 m from the vibration source[35]. Human receptors that may be exposed to vibration impacts from the project, therefore, include those who would be within 110 m of the project construction work area boundary and comprise the plant staff and workers, as well as personnel temporarily residing within the exclusive use areas.

Vibration can lead to annoyance due to sleep disturbance. Low levels of perceptible vibration may also cause disturbance and can cause concern about structural damage to nearby buildings. It is noted however that the potential for actual cosmetic damage is limited to buildings that are very close to high energy sources such as driven piling. Guidance on the effect of vibration levels on human receptors was published by the British Standard Institute and is presented in Table 6-10.

Table 6-10: Guidance on effects of vibration levels

Vibration Level ($mm.s^{-1}$)	Effects
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaints but can be tolerated if prior warning and explanation have been given to residents.
10.0	Vibration is likely to be intolerable for any more than very brief exposure to this level.

Source: British Standards Institution, 2014 35

Vibration levels are expected to attenuate within 110 m of the construction work area. There is no significant receptor within this range. It is anticipated that the staff and workers at the construction work area may be exposed to vibration levels over a short-term duration, i.e., up to a few hours a day. However, the significance of the impacts is assessed to be **Low**.

[35] British Standards Institution. (2014). *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*. BS 5228-1:2009+A1:2014. The British Standards Institution.

Impact	*Impacts due to Vibration*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project Site				
Frequency	Limited to Preconstruction and Construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures

- Appropriate equipment and machinery shall be used such as low-vibration pile drivers and hydraulic hammers, to minimize the generation of ground-borne vibration.
- A Schedule for construction activities shall be prepared that generates significant vibration during daytime hours to minimize the potential for sleep disturbance.
- Vibration-absorbing materials, such as rubber mats and pads shall be used to isolate equipment and machinery from the ground and reduce vibration transmission
- Vibration levels shall be monitored regularly during construction activities

The impact of vibration will have low intensity with project site extent for a short-term duration which will result in an overall low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.4 Impact on Water Resources

The potential sources of impact on surface and groundwater resources are as follows:

- Earthworks in the proposed Power Plant area may increase topsoil loss, especially during rainfall events, which may increase the suspended sediment concentrations and pollute water sources.
- Sewage will arise from the construction workforce (toilets and washing facilities).
- Liquid effluents will also arise from the washing of construction equipment and vehicles.
- Leakage or spillage of fuels, chemicals, waste materials, etc. stored on the project site during the construction of the power plant and transmission line that could enter water bodies.

The baseline study for the project identified the Karnatali River as the surface water-sensitive receptor due to its proximity to the project area. The Karnatali River is the major surface water body which flows 600m north from the project site. During the project construction, groundwater as well as Karnatali River (about 600 m away from the project site) water will be used. During the monsoon season, many fish species of Bangladesh are found in the Karnatali River. Groundwater is the main source of drinking water in the project study area.

6.2.2.4.1 Impacts on Surface Water

The likely impacts on water quality during the construction phase may arise from inappropriate disposal of construction waste and wastewater generated from the power plant construction site, transmission line, water intake and outfall structure construction. Wastewater generated from the site during the construction contains suspended materials, spillage and washings from the various areas. In addition to that, the presence of labours and another workforce in the construction site will generate wastewater during the construction phase of the project. For the sanitary sewage from toilets and showers, it is anticipated that about 2320 workers will be on site during the peak period of construction. At an average water use by one person of 0.1 m^3/day, it is estimated that 232 m^3/day of wastewater will be generated. Effluents from the construction area mainly contain suspended solids while the sanitary waste from the labour colonies contains suspended as well as organic matter. This is a significant amount of sanitary wastewater that without proper treatment and disposal methods could be discharged off-site with detrimental impacts on the environment. During the construction phase of the proposed power plant, water will be used for the building of civil structures, dust suppression and drinking purposes. The loose construction material like sand, cement etc. and excavated earth/ construction debris may get washed off during heavy precipitation and finally reach the nearby River. This may increase the suspended solids of the receiving water body.

The Transmission line alignment crosses 2 times of Karnatali river; however, as these are overhead crossings the impacts associated with the construction of the TL will be minimal, though there may be some temporary impacts due to the construction of access roads and foundations at locations near the water bodies. Surface water could be affected by construction activities.

As the temporary construction camp will be set up on the project premises and sanitary facilities including toilets and showers will be provided for the use of the construction workforce both on-site and at the workers' accommodation. Such liquid effluent streams are likely to be high in organic matter, suspended solids, bacteria, and other pollutants. Septic tanks will be provided to treat sanitary wastewater. A small volume of wastewater from the washing of equipment and machinery may also be generated. This wastewater may contain concentrations of suspended solids and traces of hydrocarbon. The contractor will be responsible for ensuring that any wastewater discharges meet the standards stipulated in Schedules 4 and 5 of ECR, 2023. Details of construction camp impacts and mitigation plan are given in **Appendix P**.

Changes to surface water quality within the study area may also arise from chemical and waste storage and handling during the construction stages. Unplanned events such as hazardous material leakage from machinery, e.g., overflow of the existing surface runoff infrastructure caused by a major rainfall event could also impact surface water quality. Potential impacts are expected to be short-term and localized in nature. The potential impact on surface water is **Medium-Low**.

Impact	*Impacts on surface water*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Impact on Karnatali River				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High

Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures for Surface Water

Mitigation measures for surface water quality include the following:

- Phase dust-generating activities such as land clearance, earthworks, and building construction to minimize the area of ground exposed and the volume of soil and construction material handled at any one time.
- Waste management measures should include provisions to contain and dispose of construction wastes, prohibit waste discharge on the ground or any surface watercourse, and practice recycling as far as practicable.
- Implement a regular maintenance program for all equipment and machinery to prevent fuel spillage or leakage during construction activities.
- Properly store and manage hazardous materials during construction activities. Strategically locate areas for the temporary storage of hazardous materials away from surface water resources and preferably down the topographic gradient of watercourses. Chemicals and fuels must be properly labeled and stored in a bunded area. Storage of hazardous materials on-site should be limited to minimize the impacts of any spillage or mitigation failure.
- Spill kits should be provided and all personnel managing hazardous materials should be adequately trained in hazardous materials handling and disposal. Such spill kits should be available where equipment and machinery are temporarily stored and used.
- Oil and grease separators shall be used for wastewater generated from cleaning activities.
- Refueling, oil changing, and engine maintenance of machinery, equipment, and vehicles should be undertaken in designated areas with containment to prevent any oil spills from washing away, at a distance of at least 100 m from any water course.
- Cover temporary stockpiles with tarpaulin when not in use.
- Wherever reasonable and practicable, re-vegetate exposed ground as soon as possible to stabilize surfaces.
- Control water suppression during excavation and earth handling to minimize excess water and sediment disposal into surface water.
- Discharge of wastewater from excavation to the surface water bodies will be strictly prohibited due to ecological sensitivities.
- Disposal of construction wastes into the waterbodies will be strictly prohibited.
- Vehicle maintenance and mechanical repairs are to occur in dedicated, designed locations, bounded to capture and control oil, grease, and other spills to prevent flow into surface water resources.
- Adequate sanitary facilities, i.e., toilets provided for the construction workforce.
- Workers trained in the use of designated areas/bins for waste disposal and encouraged to use toilets.
- Monitor the surface water by testing in designated laboratory should be done by the Contractor following the National Water Quality Standard (Schedule-2: Standards for Water, ECR, 2023).
- All sewage and liquid effluent will be treated to meet the standards specified in Schedules 3, 4 and 5 of the ECR, 2023.

The impact on surface water will have low intensity with a short-term duration which will result in an overall medium low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.4.2 Impacts on Groundwater

Construction activities causing impacts on groundwater resources are likely to include the following:

- Land compaction of construction work areas.
- Diversion of underground utilities.
- Construction of aboveground and underground structures.
- Leakage or spillage of fuels, chemicals, waste materials, etc. stored on the project site during construction that could enter the groundwater aquifer.

The water requirement is estimated to be approximately 280 m^3/day during peak construction. The number of staff in the whole factory is 2320 people. The required water shall be met from the groundwater wells. The total depth of the ground water well is 260m. Each well is designed with a capacity of 190 m3/h.

The groundwater borewell station (ID: GT 2648010) was located near the study area (referred to previous groundwater assessment by CEGIS, March 2022). Based on the borewell data study, groundwater levels have been found to be a decline trend. Groundwater levels have declined up to 7m from the base year 2013 to 2020. Due to abstraction of groundwater, the ground aquifer will decline. The existing groundwater quality analysis around the project does not reveal any existing contamination or pollution. Soil compaction may increase the intensity and volume of surface water runoff as a result of a decrease in water infiltration recharging the groundwater. Therefore, the local villagers will not get the water during the dry season which may create social conflict. To reduce the pressure on ground water, it is strongly encouraged to identify the alternative source of Surface Water and to use it in different purposes. In case of any adverse impact on the nearby community due to groundwater abstraction by the company, immediate mitigation measures and compensation must be ensured.

Groundwater contamination during the construction phase may occur from unplanned events such as leaks and spills of oil, lubricants, fuel from heavy equipment, and improper handling of sewage. While there is a potentially significant impact on groundwater quality from construction, with the implementation of mitigation measures for proper handling of fuel, waste, and liquid effluents, the impact on groundwater from spills and leaks is assessed to be **Medium-Low**.

Impact	*Impacts on ground water*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Groundwater in the project site and surrounding				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite

Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures for groundwater

The following measures can be taken to minimize the impact on groundwater during the construction phase

- Ensure proper spill control and management at the site.
- Ensure storage of hazardous material and waste in proper manner and dispose of the waste in a hazardous waste landfill site.
- The surface runoff or extracted groundwater contaminated by silt and suspended solids will be collected by the on-site drainage system and discharged into storm drains.
- The EPC contractor should monitor the ground water aquifer condition periodically.
- Monitor groundwater from time to time to detect any contamination.
- Conducting regular monitoring of water quality and quantity to ensure compliance with regulations and minimize environmental impact.
- To reduce the pressure on ground water, it is strongly encouraged to identify the alternative source of Surface Water and to use it in different purposes.
- Monitoring the groundwater by testing in designated laboratory should be done by the Contractor following the National Water Quality Standard (Schedule-2: Standards for Water, ECR, 2023).

The impact on groundwater resource will have low intensity with local extent for a short duration which will result in an overall medium low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.5 Impacts on Soil

The potential source of impact on land resources during the preconstruction and construction phase activities includes:

- Topsoil removal
- Site Cleaning, Levelling (cutting, stripping, excavation, earth movement, and compaction)
- Transportation and storage of construction materials/equipment
- Civil construction activities
- Influx of Labor and construction of temporary houses
- Storage, Transportation, and Disposal of Construction Debris
- Waste disposal from the construction camp

The total 31.18-acre (126187.41 m^2) acres of fallow land and low land will be altered to an industrial area. There are some fallow lands on the west and east side of the project boundary that might be affected due to the land development.

6.2.2.5.1 Soil Compaction

After land acquisition DNCC has developed the land inside the project site. The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about 850,000 cubic meters. The sand has been sourced from Padma River, Meghna River and Brahmputra Jamuna river. Preparation of the site for the power plant includes the main building (waste tipping hall, waste pool, incineration boiler house, flue gas cleaning house, turbine house, central control room, and chimney), auxiliary area (guard room, weighbridge room, access ramp, and oil depot); water treatment area (industrial fire tank, comprehensive water pump house, cooling tower, water purification station), Ash and slag comprehensive treatment area during the construction phase will require some site leveling and grading and soil compaction. The area required for the buildings and access tracks linking infrastructure is considerable. Further, the transport of materials and equipment will involve additional

movement of vehicles; construction machinery which will also lead to some degree of compaction within the site premises. Soil compaction and possible damage to the soil structure due to heavy vehicular movement will only be limited to the vicinity project site. Based on the impact assessment matrix given below the impact was assessed as **Low**.

Impact	*Impact on soil due to compaction*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within the project boundary and transmission line RoW				
Frequency	Limited to Preconstruction and Construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider	***Low***			

Mitigation Measures

The following measure will be implemented to mitigate soil compaction and erosion:

- The area to be cleared must be clearly demarcated and this footprint strictly maintained.
- Soil conservation measures will be implemented such as stockpiling topsoil or gravel for the remediation of disturbed areas.
- Scheduling activities (as far as possible) to avoid extreme weather events such as heavy rainfall and high winds.
- Work areas will be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint.
- Construction vehicles will remain on designated and prepared compacted gravel roads.

The impact on topsoil compaction will have low intensity within the project site for a short duration which will result in an overall low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be Very Low.

6.2.2.5.2 Soil Contamination

Contamination of the soil may occur from improper handling of waste. The major sources are as follows:

- General construction waste will comprise of surplus or off-specification materials such as concrete, wooden pallets, steel cuttings/filings, packaging paper or plastic, wood, plastic pipes, metals etc.
- Domestic-type waste consisting of food waste, plastic, glass, aluminium cans and wastepaper will also be generated by the construction workforce.
- A small proportion of the waste generated during construction will be hazardous and may include:

- Used paint, engine oils, hydraulic fluids and waste fuel.
- Spent mineral oils and cleaning fluids from mechanical machinery; and
- Spent solvents from equipment cleaning activities
- Spent batteries or spent acid/alkali from the maintenance of machinery on site.

Spills could have a long-term impact on soil quality but are expected to be localized in nature. During the construction stage of the power plant, a large number of workers/employees (about 2320 persons) will be engaged with the proposed project. At the same time, a significant amount of solid waste will be produced from domestic waste, garbage, sludge from food waste, by-product material, etc. Solid waste can contaminate soil if it is not managed properly. Project activities of TL with the greatest potential to affect geology and soils include land-clearing and vegetation removal, excavation for tower foundations and improper handling of excavated soil, and generation of wastes at the construction site may affect the soil quality of adjacent land. Based on the matrix the impact has been considered as **Medium-Low**.

Impact	*Soil Contamination from Spills and Leaks*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Within the project site and surrounding					
Frequency	Limited to preconstruction and construction phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

The following measure will be implemented to mitigate soil contamination:

- Fuel, lubricating oil and used oil storage areas should be contained in bunds of 110 percent capacity of the stored material.
- Spill containment and clean-up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of.
- Construction vehicles and equipment will be serviced regularly and off-site.
- The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel, or chemicals.
- Surface run-off from bunded areas will pass through oil/water separators prior to discharge to the stormwater system.
- Ensure storage areas have impermeable floors and containment.
- The contractor will restore tower footprints and other areas disturbed by construction as soon as practicable once major construction activity in that area is complete, and while construction is continuing at other sites, and not to wait until construction is complete along the entire corridor.

- The construction contractor will implement a training program to familiarize staff with emergency procedures and practices related to contamination events.
- Hazardous waste generated from the proposed project should be treated as per the ECR 2023.
- Liquid effluents arising from construction activities should be treated to the standards specified in Schedule 4 and 5 of ECR, 2023 and the applicable international guidelines prior to discharge.

The impact on soil contamination due to spills and leaks will have low intensity within the local extent for a short duration which will result in an overall medium low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be Very Low.

6.2.2.6 Impacts due to Waste Generation

The main type of waste likely to be generated during construction activities is the construction debris resulting from the excavations for building foundations, construction of the building frame, internal fittings, electrical installation, and external works. Other wastes that will be generated include waste food and packaging materials littered by workers.

Some of the waste streams include the following:

- Hazardous wastes such as solvents, thinners, cleaners, cutting oils, paints, contaminated rags, packaging and containers, adhesives, light bulbs, and batteries.
- Non- hazardous wastes such as food and canteen waste, scrap metal waste, wastepaper, wood, and cardboard packaging.
- Other wastes such as glass, uncontaminated soil and rubble, plastics, and rubber.

There is potential for the spread of construction debris to the outside areas of the project boundary. The debris generated from construction activities can contaminate the river flowing near to the plant. Construction debris can also contaminate wells, agricultural land, etc. in the proximity of the activity. Sanitary waste also will be generated during the construction phase. The improper management of the above wastes may have potentially significant impacts on the environment in the absence of appropriate mitigation measures. Therefore, the impact significance is assessed as **Medium-Low**.

Impact	*Waste Generation*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Within the project site				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

Measures to avoid, minimize, and limit the magnitude of waste generation impacts caused by the project's construction phase are outlined in the following.

- Establishment of the waste management plan at the project construction site.
- Construction wastes that will be generated during construction stage should be dump primarily in a specific area in the project site and immediately remove to the approved site.
- Ensure proper collection and disposal of solid wastes within the construction camps and construction site.
- Solid waste burning in the construction site is strictly prohibited.
- Insist waste separation by source; organic wastes in one container and inorganic wastes in another container at sources.
- The organic wastes should be always covered with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats, etc. are not attracted.
- Any construction debris generated at the site will be removed from the site immediately after the completion of construction activities and the site will be leveled as the original.
- All storage areas must also be properly demarcated and, if the material is hazardous, there should be adequate labeling and security at the facility.
- Properly store and manage hazardous materials during construction activities. Chemicals and fuels must be properly labeled and stored in a bunded area. Storage of hazardous materials on-site should be limited to minimize the impacts of any spillage or mitigation failure.
- Dispose of debris and waste in designated areas. Workers will be strictly instructed about the random disposal of any waste generated from the construction activity. Arrangements will be made to collect and prevent littering by workers on site.
- Waste will be segregated according to type and stored in a separate bin with a label.
- Regular monitoring will be carried out by the contractor to record the generation and disposal of waste on a daily basis.
- Hazardous solid waste should be sold to authorized vendors.

The impact on waste generation due to construction activities within the project site for a short duration which will result in an overall medium low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be Very Low.

6.2.2.7 Impact on Ecosystem and Biodiversity

6.2.2.7.1 Impact on Terrestrial Flora

During pre-construction and development phase, activities that might impact on terrestrial flora include very small vegetation clearance. Dust will be generated during the land filling, levelling activities. Vehicle movement will also create dust. Dust will be dispersed by wind action. Excessive dust deposition on plants might reduce the photosynthetic process of floral species and hamper plant growth which may result to causing diseases. Within the project boundary, only 10 small trees have been found, including 4 Guava trees (*Psidium guajava*), 1 Neem tree (*Azadirachta indica*), 3 Indian Jujube trees (*Ziziphus mauritiana*), 1 Java apple tree (*Syzygium samarangense*), and 1 Carambola tree (*Averrhoa carambola*).

During the construction phase, activities that might impact on terrestrial flora due to transportation and stockpiling of construction materials, and movement of construction vehicles in the project area. Dust generated from these activities will lead to dust deposition on plant leaves, twigs, and stems which may hamper photosynthesis, respiration, and other physiological processes. As a result, it will affect plant growth and cause diseases. A very negligible number of trees have been observed adjacent to the project site, so the impact on flora will be minimal. In the construction period there will be an influx of labor force from outside of the project area. The construction workers will be primarily residing in the nearby habitation or in the construction camp. There is a likelihood of impact the construction camps on nearby vegetation due to the requirement of fuel and timber from the vegetation. However, the baseline study represents no threatened terrestrial plant species within the project AOI.

Considering the project activities and potential biological receptors within the project AOI, the impact on terrestrial flora during the pre-construction and construction phase might be less significant. Therefore, it is assessed as **Low.**

Impact	*Impact on Terrestrial Flora*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Limited to project site and adjacent area					
Frequency	Limited to Preconstruction and Construction Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measures

- Tree/Vegetation clearance should be reduced as much as possible.
- Tree felling, if unavoidable, shall be done only after compensatory plantation of at least three saplings for every tree cut is done.
- Dust mitigation measures i.e., water spraying, covering stockpiles during transportation, etc. should be followed.
- Greenbelt development around the project site and surrounding area as early as possible.
- Workers should be aware of the importance of natural resources and should not unnecessarily break branches, twigs, flowers, etc. of adjacent vegetation; and
- Diesel and other oils used for machinery should be stored carefully and use drip pans to avoid mixing with soil and water.
- Reduce unnecessary clearance of vegetation cover.
- Workers should be aware of the importance of natural resources and should not unnecessarily break branches, twigs, flowers, etc. of adjacent vegetation.

As the project impact will be for the short term to a local extent within the adjacent areas of the project site, which will result in an overall low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be Very Low.

6.2.2.7.2 Impact on Terrestrial Fauna

Within the study area, 40 species across 23 families were found. The most prevalent birds belong to the families Alcedinidae and Ardeidae (6 species each), followed by Columbidae, Corvidae, and Sturnidae (3 species each). Homestead forests, grasslands, bushes, and aquatic habitats support these birds, all classified as Least Concern (LC) by the IUCN. The area also hosts 4 amphibian species from 2 families and 8 reptile species from 6 families, with Dicroglossidae and Colubridae being the most common. Mammals observed include the Common Mongoose, Indian Field Mouse, Indian Fruit Bat, Common House Rat, and Irrawaddy Squirrel, all also listed as LC by the IUCN.

Dust and noise from preconstruction and construction activities and material handling/transportation, excessive light, vibration may impact terrestrial fauna in nearby areas, causing habitat degradation and disrupting wildlife and avifauna movement. Excessive light from construction sites can hinder nocturnal animals. Additionally, vehicle and equipment movement on approach roads, along with worker and driver negligence, could hamper faunal movement and potentially cause harm or death to wildlife. However, there is no IBA within the project's AOI; the nearest IBA, the Jamuna-Brahmaputra River, is 57 km west. No migratory birds were observed in or around the project area during the field survey, so the impact on avifauna will be minimal.

Considering the project activities and potential biological receptors within the project AOI, the impact on terrestrial fauna during the preconstruction and construction phase might be less significant. Therefore, it is assessed as **Low**.

Impact	*Impact on Terrestrial Fauna*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Limited to Project Site and adjacent area				
Frequency	Limited to Preconstruction and Construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures

- Dust mitigation measures should be followed.
- Noise mitigation measures should be followed and machinery with less noise production should be used.
- Machinery with less noise production should be used as far as practicable.
- Noisy equipment such as breakers and rollers should be located as far away from receptors.
- Directional lighting facilities should be followed at the project site to avoid disturbance of the movement of nocturnal wildlife species.
- Workers should be aware of the importance of natural resources and should not do any harm or death to wildlife.
- Nighttime work should be limited and the use of lights at night should not disrupt the movement of nocturnal wildlife species.

As the project impact will be for the short term to a local extent within the adjacent areas of the project site, potential impact on terrestrial fauna can be reduced to Very Low by applying proper mitigation measures.

6.2.2.7.3 Impact on Aquatic Flora and Fauna

The nearest Karnatali River is approximately 500 m north from the proposed project site. The Karnatali River plays a crucial role in fish migration, with fish traveling from the Dhaleshwari to the Turag and Buriganga rivers via the Karnatali. During the monsoon, freshwater flows from upstream, bringing fish with it. Common species in these rivers include Tengra, Rui, Catla, Shol, Taki, Pangas, Gulsha Tengra, Shing, Magur, Koi, and Puti.

Impacts on aquatic flora and fauna during the pre-construction and development phases may occur due to dredging for land filling and navigation, transportation of machinery for site development, and the discharge of wastewater (both domestic and from cleaning machinery and equipment). The land filling activity will generate sediment from surface runoff during the monsoon season, increasing suspended solids. This rise in suspended solids will elevate turbidity and reduce dissolved oxygen levels, negatively affecting the primary productivity of the impacted area. Additionally, accidental spillage and leakage of oil and lubricants used for site development machinery may mix with surface runoff, further impacting the primary productivity of the nearby river.

The likely impacts on adjacent waterbodies during the construction phase may arise from inappropriate disposal of construction waste and wastewater generated from the power plant construction site. Wastewater generated from the site during the construction contains suspended materials, spillage and washings from the various areas. In addition to that, the presence of labours and another workforce in the construction site will generate wastewater during the construction phase of the project. During the construction phase of the proposed power plant, water will be used for the building of civil structures, dust suppression and drinking purposes. The loose construction material like sand, cement etc. and excavated earth/ construction debris may get washed off during heavy precipitation and finally reach the nearby River. This may increase the suspended solids of the receiving water body. Also, accidental spillage of hazardous materials through surface runoff and construction waste disposal to waterbodies may degrade the habitat for aquatic resources i.e., fish, aquatic plants, and aquatic invertebrates (Plankton and Macrobenthos).

Considering the project activities and potential biological receptors within the project AOI, the impact on aquatic flora and fauna during the preconstruction and construction phase duration is short term and high intensity. Therefore, it is assessed as **Medium-Low.**

Impact	*Impact on Aquatic Flora and Fauna*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Impact on Karnatali River, Project Site and adjacent area				
Frequency	Limited to Preconstruction and Construction Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider		***Medium-low***		

Mitigation Measures

- The impact on aquatic flora and fauna during the pre-construction and construction phase is assessed as medium low, it is important to take measures to mitigate potential risks and protect the environment. The following mitigation measures shall be taken to prevent or minimize harm to aquatic resources during construction:Oil leakage or spillage from land filling, levelling, and compacting associated machinery will be contained and cleaned up regularly.
- Waste oil will be collected and stored for recycling or disposal.
- Designated areas shall be established for disposal of construction waste and shall ensure that no waste is disposed of in water bodies.
- No disturbance for aquatic animals and keep provision for the fish movement.
- Regularly monitor and assess the construction activities and their impact shall be conducted on aquatic resources.
- Training and awareness to workers shall be provided on the importance of protecting aquatic resources and the potential impacts of construction activities on these resources.
- Workers shall be trained in how to handle hazardous materials safely and to prevent accidental spills.
- Turn off all unnecessary lighting to avoid attracting and disturbance of fishes and wildlife; and
- Regular monitoring the fish death and disturbance of fish and aquatic animals in the Karnatali River.

As the project impact will be for the short term to a local extent within the adjacent areas of the project site, which will result in an overall medium low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be Very Low.

6.2.2.8 Impact due to Land Acquisition: Physical and Economic displacement

Land Loss

A total of 30 acres of land comprising 29.65 acres of private land, and 0.35 acres of khas/govt land will be required for the development of proposed project. WTPNDPL issued a letter to DNC to develop a power project from waste in February 2021. In response to this letter DNCC approached DC of the project area to acquire the required amount of land. The land acquisition process was started in 2021. A Joint verification survey was conducted on 19/01/2022. Land acquisition gazette was published in October 2022. Mutation of the acquired land in favor of DNCC was done in January 2023. All the process of Land acquisition was conducted as per the Acquisition and Requisition of Immovable Property Act-2017.

According to the joint verification survey, a total of 29.65 acres of private land has been acquired. The inter-ministerial transfer was conducted for the 0.35-acre public land. This includes 2.039 acres of Bari type land, 9.2567 acres of Viti type land, and 18.7043 acres of Null types of land. Out of this, only 2.039 acres were utilized for business purposes, where structures such as two bus depots, a cow farm, and a water plant were established. The rest of the land was used for high land, null and road.

As per the gazette (Appendix E-7) published on 6/22/2022 a total of 59.36% amount of compensation has been disbursed among the awardee of this proposed project. Moreover, as discussed with the landowners, DC officials, DNCC and local community and the socio-economic survey, it was identified that legal titleholder already received the payment from DC office those who have not received yet have litigation and land mortgage issue. The landowners are very much satisfied as per the provided land price during the acquisition. As per the land market assessment, it was revealed that landowners received a satisfactory price of land compared to the current market price of the land.

As per land market survey in Bongaon Union, focusing on Boliarpur Mouza, to assess the current market price of surrounding lands. Market survey involved consultations with local elites, elected representatives, land brokers, and deed writers. Cross-verification was carried out among residents in Konda, Nogor Kunda, Boliarpur, Kandi Boliarpur, and Bongona to ensure the accuracy of the collected

data and the existing land price of that area. The results confirmed that the initial prices matched the field-level verification, validating the survey findings. Moreover, Additional compensation will not require to satisfy the Replacement Cost requirement as the provided compensation is higher than the market price.

After getting the market price a table representing land price per decimal/acre is presented to see the detailed market price of land as per the land category. Following Table 2 14 shows the consultees of the land market survey and Table 2 15 Comparison of compensation between DC's Assessment and Current Market Price Assessment.

The narrative is consistently reflected/incorporated in the whole report where applicable.

The socio-economic survey data indicates that 48% of respondents plan to use their compensation to invest in or start a business. Meanwhile, 12% intend to purchase new land, 24% will save the money as a deposit, and 16% will use it for loan repayment and family expenses

However, due to some reason, specifically mortgage and the litigation between the owner of the land, the disbursement of compensation is yet to be conducted from DC office. DC office announces to take the compensation after solving the litigation and land mortgage issues as the payment disbursement liability is solely dependent on DC office.

In terms of scale of impact, the impact is likely to be Low, extent is local, and duration is short term. The overall Impact Significance is assessed as low.

Due to the impact nature of the proposed intervention is direct and the impact scale within the project area with a frequency of limited to the prior to the construction phase. The Significance of impact has been assessed as **low.**

Impact	*Land Loss*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project Site					
Frequency	Limited to pre-construction phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measure

- Compensation should be provided to all titleholders according to the CCL.
- Any grievance from the affected landowners should be heard and act accordingly if they are not happy with the given price for their land.
- Stakeholder Engagement Plan and Grievance Redressal Mechanism should be implemented.

- The Concessionaire has to establish an effective grievance redress mechanism, which should be properly communicated to all the affected persons and stakeholders; this will be a platform to raise their concerns and complaints.
- Preference to the Project Affected Households (PAH's) for direct/indirect project employment opportunities.
- Reassessment is required if there is a loss of income. Specifically, after a designated period, income loss should be re-evaluated within 6 months of relocation time. If income loss is confirmed, appropriate measures must be implemented. If no loss is identified, this should be documented and reported.
- Updated status of payment disbursements should be included in the SEP and disclosed accordingly.

The impact due to land acquisition will have medium intensity with project site extent for a short-term duration which will result in an overall high impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.9 Impact on Structure

During the land acquisition a total of 5 structures were affected. As per joint verification survey of the DC Office, it was found that business structures of two bus depot, along with one cow farm and one drinking water plant have been impacted by the project intervention. During the land acquisition process and possession of land taking period those structures were demolished upon completion of compensation award to the rightful owner as per the ARIPA 2017.

The impacted structures are mainly from Pucca (6 nos), Semi-pucca (8 nos), steel structure (1 no) and tin (11 nos) made category along with the associated items as secondary structure like tiles, door, window, stair, electrical and utility connections, water reservoir etc. The impacted structures were used for some official purposes and storage area of bus depot. Cow farms and water plant have separate structures which was also impacted by the project intervention. The owners of the structures have given the required amount of time as per their request to be shifted to a new place within the given time to avoid business loss and establish new structures. As discussed with the structure owners and reviewing DC's awarded book, it was evident that 100% payment compensation has been received by the owners as per ARIPA 2017 with an additional 100% compensation.

Market assessment for structure is challenging due to varying regional standards, temporary business structure, diverse material costs, and fluctuating market conditions. Unlike the PWD Bangladesh analysis, which benefits from standardized data and regulatory consistency, other assessments must navigate inconsistent information and local market discrepancies.

Moreover, Additional compensation will not require to satisfy the Replacement Cost requirement as the provided compensation (assessed price for structure plus additional 100%) is higher than the market price.

Due to the impact nature of the proposed intervention is direct and the impact scale within the project area with a frequency of limited to the construction phase.

In terms of scale of impact, the impact is likely to be Low, extent is local, and duration is short term. The overall Impact Significance is assessed as low.

Impact	*Impact on Structures*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project Area				
Frequency	Limited to pre-construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary

Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures for Structures

- Ensure the given time frame was enough to shifting business through the continuous consultation process.
- Any grievance relating to structure should be heard and redressed through the proper mechanisms.
- Ensure not to create any further impact on the remaining business activities as both of the bus depots are still functioning at the very edge of the project boundary.
- An adequate timeline for relocation as the compensation (including shifting allowances, right to salvage materials, and additional transitional assistance for the loss of business) has been proposed for titleholders.
- A grievance box should be in place in any nearby area of the existing bus depot to obtain any form of grievance raised during the project construction phase.

The impact on structure will have low intensity with site extent for a short duration which will result in an overall low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.10 Impact on non-titled holders

Apart from the legal title holders, 5 non-titled holders have also been affected due to the project intervention. Five tin made temporary structure owned by the non-titled person were shifted due to the project site preparation. The business was temporarily impacted by the process of relocation to nearby places. Non-titled business owners mainly run small businesses of tea, locally made snacks, rice and mobile recharge shop in the mentioned five shops. After receiving a verbal notice from DNCC to vacate their previous location, the owners took it upon themselves to relocate their structures to a nearby suitable site.

The consultation with the non-titled holders revealed that they are operating business without paying any rent except for electricity bill of 300-500 BDT per month to the bus depot owner for electricity usage.

Moreover, 5 non-titled holders (5 shop owner within the project boundary) have 5 employees who were employed in their shops on a monthly and weekly basis on an average payment of 8-12 thousand BDT per month. They have also been affected during the relocation.

It was evident that none of the non-titleholders were compensated or even considered for compensation made by DC and DNCC as well. The non-titleholder during pre-construction activities is predicted to be **Medium-High**.

Impact	*Impact on non-titleholders*

Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project Area					
Frequency	Limited to pre-construction phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-high***					

Mitigation Measure

- Affected non-titleholders should be paid for the relocation grant as 3 of them were found vulnerable in terms of their existing income level.
- Assistance for structures and business loss should be provided to the non-titled as per the entitlement.
- Assistance should be provided to the employees of non-titled as per the eligibility and entitlement criterion.
- Project authorities may consider them (non-titled) for any suitable job based on their interest and skill.
- An adequate timeline for relocation as the compensation (including shifting allowances, right to salvage materials, and additional transitional assistance for the loss of business) has been proposed for non-titleholders.
- Each employee of business enterprises of non-title will be given Tk 10,500: Tk 350*30days based on the local wage on similar employment.
- Reassessment is required if there is a loss of income. Specifically, after a designated period, income loss should be re-evaluated within 6 months of relocation time, particularly for non-titled holders (NTH). If income loss is confirmed, appropriate measures must be implemented. If no loss is identified, this should be documented and reported.
- Monitoring is required for non-titled PAPs. Income loss should be reassessed after relocation. If income loss is confirmed, appropriate measures must be taken. If no loss is found, this should be documented and reported.
- Relocation assistance as per the real-life cost can be given if the PAPs agreed.
- The SEP and GRM for the project will be applicable to the non-titled holders.

The impact on non-titleholders due to land acquisition will have medium intensity with site extent for a permanent-mitigated duration which will result in an overall medium-high impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Low.

6.2.2.11 Impact on Waste Pickers

Construction work will impede access for waste pickers in the landfill area, as the project authority will construct fencing surrounding area of the power plant. Though the landfill site has some restriction for the outsiders to enter, but due to site preparation and sand filling for the powerplant area, the opportunity

has created for some waste collectors to enter inside the landfill area without facing security hurdles, through available alternative ways. Usually, people have to face security personnel at the entrance gate, currently the newly prepared site for the powerplant area have created alternative ways for entering inside the landfill where some waste pickers enter and collect waste on irregular basis (mostly in dry season and not regular by all of them). The full phase construction activity will create site fencing and additional security personnel, which will hinder the entrance facilities for the waste collectors in the landfill area. This impediment may result in disruption of their income generating activities from the collected waste materials from the landfill. As observed and reported by the DNCC, 40 individuals comprising 31 male, and 9 female worked as waste pickers and collecting waste from the landfill site.

A waste picker generally earns between 150-300 BDT per day for 6 hours working in the landfill site. Waste picking is the major income source for them. As they don't have any other skill apart from waste picking, their livelihood will be expected to be vulnerable.

The project will not change any process of the existing waste collection/ transport/management currently operated by DNCC, thus the waste pickers outside the project area will be not impacted.

For the waste pickers around the project area, according to the Waste Supply Agreement, the project company will order the waste from DNCC and the volume delivered to the project will be less than 3600 tons/day. According to current data, the waste delivered to Amin Bazaar has been over 3600 tons/day. That means the project will not treat all the waste delivered and the remaining waste can be the living source of the waste pickers around the site.In terms of scale of impact, the impact is likely to be medium, extent is local, and duration is long term. The significance of the impact is assessed as High. The impacts associated with the impact on waste pickers during preconstruction and construction activities is predicted to be **Medium-Low**.

Impact	*Impact on waste pickers*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project area and landfill site and surrounding area				
Frequency	Limited to preconstruction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures for Waste Collectors

- Ensure an alternative income source for them based on their willingness and their physical health.
- Site preparation and construction activity will require many unskilled work force, which may be appointed from the waste pickers based on their interest and best fit for the task.

- A permanent solution to the issue may result in a significant change in their livelihood, which should be considered by the project proponent.
- The operation phase of the power plant will require waste pickers, which also can be a choice for the employment of currently found waste pickers.
- To restore their livelihood a Livelihood Restoration Plan should be prepared.
- The SEP and GRM for the project will be applicable to the waste pickers
- In the meanwhile, the project company will conduct CSR to improve surrounding waste pickers living level and to gradually transform them to ordinary citizens, which will include:
  - Hiring certain of them for entry-level jobs of the project company;
  - Providing necessary train for improving their skills.
  - Donating food, water and necessary living material;
  - Closely work with local community, charity, government to provide necessary support.

The impact on waste pickers due to the project will have low intensity with local extent and low intensity which will result in an overall medium-low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Low.

6.2.2.12 Impact on Traffic

The main source of road traffic will be vehicles carrying equipment, construction material, and vehicles carrying workers on the project site. The river will not be used for carrying construction equipment and materials for this project.

The project will increase the volume of traffic and vehicular movement on the existing road which has heavy traffic volume at present, bearing the important economic exchanges in Dhaka-Aricha highway, National highway (N5), so traffic maintenance is the highlight of the project. According to the data from DNCC, 140 waste collection and dumping vehicles engaged in 4 trips by each vehicle per day, will increase during the construction phase for carrying construction materials and other relevant associated things for construction. Labor movement at the site during the construction phase also may cause traffic congestion at the site.

During the construction phase of the project, construction materials like construction equipment and machinery will be transported to the site. An increase in local traffic is expected as a result of the vehicles carrying construction materials, machinery, and equipment. Moreover, vehicles carrying landfill material may increase traffic intensity on the adjacent main road. An increase in traffic volume on a national highway may cause traffic congestion and accidents. The extra traffic load during the construction stage is not too high to impose a high-level impact on the road. Therefore, the impact significance is assessed as **Low**.

Impact	*Impact on Traffic*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	In and around the project site				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	

Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measures

The following steps should be taken to minimize the impact due to increasing road traffic.

- All vehicles would undergo routine repair and maintenance to keep the vehicle in good operating condition.
- Drivers and operators would be checked for fitness and any driver/operator impaired due to any reason, including but not confined to the influence of drugs and/or alcohol would not be allowed to drive.
- A speed limit of 20 km/hr. within the site would be followed and the use of mobile phones while driving would be prohibited
- Implementation of a safety program (signage, speed restrictions, lights on trucks, truckload restrictions, etc.) within the construction area
- All drivers shall follow the speed limit, the direction of the signalman, sensitive locations, horn usage restrictions, etc.

With the implementation of the precautionary and mitigation measures mentioned above, impacts on traffic movement would be negligible.

6.2.2.13 Local Conflict of Interest

As employment opportunities will be increased during the construction period, construction workers may have conflicts with the community. Approximately 2320 nos. of Local workers and Chinese workers will engage during the construction where 450 male and 10 female Chinese workers will be hired and around 1835 male and 25 female local workers will get employment opportunity due to construction activities.

There is a conflict of interest within the local community arising from the project's intervention in the nearby area. Several factors contribute to potential conflicts regarding the project, se includer resource allocation, environmental impact land use changes, and perceived inequalities. Community members may believe that the project directs essential resources away from other urgent local needs, leading to disagreements among those prioritizing different issues. Environmental concerns such as pollution, habitat destruction, and resource depletion also contribute to tensions with stakeholders concerned about the project's lasting impact on their environment. Changes in land use associated with the project may further escalate conflicts, especially if residents and landowners view these changes as harmful or imposed without sufficient consultation. Moreover, perceived inequalities in how project benefits are distributed, particularly in terms of local versus foreign labour recruitment- such as the engagement of 2,320 workers, including Chinese laborers – could foster feelings of injustice and exclusion among local community members, exacerbating existing tensions of local conflict.

The impact significance is assessed as **Medium-Low**.

Impact	*Local Conflict of Interest*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project area and surrounding area				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary

Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures

The following steps should be taken to minimize anything related to local conflict of interest.

- Job opportunities should be provided in a fair and transparent way.
- Clear information about the needs of labor (number and qualification) should be provided with local people. Ensure no labor will engage any function and any local argument. Community under its SEP.
- Project proponent should maintain a strong rapport with the local
- GRM to be implemented at the site to resolve any community or local conflict.
- The job skills and the priority for the affected people shall be taken into account and the workers can be chosen accordingly for suitable employment opportunity.
- Priority to be given to local people while recruiting employees for the project.

With the implementation of the precautionary and mitigation measures mentioned above, impacts on local conflict would be Very Low.

6.2.2.14 Cultural Heritage

The proposed project has been assessed and determined not to intersect with any ancient monuments or archaeological sites. Both primary and secondary data including the community consultation with local people, elected representatives, and elderly person it was confirmed that no archeological or culturally profound structures have been found within the project boundary. However, Chance find procedures has been incorporated in the ESMP and details are given **Appendix L**.

6.2.2.15 Gender Based Violence (GBV)/ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)

In the context of the project construction, it's notable that 25 female laborers will be engaged. This reflects a departure from typical gender dynamics in similar projects, where female participation might be limited. By actively involving female workers, the project demonstrates a commitment to gender inclusivity and empowerment. This decision not only promotes equality but also acknowledges the valuable contributions that women can make in traditionally male-dominated sectors. It's essential to ensure that these female workers receive fair treatment, including equal pay, safe working conditions, and opportunities for advancement, thus fostering a more inclusive and equitable work environment. However, it's crucial to consider the specific sensitivities and potential impacts on these female workers:

- **Safety and Security**: Ensure that appropriate measures are in place to address any safety concerns that might disproportionately affect female workers.
- **Health and Hygiene**: Recognize and accommodate the unique health and hygiene needs of female workers. This may involve providing access to clean and private restroom facilities, menstrual hygiene products, and breastfeeding accommodations, where applicable.

- **Workplace Culture**: Foster a supportive and inclusive workplace culture that promotes respect and equal treatment for all workers, regardless of gender.
- **Training and Development**: Offer opportunities for skill-building and career advancement tailored to the needs and aspirations of female workers.
- **Community Engagement**: Engage with the local community to address any cultural or social norms that may impact female workers' participation in the project.

The presence of workers in the Project sites might evoke gender-based violence activities. They are as follows:

- Harassment of women and young girls by workers at work place.
- Disturbance of women and young girls' mobility around the Project area.
- Discrimination against women in terms of employment and associated benefits.

Impacts resulting from GBV/SEA/SH on community members are of short-term, localized, temporary and reversible nature. By addressing these gender-related sensitivities and impacts, the project can create a more inclusive and supportive environment for its female workers, ultimately contributing to their empowerment and well-being. The significance of impact on gender is consider **Low**.

Impact	*Gender Based Violence (GBV)/ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project area and surrounding area				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures

The following steps should be taken to minimize anything related to gender.

- Project will ensure no gender-based violence will occur due to the project across the entire project cycle
- Women will be heard if any issue raised by them and will be mitigated with high priority.
- Announce employment opportunities and recruitment notices widely, targeted at women as well as men.
- Technical training can be provided to the local workforce, especially women for inclusion in the operation and maintenance phase.
- Ensure basic facilities (separate toilets, clean water, drinking water facilities, resting place) are provided for female as well as male workers at the construction site.

- Women are to be trained and empowered to be part of household energy solutions – their understanding and knowledge about their household energy need to be translated into defining the way forward on access to clean, affordable, and sustainable energy.
- Workers should be informed and alert regarding gender related sensitivity.
- Prepare a Code of Conduct and insert it in the induction training to be provided to all workers.
- Grievance Mechanism (GM) should be in place at site and community level. A GM box needs to be installed in a visible place with a signboard with some basic info, contact address, contact number. GM must include some info on sexual harassment.
- GM register needs to be maintained at site.
- An acknowledgement slip should be given to the complained person against the grievance for the tracking.
- GBV/SEAH should be confidential, and more options should be created to submit the grievance against GBV/SEAH.
- Conducting periodic meetings with local community for understanding their grievances.

With the implementation of the precautionary and mitigation measures mentioned above, impacts on local conflict would be Very low.

6.2.2.16 Children's Rights

The proximity of primary and high schools to the project area raises concerns about child labor employment. There is a heightened risk of child labor during the construction period, as vulnerable children might be drawn into exploitative work situations instead of attending school. It's imperative to implement comprehensive mitigation measures to safeguard the well-being of children, including strict adherence to safety protocols, minimizing noise and air pollution, and implementing robust child labor monitoring and prevention mechanisms. Additionally, close coordination with local authorities, schools, and community stakeholders is essential to address any emerging issues promptly and ensure the protection of children's rights and welfare throughout the project duration. Considering the proposed mitigation measures significance of impact on children rights is consider **Very Low**.

Impact	*Children's Rights*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project area and surrounding area				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low	Medium	High		
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures

The following steps should be taken to minimize the impact due to the risk of child labor.

- Ensure no child labor will be recruited in the project aligning with Anti-Child Labour policy
- Extending special attention during recruitment of labor so that no child can be employed.
- Ensuring coordination amongst the concerned stakeholders and sectors advocating anti-child labour concept by the project proponent.
- Raising awareness amongst parents, local village administration, community, community leaders and civil societies about the harmful consequences of child labour.
- Make sure not to create any disturbance to the school-going children and any high volume of noise that can hamper their study during school hour.

With the implementation of the precautionary and mitigation measures mentioned above, impacts on local conflict would be Very low.

6.2.2.17 Infectious Diseases, such as HIV/AIDS

Throughout the construction phase, a diverse range of labor types will be essential, including unskilled, semi-skilled, skilled, and highly skilled workers. However, the outsourced personnel are expected to primarily consist of skilled workers. It's common during construction for a significant number of migrant workers to flow into project sites. These workers may come from various regions and backgrounds, potentially bringing with them health concerns such as HIV/AIDS or other infectious diseases that could pose a risk of transmission to the local population. To address this, it's crucial to implement comprehensive health and safety protocols aimed at minimizing the spread of infectious diseases among both the migrant workers and the local community. By proactively addressing these issues and implementing appropriate measures by adopting community health and safety protocols of the contractor aligning with applicable guidelines of the project proponent, the project can mitigate the risk of disease transmission and ensure the health and well-being of both the migrant workers and the local community. However, addressing the mitigation measures the impact significance is **Low**.

Impact	*Infectious Diseases, such as HIV/AIDS*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project area and surrounding area				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measure

The following mitigation measures should be taken to minimize the impact on Infectious Diseases, such as HIV/AIDS.

- Prevention of illness among workers by undertaking health awareness and education initiatives and by conducting immunization programs for workers.

- To provide treatment through standard case management in on-site and community health care facilities as necessary.
- Conduct periodic health check-up of workers to promote better health and sarety of the wokers across the project cycle.
- Educating project personnel and area residents on risks, prevention, and available treatment.
- Promoting collaboration with local authorities to enhance access of worker's families and the community to public health services and promote immunization as necessary.
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites.
- Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements.
- Elimination of unusable impounded water.
- The Contractor will prepare and implement a Safety Plan related to infectious diseases prior to commencing work. This plan will include method statements for working methods, construction sequence, and safety arrangements.
- Prepare and disseminate Infectious Diseases related information (flayer/brochure) among the workers for awareness purpose.

With the implementation of the precautionary and mitigation measures mentioned above, impacts on local conflict would be Very low.

6.2.2.18 Occupational Health and Safety

The waste incineration power plant, the slag's comprehensive utilization, treatment facilities, and the fly ash landfill all need certain personnel to operate and maintain. The manpower during the peak time of the construction period will be about 2320 people where 450 male and 10 female Chinese workers will be hired and around 1835 male and 25 female local workers will get employment opportunity due to construction activities. The potential source of impact is given below:

- Noise from construction activities
- Impure drinking water
- Accidental injury
- Unhygienic sanitation system
- Congestion in dormitory

The construction activities of waste to energy power plant include site preparation, infrastructure utilities installation, building structures. The loading and unloading operation of the construction material may cause an injury if not handled properly. During construction works, physical injury results due to road accidents, construction accidents, and other occupational hazards. Overexertion, injuries, and illness are potentially the most common health hazards associated with construction activities. Further, there is potential for slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction material, liquid spills, and uncontrolled use of electrical cords and ropes on the ground which results in injuries and time loss during construction of waste to energy power plant. Therefore, there will be potential impacts on worker's health and safety due to exposure to risks through construction activities that lead to accidents causing injuries and death.

The implementation of the proposed project will necessitate the recruitment of laborers. Among the recruited may be identified those that are under the age of employment. Others recruited may be exposed to forced labor and discrimination.

During the construction phase, the impact on the occupational health and safety of workers is anticipated from exposure to high noise generated from the operation of heavy vehicles and equipment and fugitive dust generated from construction activity. Continuous exposure of construction workers to high noise levels and fugitive dust may lead to adverse health impacts viz. hearing loss, headache, asthma, allergy, etc. However, considering the temporary nature of the construction phase activities, intermittent operation of vehicles and equipment, and provision of proper PPEs for the workers, it may not cause any significant impact. The project workforce will be housed in a labor camp on the site. It is

proposed to provide adequate facilities in the labor camp like a housing facility with proper ventilation, electricity, a separate kitchen, solid waste collection facility, drinking water facility, sanitation facility, etc. Inadequate facilities and unhygienic conditions in the labor camp may have an impact on the occupational health of the laborers. Thus, the overall impact significance during the construction phase of the power plant will be **Medium-Low.**

Impact	*Occupational Health and Safety*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project Site					
Frequency	Limited to preconstruction and construction phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measure

The following mitigation measures should be taken to minimize the impact on occupational health and safety.

- Adequate provision of healthy living conditions should be ensured in the labor camp.
- The contractor should prepare Emergency Preparedness and Response Procedure (EPRP) and Occupational Health and Safety Management Plan.
- Training in Health and Safety policy for the workers (both regular and contractual) should be provided.
- Liaision with local hospital to be maintained to address any occupational health emergency throughout the project life-cycle.
- Establish a grievance mechanism in place, to allow the employees and workers to report any concern or grievance related to project activities.
- Child labor and forced labor during project construction should be prohibited.
- Adequate training should be provided to staff about raising awareness about the use of PPE and EPRP.
- It shall also be ensured that good housekeeping at the construction site is maintained to avoid slips and falls.
- Excessive waste debris and liquid spills should be cleaned up regularly.
- Safety signs should also be marked at appropriate places on the construction site and access road.
- Health and Safety Sign needed in all the places in Local, English and Chinese Language.
- Any accidental record including cause must be maintained on site.
- Toolbox Talk (TBT) must be ensured daily by keeping records.

- All the construction workers must wear PPE during construction.
- All the construction workers must use a face mask, ear plugs, hand gloves, helmet, safety vest.
- Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment must be engaged for work at height.
- Workers handling electricity and related components must be provided with shock- resistant gloves, shoes, and other protective gear.
- First aid box/arrangement to be ensured.
- Adequate sanitary facilities, i.e., toilets and showers, must be provided for the construction workforce.
- Toilet hygiene and sleeping arrangement should be improved.
- All the lifting equipment must be calibrated by the authorized company.
- Licenses, fitness and clearances of heavy equipment and operators need to be verified.
- Vehicles and Equipment drivers having valid licenses should be employed in the project.
- An Environmental Health and Safety (EHS) manager, Two to Three (2-3) Safety and Security Officers should be hired to monitor the Environmental and Social Condition of the construction site.

The impact on Occupational Health and Safety will have medium intensity with project site extent for a short duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

6.2.2.19 Community Health Safety

Possible sources of impacts on community health and safety during the construction phase are:

- Changes in environmental quality due to construction activities.
- Increased prevalence of disease arising from the influx of construction workers; and
- Heavy traffic movement.

Receptors can be considered as project site workers, settlements in close proximity to the Project site (within 500 m) and along the access road (with 100 m) are potential receptors of health impacts from construction-related activities. The nearest settlement (Nandonik Housing Society) is located approximately 200 meters from the south border of the project and Bongaon village about 500 meters from the northwest direction.

Changes in the environmental quality of air, surface water, groundwater, and soil quality may occur as a result of construction activities. High noise levels are also expected from the operation of heavy machinery. The discharge of domestic waste effluent from sanitary facilities for construction workers may have the potential to cause contamination of surface water and groundwater in this area.

The influx of workers to the community may cause impact on public health, especially an increase in the prevalence of diseases. The influx of migrant laborers during construction can cause a mixing of the migrant workforce with the local people. This mixing of the groups may cause some adverse impacts on public health in the neighboring villages with the potential for the spread of infectious diseases like Acquired Immune Deficiency Syndrome (AIDS) and COVID-19.

Measures such as proper collection, storage, and disposal of wastes, and construction of septic tanks to prevent contamination of water resources from sanitary effluents generated from labor camps will be implemented. Mitigation measures will be implemented to reduce the likelihood of contamination of surface and groundwater from sanitary effluents generated during construction. Thus, the overall impact significance during the construction phase of the power plant will be **Low**.

Impact	*Community Health and Safety*		
Impact Nature	Direct	Indirect	Induced
Impact Scale	Adjacent Communities and project workers		

Frequency	Limited to preconstruction and construction phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium	High		
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measures

The following mitigation measures will be put in place to reduce impacts on community receptors:

- Dust control measures should be taken by the contractor along the site approach road and dust generation site.
- Traffic sign reflecting the maximum permitted speed needed within the Plant area as well as nearest community area. The speed of vehicles on site and approach road will be limited to 15-20 km/hr.
- A traffic management plan should be followed by the contractor for the project.
- Health and Safety Sign needed in all the places in Local, English and Chinese Language.
- Training on community health and safety issues should be provided to the drivers.
- Notify the local area responsible person before starting the construction work and put signage near the educational and religious institutes and instruct the driver to carefully drive close to the sensitive area.
- Traffic controllers need to be assigned in the high-volume traffic movement area.
- Only drivers having valid licenses should be employed in the project.
- Adequate sanitation facilities at labor camps should be ensured by the contractor to maintain hygiene and minimize the spread of diseases.
- Wage discrimination between male and female workers should be minimized through a proper monitoring system.
- Ensure sustainable collaboration with local administration including police station, fire brigade and hospital to address any community health issue across all the phases of the project.
- An active grievance mechanism should be developed.
- Grievance Mechanism (GM) should be in place at site and community level. A GM box needs to be installed in a visible place with a signboard with some basic info, contact address, contact number. GM must include some info on sexual harassment.
- GBV/SEAH should be confidential, and more options will be created to submit the grievance against GBV/SEAH.
- Creating awareness about local traditions and culture among outside migrants and encouraging respect for them.
- Collaboration with local communities and responsible authorities to improve signage, visibility, and awareness of traffic and pedestrian safety.
- Providing awareness training regarding sexually transmitted diseases among the workers.

- The contractor will prepare and conduct induction and training on the project's Code of Conduct for all site personnel regarding do's and don'ts in relation to interaction with locals.

The impact on Community Health and Safety will have low intensity within adjacent communities and project workers for a short duration which will result in an overall low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be very low.

6.2.2.20 Labor Influx

The construction phase will require approximately 2,320 local and Chinese workers, comprising 450 male and 10 female works as well as 1,835 male and 25 female local workers, thereby, providing employment opportunities due to construction activity.

The Construction Contractor will be responsible for the construction of temporary labour camps and provide the workers with water supply, electricity, sanitary facilities, medical aid, and other basic amenities aligning with applicable national and international guidelines. It is assumed that the camps would be constructed in-situ. Following impacts are envisaged due to influx of migrant workers.

a. Social Impacts of Migrant Workers

Due to the migrant worker influx in the project area the following impact may arise:

- Increased community conflicts due to increased interface between migrants and locals.
- Frequent movement of vehicles may increase accidents.
- Sharp increase in daily wage rates for labour, impacting the availability of agriculture labour for cultivation activities; and
- On the contrary, there could be an enhancement of local skills and skill sets through interaction of local unskilled or semi-skilled labourers with the skilled migrant workers.

b. Community Health Impacts from Migrant Workers

As the project worker will live in the temporary construction camp and surrounding area on a rental basis. The following health risk may be brought out due to the migrant worker:

- Spread of communicable diseases, especially sexually transmitted diseases, which accompany many major constructions.
- Adequate provision of healthy living conditions should be ensured in the labor camp.
- Poor health infrastructure in the Project area may worsen the spread of any disease; and
- Lack of hygiene and adequate sanitation facilities would create health ailments related to food poisoning or diseases like malaria, viral fever, gastroenteritis which could spread within the community.

Thus, the overall impact significance of labor influx during the construction phase of the plant will be **Low.**

Impact	*Labor Influx*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project Site and Surrounding Area				
Frequency	Limited to preconstruction and construction phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High

Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measure

The following mitigation measures should be taken to minimize the impact created due to labor influx.

- Prevention of massive movement within the locality for workers.
- Proper safety protocol should be taken under the labor management plan by EPC.
- Alert the migrant workers regarding GBV, local harmony and other socio-cultural aspects to avoid any kind of collision between labor and local people.
- Promoting collaboration with local authorities to enhance access of workers for their basic necessities that can be collected from the locality.
- Promoting use of local goods and other materials to make a balance between workers and local people.
- All staff must follow both national and international regulations while roaming around.
- Waste to Energy Power Plant North Dhaka Limited will be able to influence the EPC contractor to set up labor camps in accordance with the requirements of international standards.
- Improved waste segregation and regular garbage collection along with other safety within the labor camp and residential areas.
- Toolbox training, health safety protocol and other essential guidelines should be followed by the workers and EPC should follow the OHS guidelines in this regard.
- Worker's grievance should be taken care of, and grievance boxes must be displayed in and within the plant and workers accommodation area.
- The Project will develop a Labor and Influx Management Plan (LIMP) that addresses how the Project will seek to minimize the influx related impacts.

Both project authority and EPC should develop a management plan and maintain the coordination to minimize any kind of dispute arising out of labor influx.

6.2.3 Impacts during Operation Phase

The operation stage of a waste-to-energy incineration project reduces landfill use, generates renewable energy, cuts greenhouse gas emissions, and mitigates waste management issues. However, it requires careful emission control to minimize air pollution and may face public opposition due to environmental concerns. Due to the nature of the project is a waste to energy plant with a relatively large scale of combustion, the level of impact causing pollution to the environment is quite large. The main source of contamination arises from the burning of garbage from the plant, from the waste transport to the plant, and from the daily activities of employees in the plant such as the generation of daily general waste, wastewater, local flood, etc. In addition, during the operation, there may be some problems such as fire, traffic accidents, minor impacts on biodiversity, etc.

6.2.3.1 Impacts on Air Quality

6.2.3.1.1 Emission Inventory

The waste-to-energy project will use 3000 t/d waste. The project consists of four sets of 750 t/d incinerators and waste heat boilers and two sets of 35 MW turbine generator sets with an annual operation time of not less than 8,000 hours.

Pollutants of concern released by the power stations are Particulate Matter (PM), Oxides of Nitrogen (NOx), Sulfur dioxide (SO_2), and Carbon Monoxide (CO). The waste-to-energy power station will also emit Hydrogen Fluoride (HF), Hydrochloric Acid (HCl), Dioxin & Furan, and Heavy Metals (Cadmium, Mercury, Titanium). The resulting ground level concentration (GLC) from air quality modeling will be referred to the applicable limits of ambient air quality from schedule 1 of Bangladesh air pollution control rules 2022. Substances not specified in the Government of Bangladesh regulation and WHO global air quality guidelines; environmental standard criteria fare taken from UK Environmental Agency's air emission risk assessment guidance.

The project will have different flue gas treatment systems. The flue gas treatment process is to remove pollutants such as soot, acidic gases (HCl, HF, SO_2 as well as NO_2, etc.), heavy metals (Hg, Pb, Cr, etc.) and dioxins from the flue gas emission according to flue gas standards to meet the emission standards of the project.

To improve the removal efficiency of acid gas from the flue gas treatment system, firstly the flue gas will be cooled. The water component evaporates rapidly by spraying the atomized droplet reaction agent into the flue gas and mixing it with the flue gas, which will make the flue gas temperature drop to the appropriate reaction temperature. The reactant components as well as the hydrated lime powder will be sprayed into the flue and are neutralized with acidic gases such as hydrogen chloride, sulfur oxide, and hydrogen fluoride in the flue gas to generate salts.

Dioxin and mercury in the flue gas will be adsorbed by activated carbon sprayed into the flue, and the acidic substances continue to react with hydrated lime sprayed into the flue. Salt particles generated by the acid-base neutralization reaction and activated carbon particles adsorbed with dioxin and heavy metals will be removed in the subsequent bag filter and mixed into the fly ash, which will be sent to the fly ash stabilization system by the fly ash delivery equipment for stabilization treatment. The bag filter that passes through the flue gas enters the chimney and is then excreted into the atmosphere.

Emission concentration control of acidic gas according to the flue gas from the top of the chimney, monitor the acid gas content online and adjust the deacidification dose.

Control of removal of dioxin and heavy metals according to the measured flue gas quantity, the feed quantity will be adjusted by the way of quantitative feed of activated carbon.

Emission control of nitrogen oxide gas - the operating conditions of the Selective Non-catalytic Reduction (SNCR) system will be regulated based on online monitoring of nitrogen oxide concentrations by the chimney on flue gas.

The emission inventory has been presented based on the guaranteed emission concentration from equipment. The emission inventory of the power plant is presented in **Table 6-11**. As per the IFC-WB guideline for thermal power plants running on solid fuel, the lowest guaranteed emission concentration for NO_2 is 200 mg/Nm^3.

Table 6-11: Emission Inventory of Waste to Energy Power Plant

Pollutant	Unit	Emission Concentration (Daily average)
Particulate Matter (PM)	mg/Nm^3	10
Nitrogen Dioxide (NO_2)	mg/Nm^3	200
Sulfur Dioxide (SO_2)	mg/Nm^3	50
Carbon Monoxide (CO)	mg/Nm^3	50
Mercury (Hg)	mg/Nm^3	0.05
Hydrogen Chloride (HCl)	mg/Nm^3	10
Hydrogen Fluoride (HF)	mg/Nm^3	1

Pollutant	Unit	Emission Concentration (Daily average)
Cd+Ti	mg/Nm^3	0.05
Pb+Cr and other heavy metals	mg/Nm^3	0.5
Dioxins and Furans	ng-TEQ/Nm^3	0.1

Source: EU standard DIRECTIVE 2010/75/EU

6.2.3.1.2 Background Concentration

The baseline concentration of the criteria pollutants is accounted for a different duration. Primary ambient air quality samples were taken from eight locations in both wet and dry seasons. The wet season ambient air quality monitoring was conducted in July-September 2022 and dry season monitoring was conducted in April-May 2022. Major air pollution source in the area are vehicle operation on the Dhaka-Aricha road and brick kiln cluster around the project site. During the dry season ambient air quality monitoring period, the brick kilns were in operation. The highest concentration of primary ambient air quality result shows that the criteria pollutants (NO_2) concentrations are higher than the ambient air quality standard whereas other pollutants (PM_{10}, SO_2, and CO) concentrations are well within the standard limit. Long-term air quality data is required to determine the airshed whether is degraded or non-degraded. Hence, CAMS-3 data has been used to determine the airshed of the project area. The CAMs-3 station is located approximately 6 km from the project location at Darus Salam. This location is characterized by heavy traffic; a large number of vehicles from the northern part of the country enter the city in this way. The CAMS site is situated about 100 meters away from the main road. The characteristic of the CAMS-3 location is similar to the project site. Air pollution varies from the measured CAMS-3 for several reasons such as unaccounted sources of criteria pollutants like a brick kiln, cooking, construction works, dust particles from the road, and intrusion of pollutants from outside of the domain throughout the year.

Nevertheless, the background concentration from CAMS-3 was converted into various averaging periods for compliance monitoring. The concentration of criteria pollutants has been converted to different averaging periods using the following USEPA-recommended conversion factors.

Table 6-12: Averaging Time Conversion Factors[36]

Convert to / Convert from	1 hour	8 hours		24 hours	Annual
1 hour	1	0.7		0.4	0.08
8 hours	1.67	1		-	-
24 hours	2.5	-		1	0.2
Annual	12.5	-		5	1

Table 6-13 shows the background concentration from CAMS-3 operated by the DoE in the CASE Project funded by the World Bank and the national ambient air quality standards, Air pollution Control Rules 2022.

Table 6-13: Background Concentration of Criteria Pollutants at CAMS-3, Case Project

Criteria Pollutants	Standard Concentration (APCR, 2022)	2014	2015	2016	2017	2018

[36] U.S. EPA document Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, EPA-454/R-92-019

	Averaging time	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
Carbon Monoxide (CO)	8-hr	5000	4600	4010	4580	6680	4400
	1-hr	20000	7682	6697	7649	11156	7348
Nitrogen Dioxide (NO_2)	Annual	40	29.4	40.2	42.1	24.2	27.5
	24-hr	80	147.1	200.8	210.4	121.1	137.7
Particulate Matter (PM_{10})	Annual	50	57.2	58.2	67.0	60.6	65.4
	24-hr	150	286.0	291.0	335.0	303.0	327.0
Sulfur Dioxide (SO_2)	24-hr	80	77.29	42.18	78.34	81.0	54.23
	1-hr	250	193.2	105.5	195.8	202.6	135.6

6.2.3.1.3 Air Dispersion Model

The air dispersion modeling input data consisted of meteorological data, detailed information on the physical environment (including building dimensions and terrain features), and design details for all emission points on-site. Using this input data, the model predicts ambient ground level concentrations beyond the site boundary for each hour of the modeled meteorological years. The model post-processes the data to identify the location and concentration of the worst-case ground-level concentrations.

Emissions from the site have been modeled using the AERMOD dispersion model (Version 11.2.0) which has been developed by the United States Environmental Protection Agency (USEPA). The model is a steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources. The model has been designated the regulatory model by the US Environmental Protection Agency (EPA) for modeling emissions from industrial sources in both flat and complex terrain. Resulting GLCs were determined specifically for NO_2 -24hr and Annual average, CO-1hr and 8 hr, SO_2 and PM_{10} -24 hr and Annual average.

The resultant NO_2 concentrations are largely driven by the ambient chemical environment (i.e., the reaction of NO with ambient ozone to form NO_2) and the initial NO_2/NO_x ratio of the emissions. The model has been run for NO_2 considering Tier 2 (minimum NO_2/NOx ratio- 50% and maximum NO_2/NOx ratio 90%). According to the Support for Regulatory Atmospheric Modeling (SCRAM) of USEPA[37], the NAAQS has been using a Tier-3 approach for additional stringency of the new 1-hr NO_2 of EPA-issued guidance since April 2010. They issued additional guidance on March 1, 2011, allowing for a default In-Stack Ratio (ISR) of 0.5 in absence of more appropriate sour-specific information. This recommended default ISR may still be too conservative for many applications. The equilibrium NO_2/NOx ratio is considered 0.90.

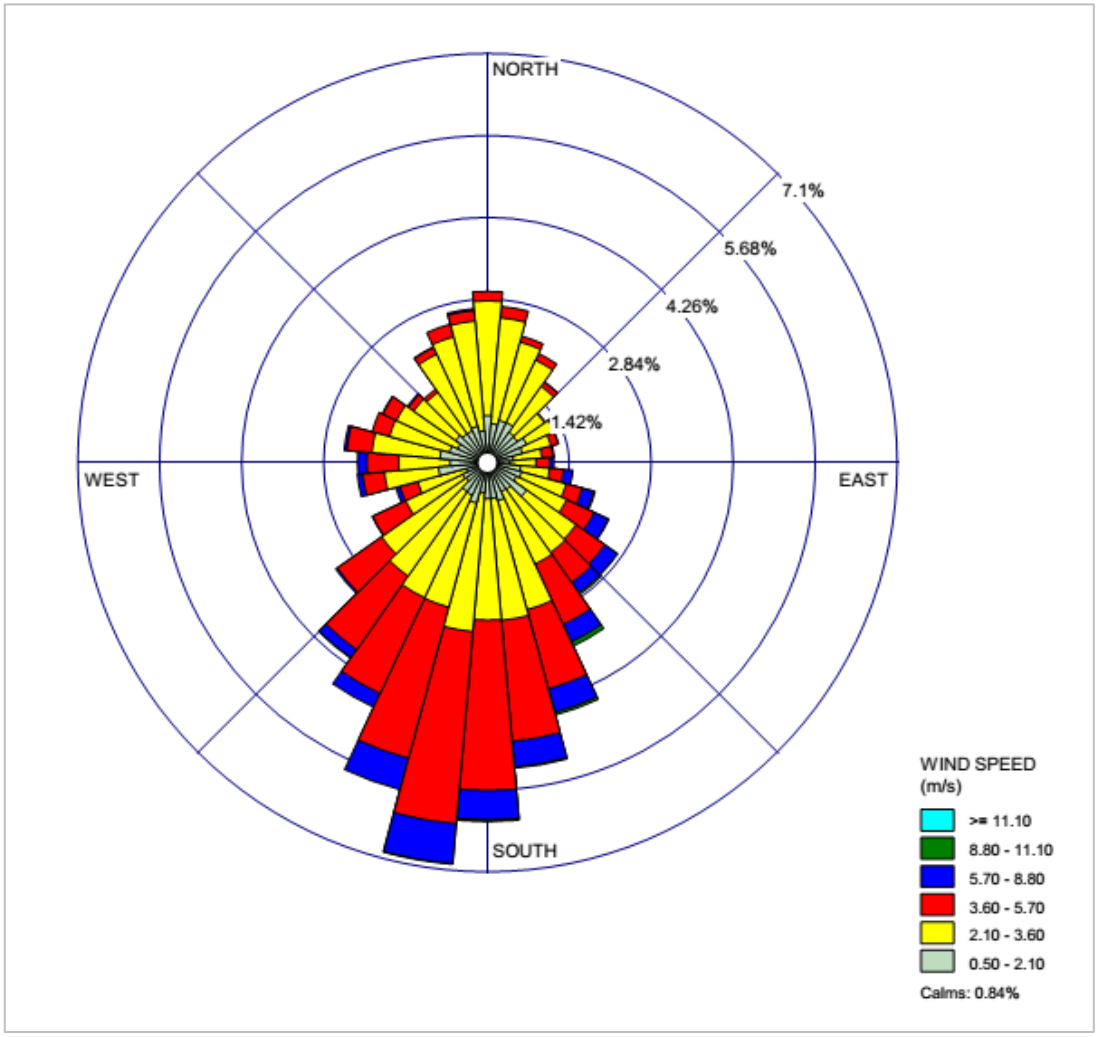
6.2.3.1.3.1 Meteorology

Air quality is dependent on the rate of pollutant emissions into the atmosphere and the ability of the atmosphere to disperse the pollutant emissions. The dispersion of air pollutants is affected by local meteorological patterns. The wind direction controls the path that air pollutants follow from the point of emission to the receptors. In addition, wind speeds affect the time taken for pollutants to travel from source to receptor and the distance over which air pollutants travel. As a result, wind speeds also impact the dispersion of air pollutants. Therefore, it is important to assess local meteorological patterns to assess potential air quality effects.

[37] http://USEPA/Nitrogen%20Dioxide_Nitrogen%20Oxide%20InStack%20Ratio%20(ISR)%20Database%20_%20Support%20Center%20for%20Regulatory%20Atmospheric%20Modeling%20(SCRAM)%20_%20US%20EPA.html

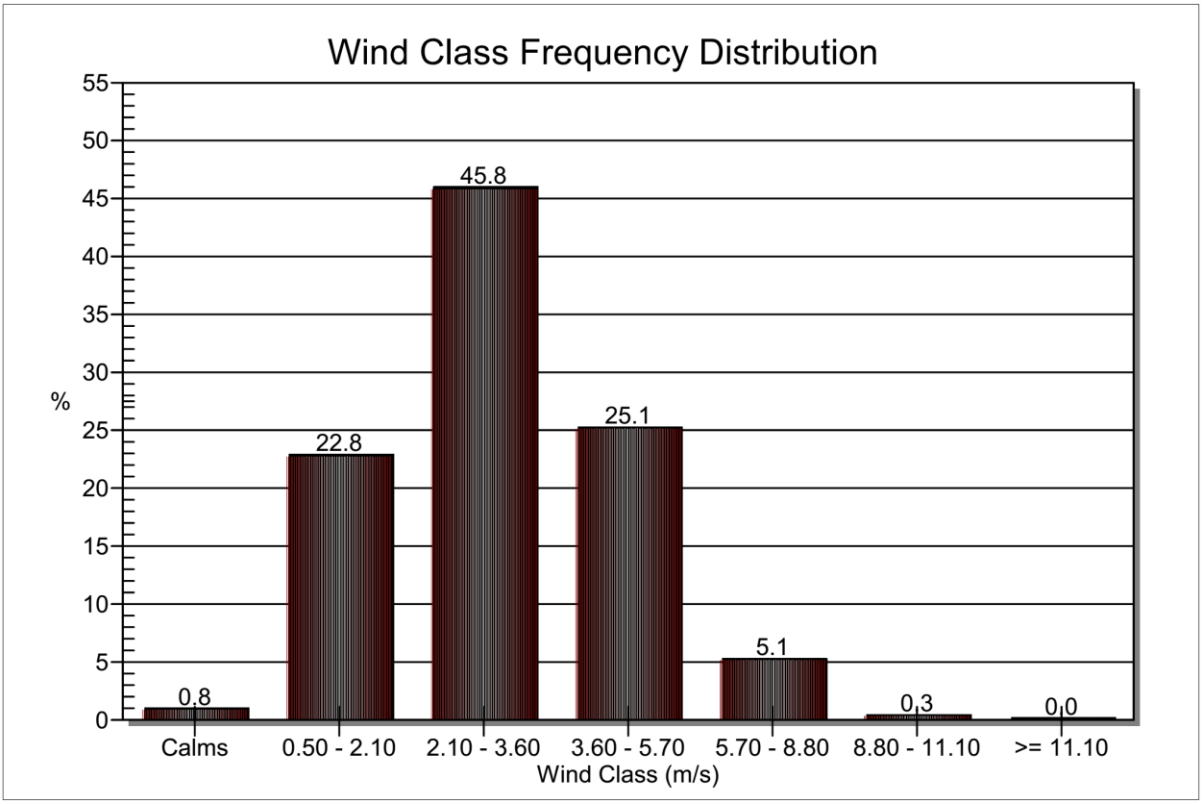
AERMET (Version #11.2.0), AERMOD's meteorological pre-processor requires hourly surface observations along with concurrent twice-daily upper air observations. As such, the dispersion modeling used three years (2019-2021) of meteorological data from lakes environment WRF data. **Figure 6-1** shows a 3-year (2019-2021) wind rose for meteorological data over the study area. The prevailing wind direction throughout the year is from South by west to North by east followed by south to north and SSW to NNE. **Figure 6-2** shows a frequency distribution of the wind over 6 wind speed class ranges. The highest wind speed varies between 2.10-3.60 m/s at 45.8% whereas 0.84% calm wind. The average wind speed over the study area is 3.11 m/s. It has been concluded that the receptors present in the North direction are more susceptible to pollution generated by the plants.

Figure 6-1: Annual Wind Rose of the Study Area



Source: Data acquired from Lakes Environmental

Figure 6-2: Wind Class Frequency Distribution of Meteorological Data (Jan. 1, 2019 – Dec. 31, 2021)

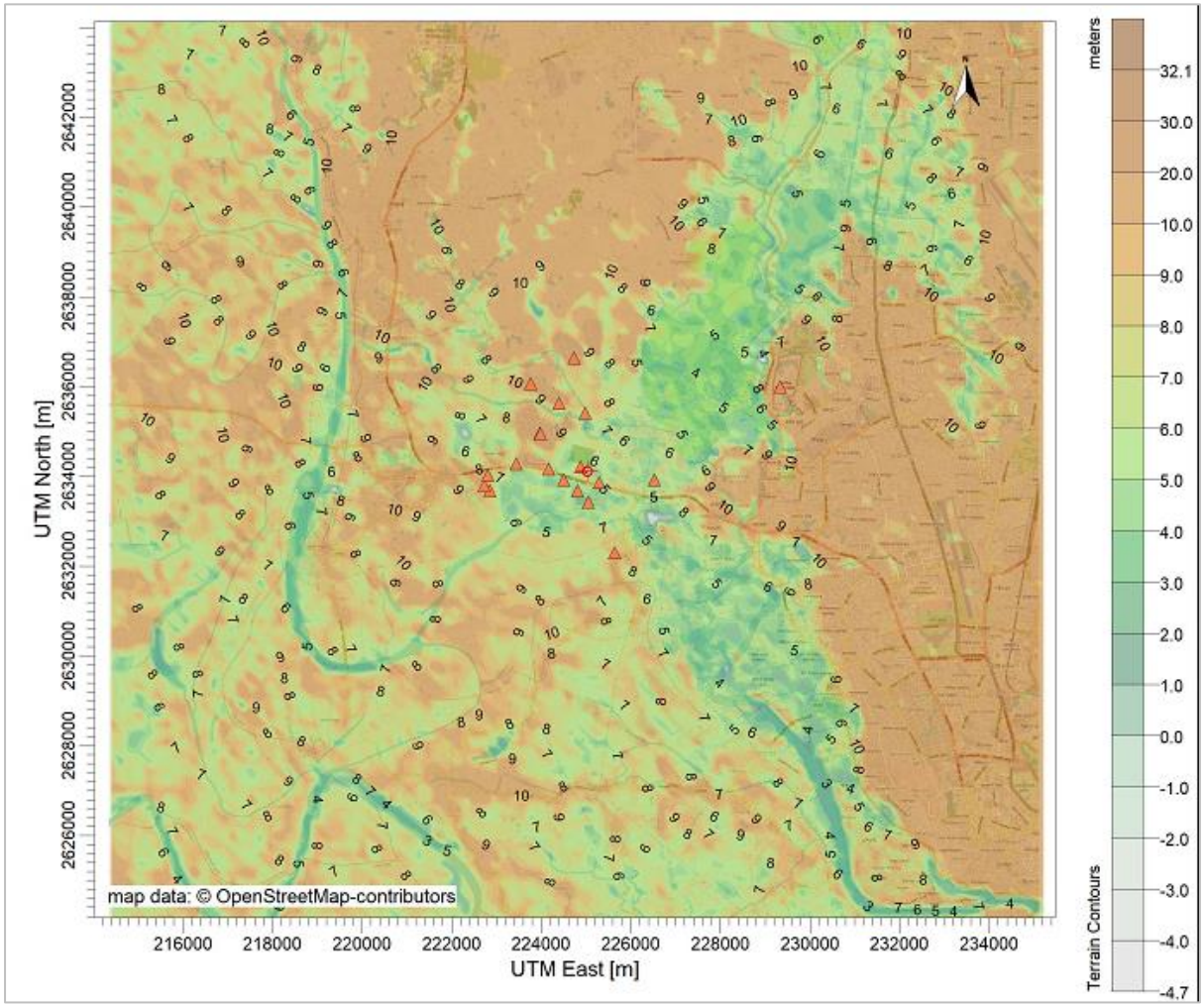


Source: Data acquired from Lakes Environmental

6.2.3.1.3.2 Terrain

A terrain height for each of the receptors on the grid was input into the model to accurately represent the changing elevations of the surrounding landscape. Terrain data for the AERMAP model were taken from the 30 m SRTM database. The elevation of the 10 km area varies between 0.20 to 27.65 m. The highest elevation of the study is found as 27.65 meters at 229505.00 m, 2636865.00 m. The land elevation of the study area is presented in **Figure 6-3**.

Figure 6-3: Land Elevation of the Study Area



Source: Shuttle Radar Topography Mission (SRTM)

6.2.3.1.3.3 Study Area

An area, of 10 km x 10 km centering the proposed waste-to-energy plant has been selected for the air quality analysis. The plant boundary and air quality-modeling domain are presented in **Table 6-14**.

Table 6-14: Project Site Coordinates

Model Domain	Easting (m)	Northing (m)
Project Center	224755.00	2634161.00
Southeast Corner	234738.00	2624169.00
Northeast Corner	234755.00	2644161.00
Northwest Corner	214748.00	2644179.00
Southwest Corner	214755.00	2624161.00

UTM Zone: N 45

The model was set up to examine the impact of emissions on the area surrounding the site using a series of receptors. A receptor is a location at which the model will calculate maximum process contributions (PCs) / GLCs. A multi-tier grid receptor system was established with the site at its center. A multi-tier grid with 3 receptor grids of a varying resolutions was established.

A 1km x 1km grid with receptors at 50m spacings was created with the development site at its center. Around this, a coarser 3km x 3km grid with 100m receptor spacings was created from the center. A third 10km x 10km grid with 300m receptor spacings was created around this. The grid network is presented in **Table 6-15**.

This network used Cartesian (X, Y) receptors with UTM coordinates. The base elevation of all the receptors was found using terrain elevations interpolated from SRTM (~30 m) Digital Elevation Model (DEM) data. In addition, 19 discrete cartesian receptors are also taken into consideration, where the sensitive receptors are located (**Table 6-16**).

Table 6-15: Multi-Tier Grid Receptors

Tier	Distance from Center (m)	Tier Spacing (m)
1	1000	50
2	3000	100
3	10000	300

6.2.3.1.3.4 Sensitive Receptors

It is important to identify the sensitive receptors in and around the project surroundings for the air quality impact assessment. A total of eight air quality samples were collected from different sensory receptors. Besides another eleven discrete sensitive receptors have been identified based on the field visit and google imagery analysis. **Table 6-16** and **Figure 6-4** show the sensitive receptor locations surrounding the project location.

Table 6-16: Location of Sensitive Receptors

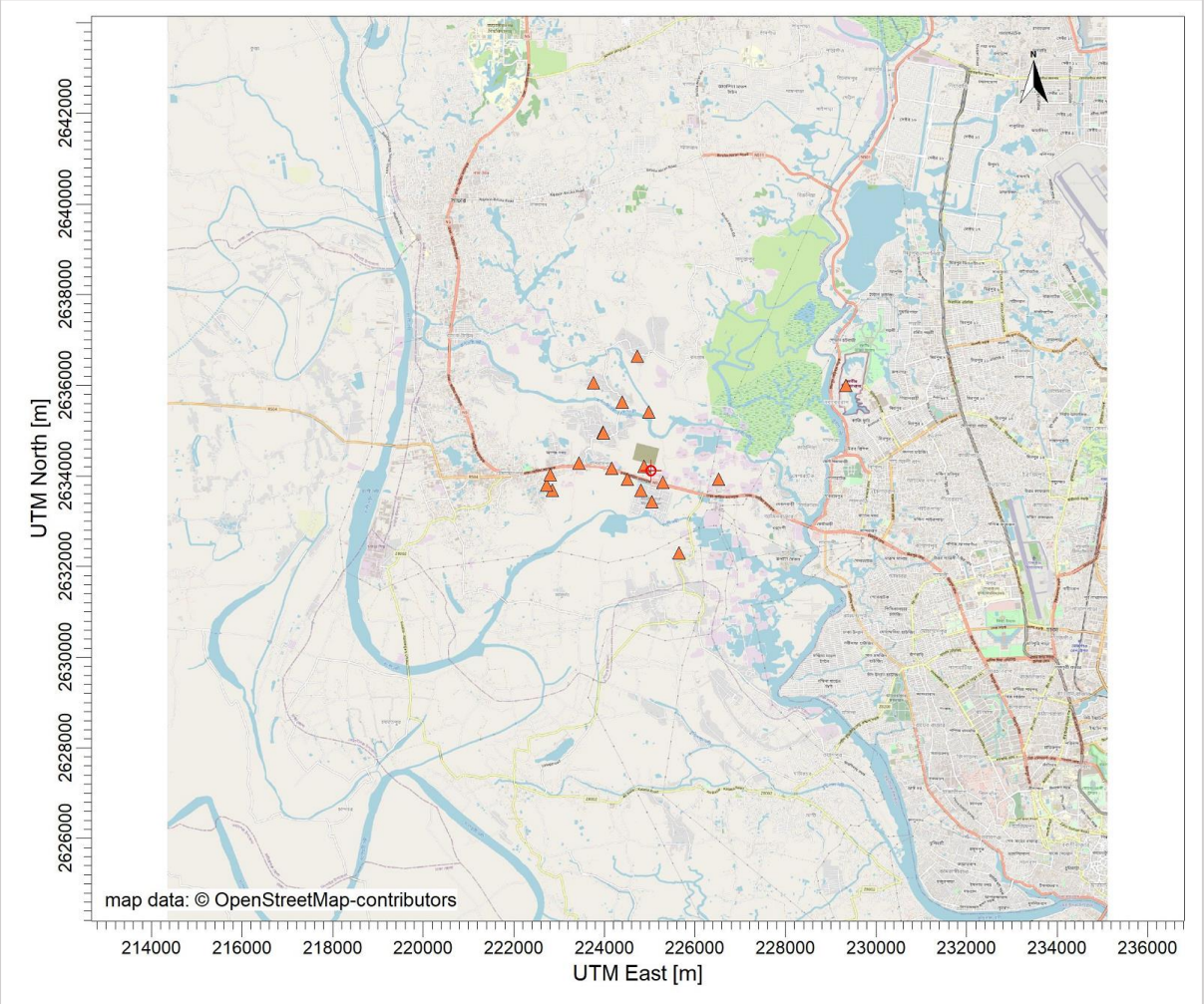
ID	Receptor's Location Name	Coordinate*		Distance and direction from the plant boundary
		X	Y	
AQ1	Project Site, Bongaon, Savar, Dhaka	224871.0	2634156.0	Project site
AQ2	Modhumoti Model Housing, Bongaon, Savar, Dhaka	224808.4	2633692.9	323 m south
AQ3	Raj filling station, Bongaon, Savar, Dhaka	225291.0	2633872.0	312 m east
AQ4	Baliapur, Bongaon, Savar, Dhaka	224167.0	2634168.0	409 m west
AQ5	Beraid lake city, Bongaon, Savar, Dhaka	224988.0	2635391.0	1151 m north
AQ6	Konda High School, Nagar Konda, Savar, Dhaka	223983.4	2634952.7	892 m NW
AQ7	Beraid Gandaria, Savar, Dhaka	223761.8	2636061.6	1930 m NNE
AQ8	Chakullia Bongaon, Savar, Dhaka	224732.6	2636644.4	2320 m north
SR1	Jamuna Natural Park	224505.0	2633930.0	157 m south
SR2	University of South Asia	226524.0	2633925.0	1468 m east
SR3	Konda High School and College	223973.0	2634964.0	910 m NW
SR3	Nurul Quran Madrasa	225645.0	2632305.0	1763 m SE

ID	Receptor's Location Name	Coordinate*		Distance and direction from the plant boundary
		X	Y	
SR4	Jadurchar Primary School	222857.0	2633687.0	1762 m WSW
SR6	Aim Ideal School	222723.1	2633796.0	1872 m WSW
SR7	Holy Touch Model School	222803.4	2634026.0	1755 m west
SR8	INOBHAT Hospital	223444.7	2634287.0	1145 m west
SR9	Baraid Govt. Primary School	224398.9	2635629.0	1315 m NW
SR10	Modhumati Model Town	225050.8	2633428.0	574 m south
SR11	National Zoo	229340.8	2635994.0	4452 m NE

*UTM-46

Source: Field Visit and Google Earth, 2022

Figure 6-4: Location of Sensitive Receptors



6.2.3.1.3.5 Building Structure

Air streams blowing across buildings can become disrupted, with turbulent eddies occurring downwind in the building wake. If an emission point is sufficiently close to a building, then the plume may become entrained in the turbulent eddies of the building wake.

This entrainment can cause plume downwash resulting in elevated emission concentrations close to the emission point. The stacks modeled are subject to downwash and, as a result, direction-specific building dimensions were calculated.

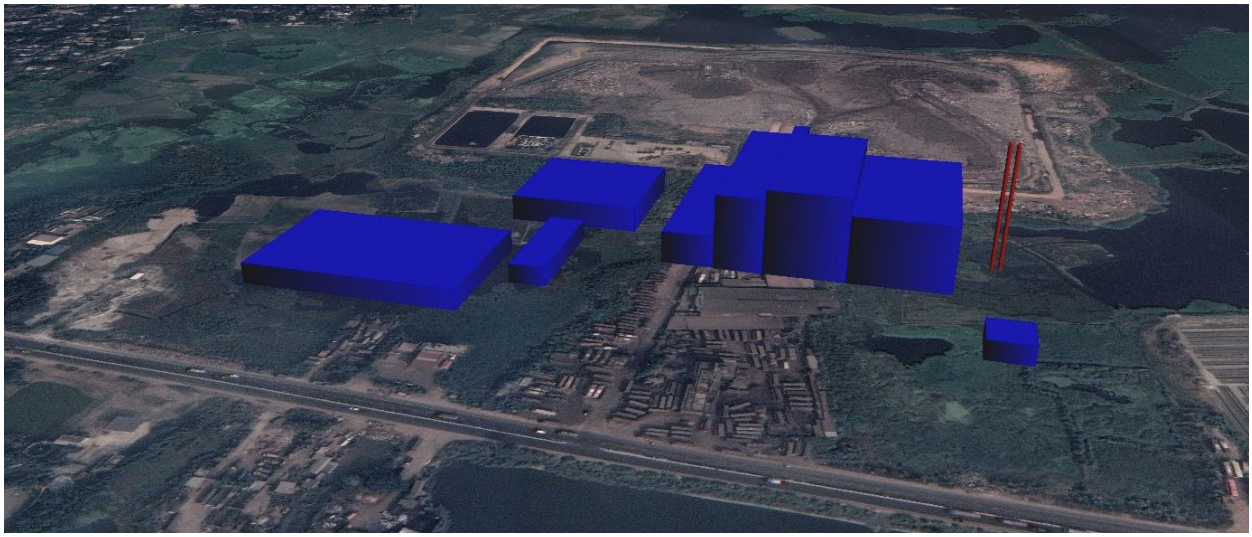
The AERMOD model interprets the influence zone of each building for a given wind direction using the Building Profile Input Program (BPIP). All of the main buildings on the site were included in the modeling analysis. Building details of the power plant are presented in **Table 6-17**. The power plant 3D view is presented in **Figure 6-5**.

Table 6-17: Detail of Power Plant Building

Description	Base Elevation [m]	Height [m]
Tripping hall	4.82	20.9
Waste pit	3.84	48.2
Main building	2.15	54.3
Flue gas purification	4.77	43
Cooling tower	4.77	12.2
Booster station	6.3	12.2
Slag treatment workshop	4.26	17
Oil pump house	5.07	5
Leachate treatment station	6	13.5

Source: WTE Power Plant North Dhaka Private Limited

Figure 6-5: 3D Model of Major Project Components



6.2.3.1.3.6 Model Input Data

The input parameters considered for the air dispersion modeling have been summarized in **Table 6-18**.

Table 6-18: Input Data Considered for Air Dispersion Modeling Exercise

No.	Scenario	Value
1	**Control Pathway**	
	Dispersion option	Non-Default Option with flat terrain, Stack-tip downwash, Output warnings, and checks for non-sequential met-data.

No.	Scenario		Value
	Terrain		Flat
2	**Meteorological Input**		
	Met Input Data		Meteorological data from 1 January 2019 to 31 December 2021 (Pre-processed Meteorological Data)
	Wind Speed Categories		Default
	Latitude		23.79511ºN
	Longitude		90.2988ºE
	Anemometer Height		14 m since the wind data were supplied as MM5 data (Lakes Environmental)
	Base Elevation		8.96 m
3	**Receptor Pathway**		
	Tier	Distance (m)	Spacing (m)
	1	1000	50
	2	3000	100
	3	10000	300
	Sensitive Receptor		19
4	**Source Pathway**		Point Source
5	**Output Pathway**		Pollutants Ground Level Concentration
	PM_{10}		1 Hourly, 24 Hourly, and Annual
	SO_2		1 Hourly, 24 Hourly, and Annual
	NO_2		1 Hourly, 24 Hourly, and Annual
	CO		1 Hourly, 8 Hourly, and Annual
	HCL		1 Hourly, 24 Hourly, and Annual
	Pb		1 Hourly, 24 Hourly, and Annual
	Hg		1 Hourly, 24 Hourly, and Annual
	HF		1 Hourly, 24 Hourly, and Annual
	DF		1 Hourly, 24 Hourly, and Annual

6.2.3.1.3.7 Emission Source

The proposed power plant can be considered located in a mixed area interspersed with residential and commercial uses. There are no major industries around the project site. There are many brickfields and the Dhaka-Aricha highway roads contributing to emissions within the same airshed (10kmX10km study area). Moreover, air pollution coming outside the project grid, transboundary air pollution and local construction works, paved and unpaved road, residential cooking, river vehicle, and city vehicular

movement is contributing to the air pollution of the airshed. Primary air quality sampling and analysis from 8 locations for both dry and wet seasons. During dry season ambient air quality monitoring, it was found that the existing brick kilns were in operation. Hence, the contribution of air pollutants forms brick kiln and vehicle transportation captured in the ambient air quality monitoring. To establish a strong baseline, data from the CAMs-3 station has been used as the background concentration of this modeling study.

The project adopts the form of a multi-tube chimney. There are 4 steel inner cylinders, one for each combustion line with reinforced concrete outer cylinders. The chimney/stack height is 100 m from the finished ground level. The finished ground base elevation for the stack has been considered as 9 meters. The locations of the stacks are presented in **Table 6-19**. There is no planned major air polluting industry in and around the same airshed. Therefore, the cumulative impact on air quality has not been carried out for this project.

Table 6-19: Stack Location

Stack	Name	X coordinate (meter)	Y coordinate (meter)	Base Elevation
1	Stack 1	225029.22	2634117.52	9.0
2	Stack 2	225033.83	2634116.23	9.0
3	Stack 3	225028.31	2634114.39	9.0
4	Stack 4	225032.87	2634113.15	9.0

Source: WTE Power Plant North Dhaka Private Limited

The air quality modeling assessment was based on the maximum plant load factor. This involves both electricity generation and equipment at maximum rates. The maximum concentrations modeled are based on the plant operating 24 hours per day, seven days per week. The facility will operate not less than 8,000 hours per annum. The point source input parameter and emission rate are presented in Table 6-20**.**

Table 6-20: Source Input Parameter and Emission Rate of the Plant

Parameter	Unit	Stack 1	Stack 2	Stack 3	Stack 4
Stack Height	m	100	100	100	100
Stack Internal Diameter	m	2.2	2.2	2.2	2.2
Stack Exit Temperature	k	413	413	413	413
Gas Exit Velocity	m/s	16	16	16	16
Gas exit flow rate	Nm^3/s	39.4	39.4	39.4	39.4
Emission Rate					
NO_2	g/s	6.30	6.30	6.30	6.30
PM	g/s	0.39	0.39	0.39	0.39
CO	g/s	1.97	1.97	1.97	1.97
SO_2	g/s	1.97	1.97	1.97	1.97
Hg	g/s	0.002	0.002	0.002	0.002
HCL	g/s	0.39	0.39	0.39	0.39
HF	g/s	0.04	0.04	0.04	0.04
Cd+TI	g/s	0.002	0.002	0.002	0.002
Pb+Cr and other heavy metals	g/s	0.02	0.02	0.02	0.02
DF	g/s	0.004	0.004	0.004	0.004

Source: WTE Power Plant North Dhaka Private Limited

Note: the pollutant mass emission rates from the waste combustion process (in g/s) have been calculated by multiplying the daily average by the volumetric flow rate at reference conditions.

6.2.3.1.3.8 Modeling Result and Discussion

The following assumptions were used for the air quality modeling:

Background level concentration: Primary air quality data for both dry and wet seasons have been collected from the study area. Long-term CAMS-3 data has been analyzed for background concentration. The highest concentration data were used for NO_2, SO_2, CO, and PM_{10}. Different scenarios considered for the air dispersion modeling as follows–

A. **Only Project Contribution (Project only)** – Primary data and detailed study of monitoring data from CAMS-3 show that the airshed is degraded on PM_{10} and NO_2 in a particular period (winter season) of a year. Air dispersion modeling was done considering the model input data, stack details, gas exit temperature, velocity, and emission rate presented in **Table 6-18** and Table 6-19. The PM emission from Table 6(B) of the IFC-WB EHS Guidelines for Thermal Power Plant 2008 does not give the breakdown of PM_{10} or $PM_{2.5}$. Hence, the PM has been considered PM_{10} during the modeling.

B. **Project Operation Period (Project Contribution + background concentration)** – this includes project contribution and background concentration from CAMS-3 of the CASE Project by DoE. The highest background concentration has been taken for analyzing the worst-case scenario.

During dry season ambient air quality monitoring, it was found that the existing brick kilns were in operation. The contribution of air pollutants forms brick kiln, vehicle transportation and other sources already captured during the ambient air quality monitoring period. During the analysis, worst case ambient air quality data has been considered for comparison with standard. As the ambient air quality data represent the contribution of all existing sources as a result, contributions from brick kiln and road vehicles have not been modelled separately.

The proposed power plant has different provisions for air pollution abatement measures therefore, the model has been carried out considering mitigation measures. The proposed power plant has four sets of incinerators and waste heat boilers. A major source of the plant is NO_2, SO2, CO, and Particulate Matter. Besides the criteria pollutants, the plant will also contribute heavy metals (Pb+Cr, Hg), HCL, Hydrogen Fluoride (HF), and Dioxin Furan (DF) to the atmosphere. The maximum ground-level concentration of different pollutants due to the plant operation is presented in **Table 6-21**. Pollutants' contribution due to plant operation to the receptors located around the plant is also analyzed and presented in **Table 6-22**.

Table 6-21: Results of Air Quality Modeling for different Pollutants

Scenario	Pollutant	Max. Concentration (µg/m³)		Max. Concentration Location	APCR, 2022[a] (µg/m³)	% of APCR 2022 standard	WHO, 2021[b] (µg/m³)	% of WHO guideline	EU Air Quality Limit (µg/m³)	% of EU Air Quality Limit	UK EAES[c] (µg/m³)	% of UK EAES
		Avg. Time	Max. Value									
Predicted Concentration (Operation of Plant)	PM_{10}	24-hr.	1.46	224955.00 2634111.00	150	0.97	45	3.24	150	0.97	-	-
		Annual	0.071	224905.00 2635061.00	50	0.142	15	0.47	50	0.142	-	-
	PM2.5	24-hr.	1.46	224955.00 2634111.00	65	2.25	5	29.2	-	-	-	-
		Annual	0.071	224905.00 2635061.00	15	0.47	15	0.47	-	-	-	-
	NO_2	24-hr.	22.8	225105.00 2634161.00	80	28.5	25	91.2	-	-	-	-
		Annual	1.3	224905.00 2635061.00	40	3.3	10	13.0	40	3.3	-	-
	SO_2	1-hr.	87.8	225055.00 2634161.00	250	35.1	-	-	350	25.1	-	-
		24-hr.	7.38	224955.00 2634111.00	80	9.2	40	18.45	125	5.9	-	-
	CO	1-hr.	87.8	225055.00 2634161.00	20000	0.4	-	-	-	-	-	-
		8-hr.	22.1	224955.00 2634111.00	5000	0.4	-	-	10000	0.2	-	-
	Pb	1-hr.	0.891	225055.00 2634161.00	-	-	-	-	-	-	-	-

Scenario	Pollutant	Max. Concentration (µg/m³)		Max. Concentration Location	APCR, 2022[a] (µg/m³)	% of APCR 2022 standard	WHO, 2021[b] (µg/m³)	% of WHO guideline	EU Air Quality Limit (µg/m³)	% of EU Air Quality Limit	UK EAES[c] (µg/m³)	% of UK EAES
		Avg. Time	Max. Value									
		24-hr.	0.075	224955.00 2634111.00	0.5	15.0	-	-	-	-	-	-
		Annual	0.0037	225455.00 2634511.00	0.25	1.5	-	-	0.5	0.7	-	-
	HCL	1-hr.	17.4	225055.00 2634161.00	-	-	-	-	-	-	750	2.3
		24-hr.	1.46	224955.00 2634111.00	-	-	-	-	-	-	-	-
		Annual	0.071	224905.00 2635061.00	-	-	-	-	-	-	-	-
	Hg	1-hr.	0.08	225055.00 2634161.00	-	-	-	-	-	-	7.5	1.07
		24-hr.	0.0075	224955.00 2634111.00	-	-	-	-	-	-	-	-
		Annual	0.00037	224905.00 2635061.00	-	-	-	-	-	-	0.25	0.15
	HF	1-hr.	1.78	225055.00 2634161.00	-	-	-	-	-	-	160	1.11
		24-hr.	0.15	224955.00 2634111.00	-	-	-	-	-	-	-	-
		Annual	0.0073	224905.00 2635061.00	-	-	-	-	-	-	-	-
	DF	1-hr.	0.178	225055.00 2634161.00	-	-	-	-	-	-	-	-

Scenario	Pollutant	Max. Concentration (µg/m³)		Max. Concentration Location	APCR, 2022[a] (µg/m³)	% of APCR 2022 standard	WHO, 2021[b] (µg/m³)	% of WHO guideline	EU Air Quality Limit (µg/m³)	% of EU Air Quality Limit	UK EAES[c] (µg/m³)	% of UK EAES
		Avg. Time	Max. Value									
		24-hr.	0.015	224955.00 2634111.00	-	-	-	-	-	-	-	-
		Annual	0.00073	224905.00 2635061.00	-	-	-	-	-	-	-	-
Baseline Concentration* (µg/m³)	PM_{10}	24-hr.	335.0		150	223.3	45	744.4				
		Annual	67.0		50	134.0	15	446.7				
	PM2.5	24-hr.	335.0		65	515.38	5	6,700				
		Annual	67.0		15	446.67	15	446.67				
	NO2	24-hr.	210.4		80	263.0	25	841.6				
		Annual	42.1		40	105.3	10	421.0				
	SO_2	1-hr.	202.6		250	81.0	-	-				
		24-hr.	81.0		80	101.3	40	202.5				
	CO	1-hr.	11156.0		20000	55.8	-	-				
		8-hr.	6680.0		5000	133.6	-	-				
Total Concentration (Only Project Contribution +Baseline)	PM10	24-hr.	336.5	-	150	224.3	-	-				
		Annual	67.1	-	50	134.1	-	-				
	PM2.5	24-hr.	336.46		65	517.63	5	6,729.2				
		Annual	67.071		15	447.14	15	447.14				
	NO2	24-hr.	233.2		80	291.5	25	932.8				
		Annual	43.4		40	108.5	10	434.0				
	SO_2	1-hr.	290.4	-	250	116.2	-	-				

Scenario	Pollutant	Max. Concentration (µg/m³)		Max. Concentration Location	APCR, 2022[a] (µg/m³)	% of APCR 2022 standard	WHO, 2021[b] (µg/m³)	% of WHO guideline	EU Air Quality Limit (µg/m³)	% of EU Air Quality Limit	UK EAES[c] (µg/m³)	% of UK EAES
		Avg. Time	Max. Value									
		24-hr.	88.4	-	80	110.5	40	221.0				
	CO	1-hr.	11244		20000	56.2	-	-				
		8-hr.	6702.1		5000	134.0	-	-				

[a] Schedule-1 (Ambient Air Quality Standards), Air Pollution Control Rules 2022

[b] World Health Organization (WHO) Ambient Air Quality Guideline Values 2021

[c] UK Environmental Agency Environmental Standard

Table 6-22: Predicted Concentration of Pollutants at Receptor Locations

Pollutants	Avg. Time	Concentration at Receptor Points (µg/m³)																			APCR, 2022[a] (µg/m³)	WHO, 2021[b] (µg/m3)	EU Air Quality Limit (µg/m³)	UK EAES[c] (µg/m3)
		AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11				
PM	24-hr.	0.79	0.34	0.31	0.45	0.47	0.58	0.26	0.34	0.29	0.53	0.58	0.19	0.26	0.20	0.21	0.31	0.46	0.33	0.07	150	45	150	-
	Annual	0.024	0.033	0.033	0.030	0.062	0.046	0.028	0.032	0.028	0.032	0.046	0.015	0.015	0.014	0.016	0.023	0.046	0.032	0.008	50	15	50	-
NO_2	24-hr.	11.5	4.9	4.6	6.6	6.8	8.5	3.7	5.0	4.2	7.6	8.4	2.7	3.8	2.9	3.1	4.5	6.7	4.8	1.1	80	25	-	-
	Annual	0.35	0.48	0.47	0.43	0.90	0.67	0.40	0.46	0.40	0.46	0.66	0.22	0.22	0.21	0.23	0.34	0.67	0.46	0.11	40	10	40	-
SO_2	1-hr.	20.1	8.3	9.3	10.2	15.5	10.2	8.8	8.3	8.0	21.2	10.2	7.9	13.8	12.0	13.1	18.6	8.9	7.2	4.2	250	-	350	-
	24-hr.	4.0	1.7	1.6	2.3	2.4	2.9	1.3	1.7	1.5	2.7	2.9	1.0	1.3	1.0	1.1	1.6	2.3	1.7	0.4	80	40	125	-
CO	1-hr.	20.1	8.3	9.3	10.2	15.5	10.2	8.8	8.3	8.0	21.2	10.2	7.9	13.8	12.0	13.1	18.6	8.9	7.2	4.2	20000	-	-	-
	8-hr.	12.0	4.6	4.3	4.1	3.4	6.8	2.8	2.3	4.0	6.5	6.7	2.8	3.0	1.7	1.9	3.8	3.9	4.8	0.9	5000	-	10000	-
Pb	1-hr.	0.204	0.084	0.094	0.103	0.157	0.104	0.089	0.084	0.081	0.215	0.104	0.080	0.140	0.122	0.133	0.189	0.091	0.073	0.043	-	-	-	-
	24-hr.	0.041	0.017	0.016	0.023	0.024	0.030	0.013	0.018	0.015	0.027	0.030	0.010	0.013	0.010	0.011	0.016	0.024	0.017	0.004	0.5	-	-	-
	Annual	0.0025	0.0021	0.0022	0.0024	0.0066	0.0037	0.0021	0.0024	0.0014	0.0016	0.0023	0.0008	0.0008	0.0007	0.0008	0.0012	0.0024	0.0016	0.0004	0.25	-	0.5	-
HCL	1-hr.	3.99	1.64	1.84	2.02	3.06	2.02	1.74	1.64	1.58	4.19	2.02	1.56	2.72	2.37	2.59	3.69	1.77	1.43	0.84	-	-	-	750
	24-hr.	0.79	0.34	0.31	0.45	0.47	0.58	0.26	0.34	0.29	0.53	0.58	0.19	0.26	0.20	0.21	0.31	0.46	0.33	0.07	-	-	-	-
	Annual	0.024	0.033	0.033	0.030	0.062	0.046	0.028	0.032	0.028	0.032	0.046	0.015	0.015	0.014	0.016	0.023	0.046	0.032	0.008	-	-	-	-
Hg	1-hr.	0.020	0.008	0.009	0.010	0.016	0.010	0.009	0.008	0.008	0.022	0.010	0.008	0.014	0.012	0.013	0.019	0.009	0.007	0.004	-	-	-	7.5
	24-hr.	0.0041	0.0017	0.0016	0.0023	0.0024	0.0030	0.0013	0.0018	0.0015	0.0027	0.0030	0.0010	0.0014	0.0010	0.0011	0.0016	0.0024	0.0017	0.0004	-	-	-	-
	Annual	0.00012	0.00017	0.00017	0.00015	0.00032	0.00024	0.00014	0.00016	0.00014	0.00016	0.00023	0.00008	0.00008	0.00007	0.00008	0.00012	0.00024	0.00016	0.00004	-	-	-	0.25
HF	1-hr.	0.41	0.17	0.19	0.21	0.31	0.21	0.18	0.17	0.16	0.43	0.21	0.16	0.28	0.24	0.27	0.38	0.18	0.15	0.09	-	-	-	160
	24-hr.	0.081	0.035	0.032	0.046	0.048	0.060	0.026	0.035	0.029	0.054	0.059	0.019	0.027	0.021	0.022	0.032	0.047	0.034	0.007	-	-	-	-
	Annual	0.0025	0.0034	0.0034	0.0030	0.0063	0.0047	0.0028	0.0033	0.0028	0.0033	0.0047	0.0016	0.0015	0.0015	0.0016	0.0024	0.0047	0.0032	0.0008	-	-	-	-
DF	1-hr.	0.041	0.017	0.019	0.021	0.031	0.021	0.018	0.017	0.016	0.043	0.021	0.016	0.028	0.024	0.027	0.038	0.018	0.015	0.009	-	-	-	-
	24-hr.	0.0081	0.0035	0.0032	0.0046	0.0048	0.0060	0.0026	0.0035	0.0030	0.0054	0.0059	0.0019	0.0027	0.0021	0.0022	0.0032	0.0047	0.0034	0.0007	-	-	-	-
	Annual	0.0003	0.0003	0.0003	0.0003	0.0006	0.0005	0.0003	0.0003	0.0003	0.0003	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0003	0.00008	-	-	-	-

[a] Schedule-1(Ambient Air Quality Standards), Air Pollution Control Rules 2022

[b] World Health Organization (WHO) Ambient Air Quality Guideline Values 2021

[c] UK Environmental Agency Environmental Standard

Based on the emission rates, operating data, meteorological data as well as the assumption given above, the following section presents the results of air quality modeling.

Particulate Matter (PM_{10})

Project Contribution (Project Only)

The particulate matter emission standard of the plant is 10 mg/Nm^3. Since there is no fraction of particulate matter such as PM_{10} and $PM_{2.5}$ in national standards and WHO guidelines hence, it has been assumed that $PM=PM_{10}=PM_{2.5}$, waste-to-energy power plants will have the same contribution as $PM_{2.5}$. **Table 6-21** shows that the 24-hourly predicted maximum PM_{10} concentration was found as 1.46 µg /m^3 (0.97% of national standard and 3.24% of WHO guideline value) at 76 meters (224955.00 m E 2634111.00 m N) to the west direction from the stack location. The annual predicted maximum PM_{10} concentration was found as 0.07 µg /m^3 (0.14% of national standard and 0.47% of WHO guideline value) at 958 meters (224905.00m E 2635061.00m N) to the north direction of the power plant stack location. Hence, it can be stated that the proposed waste-to-energy power plant will have a negligible contribution to the GLC of particulate matter (PM). PM_{10} Isopleths of project contribution is shown in **Figure 6-6**.

Table 6-22 presents that the 24-hourly maximum PM_{10} has been found at plant area (AQ1) among 19 receptors point as 0.79 µg/m^3 (0.1% of national standard-APCR and 3.2% of WHO guideline value) whereas annual concentrations found as 0.062 µg/m^3 (0.15% of national standard and 0.62% of WHO guideline value) at AQ5 (Beraid lake city, Bongaon, Savar, Dhaka). The project contribution is well within the national and WHO guideline value. However, a health impact assessment needs to be carried out before works commence to provide a baseline for monitoring health impacts and confirm no significant impact on human health.

Project Contribution + Background Concentration

Table 6-21 shows that the maximum 24-hourly background concentration was found 335.0 µg/m^3 (223.3% of national standard-APCR and 744.4% of WHO guideline value) which is significantly higher than the standard. Annual maximum background concentration was recorded as 67.0 µg/m^3 which is 134.0% of the national standard and 446.7% of the WHO guideline value. The project contribution including baseline concentration shows that the 24-hourly maximum PM_{10} concentration stands at 336.5 µg/m^3 (224.3% of the national standard and 747.7% of WHO guideline value) whereas the annual maximum concentration was found 67.1 µg/m^3 (134.1% of national standard-APCR and 447.1% of WHO guideline value). It can be concluded that only the project will contribute very negligible concentration to the local airshed compared to the existing baseline condition. So, particulate matter emission may not impact the local environment due to the proposed plant operation. However, as stated earlier a health impact assessment needs to be carried out before commencing the construction work.

Particulate Matter ($PM_{2.5}$)

Project Contribution (Project Only)

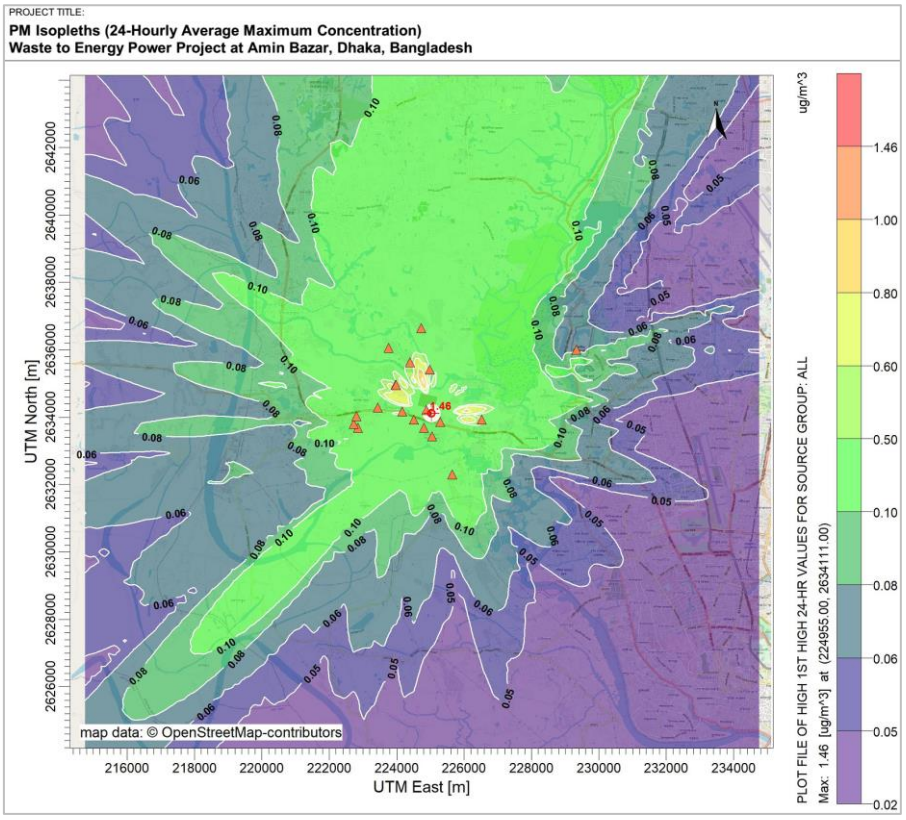
The particulate matter emission standard of the plant is 10 mg/Nm^3. Since there is no fraction of particulate matter such as PM_{10} and $PM_{2.5}$ in national standards and WHO guidelines hence, it has been assumed that $PM=PM_{10}=PM_{2.5}$, waste-to-energy power plants will have the same contribution as PM_{10}. **Table 6-21** shows that the 24-hourly predicted maximum $PM_{2.5}$ concentration was found as 1.46 µg /m^3 (2.25% of national standard and 29.2% of WHO guideline value) at 76 meters (224955.00 m E 2634111.00 m N) to the west direction from the stack location. The annual predicted maximum $PM_{2.5}$ concentration was found as 0.07 µg /m^3 (0.47% of national standard and 0.47% of WHO guideline value) at 958 meters (224905.00m E 2635061.00m N) to the north direction of the power plant stack location. Hence, it can be stated that the proposed waste-to-energy power plant will have a negligible contribution to the GLC of particulate matter (PM).

Project Contribution + Background Concentration

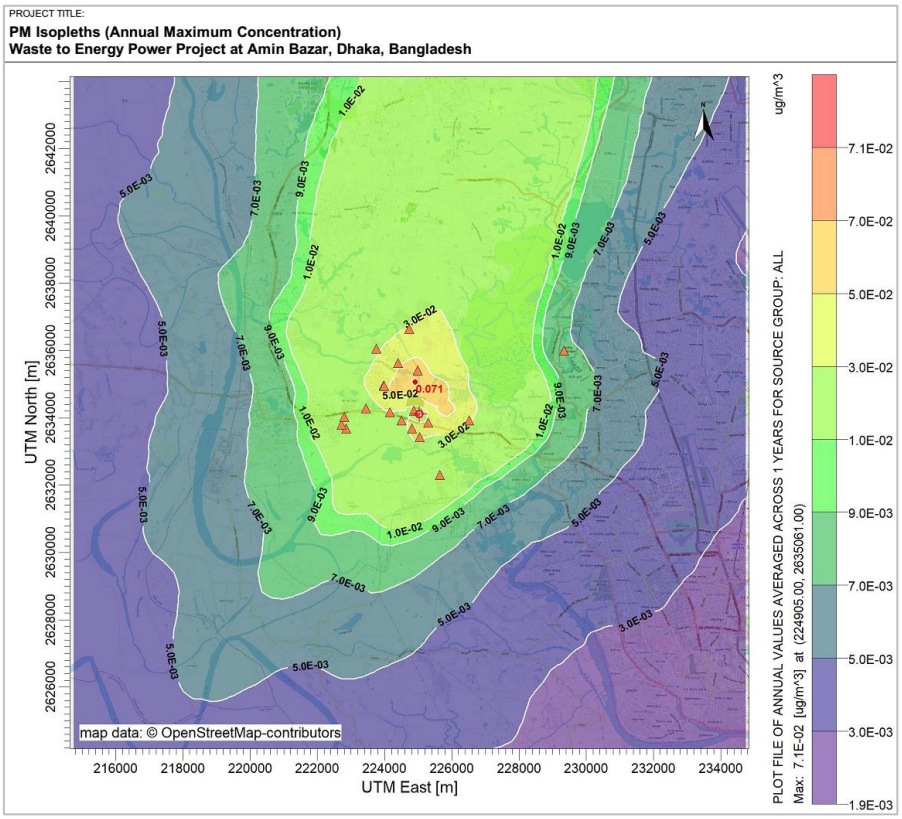
Table 6-21 shows that the maximum 24-hourly background concentration was found 335.0 µg/m^3 (515.38% of national standard-APCR and 6,700% of WHO guideline value) which is significantly higher than the standard. Annual maximum background concentration was recorded as 67.0 µg/m^3 which is 446.67% of the national

standard and 446.67% of the WHO guideline value. The project contribution including baseline concentration shows that the 24-hourly maximum $PM_{2.5}$ concentration stands at 336.46 µg/m^3 (517.63% of the national standard and 6,729.2% of WHO guideline value) whereas the annual maximum concentration was found 67.071 µg/m^3 (447.14% of national standard-APCR and 447.14% of WHO guideline value). It can be concluded that only the project will contribute very negligible concentration to the local airshed compared to the existing baseline condition. So, particulate matter emission may not impact the local environment due to the proposed plant operation. However, as stated earlier a health impact assessment needs to be carried out before commencing the construction work.

Figure 6-6: PM_{10} Isopleths of Project Contribution



24 Hourly PM_{10} Isopleths



Annual PM_{10} Isopleths

Nitrogen Dioxide (NO_2)

Project Contribution (Project Only)

The air quality assessment is made in relation to ensuring compliance with national standards. Waste to energy plant will contribute a maximum GLC of 1.3 µg/m^3 (annual averaging time) of NO_2 to the airshed based on an emission concentration of 200 mg/Nm^3 with Tier 2 ((minimum NO_2/NOx ratio- 50% and maximum NO_2/NOx ratio is 90%) (**Table 6-21**). The annual predicted maximum NO_2 concentration was found as 1.3 µg /m^3 (224905.00m E 2635061.00m N) at 958 meters to the north direction of the power plant. The 24-hourly predicted maximum NO_2 concentration was found as 22.8 µg /m^3 (225105.00 m E 2634161.00 m N) at 58 meters to the northeast direction of the power plant. With an emissions concentration of 200 mg/Nm^3, the emissions are considered to have more than a fraction of the national ambient air quality standard. Given the negligible impact on national ambient air quality standards, and the high costs involved in maintaining selective catalytic reduction to further reduce NO_2 levels, a 200 mg/Nm^3 emission standard with 100 meters of stack height can be both technical and financially viable. In terms of impact on health, the maximum project contribution to GLC with a 200 mg/Nm^3 emission concentration and 100 m stack height is about 3.3% and 13.0% of the annual national standard and WHO guideline for NO_2 considering Tier 2. The plant will contribute about 28.5% and 91.2% of the short-term 24-hr national standard and WHO guideline value. NO_2 Isopleths of project contribution is shown in **Figure 6-7**.

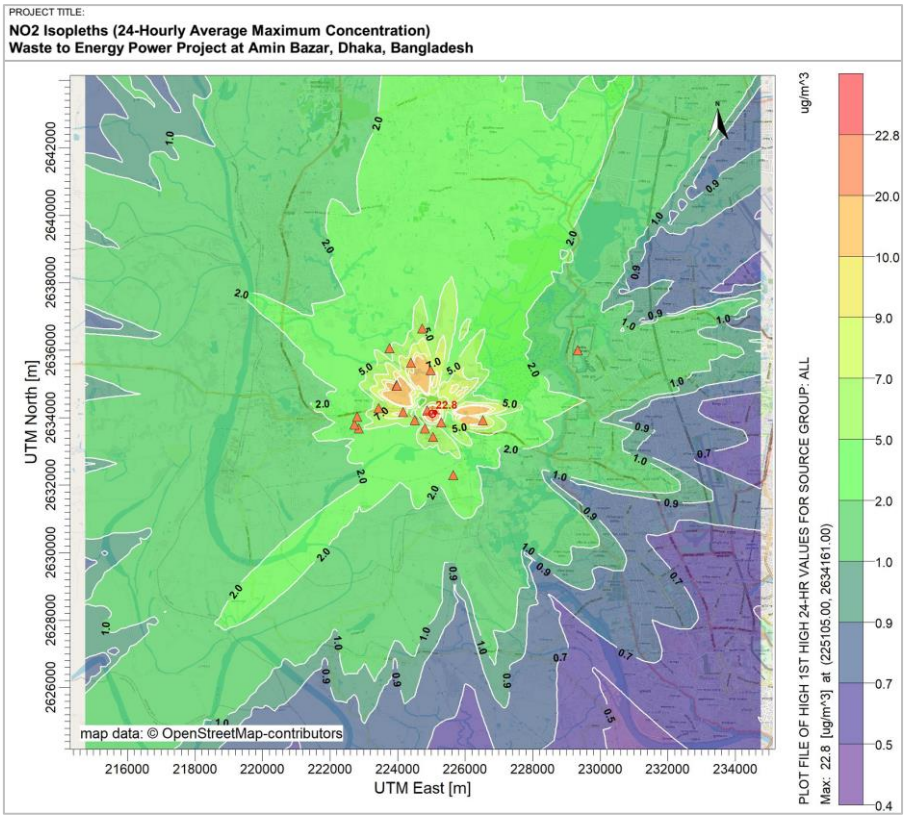
There are two sensitive receptors near the plant e.g Jamuna natural park & picnic spot and Madhumati Model town in the south. **Table 6-22** presents that the predicted 24-hourly and annual PM_{10} concentration varies between 1.1-11.5 µg/m^3 and 0.11-0.9 µg/m^3 at 19 sensitive receptor locations. It reveals that predicted NO2 concentrations on sensitive receptors are well within both national and WHO guidelines values. Among the 19 receptors modeled, the maximum annual GLC of 0.90 ug/m^3 (2.24 % of APCR and 8.97% of WHO guideline value) found at AQ5 (Beraid lake city, Bongaon, Savar, Dhaka) and maximum 24-hr GLC of 11.5 ug/m^3 (14.4% of APCR and 46.2% of WHO guideline value) were found at AQ1 (within the plant boundary).

Whilst the project makes a significant contribution to the short-term national and WHO guidelines in a degraded airshed, the project itself does not result in any exceedance of the guidelines. Short-term impacts on health tend to be less severe than long-term impacts (e.g. eye irritation versus increased mortality) and the maximum short-term concentration from the project whilst significant is unlikely. The government has taken initiatives to convert the exiting brick kilns into more environment-friendly industries by 2025. A health impact assessment will be completed before works commence, to provide a baseline for monitoring health impacts and confirm no significant impact on human health.

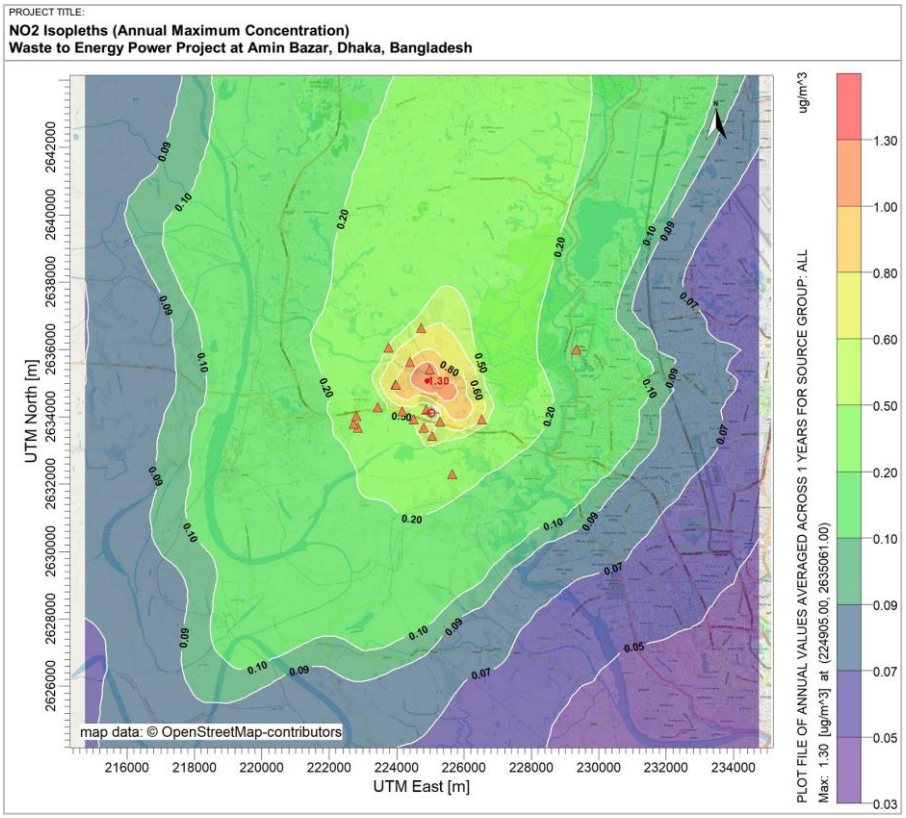
Project Contribution + Background Concentration

During the scenario-2 analysis, the highest background concentration has been taken for worst-case analysis (**Table 6-21**). Annual maximum baseline concentration was recorded as 42.1 µg/m^3 which is 105.3% of the national standard and 421.0% of the WHO guideline value whereas short-term 24-hourly concentration was 210.4 µg/m^3 (263% of national standard-APCR and 841.6% of WHO guideline value). Hence, the background maximum NO_2 concentration is significantly higher. The project contribution including baseline concentration shows that the annual and 24 hours maximum concentration stands at 43.4 µg/m^3 (108.5% of national standard and 434.0% of WHO guideline value) and 233.2 µg/m^3 (291.5% of national standard-APCR and 932.8% of WHO guideline value). It seems that only the project will contribute less to the airshed compared to the existing baseline condition.

Figure 6-7: NO_2 Isopleths of Project Contribution



24 Hourly NO_2 Isopleths



Annual NO_2 Isopleths

Carbon Monoxide (CO)

Project Contribution (Project Only)

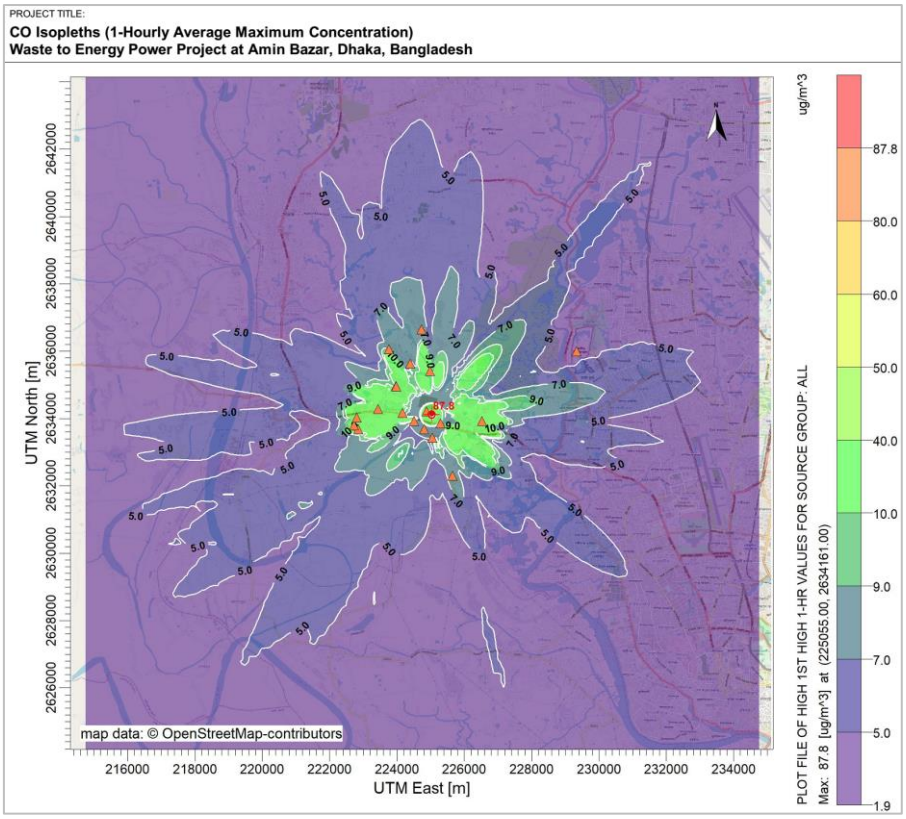
Major sources of CO in the study area are brick kilns, vehicles, cooking, etc. During the operation of the power plant, there will be a negligible contribution to the GLC of CO. **Table 6-21** shows that plant operation will contribute 1- hourly maximum CO concentration as 87.8 µg/m^3 (0.4% of national standard) at 50.9 m (225055.00 m E 2634161.00 m N) north direction from the stack location which is within the project boundary. Whereas 8-hourly maximum CO concentration was found at 22.1 µg/m^3 (0.4% of national standard) at a distance of 76.5 m west direction from the stack location and also within the project boundary (224955.00m E 2634111.00 m N). CO Isopleths of project contribution is shown in **Figure 6-8**.

The 1 hourly CO concentration varies at 19 receptor locations between 4.2-21.2 µg/m^3 (0.02-0.11% of national standard) whereas 8-hourly CO concentration varies from 0.9-12.0 µg/m^3 (0.02 - 0.24% of national standard). The 1-hourly maximum concentration (21.2 µg/m^3) was found at S2 (University of South Asia) and the 8-hourly maximum concentration (12.0 µg/m^3) was found at AQ1 (within the project location). It reveals that CO concentration on sensitive receptors will be negligible due to the operation of proposed waste-to-energy power plants. The pollution concentration on sensitive receptors is presented in **Table 6-22**.

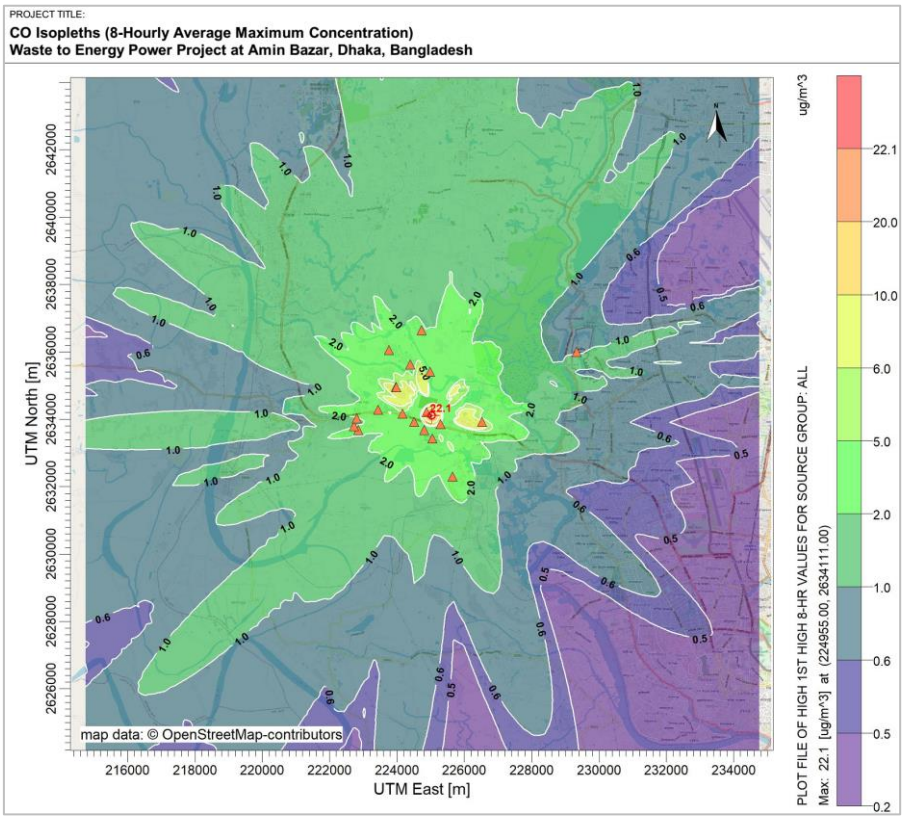
Project Contribution + Background Concentration

The highest background concentration from CAMS-3 has been taken for worst-case analysis (**Table 6-21**). 1-hourly and 8-hourly maximum background CO concentrations were found as 11156 µg/m^3 (55.8% of the national standard) and 6680 µg/m^3 (133.6% of the national standard). The background concentrations show that the 8-hourly CO concentration is higher than the national standard. The project contribution including baseline concentration shows that the 24 hours and annual maximum concentration stands at 11244 µg/m^3 (56.2% of national standard-APCR) and 6702 µg/m^3 (134.0% of national standard-APCR). It can be concluded that the only project contribution is insignificant due to the plant operation compared to the background CO concentration.

Figure 6-8: CO Isopleths of Project Contribution



1 Hourly CO Isopleths



8 Hourly CO Isopleths

Sulfur Dioxide (SO_2)

Project Contribution (Project Only)

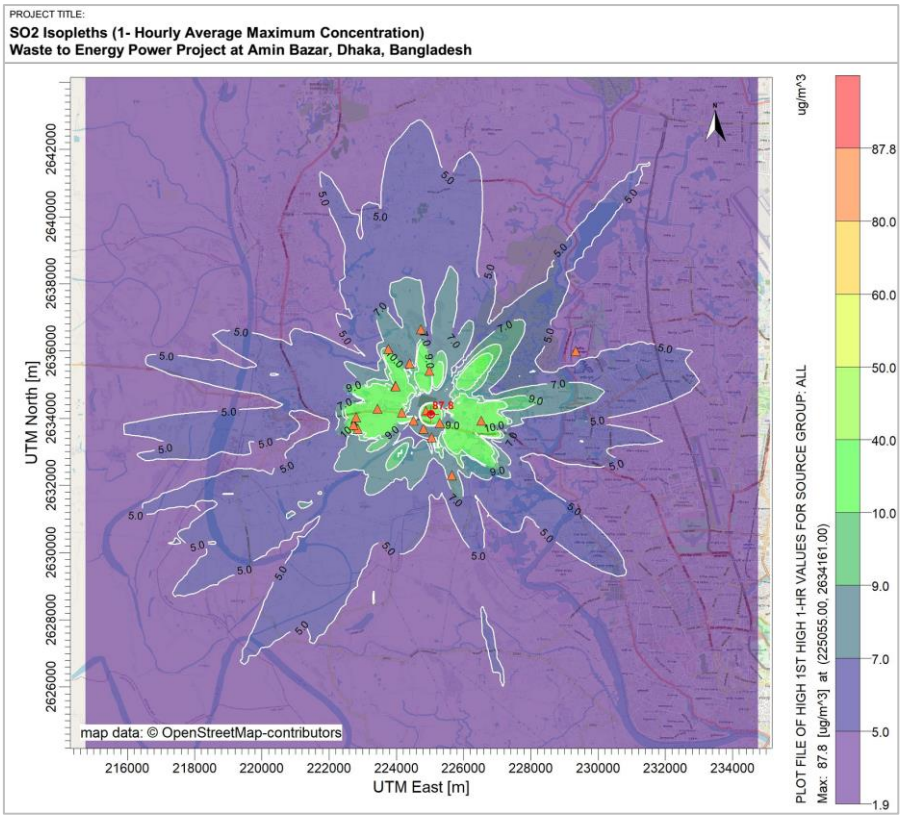
The air quality assessment is made about ensuring compliance with national standards. The major sources of SO_2 are brick kilns and vehicular movements. Due to the power plant operation, 1- hourly maximum SO_2 concentration has been found at 87.8 µg/m^3 (35.1% of national standard) at 50.9 m (225055.00m E 2634161.00 m N) north direction from the stack location which is within the project boundary whereas 24- hourly SO_2 concentration has been found 7.38 µg/m^3 (9.2% of national standard and 18.5% of WHO guideline value) at 76 meters (224955.00 m E 2634111.00 m N) to the west direction from the stack location (**Table 6-21**). The project alone SO_2 contribution to the airshed is within the standard; however, it is higher than a single project. Hence, a health impact assessment needs to be carried out before work commences to provide a baseline for monitoring health impacts and confirm no significant impact on human health. SO_2 Isopleths of project contribution is shown in **Figure 6-9**.

A total of 19 sensitive receptors have been modeled to find incremental SO_2 concentration. The 1-hourly SO2 concentration varies from 4.2-21.18 µg/m^3 (1.7%-8.5% of the national standard-APCR) at the receptor locations whereas 24-hourly SO_2 concentration was found between 0.4-4.0 µg/m^3 (0.46%-5.0% of the national standard-APCR and 0.92%-10.0% of the WHO guidelines value). The maximum 1-hourly SO2 concentration was found at S2- the University of South Asia and the 24-hourly maximum concentration was found at AQ1 (within the project boundary). According to the national standard, SO_2 will not contribute a significant increment to the nearest sensitive receptors. The project contribution is well within the national and WHO guideline value. On the other hand, the 24-hr increment is significant (67.3%) as per the WHO guideline value in a degraded airshed. The pollution concentration on sensitive receptors is presented in **Table 6-22**.

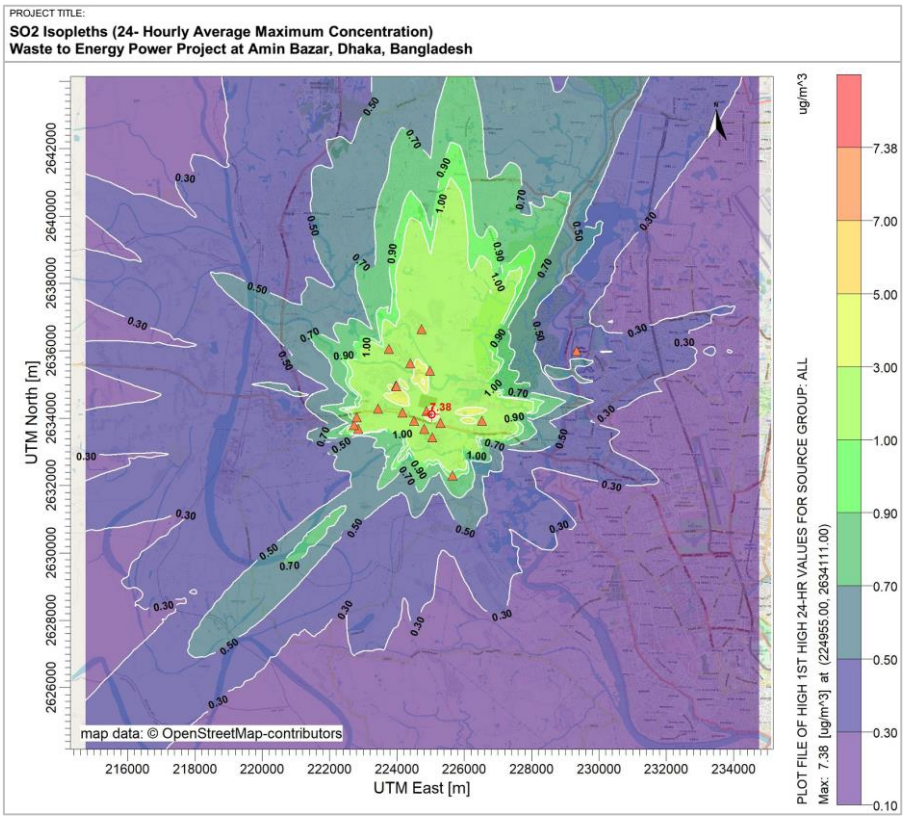
Project Contribution + Background Concentration

Table 6-21 shows that 1-hourly and 24-hourly maximum background SO_2 concentrations are 202.6 µg/m^3 (81.0% of the national standard) and 81.0 µg/m^3 (101.3% of the national standard and 202.5% of WHO guidelines value). The background concentrations show that 24-hourly SO_2 concentration is slightly higher than the national standard. The project contribution including baseline concentration shows that the 1-hourly and annual maximum concentration stands at 290.4 µg/m^3 (116.2% of national standard-APCR) and 88.4 µg/m^3 (110.5% of national standard-APCR and 221.0% of WHO guidelines value). It can be concluded that the only project contribution is significant due to the plant operation. Hence, a health impact assessment needs to be carried out before works commence to provide a baseline for monitoring health impacts and confirm no significant impact on human health.

Figure 6-9: SO_2 Isopleths of Project Contribution



1 Hourly SO_2 Isopleths



24 Hourly SO_2 Isopleths

Sum of Lead and Chromium and other Heavy Metal (Antimony, Copper, Manganese, Vanadium, Tin, Cobalt, Nickel)

Project Contribution (Project Only)

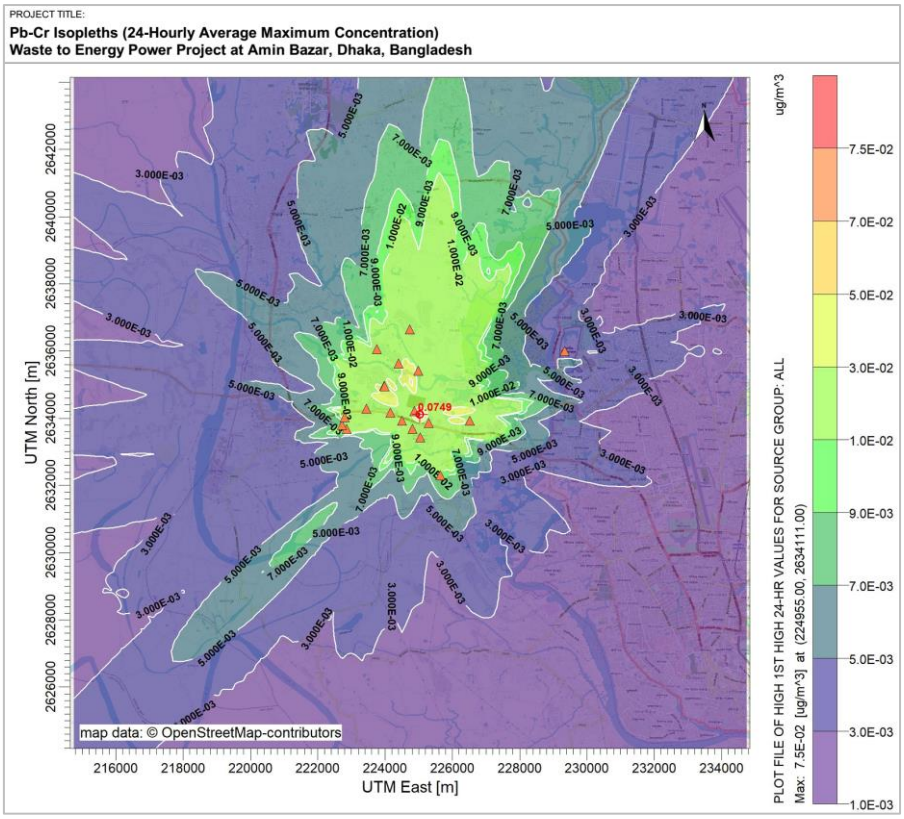
There is no available ambient air quality standard/guideline for the mentioned metal in the national and other internationally. Air Pollution Control Rules of Bangladesh 2022 has only ambient air quality standards for Lead (Pb). Hence, it has been used for comparison with maximum ground-level concentration. **Table 6-21** shows that the 24-hourly predicted maximum sum of Pb and Cr concentration is 0.075 µg /m^3 (15% of national standard) at 76 meters (224955.00 m E 2634111.00 m N) to the west direction from the stack location. The annual predicted maximum sum of Pb and Cr concentration was found as 0.0037 µg /m^3 (1.5% of national standard) at 958 meters (225455.00m E 2634511.00m N) to the north direction of the power plant stack location. It shows that the maximum short-term (24-hr) concentration of Pb & Cr is more than 10% of the national standard. Hence, a health impact assessment needs to be carried out prior to the start of the commencement of project work. The Sum of Pb and Cr Isopleths of project contribution is shown in **Figure 6-6**.

A total of 19 sensitive receptors have been modeled to find the incremental sum of Pb and Cr concentration. The 24-hourly sum of Pb and Cr concentration varies from 0.004-0.041 µg/m^3 (0.74%-8.1% of the national standard-APCR) at the receptor locations whereas the annual sum of Pb and Cr concentration was found between 0.0004-0.007 µg/m^3 (0.16%-2.64% of the national standard-APCR). **Table 6-22** presents that the 24-hourly maximum sum of Pb and Cr has been found at plant area (AQ1) among 19 receptors point as 0.041 µg/m^3 (8.1% of national standard-APCR) whereas annual concentrations found as 0.007 µg/m^3 (2.64% of national standard-APCR) at AQ5 (Beraid lake city, Bongaon, Savar, Dhaka). The project's contribution to the sensitive receptors is well within the national standard.

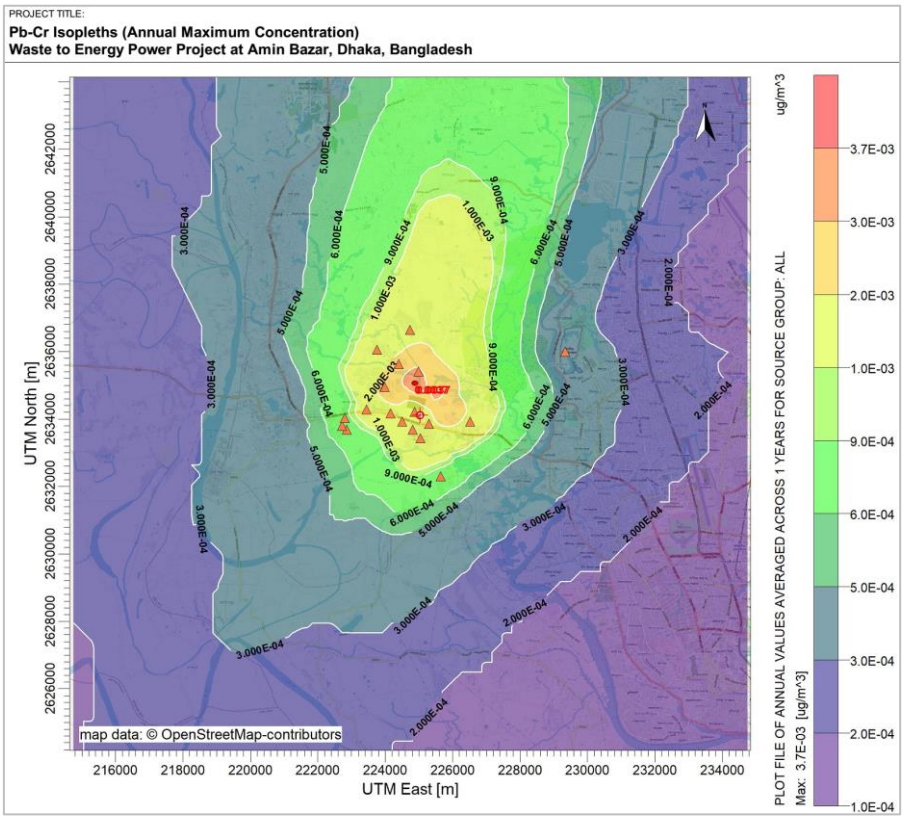
Project Contribution + Background Concentration

There is no background concentration of Pb and Cr in the CASE study. Hence, cumulative assessment (project contribution + background concentration) has not been analyzed for lead.

Figure 6-10: Sum of Pb and Cr Isopleths of Project Contribution



24 Hourly Sum of Pb and Cr Isopleths



Annual Sum of Pb and Cr Isopleths

Hydrogen Chloride (HCL)

Project Contribution (Project Only)

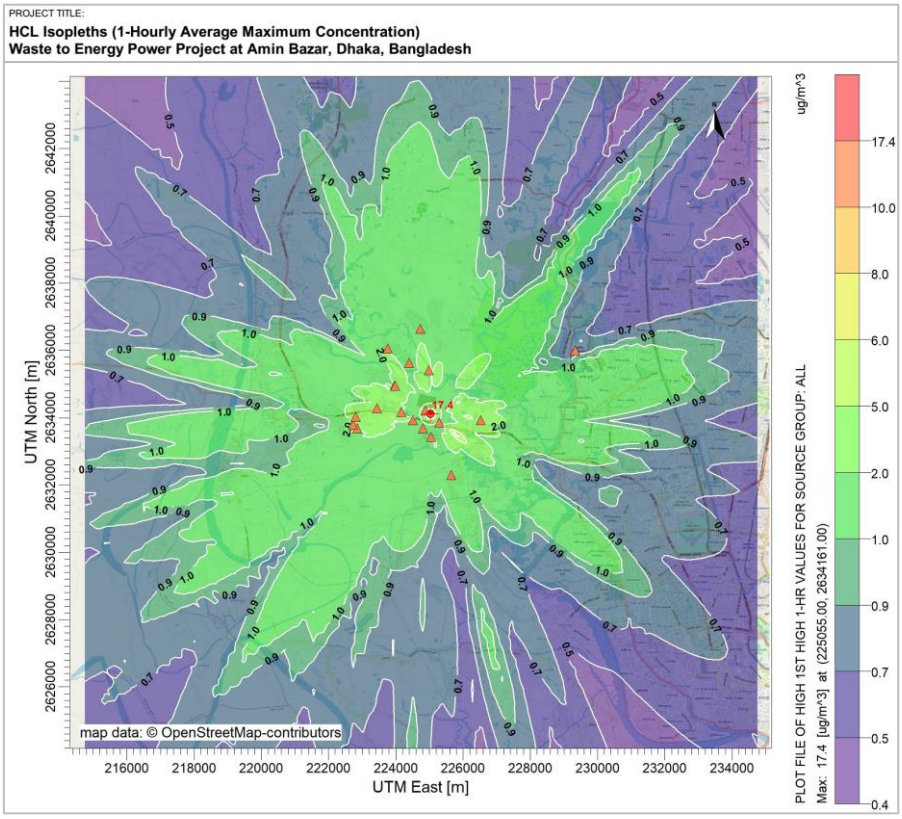
Predicted short-term (1 hour) for controlled hydrogen chloride (HCl) maximum ground level concentrations are 17.4 µg /m^3 located 50.9 m meters N from the Stack location (**Table 6-21**). The 24-hour controlled HCl maximum ground level concentrations are 1.46 µg /m^3 located 76 meters W from the stack location. The annual controlled HCl maximum ground level concentration is 0.071 µg /m^3 located 958 meters N from the stack location. There are no HCl standards in the national air pollution control rules and WHO air quality guideline values. There is only a 1-hourly ambient air quality standard in UK Environmental Agency Environmental Standard which is 750 µg /m^3. The project will contribute 2.3% of the UK Environmental Agency Environmental Standard. According to the IRIS Reference concentration of annual HCl for inhalation exposure is 20 µg /m^3 whereas the US EPA reference concentration is 2100 µg /m^3 for 24 hours. Therefore, the contribution of HCL due to the plant operation has been considered negligible. HCL Isopleths of project contribution is shown in **Figure 6-11**.

Table 6-22 shows that the 1-hourly and 24-hourly HCl concentration varies from 0.84-4.2 µg/m^3 and 0.07-0.79 µg/m^3 at the sensitive receptor locations whereas annual HCl concentration was found between 0.007-0.062 µg/m^3. It can be concluded that the project contribution of HCl to the sensitive receptors is negligible.

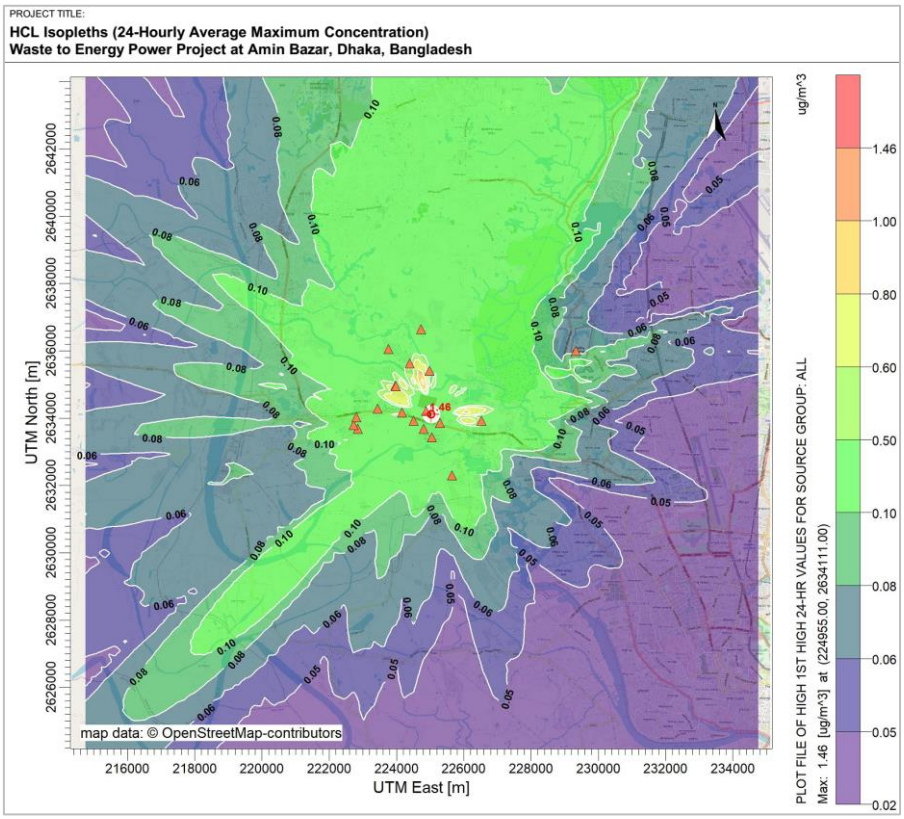
Project Contribution + Background Concentration

There is no background concentration of HCl in the CASE study. Hence, cumulative assessment (project contribution + background concentration) has not been analyzed for HCl.

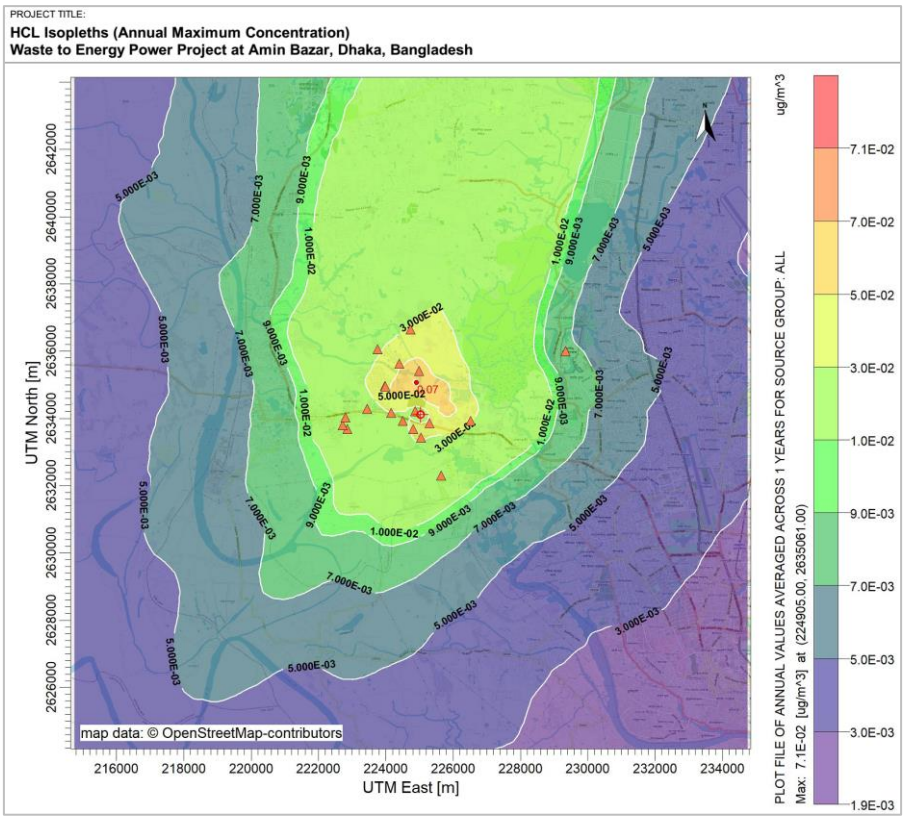
Figure 6-11: HCl Isopleths of Project Contribution



1 Hourly HCl Isopleths



24 Hourly HCl Isopleths



Annual HCl Isopleths

Mercury (Hg)

Project Contribution (Project Only)

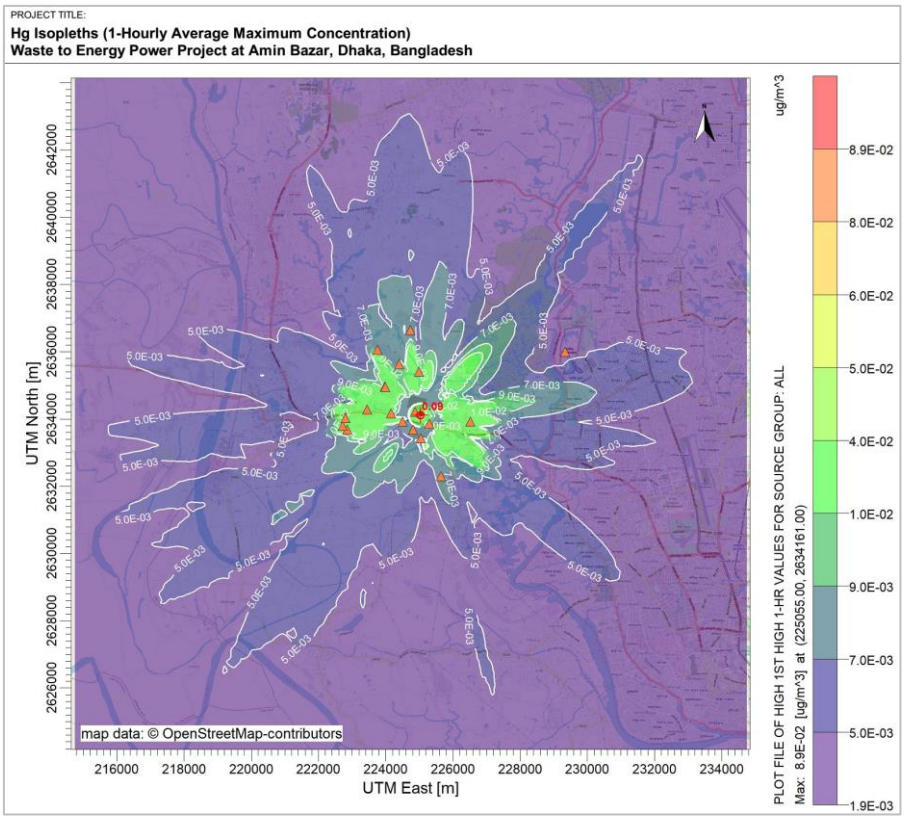
The predicted short-term (1 hour) for controlled mercury (Hg) maximum ground level concentrations are 0.08 µg /m^3 located 50.9 m meters N from the stack location (**Table 6-21**). The 24-hour controlled Hg maximum ground level concentration is 0.0075 µg /m^3 located 76 meters W from the stack location. The annual controlled Hg maximum ground level concentration is 0.00037 µg /m^3 located 958 meters N from the stack location. There are no Hg standards in the national air pollution control rules and WHO air quality guideline values. There are 1-hourly and annual ambient air quality standards in UK Environmental Agency Environmental Standard which are 7.5 µg /m^3 and 0.25 µg /m^3. The project will contribute 1-hourly and annually 1.07% and 0.15% of the UK Environmental Agency Environmental Standards. Therefore, the contribution of Hg to the local airshed due to the plant operation has been considered negligible. Hg Isopleths of project contribution is shown in **Figure 6-12**.

The 1-hourly Hg concentration varies from 0.004-0.02 µg/m^3 (0.06%-0.3% of the UK environmental agency environmental standard) at the receptor locations whereas annual Hg concentration was found between 0.00004-0.0003 µg/m^3 (0.016%-0.13% of the UK environmental agency environmental standard). The project Hg's contribution to the sensitive receptor can be considered negligible. The pollution concentration on sensitive receptors is presented in **Table 6-22**.

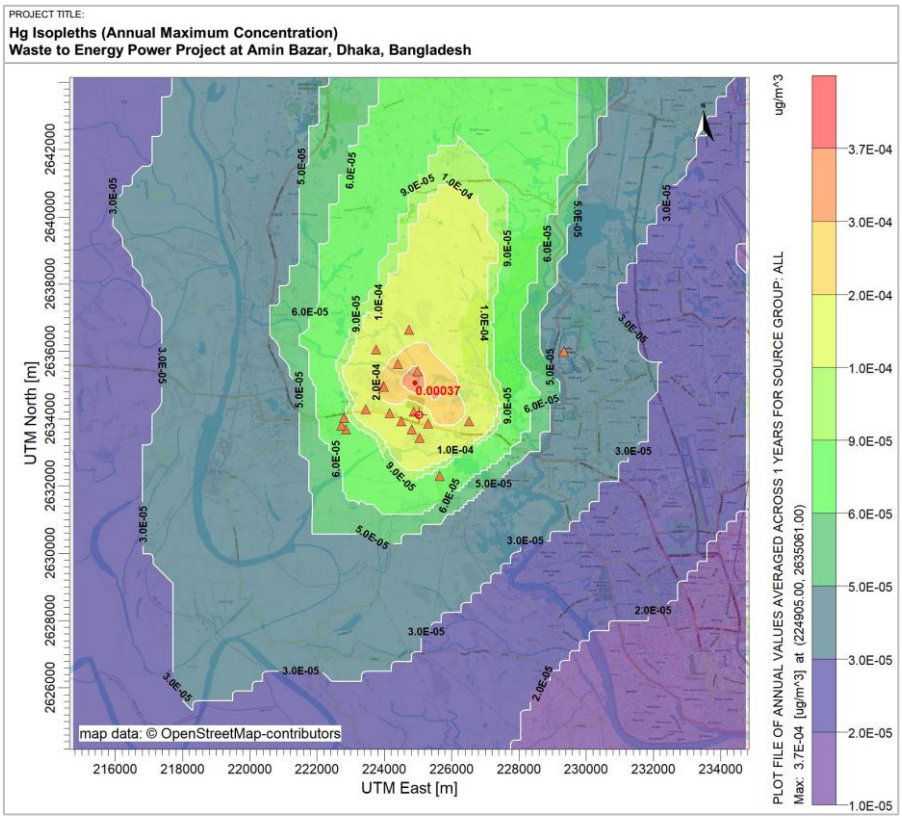
Project Contribution + Background Concentration

There is no background concentration of Hg in the CASE study. Hence, cumulative assessment (project contribution + background concentration) has not been analyzed for Hg.

Figure 6-12: Hg Isopleths of Project Contribution



1 Hourly Hg Isopleths



Annual Hg Isopleths

Hydrogen Fluoride (HF)

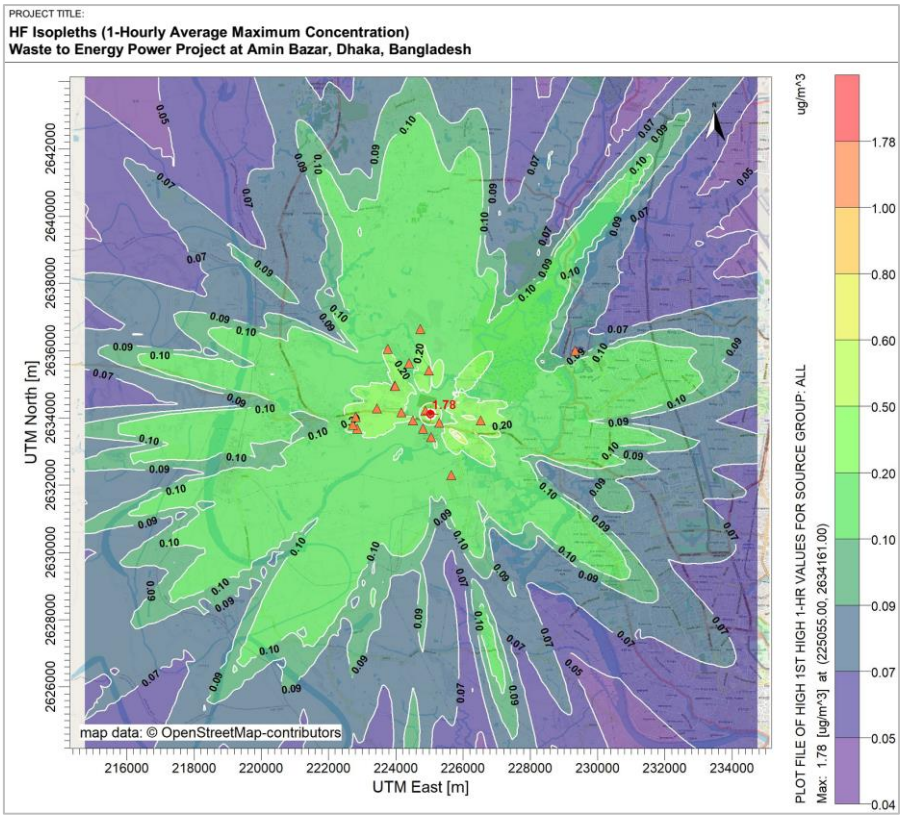
The predicted short-term (1 hour) for controlled hydrogen fluoride (HF) maximum ground level concentrations are 1.78 µg /m^3 located 50.9 m meters N from the stack location (**Table 6-21**). The 24-hour controlled HF maximum ground level concentrations are 0.15 µg /m^3 located 76 meters W from the stack location. The annual controlled HF maximum ground level concentration is 0.0073 µg /m^3 located 958 meters N from the stack location. There are no HF standards in the national air pollution control rules and WHO air quality guideline values. There is only a 1-hourly ambient air quality standard in UK Environmental Agency Environmental Standard which is 160 µg /m^3. The project will contribute 1-hourly 1.1% of the UK Environmental Agency Environmental Standard. Therefore, the contribution of HF to the local airshed due to the plant operation can be assessed as negligible. HF Isopleths of project contribution is shown in **Figure 6-13**.

The pollution concentration on sensitive receptors is presented in **Table 6-22**. It shows that the 1-hourly HF concentration varies from 0.086-0.43 µg/m^3 (0.05%-0.3% of the UK environmental agency environmental standard) at the receptor locations whereas annual HF concentration was found between 0.0008-0.006 µg/m^3. Hence, the project HF contribution to the sensitive receptor can be considered negligible.

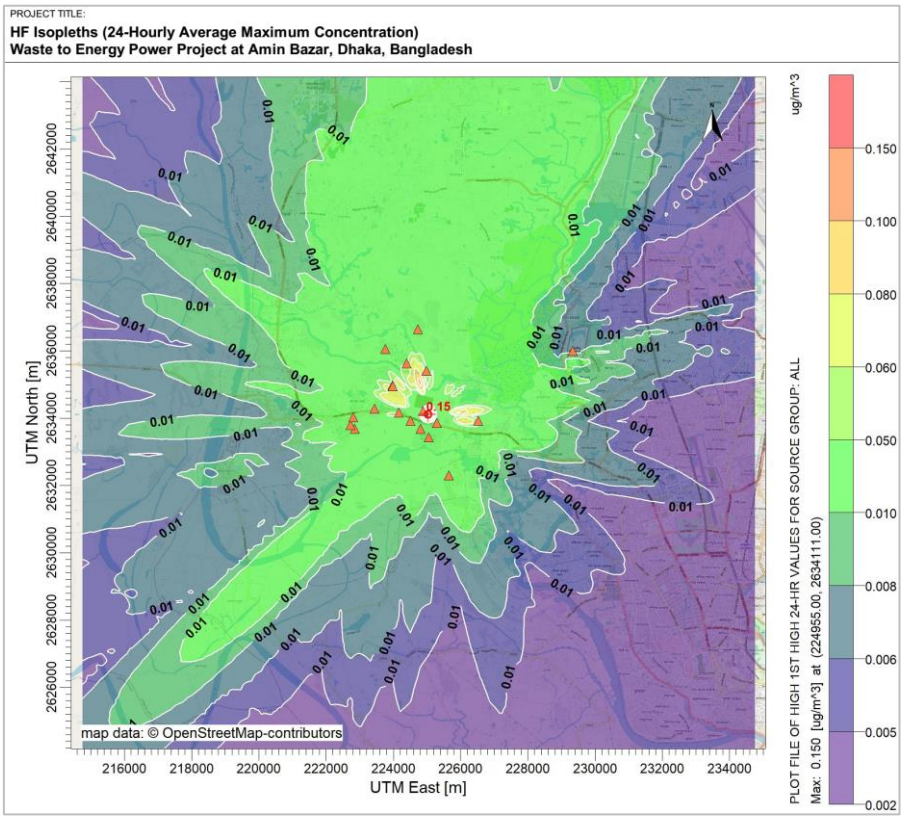
Project Contribution + Background Concentration

There is no background concentration of Hydrogen Fluoride (HF) in the CASE study. Hence, cumulative assessment (project contribution + background concentration) has not been analyzed for HF.

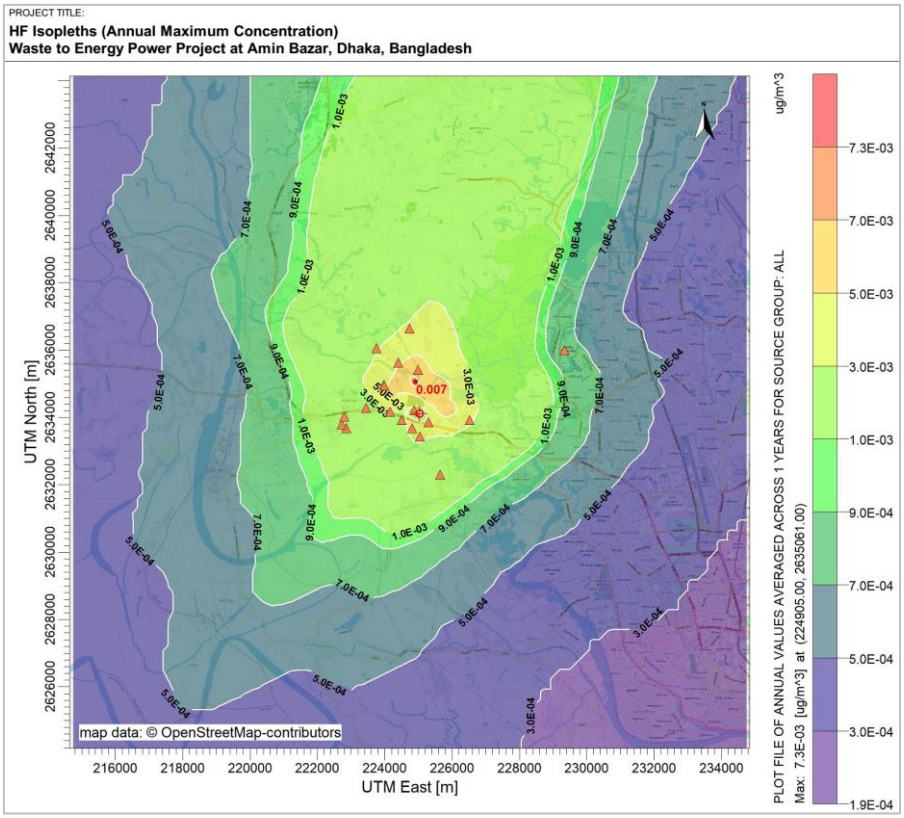
Figure 6-13: HF Isopleths of Project Contribution



1 Hourly HF Isopleths



24 Hourly HF Isopleths



Annual HF Isopleths

Dioxin Furan (DF)

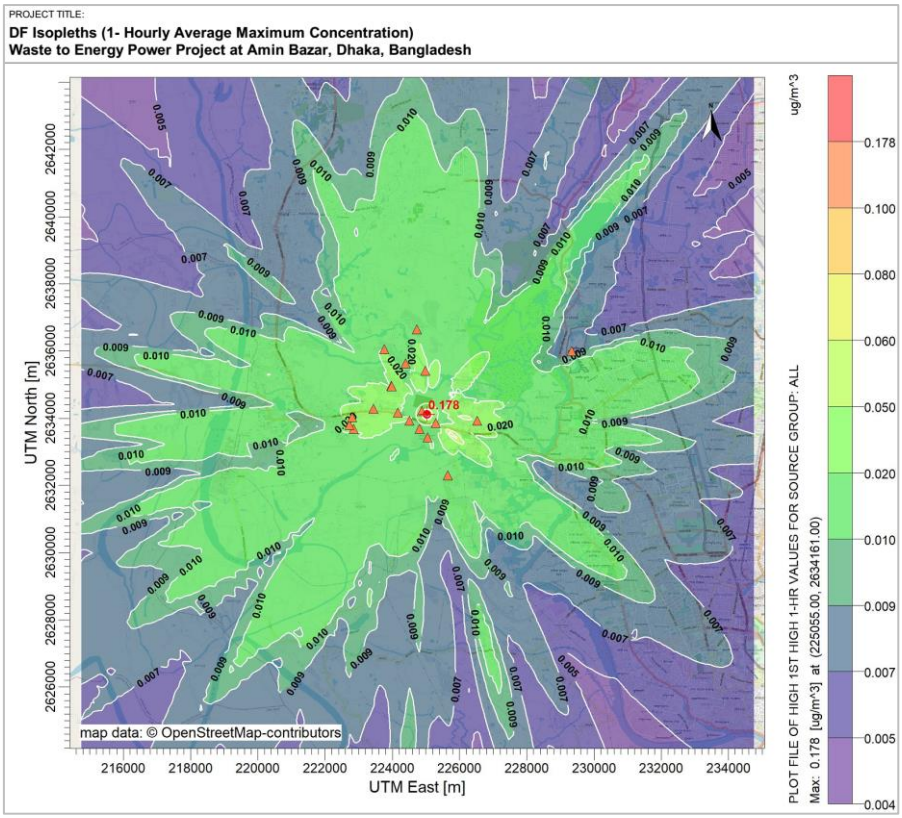
Table 6-21 shows the model result of different pollutants including Dioxin Furan (DF). It shows that the predicted short-term (1 hour) for controlled Dioxin Furan (DF) maximum ground level concentrations are 0.178 µg /m^3 located 50.9 m meters N from the stack location (**Table 6-21**). The 24-hour controlled DF maximum ground level concentrations are 0.015 µg /m^3 located 76 meters W from the stack location. The annual controlled DF maximum ground level concentration is 0.00073 µg /m^3 located 958 meters N from the stack location. There are no DF standards in the national air pollution control rules and WHO air quality guideline values. The contribution of HF to the local airshed due to the plant operation can be considered negligible. DF Isopleths of project contribution is shown in **Figure 6-13**.

The pollution concentration on sensitive receptors is presented in **Table 6-22**. It shows that the 1-hourly DF concentration varies from 0.009-0.043 µg/m^3 at the receptor locations whereas annual DF concentration has been found between 0.00008-0.0006 µg/m^3. Hence, project DF's contribution to the sensitive receptor can be considered negligible.

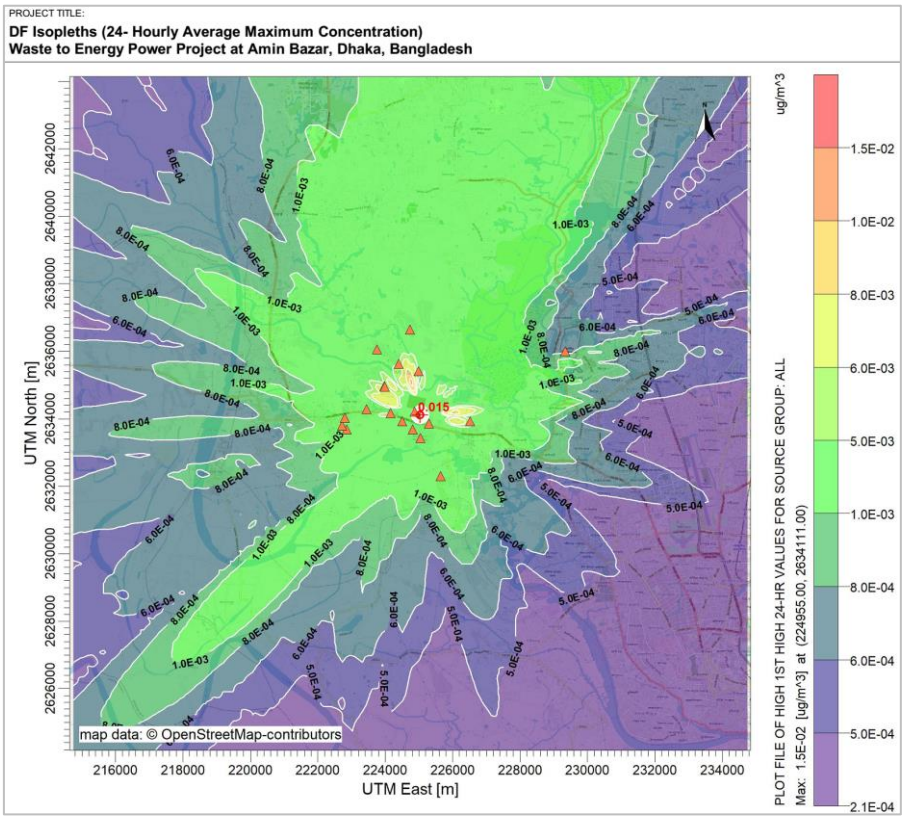
Project Contribution + Background Concentration

There is no background concentration of Dioxin Furan (DF) in the CASE study. Hence, cumulative assessment (project contribution + background concentration) has not been analyzed for DF.

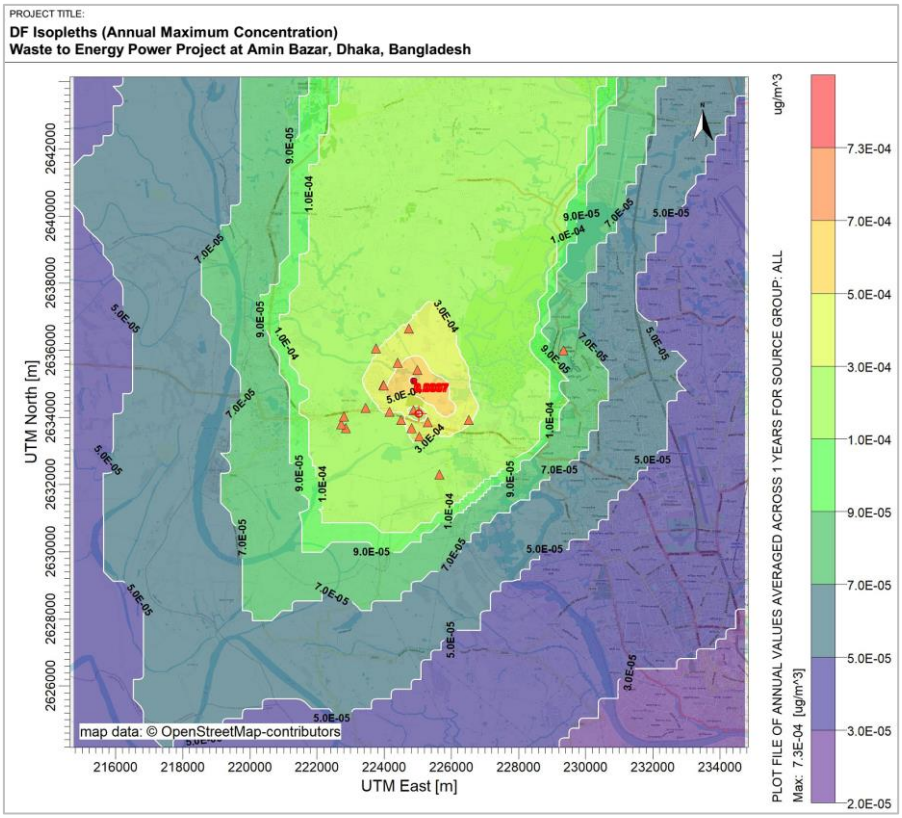
Figure 6-14: DF Isopleths of Project Contribution



1 Hourly DF Isopleths



24 Hourly DF Isopleths



Annual DF Isopleths

Impact	*Ambient Air Quality*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	The maximum impact zone would be confined to 3km from Project Site				
Frequency	Throughout the project lifecycle				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Magnitude	Insignificant	Low	Medium-low	Medium-high	High	Very High
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High

	Significance of impact consider ***Medium-low***

Mitigation Measures

The following mitigation measures should be followed

- The flue gas is to be exhausted at 100m stack height.
- Ensuring the standard of Bangladesh (MoEF) where emissions always should be lower due to nearly presence of any sensitive area.
- The plant equipment must be performance tested during the commissioning phase to ensure standard has been maintained.
- A continuous Emission Monitoring System (CEMS) will be installed to detect the emission of pollutants from the flue gas.
- Automatic monitoring process and presenting on the real-time Web Pages should be implemented
- Ambient air quality monitoring stations are to be installed within the project site to obtain such measurable parameters, while periodic air quality monitoring using high/low volume samplers is to be conducted at other locations.
- Install instruments to record meteorological data such as wind speed, direction, solar radiation, relative humidity, and temperature shall be established so that the operating power plant can record these parameters at regular intervals.
- Regular maintenance and overwhelming as per design specification.
- Regular inspection and maintenance of boiler, pressure parts, Forest Department (FD) and ID fans bag filter and ash separation and handling system, and other ancillaries.
- Particulate Matter emission concentration will be controlled by a bag filter.
- Selective Non-Catalytic Reduction-SNCR (urea water injection in the furnace) will be adopted for nitrogen oxides control and space for Selective Catalytic Reduction (SCR) will be reserved to cope with the possible improvement of denitrification standards in the future since the airshed is already degraded.
- Combination mode of "SNCR (urea water injection in the furnace) + semi-dry method (lime pulp solution) + dry method (Ca (OH)2 dry powder) + activated carbon injection + bag filter + (reserved SCR) will be adopted to control acidic gases (HCl, SO_2 and HF);
- Control the residence time of flue gas in the furnace above 850°C to ensure adequate decomposition of dioxins.
- Maintain the more stringent emission standard of the European Union Pollutant Emission Standard (European Union 2010/75/EU) since the project location airshed already degraded and
- It is highly recommended to conduct a validation run after 1 to 3 months during the operations stage using actual CEMS, stack testing, and ambient air monitoring results.

Measures taken to prevent excessive emission of flue gas components from domestic waste incineration:

- Optimize the incineration process: adjust the combustion conditions, such as temperature, oxygen supply, combustion time, etc., to ensure that the waste is fully burned and reduce the generation of incomplete combustion products.
- Improve equipment performance: Regularly maintain, overhaul and upgrade incinerators, waste heat boilers, flue gas purification equipment, etc. to ensure their normal operation and efficient work.
- Strengthen feed management: reasonably control the feed amount, composition and humidity of garbage to avoid uneven combustion.
- Improve the flue gas purification system: adopt more advanced and efficient flue gas purification technologies, such as increasing the amount of activated carbon injection, optimizing the filtration efficiency of the bag filter, and improving the desulfurization and denitrification device.

- Real-time monitoring and data analysis: Install high-precision online monitoring equipment to monitor flue gas emission indicators in real time, conduct in-depth analysis of monitoring data, find problems in time and take targeted measures.
- Personnel training and operation specifications: Strengthen the training of operators to familiarize them with the incineration process and equipment operation specifications, so as to avoid excessive emissions due to improper operation.
- Establish an emergency response mechanism: Formulate an emergency plan for sudden emissions exceeding the standard, and take timely measures to reduce emissions, such as suspending feeding, adjusting operating parameters, etc.
- Regular environmental protection testing and evaluation: Conduct regular environmental protection testing in accordance with the regulations to evaluate the flue gas emission compliance and provide a basis for improvement measures.

Measures taken for domestic waste incineration flue gas component emissions exceeding the standard:

- Optimize the incineration process: adjust the combustion conditions, such as temperature, oxygen supply, combustion time, etc., to ensure that the waste is fully burned and reduce the generation of incomplete combustion products; Reduces combustion compliance and reduces pollutant emissions.
- Adjust the flue gas purification system: increase the amount of activated carbon injection, increase the frequency of bag filter cleaning, and increase the injection amount of reactants of the desulfurization and denitrification device, so as to reduce the emission of pollutants until the standard is reached.

6.2.3.2 Impacts due to Odor from Waste

The main sources of odors during the operation phase will come from the following sources.

- Odorous gas is produced by waste bunkers.
- Odorous gas is produced in the leachate ditch corridor and asphalt collection tank.
- The Discharging Hall produces odor due to the entry and exit of waste trucks.
- Leachate treatment station deodorization.

The waste requirement is 3,000 t/d whereas the daily wet slag output of this project is estimated at about 500 t/d. The maximum wet slag output can reach 600 t/d. DNCC will transport municipal solid waste from the source to the plant. The estimated odor quantity of leachate treatment station into waste bin of this project is about 15000m^3/h. The estimated amount of odor from leachate trench to waste bin was about 15,000 m^3/h. When the unloading door is opened, the cross-section wind speed is calculated according to 0.6m/s, so the inlet air volume at the unloading door is about 7000m^3/h; The gas production of waste bin fermentation is about 20,000 m3/h. Other air leakage volume is estimated to be about 12000m^3/h according to volume. Therefore, the air volume of the emergency deodorization system in this project is about 132000m^3/h, and a set of activated carbon adsorption deodorization device with processing capacity of 140000m^3/h is set. The source of malodor pollution mainly comes from the original waste entering the plant and the produced leachate. The malodorous gas will be emitted by the waste transport vehicle during the unloading process and the waste heap placed in the waste tank, and the malodorous gas may also be emitted by the leachate in the collection facilities and transmission process.

Malodorous substances in waste (including Stench concentration, Ammonia, Hydrogen sulfide, Methylthiol, Methyl sulfide, Dimethyl sulfide, Trimethylamine, Acetaldehyde, and Styrene) can possess health risks to the workers and staff working during the operation phase. Respiratory problems, nausea, headache, and psychological stress could be the main impacts of waste odor. However, the existing landfill system are producing malodor that affects negatively to the landfill workers, people of nearby villages and those walking or traveling along the highway/roads. Malodor that generates during the operation phase could pose less impacts than the present negative impacts of existing landfill. Once the project is finished, the existing landfill's harmful effects will be lessened. Thus, the overall impact significance without mitigation measures during the operation phase of the power plant will be **Medium-Low**.

Impact	*Odor from Waste*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Within the project site and surrounding area					
Frequency	Limited to Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

Aiming at the source of malodorous pollution in waste tank, the following control measures shall be taken.

- The waste loading ramp shall be capped to control the malodorous diffusion caused by the dissipation of leachate from the waste truck.
- An Air curtain shall be set up at the inlet and outlet of the tipping hall to prevent malodor escape.
- Negative pressure shall be maintained inside the waste tank to prevent the spread of malodor inside the waste tank.
- Aiming at the characteristics that malodor can be decomposed at high temperatures, the gas in the pit is extracted from the upper part of the waste tank by Primary Air (PA) fan and fed into the incinerator after preheating, which is used as a secondary air for combustion.
- In the incinerator and maintenance, in order to ensure the negative pressure in the waste tank, the odor in the waste tank should be pumped out by the deodorizer and fed into the activated carbon adsorption deodorizer. The odor pollutants are adsorbed and filtered by the activated carbon and discharged into the atmosphere after reaching the malodor discharge standard.
- In abnormal operation (when the shutdown state or the negative pressure is not enough), the deodorizing fan of the deodorizing system feeds the odor of the waste tank into the activated carbon deodorizing device located in the deodorizing room for adsorption and filtration and then drains it to the upper air, so as to ensure the air quality in the incineration power plant area.
- The waste leachate collection chamber is composed of a leachate sump, leachate pump room and corridor, and these areas will produce a large amount of odor. Therefore, the air supply and exhaust outlets shall set in the space of the leachate collection room, the air supply fan feeds fresh air, and the exhaust fan introduces the odor generated in this space into the waste tank and burns and decomposes in the Primary Air (PA) fan inhalation incinerator.
- Personal Protective Equipment (PPE) must be worn when working at the bunker, leachate treatment area, or leachate ditch. This shall include appropriate mark, safety shoes, safety eyewear, and hard hats.

In addition, waste-transporting vehicles shall be covered properly. However, with the proper implementation of suggested mitigation measures, the overall impact will be Very Low.

6.2.3.3 Impact on Climate Change

6.2.3.3.1 Climate Change Risk

Climate projections for RCP4.5 and RCP8.5 were assessed to determine potential impacts and consequences to the construction and operation of the project.

Mean temperature, maximum daily temperature, and number of hot days are expected to increase in Dhaka with similar (minute differences/more or less similar) magnitude on average for both Bangladesh as well as Dhaka region under both scenarios. The mean annual temperature in Dhaka is expected to increase by over 0.84° C (2020-2039) and 1.44° C (2040-2059) as per RCP4.5 while it slightly lowers in magnitude during 2020-2039 (0.82° C) but again increases towards the end of the period (2040-2059) as per RCP8.5. However, both the RCP's projected a rise in mean annual temperature as compared to the 1992-2021 baseline.

Regarding the climate-related risks for the plant, within the present report the past trends for temperature, precipitations, and extreme weather events are evaluated at the Project site and the expected changes for the future decades, up to 2059, are considered. The analysis of the observed historical weather data and the climate projections indicate that the changes in the climate pattern in the area under consideration are significant and in line with the average trends for Bangladesh.

Therefore, as concerns physical risks, it has been found that in the long-term the Project may be affected by the expected increase in average annual temperatures as well as by the increase in the number and intensity of extreme events (all events with moderate-low risk factor) and by an increase of precipitations. However, the detail climate risk assessment report is given in **Appendix J**.

6.2.3.3.2 Green House Gas Emissions

The operation of the WTE Plant will be a potential source of greenhouse gas emissions due to the inherent combustion processes involved in plant operations. This GHG emission poses a potential impact on endangered species and habitats. However, compared with the current practice of landfilling solid wastes in the project site, the incineration process will greatly reduce the volume of the waste (in the form of residual ash) that need to be disposed of in sanitary landfills. Therefore, the production of greenhouse gases due to landfill will be reduced. The WTE plant will generate electricity for industries and households, replacing their dependence on fossil fuel use for power generation. As per the given report by WTE Power Plant North Dhaka Private Limited, the annual average carbon emission reduction during the period is 361,700 tons of CO_2, which is equivalent to 0.332 t CO_2 of carbon emission reduction per ton of waste. The detail GHG report has been given in **Appendix K**.

However, the Project is required to report annual GHG emissions. Considering this fact, the GHG emission impact will be Low.

Impact	*Impact on climate due to greenhouse gas emissions*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Impact zone will be regional/national				
Frequency	Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	

Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation Measures

The following mitigation measures will minimize GHG emissions to ALARP (as low as reasonably practicable) level:

- The project proponent have to utilized high-efficiency combustion systems to ensure complete burning of waste, reducing carbon dioxide and other emissions.
- Pre-treat waste to remove recyclable and hazardous materials, reducing the volume and toxicity of incinerated waste.
- Monitoring and recording of CO_2 emissions from the stacks
- Ensure that all equipment and machinery are maintained in accordance with the manufacturer's specifications; and
- Improved efficiency of auxiliary drives.

After the incineration method is adopted for the treatment of urban domestic waste in this project, the decomposition and release of CH4 during the stacking process of this part of waste in the landfill site are avoided; The project uses the superheated steam generated by the waste incineration boiler to generate electricity for the steam turbine generator unit, which can replace the equivalent electricity of the main coal-fired power plants, thus avoiding the greenhouse gas emissions caused by the corresponding electricity generated by thermal power generation, and achieving greenhouse gas emission reduction.

6.2.3.4 Impact on Noise Quality

Significant sources of noise during the operation of the power plant will be:

- Operations of the turbine, blower, cranes, bucket elevator, and conveyor belt.
- Boiler, air compressor, pumps
- Cooling tower

The noise level of main noise source is shown in Table 6-23.

Table 6-23: Level of main noise sources in Waste to Energy

Noise sources	Equipment source strength [dB (A)]	Dissemination Modalities	Noise sources	Equipment source strength [dB (A)]	Dissemination Modalities
Boiler air exhaust	≤120	Instantaneous	Distribution equipment	~60	Continuous
Turbine generator set	≤100	Continuous	Mechanical ventilation cooling tower	~85	
Fan	~92		Circulating water pump	~90	
Air blower	~97		Garbage transport vehicles	88～90	Intermittent

Noise sources	Equipment source strength [dB (A)]	Dissemination Modalities	Noise sources	Equipment source strength [dB (A)]	Dissemination Modalities
Air compressor	95～105				

Source: Feasibility report

Noise Level Guidelines

Ministry of Environment, Forest, and Climate Change, Bangladesh has set the standard for noise levels for different areas of use. Noise standard as per Bangladesh Noise Pollution (Control) Act, 2006 is presented in Table 6-24.

Table 6-24: Bangladesh Noise Level Guidelines

Receptor	Limit in dB(A) Leq	
	Daytime 06:00 – 21:00	Night-time 21:00 – 06:00
Silent	50	40
Residential	55	45
Mixed	60	50
Commercial	70	60
Industrial	75	70

Source: Noise Pollution (Control) Rules, 2006

International Finance Corporation (IFC) has also set EHS guidelines for ambient noise levels. EHS noise guidelines of IFC are given in Table 6-25.

Table 6-25: IFC Noise Level Guidelines [38]

Receptor	One Hour Leq in dB(A)	
	Daytime 07:00 – 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational [39]	55	45
Industrial; commercial	70	70

Prediction of Impacts

Methodology:

The environmental noise prediction model Sound PLAN 8.2 was used for modeling noise emissions from the plant operation. This assessment is attentive to evaluating the noise contributions from the operational phase of the plant to the sensitive receptors in the adjoining area. The major noise sources are machinery in the production and processing unit, Compressors, Turbines, Boiler exhaust, pumps, etc.

Noise escape from the turbine hall is 70 dB(A). Noise generated in pumps is 85 dB(A). The noise from the air compressor is 90 dB(A). Noise generated from primary or secondary ID fans is 85 dB(A). Noise from the cooling

[38] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.

[39] For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999).

tower fan is 85 dB(A). The Boundary brick wall height is 2.2 m. We have assumed cooling tower fan speed is decreased by 20% during nighttime and that noise generation from the fan will be decreased by 5 dB(A). The operation of equipment with a 100% usage scenario was modeled to cover the operation phase of the Project. As a conservative approach to the assessment, atmospheric absorption during sound transmission was not included in the assessment. In addition, to represent a worst-case scenario for the assessment, all equipment was assumed to operate simultaneously. To assess the impact on noise reflection/ barrier due to the structures, buildings within the power plant have been considered. The model has been run to predict the day and nighttime noise levels around the power plant during its operation of the power plant.

Noise contour map

Based on the noise propagation from the power plant noise contour map has been prepared using the modeling tool. The power plant's day and nighttime noise contour maps are shown in Figure 6-15 and Figure 6-16, respectively. The predicted noise level in the receptors point during the operation of the power plant is shown in Table 6-26.

Figure 6-15: Noise contour map for WTE Power Plant North Dhaka Private Limited Waste to Energy Power Plant during the day (Leq day)

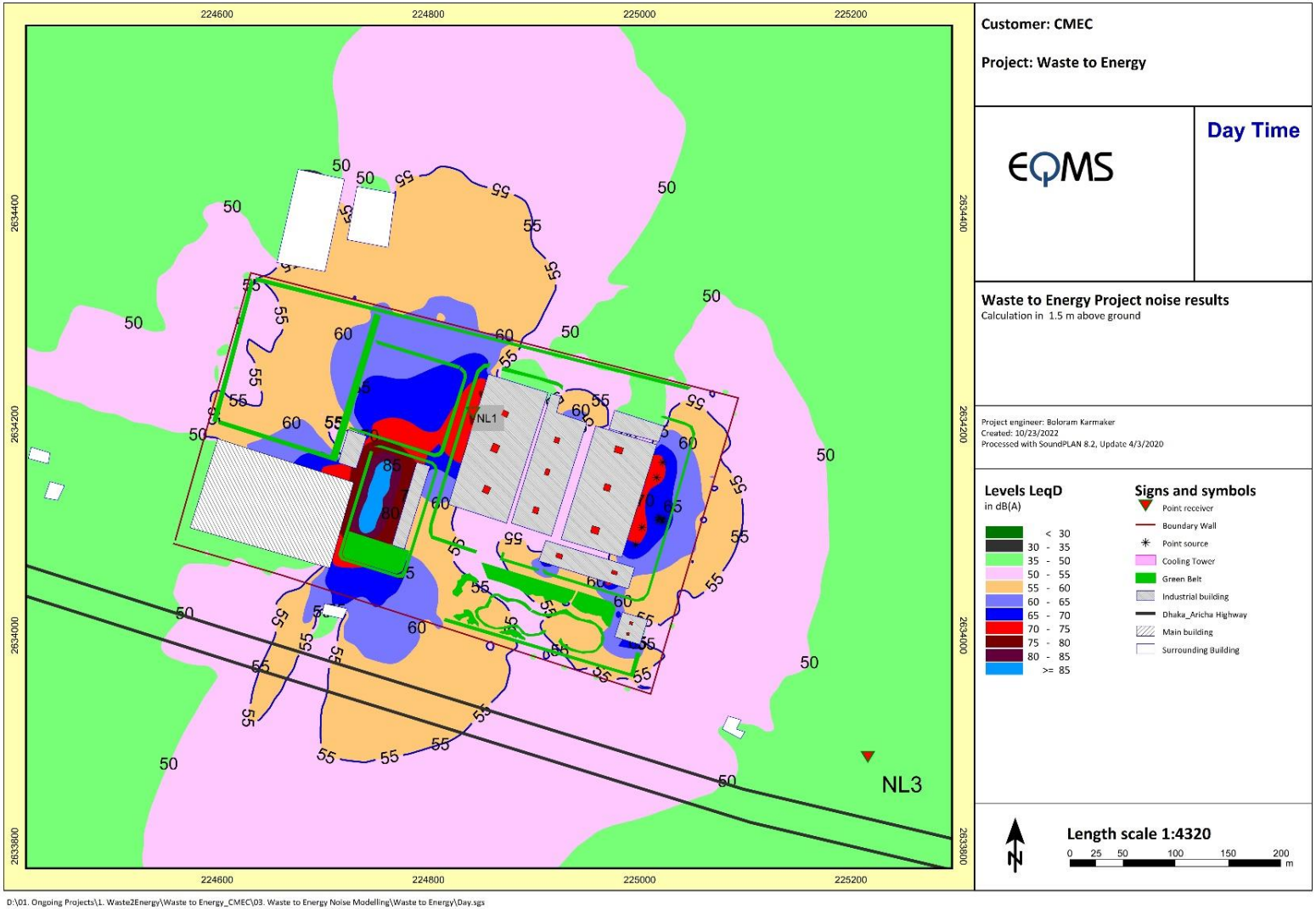


Figure 6-16: Noise contour map for WTE Power Plant North Dhaka Private Limited Waste to Energy Power Plant during the night (Leq Night)

Table 6-26: Predicted Noise Levels at Receptors during operation of Waste to Energy power plant operation

Receptor	Category of Area/Receptor	Distance from plant center point	Baseline Sound Pressure Levels at Receptors, Leq (dBA)[1]		Noise Contribution from Power Plant at Receptors, Leq (dBA)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA)		Applicable Standard, dB(A) [2] as per Land use		IFC EHS Guideline (2007)3	
			Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn
NL1	Project Area	70	66.8	57.5	74.3	73.8	75.0	73.9	75	70	70	70
NL2	Residential	472	54.8	43.1	48.9	43.8	55.8	46.5	55	45	55	45
NL3	Mixed	466	67.3	64.6	47.9	46	67.3	64.7	60	50	70	70
NL4	Mixed	1047	76.9	72.8	43	36.8	76.9	72.8	60	50	70	70
NL5	Residential	988	55.1	43.2	43	37.5	55.4	44.2	55	45	55	45
NL6	Silent	1160	51.5	43.2	40.3	35.2	51.8	43.8	50	40	55	45

1) Ambient noise levels as monitored during the baseline survey
2) Noise Pollution (Control) Rules, 2006
3) Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999

Impact Significance

Since power generating auxiliary equipment's, and traffic would generate considerable noise throughout the project lifecycle, noise generated during the operational phase may be significant; however, with adequate additional management/mitigation measures, the impact of noise on the environment can be minimized.

Noise Impact within the Project Site

The predicted noise level at NL1 is 75.0 and 73.9 dB(A) for day and nighttime respectively which exceeded the IFC permissible limit. As the point is very close to the main power plant noise level will be higher. During operation phase, the maximum expected noise level from turbine generator set and Boiler air exhaust will be ≤100 dB(A) to ≤120 dB(A) and other sources could be ~60 to 90 dB(A) from on any specific source point within plant premises. The noise dissemination modalities are some Continuous and instantaneous. The sound pressure levels generated by various noise sources decrease with increasing distance mainly due to wave divergence. About 280 persons will be engaged during operation phase. Staff and workers who will be working proximity to the several high noise generating facilities could affect in hearing, productivity and other could create other sickness.

Thus, the overall impact significance without mitigation measures during the operation phase of the power plant will be Medium-Low.

Impact	*Impact on ambient noise level due to operation of the power plant*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Noise Impact within the Project Site				
Frequency	Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures due to Noise within the Project Site

- Use of PPEs like ear mufflers, earplugs etc. by the workers working in high noise zone.
- Equipment shall be selected with low noise as far as possible.
- The high-noise equipment, such as air compressors, machine repair equipment and incineration system in the general layout, is centrally arranged in the incineration power plant room.
- For equipment with the higher noise level, such as fan, sound insulation, sound elimination and vibration reduction under different circumstances shall be adopted

- Comprehensive control measures shall be adopted such as low noise equipment and sound absorption, for example, PA and SA fan and ID fan set up mufflers and vibration damping devices to make the noise in the workplace and environment reach the standard.
- Where it is still difficult to reach the control standard for the workplace after treatment, such as the place where Turbine Hall and other equipment are continuously operated, the measures for setting sound insulation Control Room shall be taken.
- The flexible connection measures shall be taken for the pipeline that may generate noise, especially the pipeline connected with the pump and fan outlet, so as to control the vibration noise.
- Noise attenuation provisions such as air intake silencers and acoustic insulation around noisy equipment shall be installed
- Buildings shall be designed with improved acoustic performance, and sound insulation shall be provided.
- The diesel generator unit shall be arranged in outdoor box, and attention shall be paid to sound insulation and noise reduction.
- Periodic monitoring shall be ensured of work-zone during the operation phase.

With implementation of the precautionary and the additional mitigation measures mentioned above, impacts due to noise generation from project during operational period would be much lesser.

Noise impact to the outside of Project Boundary

The predicted noise level at NL2 was found little higher than the residential area's noise permissible limit as the surrounding environment of the receptors is not considered. However, the incremental noise is below 3 dB(A), which complies IFC noise level guideline[40].

NL3 is located beside the Dhaka-Aricha highway, therefore, the baseline noise is exceeded, and the project operation will increase the baseline noise by 0.1 dBA in the nighttime.

The model depicts that the baseline noise at NL4 will remain the same for daytime and 0.1 dB(A) increase in nighttime during the operation of the power plant.

Baseline noise during daytime at NL5 has already exceeded 0.1 dB(A). Which will be further increased by 0.3 dB(A) during the operation of the power plant.

Baseline noise at NL6 has slightly exceeded the permissible limit and during the operation period, it will be increased by 0.3 and 0.6 dB(A) in day and nighttime, respectively. The noise level in the boundary of the power plant will vary from 55 to 60 dB(A) which is well below the IFC industrial permissible limit of 70 dB(A). Therefore, community health and safety may be impacted during operation phase due to noise generation. Thus, the overall impact significance without mitigation measures during the operation phase of the power plant will be **Medium-Low**.

Impact	*Impact on ambient noise level due to operation of the power plant*				
Impact Nature	Direct	Indirect		Induced	
Impact Scale	Outside of the project boundary				
Frequency	Operational phase				
Extent and location	Project Site	Local	Regional	National	Transboundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Insignificant	Low	Medium	High	Very High

[40] IFC Environmental, Health and Safety (EHS) General Guidelines (2007)

Potential for irreplaceable loss of resources	Low		Medium		High	
Magnitude	Insignificant	Low	Medium-low	Medium-high	High	Very High
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very low	Low	Medium-Low	Medium-high	High	Very High
	Significance of impact is considered Medium-Low					

Mitigation Measures for outside of the project boundary

The noise level in the proposed power plant can be controlled to a tolerable limit by implementing the following mitigation measures:

- Green belt shall be developed around and inside the power plant
- Unnecessary use of alarms, horns, and sirens shall be avoided
- Periodic monitoring of ambient noise shall be performed

The impact due to noise generation will have medium intensity with locally extent for a long duration which will result in an overall medium-low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be low. As per the monitored baseline noise and predicted noise level for operation phase, with implementation of proper mitigation measures, noise impact will be low.

6.2.3.5 Impact on Water Resources

6.2.3.5.1 Water Abstraction from Surface Water

The Karnatali River is located approximately 600 m north side from the proposed plant site which has considered as the water source of this project. The project developer has already taken the NOC from WARPO and Local Union Chairman for surface water and ground water intake. The water inlet and pump house of this project is placed on the riverbank. As per Water Resources Investigation, 2022, during dry period, the monthly average flow of the Karnatali River varied from 1.2 to 6.0 m^3/s from December to April. The average flow is minimum from February to March (1.2 m^3/s) which is not the minimum ecological flow. The average flow rises rapidly and reaches its peak during August (274.7 m^3/s). The rest of the month from May to November, the average monthly water flow increases (range 16.4 m^3/s to 274.7 m^3/s) gradually which can serve water requirement for the proposed project. During the monsoon season water flow has been found to be minimum 59,040 m^3/hr (May) and in the dry season flow rates have been found to be minimum 4,320 m^3/hr (February and March), which meets the requirement of both environmental and industrial water usage of the study area. The total amount of water that will be needed to uptake from surface water will be 349.5 m^3/h. Based on the water demand of the Waste-to-Energy (WtE) project, Only 8% of the total river flow (4,320 m^3/hr), will be abstracted from surface water sources during the worst months of the dry season (February and March).The withdrawal rate (349.5 m^3/hr) designed for the proposed project is minimum (8%) considering the availability in the river which will meet industrial demand during the dry season. The Karnatali River is not a main or significant river. This River links to two big rivers named Dhaleshwari and Turag Rivers, which help sustain its normal water flow. After consulting with local residents and fisheries officer, it was determined that the Karnatali River is not ecologically rich, and no important or threatened species have been identified within it. Recently, Sugarmouth catfish have been found in abundance in the Karnataka River. These fish species are 'polluted' as they compete with native fish and alter the aquatic food web

by indiscriminately eating phytoplankton and zooplankton. The local people are not dependent on this waterbody for domestic purpose. The extraction of surface water from this river will not impact ecological species, local communities and or any other stakeholders. The filtration or water purification system should be designed to handle low-quality water. Detailed Design Description for Raw Water Pretreatment in Bangladesh Waste-to-Energy Project has been given in section 2.13.9. During the dry season (January to March), when water flow decreases and quality deteriorates, or in the event of damage to the water intake pipeline, groundwater will be used as an emergency water source to meet the day-to-day operation of industrial water needs of the project site.

Month	Average Flow (m^3/s)	Average Flow (m^3/hr)	Water Withdrawal Percentage (%)
January	2.2	7920	4.41
February	1.2	4320	8.09
March	1.2	4320	8.09
April	3.4	12240	2.86
May	16.4	59040	0.59
June	81.2	292320	0.12
July	233.2	839520	0.04
August	274.7	988920	0.04
September	264.4	951840	0.04
October	138	496800	0.07
November	28.3	101880	0.34
December	6	21600	1.62

According to the Water Resources Investigation report from 2022, the abstraction of water from Karnatali River without proper mitigation measures may have surface water impacts. This could disrupt the natural balance of river ecosystems, negatively affecting fish populations and other aquatic organisms. Additionally, surface water abstraction could worsen water temperature fluctuations and increase the concentration of pollutants due to reduced dilution capacity. These changes can degrade water quality, decrease biodiversity, and impair ecosystem functions.

To avoid using groundwater, the plant's filtration unit has been designed to accept low-quality water. However, sustainable management of water resources for the WtE project in the study area requires a water purification system that can handle low-quality water, enhanced storage capacity of the river, continuous monitoring of water quality and flow rates, water depth, and adaptive and conservation measures. The plan is to use river water as the primary source of industrial water for the project, with groundwater reserved as a backup source for emergency use only.

Potential impacts are expected to be long-term and localized in nature. The potential impact on surface water is **Medium-High**.

Impact	*Surface Water Abstraction*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Karnatali River and Surrounding area of the Project Location				
Frequency	Throughout the Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium		High

Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-high***					

Mitigation Measures

The following measure will be implemented to mitigate water consumption:

- Records will be maintained to monitor the quantity of water being used.
- Efforts shall be made to ensure that the reuse of processed water is carried out to reduce the net water requirement.
- The Water will not be used for other purposes except the approved case i.e. plant's operations, daily uses for the employees etc.
- The wastewater emanating from cleaning operations shall be recycled for plantation and greenbelt development around the project.
- Advanced water recycling and reuse systems should be implemented to minimize surface water intake.
- Installing efficient cooling technologies like closed-loop cooling systems to reduce water consumption.
- Conducting regular monitoring of water quality and quantity to ensure compliance with regulations and minimize environmental impact.
- The filtration plant or water purification system should be designed in such a way that it can accept low-quality water.
- To reduce the pressure on Karnatali River, it is strongly encouraged to identify the alternative source of Surface Water and to use it in different purposes.
- The project developer will not change the natural flow of the river.
- In case of any adverse impact on the nearby community due to surface water abstraction by the company, immediate mitigation measures and compensation must be ensured.
- If there is any negative impact to surrounding local caused by plant's water usage, the proponent will make reasonable countermeasures to reduce the impact, such as help locals to dig a new well, providing drinking water in dry season.
- There should be adequate green space with vegetation around the plant area.
- Extensive awareness needs to be built regarding water use and impact on the employees of the company and the nearby community of project area.
- The WARPO permit would be valid for 2 (two) years from the date of issue and will require renewal before 30 days of the end period.

Effective management strategies, such as sustainable abstraction practices, flow regulation, and environmental monitoring, are essential to mitigate these surface water impacts and ensure the ecological integrity and sustainability of river systems. The impact due to water abstraction from Karnatali River will have high intensity with locally extent for a long duration which will result in an overall medium-high impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be low.

6.2.3.5.2 Water Abstraction from Ground Water

The total amount of water that will be needed to uptake will be 349.5 m^3/h. The consumption of water mainly comes from the consumption of domestic water, water purification, evaporation loss of cooling towers, windage loss, boiler, ash wetting water, leachate treatment station, Flushing water, etc.

According to BBS data, Bonogaon Union covers 4,460 acres. It has a population of 33,627 people living in 7,742 households. Most residents, about 92.5%, use tube-wells for drinking water. A smaller group,

5.8%, uses multiple sources. Only 1.7% of the population uses tap water. These figures show that most people in Bonogaon rely on tube-wells for their drinking water. A small portion of the population uses a mix of sources. As per Banagong union web data (accessed on 15/07/24), approximately 4500 Tube-well has been counted in Bonogaon union.

Union	Area in Acres	Total Households	Population	Source of Drinking Water		
				Tap	Tube-well	Multiple source
Bonogaon	4460	7742	33627	1.7	92.5	5.8

Source: Bangladesh Bureau of Statistics (BBS), Dhaka District Statistics 2011

Based on the available lithologic information (Water Resources Investigation, 2022), groundwater in the study area is available from a single aquifer unit from a shallow depth (6-17m) in most of the places. As discussed with the local community, the groundwater depth ranges approximately from 200 to 220 ft but can reach 300 ft during peak summer and 50 ft during peak monsoon, and they are not facing any water scarcity so far where the drinking water quality is safe and free from Arsenic, Iron and Fluoride.

The primary industrial water source of the Project will be surface water. However, groundwater will serve as an emergency water source for industrial water purposes within the project site. From January to March, surface water withdrawal percentage comparatively high compared to other months (4.41%-8.09%), during the dry season (January to March), when water flow decreases and quality deteriorates, or in the event of damage to the water intake pipeline, groundwater will be used as an emergency water source to meet the day to day operation of industrial water needs of the project site.

This project will adopt 3 Deep tube wells for the abstraction of groundwater as well only for emergency purpose. The total depth of the ground water well is 260m. Each well is designed with a capacity of 190 m^3/h. The groundwater borewell station (ID: GT 2608001) was located near the study area (referred to previous water resources investigation by CEGIS, March 2022). Based on the borewell data study, groundwater levels have been found to be a decline trend. Groundwater levels have declined up to 7m from the base year 2013 to 2020. From the isotopic analysis of the groundwater flow within the study area, it has been found that the study area groundwater is connected to base flow the Dhaleshwary river located around 14km upstream from WtE project area and the project area groundwater have been recharging from that flow. Annual groundwater recharge has been found 250-300mm/year which is not sufficient for any heavy industry abstraction-recharge ratio, thus imply on the groundwater impacts on the nearby societal and environmental demands.

Due to abstraction of groundwater, the ground aquifer will decline. Therefore, the local villagers will not get the water during the dry season which may create social conflict. To reduce the pressure on ground water, it is strongly recommended to identify the alternative source of Surface Water and to use it in different purposes. A monitoring well must be installed at the project site to continuously measure the groundwater level. In case of any adverse impact on the nearby community due to groundwater abstraction by the WTE plant, immediate mitigation measures and compensation must be ensured. The Project developer has engaged CEGIS, a local consultancy firm, to conduct further investigation into groundwater aquifer monitoring. However, CEGIS anticipates that it will take 3-4 months to provide additional information. This report will focus on the availability of water resources and the potential impacts of abstraction, use, and discharge on the project area and its surroundings, considering both shallow and deep aquifers in accordance with WARPO requirements.

Moreover, due to proposed hard-standing areas (lay down areas, building foundations, compacted gravel roads), and compacted soil (rows between arrays) covering large parts of the site, the recharge to groundwater from rainfall is expected to be reduced on the site. Considering the abovementioned fact, the groundwater availability during the operation fact assessed as Medium-High.

Impact	*Ground Water Abstraction*

Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project site and Surrounding area					
Frequency	Throughout the Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-high***					

Mitigation Measures

The following measure will be implemented to mitigate water consumption:

- The Water will not be used for other purposes except the approved case i.e. plant's operation, daily uses for the employees etc.
- The wastewater emanating from cleaning operations shall be recycled for plantation and greenbelt development around the project.
- Advanced water recycling and reuse systems should be implemented to minimize ground water intake.
- A rainwater harvesting system has been recommended in the plant and the harvested water can be used for different purposes.
- Installing efficient cooling technologies like closed-loop cooling systems to reduce water consumption.
- Conducting regular monitoring of water quality and quantity to ensure compliance with regulations and minimize environmental impact.
- To reduce the pressure on ground water, it is strongly recommended to identify the alternative source of Surface Water and to use it in different purposes.
- A standalone study will be conducted on "water resources availability and impact due to abstraction, use and discharge to the project area and surroundings considering the shallow and deep aquifer.
- A monitoring well must be installed at the project site to continuously measure the groundwater level.
- The proponent will ensure continuous monitoring arrangements for groundwater aquifers to assess the impacts on groundwater levels as per Environmental & Social Monitoring Plan in Table 10-6.
- In case of any adverse impact on the nearby community due to groundwater abstraction by the company, immediate mitigation measures and compensation must be ensured.
- If there is any negative impact to surrounding local caused by plant's water usage, the proponent will make reasonable countermeasures to reduce the impact, such as help locals to dig a new well, providing drinking water in dry season.

- There should be adequate green space with vegetation around the plant area. It is recommended to build a water reservoir for recharge to Groundwater. However, it is strictly prohibited to inject contaminated water or wastewater into the underground aquifer.
- The Company have to arrange the Training Programme regarding 'Water Governance and Compliance Monitoring' from time to time for their employees.
- Extensive awareness needs to be built regarding water use and its impact on the employees of the company and the nearby community of project area.
- The Depth of Deep Tube well, Diameter of Pipe, Horsepower (HP) of Pump cannot be changed without permission of WARPO Authority.
- The Distance between the two Deep Tube wells should be followed as per national regulations.
- It is suggested the design of plant should comply with the requirement in WAPRO
- The WARPO permit would be valid for 2 (two) years from the date of issue and will require renewal before 30 days of the end period.

The impact due to water abstraction from groundwater will have high intensity with locally extent for a long duration which will result in an overall medium-high impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be Low.

6.2.3.5.3 Surface and Ground Water Contamination

During the operation of the project, sources of water pollution include:

- Waste or scattered oil on the roads in the project area of the means of transportation of garbage to the plant.
- Industrial and Domestic Wastewater
- Waste leachate

The surface water body in the study area may be affected by runoff from areas of storage of leachate, blow-down water from the cooling tower & boiler, effluent from the ash quenching area, or flow of untreated sewage.

The sources of liquid effluent generation in the plant include:

- The leachate treatment system is engineered to handle up to 1,500 tons per day during peak rainfall periods, with a storage tank volume of 12,000 m^3. This capacity provides a minimum retention time of 8 days for optimal treatment and management.
- For the sanitary sewage, it is anticipated that about 280 workers will be on site during operation period. At an average water use by one person of 0.1 m3/day, it is estimated that 28 m3/day of wastewater will be generated. This is a significant amount of sanitary wastewater that without proper treatment and disposal methods could be discharged off-site with detrimental impacts on the environment.
- Flushing water about 1 m^3/hr or 24 m^3/day, Unforesee water & water leakage is approximately 17.3 m^3/hr or 415.2 m^3/day etc.
- Oily effluents from engine hall, transformer yard, compressor, and Emergency DG set area; fuel loading/ unloading areas
- Filters (service water filtration plant) backwash.
- Domestic wastewater is generated from offices, canteen, dormitory and guest houses, and driver rest areas.
- Wastewater from the water treatment plant
- Oily water from transformer pits.
- Oily water from buildings/areas like lube oil storage tanks, equipment maintenance area floor drain, etc

The industrial sewage of the whole factory mainly comes from the leachate produced by the waste pit, the vehicle flushing water in the factory, and the ground flushing water in the separate system. The

production of wastewater of the project mainly includes recirculating water sewage, backwashing water of water purification station, etc. Approximately 98.4 m^3/day will be generated at plant rainwater system during the plant operation and discharged from the plant to the water body nearby. Discharge of untreated liquid waste may generate during operation phase is likely to contaminate/degrade the surface water quality, when discharged into the adjoining channel of Karnatali. Discharges from the proposed project's operation activities are likely to have an impact throughout the project life, and likely to pose a significant impact on the surface water quality, if discharged without adequate treatment and mitigation measures. In addition, surface water and groundwater impacts associated with leaks and spills are reduced during the operation phase since on-site storage of hydrocarbons and site activities will be considerably reduced.

Surface and Groundwater contamination during the operation phase have been assessed as Medium-Low.

Impact	*Surface and Ground Water Contamination*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Karnatali River and Surrounding area of the Project Location				
Frequency	Throughout the Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low	Medium	High		
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider	*Medium-low*			

Mitigation Measures

Following measures shall be taken.

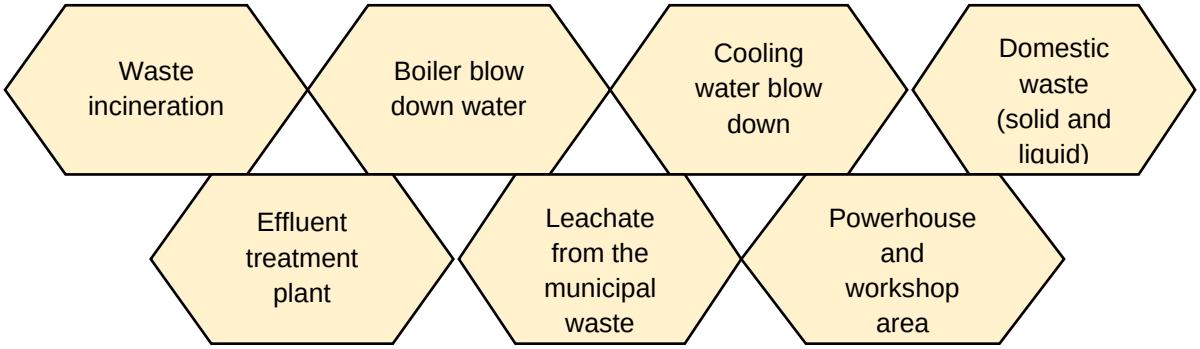
- Monitoring of temperature at the discharge point at a frequency of every 15 days.
- Discharge system shutdown in event that the discharge temperature of effluent exceeds the standard.
- Leak-proof oil transfer mechanism from oil tanker to oil storage tank.
- Sanitary effluent should be deposited in the septic tank.
- Liquid waste such as waste oil, etc. will be collected and stored for recycling in cemented areas.
- All drainage/tanks, etc. will be positioned on concrete hard standing to prevent any seepage into the ground.
- Wastewater of similar nature from different units will be treated in accordance to GOB Environment Conservation Rule (2023) Schedule 4 (Standards for Waste from Industrial Units or Project Waste).
- Implementing emergency response plans to address any accidental spills or contamination events promptly.

- All chemicals will be stored in primary containers that have in-built secondary containment of capacity that is at least 110% of primary containment.
- Regularly testing groundwater quality for contaminants and implementing remediation measures if contamination is detected.All the waste that would be produced during the power plant operation units and workers facilities must be treated in the ETP and STP plant.
- Increase the efficiency of water reuse and recycling.
- Water conservation plans should be implemented on a broader scale.
- Direct emission of any harmful effluents and wastes from power plant must be restricted.
- The oily sludge shall be reused or disposed offsite through an authorized agency.
- Landfills must be treated against seepage to prevent contamination of groundwater and surface water, while preventing groundwater from entering the landfill area. The permeability coefficient of natural clay lining, and modified clay lining shall not exceed 1×10-7 cm/s, and the thickness of field bottom and four-wall lining shall not be less than 2m.
- The project developer should follow slag treatment system are described in section 3.12.4
- The project developer should follow details of the leachate treatment process are described in section 3.12.5

The impact on surface and groundwater will have medium intensity with locally extent for a medium-term duration which will result in an overall medium-low impact without mitigation. However, with the proper implementation of suggested mitigation measures, the overall impact will be Very low.

6.2.3.6 Impact due to Waste Generation

The potential sources of waste generated during the operation of the Power plant are the following:



Solid Waste

The operation of waste to energy power plant will generate both solid and liquid waste. Solid waste includes fly ash, bottom ash, general refuse, scrap, and used metals, batteries, empty containers, used paint, engine oils, hydraulic fluids, as well as waste fuel etc.

As per the feasibility study report, waste will be dumped for 365 days and incinerate for 333 days where about 3000-ton waste is planned to be burnt daily. The incineration process will produce fly ash and bottom ash as well. Estimated fly ash output from the whole plant is about 73.6 m^3/d. The storage capacity of a landfill for 5 years is about 122560 cubic meters. The existing landfill site can meet the requirements of operation and maintenance for 5 years, and the project will sell the fly ash to the cement factory. This landfill will be used as an emergency fly ash landfill. The fly ash of this project is mainly composed of the discharge of the reaction tower and the soot collected by the bag filter. The composition of fly ash is complex and high leaching concentration of heavy metals such as lead (Pb) and cadmium (Cd) and other toxic substances such as dioxins. If the fly ash is directly landfilled, and by the action of rainwater immersion, the soluble harmful components have the risk of leaching into the groundwater and surface water which can affect groundwater quality and the aquatic ecosystem of Karnatali River. This could also impact on air quality and human health due to the size and density that can go airborne with the combustion gases when released to the atmosphere. After

solidification/stabilization treatment, the fly ash will be transported to the landfill site for safe disposal if the following conditions are met: (1) Water content is less than 30%; (2) dioxin content is less than 3 μg-TEQ/kg.

The sludge in this project is obtained from the feed water Treatment System and the leachate treatment system. The sludge produced by this operation will be pre-treated, during which main metals such as iron, aluminum, and copper will be extracted and sold externally. Once tested, the residual fine sand fulfills the requisite standards and will be supplied to the construction materials market.

The slag in this project is mainly the residue after waste combustion, and its generation depends on waste composition; its main components are MnO, SiO2, CaO, Al2O3, Fe2O3, and a small amount of unburned organic matter, scrap metals, etc. The reciprocating grate incinerator is used in this project to ensure that the slag thermal ignition reduction rate can be $\leqslant$ 3%. Tthe project will produces about 500t/d wet slag per day and 182,500 t/a wet slags per year. The main plant is equipped with slag pits that can meet the storage capacity of the whole plant for more than 3 days. The slag in the slag pond is lifted by a grab truck and sent to the comprehensive utilization workshop for disposal and production of asphalt concrete or the slag treatment plant for landfill. The components after sorting and sifting will be treated according to their nature, e.g., the metal to be sold and the remaining will be used for brick making. However, the project does not include the brick-making facilities.

Also, during the operation phases, there would be the generation of solid waste and municipal waste including paper, cartons, bags, boxes, office wastes, etc. along with a minor quantity of domestic waste. During the operation phase of the project, around 280 workers would be employed. Waste generated per person per day averages 0.74 kg. It is estimated that around 207.2 kg/day of municipal solid waste would be generated. Solid and municipal waste would be collected, segregated, and disposed of through local waste management bodies.

Liquid Waste

The liquid waste will generate for this project can consider comprising domestic sewage, production sewage, waste leachate, and waste truck flushing sewage.

Wet slag also will be produced due to the waste incineration process. The amount of wet slag to be produced is about 500 tons/day. Hazardous constituents of ash and slag can migrate from the dump surface through the air and water action contaminate the atmosphere, soil, groundwater, and surface water. Fly ash landfill and slag comprehensive utilization workshop, considering the occupational health safety and convenience of logistics and transportation, this area is arranged on the northwest side of the plant, and is also arranged far from the front area of the plant. The total area for fly ash landfill and slag comprehensive utilization are 19,350 m^2 and 6,850 m^2, respectively.

The leachate treatment system is engineered to handle up to 1,500 tons per day during peak rainfall periods, with a storage tank volume of 12,000 m^3. This capacity provides a minimum retention time of 8 days for optimal treatment and management. For the sanitary sewage, it is anticipated that about 280 workers will be on site during the operation period. At an average water use by one person of 0.1 m^3/day, it is estimated that 28 m^3/day of wastewater will be generated. This is a significant amount of sanitary wastewater that without proper treatment and disposal methods could be discharged off-site with detrimental impacts on the environment. Flushing water about 1 m^3/hr or 24 m^3/day, Unforesee water & water leakage is approximately 98.4 m^3/hr or 415.2 m^3/day etc.

Also, fuel and chemicals like acids/alkali for water treatment purposes can be generated during the operation phase. Various types of hazardous and non-hazardous wastes would be generated during normal operation of the power plant which has the potential to degrade soil quality and sediment quality if not stored and handled properly. Land around the Project site is mostly fallow land and low land. The Karnatali River is located adjacent to the project site on the north side. Improper storage, handling, and disposal of solid and hazardous waste may lead to contamination of the land and water bodies nearby. In addition, waste can generate odor and cause health hazards to employees and communities nearby.

Thus, the overall impact significance without mitigation measures during the operation phase of the power plant will be **Medium-Low**.

Impact	*Impact due to Waste Generation*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	In and around the project site					
Frequency	Limited to Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures

- The Contractor would ensure that the hazardous waste plan is based on national as well as WB/IFC EHS guidelines for all solid and hazardous waste and implemented adequately.
- Establishment of the waste management plan and hazardous material handling plan at the project construction site.
- Recyclable Waste will be sold to the authorized recycler and the other solid wastes will be disposed of to a local designated landfill facility.
- Adequate sanitary facilities, i.e. toilets and showers, will be provided for the construction workforce.
- Oily waste and chemicals would be stored in tanks/containers that have sufficient secondary containment (~110% more than its capacity).
- All hazardous waste should be properly leveled with information including the Name & type of waste, and the amount of waste. The waste will be removed from the site at regular intervals for safe disposal at the designated site through authorized vendors.
- The Contractor would have a Spill Management plan in place delineating plans and procedures for preventive and corrective actions against any potential spillage of harmful materials and provision of adequate spill kits.
- It would be ensured that activities involving oil handling are carried out at impermeable surfaces and training of workers would be undertaken to manage spill management.
- The wastewater in the plant area after treatment may be used for car washing, ground washing, residue cooling, and greening.
- Prevent the indiscriminate discharge of untreated effluent from the process, equipment/vehicle washing, and chemical/fuel storage areas into the unpaved and open ground.
- A spill response plan and emergency plan will be prepared to address accidental spillages or release of hazardous wastes.

- Wastewater containing high concentrations of inorganic chlorine salts and heavy metals can only be discharged after treatment.
- Bottom ash will be managed separately from fly ash and other flue gas treatment residues to avoid contamination of the bottom ash for its potential recovery.
- Will Separate remaining ferrous and non-ferrous metals from bottom ash as far as practicably and economically viable, for their recovery.
- Bottom ash will treat on or off-site (e.g., by screening and crushing) to the extent that is required to meet the specifications set for its use or at the receiving treatment or disposal site (e.g., to achieve a leaching level for metals and salts that is in compliance with the local environmental conditions at the place of use);
- Bottom ash and residuals would be managed based on their classification as hazardous or non-hazardous materials. Hazardous ash should be managed and disposed of as hazardous waste. Non-hazardous ash may be disposed of in an MSW landfill or considered for recycling in construction materials.
- Construction camp wastewater (both grey and black water) will be stored in soaking pits/ septic tanks and treated in STP.
- All liquids effluent will be treated to meet the standards specified in Schedules 3 and 4 of the ECR, 2023 prior to discharge.
- The project developer should follow details of flying ash collection and treatment system are described in section 3.12.2
- The project developer should follow details of slag treatment system are described in section 3.12.4
- The project developer should follow details of the leachate treatment process are described in section 3.12.5
- The project developer should follow details of the effluent treatment process are described in section 3.12.6

However, with the proper implementation of suggested mitigation measures, the overall impact will be Very Low.

6.2.3.7 Impact on Soil Quality

During the operation phase of the project, the soil may get polluted/ contaminated from littering of various kinds of municipal wastes, leakage of leachates, and due to fly ash or bottom ash.

The following activities will lead to impact on soil quality:

- Material Handling and Storage
- Hazardous and Non- Hazardous Material during maintenance activity
- Fly ash storage
- Leachate treatment station

Slag treatment plantThe incineration process will produce fly ash and bottom ash as well. Estimated fly ash output form the whole plant is about 73.6 m3/d. Based on the calculation in the above table, the storage capacity of a landfill for 5 years is about 122560 cubic meters. The existing landfill site can meet the requirements of operation and maintenance for 5 years, and the project will adopt the way of fly ash and cement kiln to handle fly ash. This landfill will be used as an emergency fly ash landfill. If this landfill not managed properly, the soil quality may be contaminated. After WtE, some minerals and elements are enriched in incineration ash. Compared with the original waste, the content of toxic elements in urban waste incineration fly ash is 10 to 100 times higher than that in general soil.

The project will produce approximately 500 tons of wet slag per day, totaling 182,500 tons per year. The main plant is equipped with slag pits that can store the plant's output for over three days. Slag from the slag pond is lifted by a grab truck and transported to the comprehensive utilization workshop for

disposal and production of asphalt concrete or to the slag treatment plant for landfill. Sorted and sifted components will be treated according to their nature; metals will be sold, and the remaining material will be used for brick making. However, the project does not include brick-making facilities.

Compaction of soils from increased leveling and grading of areas within the site will result in lower permeability and therefore, decreased infiltration and increased runoff. Without appropriate measures, compacted areas and hard-standing areas in addition to erosion by wind may increase erosion and increase the sediment load in run-off.

Once the project is commissioned there will be a limited disturbance to the soil, however, repair and maintenance of underground cables and associated utilities will lead to generation of hazardous wastes such as used transformer oil. The defunct/damaged equipment will also be generated and storage/disposal on the unpaved ground can lead to contamination of soil is hazardous waste. Without proper management, the impact on soil quality has been assessed as Low.

Impact	*Soil Contamination from waste and spillage*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Within the project site				
Frequency	Throughout the Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High / Very High
	Significance of impact consider ***Low***				

Mitigation Measures

- Wastes will be stored in a manner that will prevent contact between incompatible wastes, i.e. post compatibility checks,
- Proper labelling of hazardous waste.
- Waste oil will be collected in MS drum and stored on paved platforms with proper labelling. the waste will be sold to DoE approved vendors.
- Special care will be taken in the storage areas to prevent any spillage of hazardous wastes and restrict access (except for trained staff) to such areas.
- Periodic audits will be carried out for such areas and containers; also, on the segregation and collection systems and the findings will be documented and appropriate action taken against irregularities.
- A spill response plan and emergency plan will be prepared to address accidental spillages or release of hazardous wastes.
- A proper manifest record will be maintained of waste travelling/ removed from the site.
- Awareness growing to use the by-product of the power plant efficiently.
- Monitoring not only inside but also outside the land areas free from any kind of waste disposal or potentially to be polluted lands.

- Increase the facilities of ash marketing through infrastructure development, creating awareness and formulating policies.
- Landfills must be treated against seepage to prevent contamination of soil, while preventing soil from entering the landfill area. The permeability coefficient of natural clay lining, and modified clay lining shall not exceed 1×10-7 cm/s, and the thickness of field bottom and four-wall lining shall not be less than 2m.
- The hazardous waste such as spent oil as well as non-hazardous wastes shall be disposed of off to DoE authorised vendors only.
- Disturbance to soil from repair and maintenance activity will be limited and will ensure proper restoration of soil wherever excavation is undertaken.

However, with the proper implementation of suggested mitigation measures, the overall impact will be Very low.

6.2.3.8 Impact on Ecosystem and Biodiversity

6.2.3.8.1 Impact on Terrestrial Flora

During the operation phase, activities that might impact on terrestrial flora include, operation of boiler, turbine and generator, waste conveying, disposal of fly ash and bottom ash, hazardous and domestic waste disposal.

The primary sources of impact on terrestrial flora during the operation phase include flue gas and fly ash production from waste incineration. The project will generate 73.6 m³ of fly ash daily, or 24,512 m³ annually, considering 333 operational days. Particulate matter from fly ash will settle on plant leaves, twigs, and stems, potentially disrupting photosynthesis, respiration, and other physiological processes, thereby hindering plant growth and causing diseases. Key pollutants from the waste-to-energy power plant operation include PM, SO_2, and NO_2. Accidental dispersion of flue gas, fly ash, and bottom ash could impact terrestrial flora. Nitrogen and sulfur-containing air pollutants can harm plant health directly by settling on leaves or indirectly through chemical reactions. Airborne nitrogen can cause toxic effects, eutrophication, and acidification. Stack emissions, such as sulfur dioxide, nitrogen oxides, carbon monoxide, and heavy metals (e.g., mercury), can contribute to acid rain, which corrodes plant surfaces and acidifies terrestrial ecosystems, impairing plant growth. Additionally, waste unloading and conveying will generate particulate matter, which can hinder plant growth by obstructing physiological processes like transpiration when dust blocks leaf stomata.

However, the dispersion of Flue gas emission and deposition of fly ash contents decreases over the distance considering wind speed, topography, and the presence of physical barriers. The project site is in an open area and there is no significant terrestrial flora around the project site. However, the baseline study represents no threatened terrestrial plant species within the project AOI.

Considering the project activities and potential biological receptors within the project AOI, the impact on terrestrial flora during the operation phase might be less significant. Therefore, it is assessed as **Medium-Low**.

Impact	*Impact on Terrestrial Flora*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project Location and Surrounding area				
Frequency	Throughout the Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation

Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures

- A plantation plan shall be implemented for greenbelt development with appropriate indigenous species. Extensive plantation of pollutant-resistant trees in and around the project area will serve as a pollution sink and noise barrier.
- Plant health monitoring shall be conducted regularly.
- Suppression of fugitive dust emissions through spraying water in the construction area.
- Covering dust generates loose materials with tarpaulin sheets during transportation to the site.
- Restrict vehicle movement within site to a speed less than 20 km/hour at site to minimize potential for dust generation in the surroundings.
- Supply fuel to the workers for cooking and train them not to use wood as a fuel which will reduce the impacts on vegetation in the surrounding of the project site.
- Construction activities should be planned and undertaken in a phased manner.
- Greenbelt development around the project site and surrounding area as early as possible; and
- Plantation of local species for stabilization of the filled in material and plantation in surrounding areas.
- The project developer should follow details of flying ash collection and treatment system are described in section 3.12.2.
- The project developer should follow the details of Flue Gas Treatment Process described in section 3.12.1.

The project impact will be for long term to a local extent within the project AOI of the project site but probability of impact and potential for irreplaceable loss of resources will be low. Therefore, potential impact on terrestrial flora can be reduced to Very Low by following proper mitigation measures.

6.2.3.8.2 Impact on Terrestrial Fauna

Noise generation from turbines, generators, compressors, pumps, fans, waste loading and unloading, light generation from operational activities, and dust emissions from vehicle movement and waste handling systems are key sources of potential impacts on terrestrial fauna in the proposed project. The high noise levels from these activities may disturb and alter the behavior of faunal species, including birds, around the project site. Artificial lighting could attract wildlife from adjacent areas, causing disoriented movement and confusion. Increased vehicle operation for transporting workers will raise dust and exhaust emissions from burning fossil fuels. Dust emissions from these activities might affect the respiration of both fauna and avifaunal species.

The project will generate 73.6 m^3 of fly ash daily, or 24,512 m^3 annually, considering 333 operational days. Flue gas and fly ash production from waste incineration during the operation phase will impact the health, behavior, and reproduction of terrestrial fauna. Heavy metal components could enter the food chain, affecting the biogeochemical cycles of various species. However, the dispersion of flue gas emissions and fly ash deposition decreases with distance, influenced by wind speed, topography, and

physical barriers. Additionally, noise and light from plant operations will impact the movement and habitat quality of nocturnal species.

Considering the project activities and potential biological receptors within the project AOI, the impact on terrestrial fauna during the operation phase might be less significant. Therefore, it is assessed as **Medium-Low**.

Impact	*Impact on Terrestrial Fauna*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project Location and Surrounding area					
Frequency	Throughout the Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures:

- Disturbance on wildlife shall be monitored regularly
- Rescue, rehabilitation, and relocation shall be done for terrestrial fauna when necessary
- Comply with the existing rules and regulations of the Department of Environment regarding air and noise which will also ensure less/no impact on the migratory birds in the National Botanical Garden, Mirpur.
- The construction activities should be scheduled in such a way that it minimizes noise and vibration.
- The noise generating activities should be scheduled during the daytime only.
- Provide acoustic enclosures and noise barriers in areas of high noise generating sources to avoid discomfort to local wildlife. The barriers should be erected in such a way that it does not interfere with the natural movement migratory and bird roosting, and foraging ground.
- Dust suppression measures should be implemented to minimize dust pollution during operation work.
- Use low-intensity lighting, which reduces the brightness of the lights and helps to reduce the glare.
- Movement of waste transport vehicles should be restricted to dedicated paths to minimize any harm to small mammals near to proposed site.
- Traffic management plans shall be developed to minimize the impact of operation traffic on wildlife, such as by limiting the speed of vehicles (20 km/hr) or the number of vehicles on site at any given time to avoid roadkill.

- Strict prohibition will be implemented on trapping, hunting or injuring wildlife within the subcontractors and should bring a penalty clause under contractual agreements.

The project impact will be for long term to a local extent within the project AOI of the project site, but probability of impact will be high. Therefore, potential impact on terrestrial fauna can be reduced to Very Low by following proper mitigation measures.

6.2.3.8.3 Impact on Aquatic Flora and Fauna

During the operation of the project, aquatic flora and faunal impact sources include:

- Waste or scattered oil on roads from garbage transportation vehicles
- Industrial and domestic wastewater
- Waste leachate

The nearest Karnatali River is approximately 500 m north from the proposed project site. The Karnatali River plays a crucial role in fish migration, with fish traveling from the Dhaleshwari to the Turag and Buriganga rivers via the Karnatali. During the monsoon, freshwater flows from upstream, bringing fish with it. Common species in these rivers include Tengra, Rui, Catla, Shol, Taki, Pangas, Gulsha Tengra, Shing, Magur, Koi, and Puti. The Karnatali River is linked to the Dhaleshwari and Turag Rivers, which help sustain its ecological flow. After consulting with local residents and fisheries officer, it was determined that the Karnatali River is not ecologically rich, and no important or threatened species have been identified within it. Recently, Sugarmouth catfish have been found in abundance in the Karnataka River. These fish species are 'polluted' as they compete with native fish and alter the aquatic food web by indiscriminately eating phytoplankton and zooplankton. The extraction of surface water from this river will not impact ecological species, local communities, or any other stakeholders.

Sample analysis from three predefined locations identified a total of seven species of phytoplankton across three groups, with Bacillariophyceae being the dominant group and Microcystis sp. (under Cyanophyceae) being the dominant species. Additionally, four species of zooplankton were identified: two species of Branchiopoda (Daphnia sp. and Moina sp.), one species of Monogononta (Brachionus sp.), and one species of Copepoda (Diaptomus sp.). Among these, Diaptomus sp. and Moina sp. were the most abundant zooplankton species.

Surface water bodies in the study area may be affected by runoff from leachate storage areas, blowdown water from the cooling tower and boiler, effluent from the ash quenching area, or untreated sewage. The plant generates various types of liquid effluent, including domestic sewage (22 tons/day), production sewage (2,793.2 tons/day), and waste leachate (1,478 tons/day). The leachate treatment system can handle up to 1,500 tons per day during peak rainfall, with a storage tank volume of 12,000 m^3, ensuring a minimum retention time of 8 days. Sanitary sewage from approximately 280 workers is estimated at 28 m^3/day, along with flushing water (24 m^3/day) and unforeseeable water and leakage (415.2 m^3/day). Additionally, oily effluents are generated from the engine hall, transformer yard, compressor, emergency DG set area, and fuel loading/unloading areas. The plant also produces backwash from the service water filtration plant, domestic wastewater from offices, canteen, dormitory, guest houses, and driver rest areas, wastewater from the water treatment plant, and oily water from transformer pits and equipment maintenance areas.

Industrial sewage primarily comes from leachate in the waste pit, vehicle flushing water, and ground flushing water. The project also generates wastewater from recirculating water, backwashing water of the water purification station, and plant rainwater (98.4 m^3/day). Discharge of untreated liquid waste may contaminate surface water, particularly if discharged into the Karnatali River, degrading its quality. Adequate treatment and mitigation measures are crucial to prevent significant impacts throughout the project's lifespan.

High thermal exposure will directly and indirectly impact the aquatic organism's biology. Most aquatic organisms have specific temperature needs and are unable to survive sudden changes. Even small

temperature changes may result in thermal shock to aquatic life, cause reproduction difficulties and lower disease resistance. Organic matter decomposes faster in warmer temperatures, depleting dissolved oxygen and local aquatic life may be forced to migrate from the area, relocating to a more suitable location. Thermal discharge will also negatively impact on plankton and benthos cover of surface water.

Accidental discharge of surface runoff with high sediment load, spilled oil, etc into the river have the potential to affect the water quality by leading to an increase in turbidity, organic matter content, oil content etc.

Accidental spillage and waste disposal from operation material and secondary fuel transportation, waste transport will affect the water quality of adjacent waterbodies and reduce the diversity of aquatic flora, planktonic profile, and fisheries resources.

Considering the project activities and potential biological receptors within the project AOI, the impact on aquatic flora and fauna during the operation phase might be less significant. Therefore, it is assessed as **Low**.

Impact	*Impact on Aquatic Flora and Fauna*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Karnatali River, Project Location and Surrounding area				
Frequency	Throughout the Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***				

Mitigation Measures

- Leaching of hazardous chemicals in adjacent waterbody must be controlled
- Regular monitoring of aquatic ecosystem health and fish production in monsoon shall be done
- Monitoring of temperature at the discharge point at a frequency of everyday.
- A log of all dangerous chemicals be kept, how to be used, transported stored and disposed of;
- Keep all dangerous chemicals, oils, greases, solvents, and residues in a secure room.
- Have a standard operating procedure on how to deal with spills.
- Have a spill response team readily available to respond.
- Train workers on spills and how to deal with them.
- Restricting the night lighting during operation where not necessary.
- Have a containment and disposal plan for all hazardous material (where to dispose).
- Collect and separate the spilled water from runoff water then store and treat separately.

- All oils and hazardous materials to be disposed of after proper treatment satisfying Environmental Conservation Rules 2023.
- The water supply pipeline intake point should be provided with sufficient screening to filter out larger aquatic organisms (e.g., fish, frogs, and toads) and foreign matter, preventing this material from being drawn into the pumps.
- Drum screens need to be adopted in order to limit the entrainment of fish in the cooling water system, and intake velocities should be as low as possible.
- The intakes for the water pumps in the main pump-house will meet the IFC guidelines, including recommended intake velocity less than 0.30 m/s and a mesh size of 9.5 mm.
- The channel can be built for water channelization rather than a direct abstraction from the river.
- Monitoring should continue to ensure that the deterrents are working effectively.
- On-site wastewater should be treated to achieve maximum reuse and recycling rather than ultimate disposal to the river.
- Regular consultation, training and stakeholder meetings should be arranged with the local bodies and project personnel.
- Use of bio-indicator for pollution measurements like benthic community, plankton or sensitive organisms.
- Avoid the area where the dolphin and other aquatic wildlife in abundant
- Awareness building activities should be carried out continuously.
- No trapping and killing of Dolphin.

The project impact will be for long term to a regional extent within the project AOI of the project site but probability of impact will be low. Therefore, potential impact on aquatic flora and fauna can be reduced to Very Low by following proper mitigation measures.

6.2.3.9 Impact on Traffic

The south side of the proposed plant site is the N5 highway, which can be used as the main road for waste transportation. A new connecting road on the east side of the plant is planned to be connected with the N5 highway, which is used as the entry road of the project. A total of 140 trucks will be operational during the operation phase to transport waste to the plant. The existing highway (N5) has connected the capital city Dhaka to the northern part of Bangladesh. The DNCC is responsible for the garbage transport vehicles in this project, and the number of vehicles transported is about 30 per hour. There are many types of vehicles, which vary in size. This highway remains busy with several kinds of vehicles such as buses, Microbus, Minibus, Jeep, Truck, Covered Van, Ambulance, Motorcycle, etc. Road transportation will be used for waste commuting to and from the project site, there would be added existing traffic due to plying of trucks of DNCC.

After retrieving the data of DNCC weighbridge room for three consecutive days, the vehicles are counted for 24 consecutive hours. The specific data are as follows:

- On May 8, 2024, 634 garbage trucks entered the site with 3436 tons of garbage, an average of 27 vehicles per hour.
- On May 9, 2024, 629 garbage trucks with 3476 tons of garbage, an average of 27 vehicles per hour.
- On May 10, 2024, 650 garbage trucks with 3436 tons of garbage, an average of 27 vehicles per hour.

Assuming that the maximum traffic volume is approximately 30 vehicles per hour, each vehicle is 15 meters long and 4 meters wide, covering an area of 60 square meters. There is a 368-meter-long road entering the factory area, plus a 2226-square-meter unloading hall. Even if they enter the site at the same moment, it is enough to suspend and store more than 60 vehicles, so it will not affect the road traffic outside the site. And there is sufficient room for all the vehicles in the Project site.

The inflow of waste transporting and carrying workers during operation is likely to generate noise and dust emissions. Therefore, the impact significant on Road Traffic during the operation of the power plant will be low.

Impact	*Impact on Traffic*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Adjacent Road					
Frequency	Limited to Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***					

Mitigation measures

The following steps should be taken to minimize the impact due to increasing road traffic.

- The Project Company will implement a staggered schedule for garbage trucks entering and exiting the site. Assign specific time slots to different trucks to avoid congestion during peak hours.
- The Project Company will install clear and visible signage for directions, speed limits, and entry/exit points to guide the truck drivers efficiently.
- The Project Company will restrict truck movement on certain roads during peak traffic hours or in sensitive areas to reduce congestion and disturbances.
- The Project Company will implement use of GPS and tracking systems to monitor truck movements and optimize routes to reduce travel time and congestion.
- The Project Company will create temporary holding areas for trucks within the site to manage overflow and prevent trucks from waiting on public roads.
- The Project Company will implement a real-time monitoring system to manage the holding areas efficiently and direct trucks as needed.
- Collaboration will be undertaken with local communities and responsible authorities to improve signage (e.g., pedestrian crossings, speed limits, etc.), visibility and awareness of pedestrian safety.
- The transportation of waste shall be carried out in the covered condition.
- Adoption of Stakeholder measures for avoidance of traffic incidents like display of educational materials and signboards to ensure elderly and children are aware of the increased traffic risk and safety measures.
- The Project Company will establish a feedback mechanism for residents to report traffic issues and concerns and address them promptly.

- The Project Company will appoint flagman at the entry point from the highway. Also, engage security guards and flagman in the main gate of the power plant to manage the flow of traffic and ensure smooth entry and exit.
- Every vehicle will be protected with proper leakage safety, so that no garbage spilling will occur while carrying of waste. DNCC waste management department will ensure such safety protocol of waste carrying and no waste spilling. Some measures that shall be taken to prevent and mitigate the possible spilling of garbage by trucks on highways:
    - Ensuring that garbage trucks are properly maintained and inspected regularly to identify and fix any leaks or mechanical issues that could cause spills.
    - Proper loading and covering of waste in garbage trucks can significantly reduce the chances of spillage. Garbage trucks should be loaded within their capacity, and the waste should be covered securely using a tarpaulin or other appropriate cover.
    - Garbage truck drivers should undergo regular training in proper driving techniques and waste management practices. They should also be trained in how to secure the load correctly and how to respond in case of a spillage.
    - By implementing these measures, we can prevent and mitigate the possible garbage spilling by trucks on highways and ensure that waste management operations are safe and environmentally friendly.

With the implementation of the precautionary and mitigation measures mentioned above impacts due to increasing traffic would be very low.

6.2.3.10 Occupational Health and Safety

Operation of the WTE plant and its components poses significant occupational health and safety risks. To reduce the risks, contractors will be required to appoint health and safety officers for each site and to ensure regular briefing of the construction workforce on health and safety issues. The contractor shall establish its health and safety plans to be adopted at each site following international best practices and the World Bank EHS guidelines on construction and decommissioning activities.

The machinery and plants require different chemicals and hazardous substances for operation. There is invariably a risk when such chemicals are handled. Although the WTE Plant is located away from residents, there is a considerable safety risk to workers at the plant and the surrounding environment in the event of any leak or spill.

The most significant occupational health and safety impacts typically associated with workers at waste management facilities occur during the operational phase and include accidents and injuries, chemical exposure, and exposure to pathogens and vectors.

Physical hazards encountered at waste management facilities are similar to those at other large industrial projects. Solid waste workers are particularly prone to accidents involving trucks and other moving equipment, so traffic management systems and traffic controllers are recommended. Accidents include fires, explosions, being caught in processing equipment, and being run over by mobile equipment. Other injuries occur from heavy lifting, contact with sharps, chemical burns, and infectious agents. Smoke, dust, and bioaerosols can lead to injuries to the eyes, ears, and respiratory systems.

Chemical hazards encountered at waste management facilities are similar to those at other large industrial facilities, such as toxic and asphyxiating gases, and are addressed in the General EHS Guidelines. However, the full composition of waste and their potential hazards is often unknown. Even MSW often contains hazardous chemicals, such as heavy metals from discarded batteries, lighting fixtures, paints, and inks.

Processing MSW can also generate bioaerosols, suspensions of particles in the air consisting partially or wholly of microorganisms, such as bacteria, viruses, molds, and fungi. These microorganisms can remain suspended in the air for long periods of time, retaining viability or infectivity. Workers may also

be exposed to endotoxins, which are produced within a microorganism and released upon destruction of the cell, and which can be carried by airborne dust particles.

In summary, the operation and maintenance of the power plant will have risks of industrial accidents and fatalities for workers. Both direct employees and Contractors would be exposed to such risks. Thus, the overall impact significance without mitigation measures during the operation phase of the power plant will be **Medium-low**.

Impact	*Occupational Health and Safety*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Impact zone will be regional/national					
Frequency	Limited to Operation Phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider		***Medium-low***			

Mitigation Measures

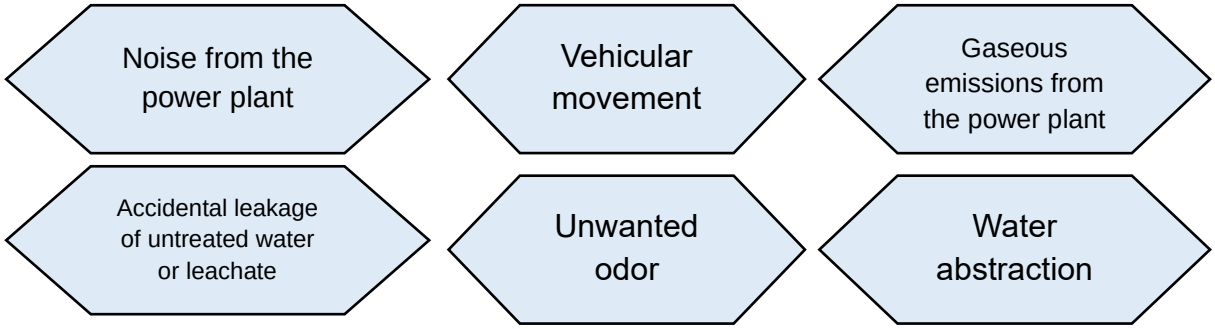
In order to minimize the risk of industrial accidents and fatalities to workers during operations, the following mitigation measures are proposed:

- Provide adequate health care facilities and first aid within the project sites.
- Provide OHS training program and information of basic site rules of work, basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures.
- Provide adequate lavatory facilities for the number of people expected to work in the facility.
- Adequate preventive measures from negative factors such as fire precautions, lighting, safe access, work environment temperature, area signage, labeling of equipment, communication Hazard codes, and electrical.
- Establish rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction.
- Identify and provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors.
- Proper maintenance of PPE and the instruction of proper use.
- Conduct safety manual classes or orientation on a regular basis
- Monitor and report safety protocols and incidents
- Maintain a register for occurred incidents and take measures to prevent it in future
- OPs need to be developed for the operation and maintenance of the Plant.

With the implementation of mitigation, the measured impact will be very low.

6.2.3.11 Community Health and Safety

During the operation phase of the project the main sources of impacts on community health and safety are:



Community health and safety may be impacted during operation phase due to noise generation and gaseous emissions. There might have a chance of being affected by gaseous pollution which could impact on human health. Mostly breathing difficulties, particularly for people with asthma and heart disease, headache, vomiting could be seen during operation phase. The flue gas treatment system will be implemented to mitigate the impacts due to gaseous emissions. Deterioration of surface water quality due to discharge of wastewater would also impact local community. Planned green belt within the plant also reduce the noise and air pollution impact on surrounding environment significantly. In case of water quality, WTE Power Plant North Dhaka Private Limited would install ETP and STP for treatment of wastewater generated in their plant before discharge. Hence impact on community health safety due to plant operation would be **Low**.

Impact	*Community Health and Safety*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Adjacent Communities and project workers				
Frequency	Limited to Operation Phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures

- The machinery and vehicles should be equipped with mufflers, silencers, foam, rubber, and other soundproofing materials necessary to reduce operation noise; the diesel generators should be covered with a canopy.
- Only well-maintained equipment will be operated on-site.

- Regular maintenance of equipment, such as lubricating moving parts, tightening loose parts, and replacing worn-out components, should be conducted.
- Machinery and construction plants that may be in intermittent use (e.g., trucks) shall be shut down or throttled down during non-work periods.
- Low-noise equipment shall be used as far as practicable.
- The number of equipment operating simultaneously shall be reduced as far as practicable.
- Developing a Disaster Management Plan (DMP) to charter proper protocol to be followed in the event of a disaster in order to limit the impact on the local community.
- Disclose potential disasters and potential risks from the plant to the local community as well as the plan of action on the emergency protocol in the event of these accidents.
- Disclose and generate awareness on the DMP as well the measures and protocols prescribed by the same.
- Train employees and plant personnel in health and safety as well as handling and managing disasters and emergency events.
- Proper combustion along with appropriate air pollution control devices can reduce emissions of these substances to acceptable levels.
- Appropriate and suitable technological solutions can reduce the impact of gaseous pollution.
- Maintain harmonious relations with the community and create a feedback system.
- Maintain sound labor and management relations to avoid conflict and disruption in operation.
- Firefighting systems, such as sprinklers, portable extinguishers (appropriate to the flammable hazard in the area), and automated fire extinguishers will be provided at strategic locations with clear labeling of the extinguisher type. The main hydrant will also be available around the buildings. An automated fire detection system will be in place on all floors.

Implementing proper mitigation measures the impact will be very low.

6.2.3.12 Gender Based Violence (GBV)/ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)

In the context of the project operation, it is noteworthy that 10 Chinese and 50 local female laborers will be employed. Ensuring fair treatment for these female workers is essential, including providing equal pay, safe working conditions, and opportunities for advancement, to promote a more inclusive and equitable work environment. However, it is crucial to address the specific sensitivities and potential impacts on these female workers.

To ensure the well-being and equitable treatment of female workers in the project, several measures must be prioritized. Safety and security protocols should be robust, addressing any concerns that might disproportionately affect women. Health and hygiene considerations are paramount, necessitating the provision of clean and private restroom facilities, menstrual hygiene products, and breastfeeding accommodations where necessary. A supportive and inclusive workplace culture is crucial, promoting respect and equal treatment for all workers regardless of gender. Additionally, offering tailored training and development opportunities will empower female workers to build skills and advance their careers. Community engagement is also essential to address cultural and social norms that may influence female workers' participation in the project

The presence of workers in the Project sites might evoke gender-based violence activities. They are as follows:

- Harassment of women and young girls by workers, such as honour crimes in extreme cases.
- Disturbance of women and young girls’ mobility around the Project area.
- Discrimination against women in terms of employment.

Impacts resulting from GBV/SEA/SH on community members are of long-term, localized, temporary and reversible nature. By addressing these gender-related sensitivities and impacts, the project can

create a more inclusive and supportive environment for its female workers, ultimately contributing to their empowerment and well-being. The significance of impact on gender is consider **Low**.

Impact	*Gender Based Violence (GBV)/ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	Project area and surrounding area				
Frequency	Limited to operation phase				
Extent and Location	Project Site	Local	Regional	National	Trans Boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceable Loss of Resources	Low	Medium	High		
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Low***				

Mitigation Measures

The following steps should be taken to minimize anything related to gender.

- Project will ensure no gender-based violence will occur due to the project.
- Women will be heard if any issue raised by them and will be mitigated with high priority.
- Announce employment opportunities and recruitment notices widely, targeted at women as well as men.
- Technical training can be provided to the local workforce, especially women for inclusion in the operation and maintenance phase.
- Ensure basic facilities (separate toilets, clean water, drinking water facilities, resting place) are provided for female as well as male workers at the operation site.
- Women are to be trained and empowered to be part of household energy solutions – their understanding and knowledge about their household energy need to be translated into defining the way forward on access to clean, affordable, and sustainable energy.
- Workers should be informed and alert regarding gender related sensitivity.
- Prepare a Code of Conduct and insert it in the induction training to be provided to all workers.
- Grievance Mechanism (GM) should be in place at site and community level. A GM box needs to be installed in a visible place with a signboard with some basic info, contact address, contact number. GM must include some info on sexual harassment.
- GM register needs to be maintained at site.
- An acknowledgement slip should be given to the complained person against the grievance for the tracking.
- GBV/SEAH should be confidential, and more options should be created to submit the grievance against GBV/SEAH.
- Conducting periodic meetings with local community for understanding their grievances.

With the implementation of the precautionary and mitigation measures mentioned above, impacts on local conflict would be Very low.

6.2.3.13 Labor Influx

The operation of the project will involve around 280 people will be required for the plant operation where 30 male and 10 female Chinese skilled workers will be hired, and 150 male and 50 female local skilled workers will be engaged. During plant operation, approximately 35 male and 5 female unskilled workers will also be required for different purpose. Thus, the overall impact significance of labor influx during the operation phase of the plant will be **Low.**

Impact	*Labor Influx*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	*In and around the project area*				
Frequency	*Limited to construction phase*				
Extent of Affected Stakeholders	Insignificant	Low	Medium	Moderate	High
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceability/ Vulnerability	Low		Medium	High	
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider *Low*				

Mitigation Measure

The following mitigation measures should be taken to minimize the impact created due to labor influx during the operation phase.

- Proper safety protocol should be taken under the labor management plan by plant management.
- Alert the migrant workers regarding GBV, local harmony and other socio-cultural aspects to avoid any kind of collision between labor and local people.
- International (Chinese) workers must follow both national and international regulations while roaming around.
- Toolbox training, health safety protocol and other essential guidelines should be followed by the workers and plant management should follow the OHS guidelines in this regard.
- Grievance system should be established and maintained within the plant and workers accommodation area.

6.2.3.14 Infectious Diseases, such as HIV/AIDS

The entire operation phase will require only skilled and highly skilled labor. However, it is envisaged that outsourced personnel will comprise mostly skilled laborers and workers. During operation, in general, about 280 persons will be involved in the plant operation. Both technical and non-technical sides will require the said amount of people for the smooth operation of the plant. There are some people who might have chances to engage with the community people. Therefore, infectious diseases could spread among the community and plants as well. The overall impact significance due to Infectious Disease such as HIV/AIDS without mitigation measures during the operation phase will be Low.

Impact	*Infectious Diseases such as HIV/AIDS*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	*Within the project area*				
Frequency	*Limited to the operation phase*				
Extent of Affected Stakeholders	Insignificant	Low	Medium	Moderate	High
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High
Potential for Irreplaceability/ Vulnerability	Low	Medium	High		
Probability of Impact	Unlikely	Low	Medium	High	Definite
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider *Low*				

Mitigation Measure

In order to minimize the impact, preventive measures against such diseases, the following measures shall be considered and implemented.

- Inform workers of the risk of disease and the need for adhering to all preventative and control measures.
- Recommend a specific medical assessment of workers for histoplasmosis prior to the start of the project. This may include chest x-rays, serologic (blood) tests, and skin tests. Also consider pulmonary function tests, fitness to wear a respirator, and immunization against tetanus.
- Ensure that hygiene facilities have been installed or are available (for example temporary showers)
- Ensure workers are aware of the symptoms of heat stress conditions and the importance of maintaining adequate fluid and salt intake when working in hot conditions.
- Recommend that arrangements for providing cool drinking fluids, in an uncontaminated area, should be made, especially replenishing fluids and electrolytes like Gatorade.
- Posting of signs warning of potential health risks
- Emergency procedures/key contact person/phone/fax/cell/e-mail

However, with the proper implementation of suggested mitigation measures, the overall impact will be Very low.

6.2.3.15 Impact on Waste Pickers

The landfill site has some restriction for the outsiders to enter, but due to site preparation and sand filling for the powerplant area the opportunity has created for some waste collectors to enter the site without facing security in different alternative ways. Those waste pickers enter and collect waste on an occasion basis (mostly in dry season and not regular by all of them). During operational activity will create site fencing and additional security personnel, which will hinder the entrance facilities for the waste collectors in the landfill area. This impediment may result in disruption of their income generating activities from the collected waste materials from the landfill. As observed and reported by the DNCC, 40 individuals identified from both male and female as collecting waste from the site.

The project will not change any process of the existing waste collection/ transport/management currently operated by DNCC, thus the waste pickers outside the project area will be not impacted.

For the waste pickers around the project area, according to the Waste Supply Agreement, the project company will order the waste from DNCC and the volume delivered to the project will be less than 3600 tons/day. According to current data, the waste delivered to Amin Bazaar has been over 3600 tons/day. That means the project will not treat all the waste delivered and the remaining waste can be the living source of the waste pickers around the site.

The operation of waste-to-energy (WtE) projects can impact waste pickers, especially when these projects lead to a reduction in the amount of waste available at landfill sites. Here are some key impacts:

- Waste pickers rely on scavenging recyclables and other valuable materials from landfills to earn a living. With WtE projects diverting waste away from landfills, their access to these materials diminishes, directly affecting their income.
- With less waste available, competition among waste pickers can increase, leading to lower incomes and potential conflicts.
- The transition to new methods of waste collection or finding alternative livelihoods requires adaptation, which can be difficult without proper support and resources.

However, with mitigation measures the magnitude of the impact associated with the impact on waste pickers during preconstruction and construction activities is predicted to be **Medium-Low**.

Impact	*Impact on waste pickers*					
Impact Nature	Direct		Indirect		Induced	
Impact Scale	Project area and landfill site and surrounding area					
Frequency	Limited to preconstruction phase					
Extent and Location	Project Site	Local	Regional	National	Trans Boundary	
Impact Duration	Short Term	Medium Term	Long-term	Permanent-mitigated	Permanent-no mitigation	
Impact Intensity/ Severity	Insignificant	Low	Medium	High	Very High	
Potential for Irreplaceable Loss of Resources	Low		Medium		High	
Probability of Impact	Unlikely	Low	Medium	High	Definite	
Impact Significance	Very Low	Low	Medium-low	Medium-high	High	Very High
	Significance of impact consider ***Medium-low***					

Mitigation Measures for Waste Collectors

- Ensure an alternative income source for them based on their willingness and their physical health.
- A permanent solution to the issue may result in a significant change for their livelihood, which should be considered by the project proponent.
- The operation phase of the power plant will require waste pickers, which also can be a choice for the employment of currently found waste pickers.

- Waste pickers can be integrated into WtE projects through formal employment or by setting up cooperatives that supply waste to these projects.
- Providing training for alternative livelihoods, financial support, and educational programs can help waste pickers transition to new forms of employment.
- The project developer can implement policies to protect waste pickers' rights and ensure they are not adversely affected by the introduction of WtE projects.
- In the meanwhile, the project company will conduct CSR to improve surrounding waste pickers living level and to gradually transform them to ordinary citizens, which will include:
  - Hiring certain of them for entry-level jobs of the project company;
  - Providing necessary train for improving their skills.
  - Donating food, water and necessary living material;
  - Closely work with local community, charity, government to provide necessary support.

The impact on waste pickers due to project will have low intensity with local extent which will result in an overall medium-low impact without mitigation. However, with proper implementation of the suggested mitigation, the impact will be reduced to Very Low.

7 STAKEHOLDER ENGAGEMENT

7.1 Introduction

Stakeholder engagement is the continuing and iterative process by which the Borrower identifies, communicates, and facilitates a two-way dialogue with the people affected by its decisions and activities, as well as others with an interest in the implementation and outcomes of its decisions and the project. It considers the different access and communication needs of various groups and individuals, especially those more disadvantaged or vulnerable, including consideration of both communication and physical accessibility challenges. Engagement begins as early as possible in project preparation because early identification of and consultation with affected and interested parties allows stakeholders views and concerns to be considered in the project design, implementation, and operation.

According to the AIIB ESF 2022 guidelines consultations are a necessary step to obtain the views of people who may be affected by development projects or may otherwise have an interest in their outcomes, and to inform them about changes that could affect them. Such feedback assumes greater significance in the case of people who may be adversely affected.

To make the consultation and disclosure process effective and fruitful, comprehensive planning is required to assure that local government, host population, and project staff interacts regularly and purposefully, throughout all stages of the project and contribute toward a common goal.

7.1.1 Objective of stakeholder engagement

Specific objectives of the consultation process carried out as part of the current ESIA are listed below

- Developing and maintaining communication links between the project proponents (W2E) and stakeholders,
- Sharing of information with stakeholders on the proposed project activities and provide key project information to the stakeholders, and to solicit their views on the project and its potential or perceived impacts,
- Understanding the stakeholders' concerns regarding various aspects of the project, including the existing situation, construction works and the potential impacts of the construction-related activities and operation of the project.
- Receiving feedback on environmental and social impacts and verifying their significance.
- Ensuring that views and concerns of the stakeholders are incorporated into the project design and implementation as much as possible with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed project.
- Managing expectations and misconceptions related to the project.
- Engaging and assessing the specific needs of vulnerable groups, especially those below the poverty line, the landless, people with disabilities, the elderly, women, and children, and those without legal title to land and ensure their participation to in consultations.
- Interaction with the project affected population and other stakeholders for the collection of primary and secondary data on environment and people; and
- Engaging stakeholders for maximization of the project benefits.

7.2 Applicability

This Stakeholder Engagement Plan is developed for the current Project design and capacity and is designed to facilitate information disclosure, consultation and participation, grievance redress mechanism including indigenous peoples located within the project area. The plan outlines the project provisions with regards to engaging with the community and also receiving feedback during the project operation.

7.2.1 Requirement of the AIIB

The Bank believes that transparency and meaningful consultation is essential for the design and implementation of a Project and works closely with its clients to achieve this objective. Meaningful consultation is a process that begins early and is ongoing throughout the Project. It is inclusive, accessible, timely and undertaken in an open manner. It conveys adequate information that is understandable and readily accessible to stakeholders in a culturally appropriate manner and in turn enables the consideration of stakeholders' views as part of decision-making. Stakeholder engagement is conducted in a manner commensurate with the risks to, and impacts on, those affected by the Project.

7.2.2 Consultation

Consultation involves information exchanges among the government, the Implementing Agency, the project executing agencies, and other stakeholders. Although decision-making authority rests with the government, the Implementing Agencies and the project executing agencies, periodic consultations throughout the project cycle help managers make informed choices about project activities. More importantly, it provides opportunities for communities and local groups to contribute to project design, implementation, and evaluation. List of identified stakeholders is given in Table 7-1.

Table 7-1: List of Identified Stakeholders

Disclosure	Office/Group	Frequency	Time
KII	• DNCC • Local Union • Upazila Agriculture • SWM official at Ward • Local School Teacher	Once	During ESIA
FGD	• Local Community • Women group • Local Youth • Landowners • Business Operators (titled) • Business Operators (Non-titled) • Waste Vendors/Buyers • Waste management group	Once	During ESIA
PCM	• Local Community • Landowners • Civil Society Member • Community Influential	Once	During ESIA

7.3 Approach and Methodology for Stakeholder Mapping and Analysis

A stakeholder is defined as "a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project or its Proponent's actions, objectives, and policies". Stakeholders vary in terms of degree of interest, influence, and control they have over the Project or the proponent. In the present study, all the stakeholders have been primarily categorized into two categories that have been identified as:

- Primary Stakeholders: include people, groups, institutions that either has a direct influence on the project or are directly impacted (positively or adversely) by the project and its activities; and
- Secondary stakeholders: are those that have a bearing on the project and its activities by the virtue of their being closely linked or associated with the primary stakeholders and due to the influence, they have on the primary stakeholder groups.Apart from categorization, the

stakeholders have also been classified in accordance with the level of influence they have on the project as well as their priority to the WTE Power Plant North Dhaka Private Limited.

- The influence and priority have both been primarily rates as:

  ✓ High Influence/Priority (Manage Closely): People who have high power and interest are grouped in this category. They always must be managed closely. This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority for the WTE Power Plant North Dhaka Private Limited to engage that stakeholder.

  ✓ Medium Influence/Priority (Keep Satisfied/ keep informed): People who have high power but low interest as well as who have high interest, but low power should be kept satisfied or informed. This implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level for WTE Power Plant North Dhaka Private Limited to engage the stakeholder who is neither highly critical nor are insignificant in terms of influence.

  ✓ Low Influence/Priority (Monitor with minimum effort): This implies a low degree of influence or interest of the stakeholder on the project in terms of participation and decision making or low priority for WTE Power Plant North Dhaka Private Limited to engage that stakeholder.

Figure 7-1: Power/Interest Grid for Stakeholder Prioritization

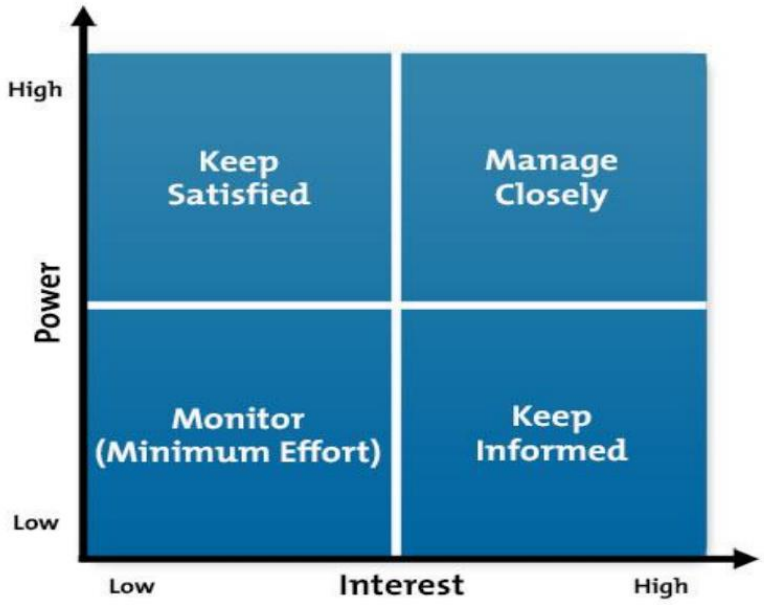


Table 7-2: List of Identified Key Project Stakeholders Basis on Influence

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Project Management				
Project Owner	Primary	Waste to Energy Power Project North Dhaka Private Limited is the primary project proponent who own a controlling stake of 100% in the project	High	• Primary project proponents. • Primary financial beneficiaries. • Responsible for all the project risks and impact liabilities. • Responsible for establishment and operation of this project.
Project Financiers	Primary	May include local and regional bank, national and international banks as well as development partner organization.	High	• Engagement is limited at the corporate management level. • Key participants in the decision-making process. • Compliance to funding agencies' safeguards/operation policies and other policies.
EPC contractor	Primary	Construct to deliver a functioning facility or asset to their clients	Medium	• Carry out the detailed engineering design of the project • Procure all the equipment and materials necessary • Carry out the works in accordance with the agreed scope of works and in accordance with the Contract
Migrant Worker and Labor	Primary	Labors and workers inside, outside of Savar upazilla for participating in construction and production activities	Medium	• Responsible for undertaking mostly skill and unskilled based work during construction phase. • Skilled based work during operation/production period.
Community				

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Local Community	Primary	Primarily includes community residing adjacent to the project site including women and vulnerable households.	Medium	• Receptor of potential air, water pollution and other environmental risks. • Potential beneficiaries of the infrastructural and other development activities. • Potential beneficiaries of business and job opportunities.
Business owners (Titled)	Primary	Primarily includes titled busine owners who has business in the acquired land.	Medium	• Business Status • Previous status before acquisition and Current Status
Non-titled business owners	Primary	Primarily includes non-titled busine owners who has business in the acquired land.	Medium	• Business Status • Impacts on livelihood. • Alternative income sources • Previous status before start business here
Employees of non-titled business owners	Primary	Primarily includes employees of non-titled busine owners who has been employed in the business established in the acquired land.	Medium	• Employment Status • Time of employment • Alternative income sources • Previous employment status before start employing here
Landowners	Primary	Primarily includes landowners whose land were acquired.	Medium	• Land Buying Status

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Women	Primary	Includes women residing villages around the project site	Medium	• No major direct impacts on women community except the potential air, water, and other environmental impacts. • Mostly, no major stake on households' income and decision making • Expected to be the beneficiaries of work opportunities.
Regulatory/Administrative Authorities & Agencies				
Department of Agriculture	Secondary	Local governmental agency responsible for implementation of governmental agricultural activities.	Medium	• Expert input in design phase
Local Administration				
Elected Representatives (Chairman, Member)	Secondary	Elected representatives of local Union Parishad	Medium	• Plays important role in providing public opinion and sentiment on the project • Empowered to provide consent and authorization for establishment of project on behalf of the community
Waste Supply Chain				
Chief Waste Management Officer, DNCC	Secondary	DNCC official of waste management	High	• Plays an important role in providing opinion and discission on the project. • Plays important role on operation phase.

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Waste Supervisor/Manger	Secondary	SWM official at WARD level	High	• Plays important role in providing information regarding the waste supply chain
Waste Buyer/Vendor	Secondary	Different location at waste dumping point	Medium	• Plays moderate role in providing information on waste supply chain.

7.3.1 Information Disclosure

Disclosure of relevant project information helps stakeholders understand the risks, impacts and opportunities of the project. If communities may be affected by adverse environmental or social impacts from the project, the client will disclose to them the following information ("the Information"):

- the purpose nature and scale of the project.
- the duration of proposed project activities.
- any risks to and potential impacts regarding environment, worker health and safety, public health and safety and other social impacts on communities, and proposed mitigation plans.
- the envisaged consultation process, if any and opportunities and ways in which the public can participate.
- the proposed stakeholder engagement process highlighting the ways in which stakeholders can participate.
- Time/venue of any envisaged public meetings and the process by which meeting are notified and reported.

The information will be disclosed in the local languages and in a manner that is accessible and culturally appropriate, considering any vulnerable people. Meaningful stakeholder engagement depends on timely, accurate, accessible, and comprehensible information. Information may include presentation printouts, nontechnical summaries, project leaflets and pamphlets. Documents used in stakeholder consultation should be made available to stakeholders, for example on community public notice boards, and where possible, on the borrower's website. Additional information may need to be disclosed on an ongoing basis, as the project or its impacts, or if material new risks and impacts arise.

7.3.2 Key Informant Interview

During the site visit conducted by EQMS, the following key informant interviews with the different stakeholders taken place to disseminate and disclose information on the proposed activities. Summary of the KII and photographs are given in the below Table.

Table 7-3: Summary of Key Informant Interview

Key Stakeholder	Office/Department	Date	Key Points Discussion	Responses
Community Influential				
Md Saiful Islam	Chairman, Bongaon Union	30-08-22	• Area Name correction • Proper maintenance of waste • Employment for the qualified locals • NoC, Trade License and Tax payment	• Chairman raised his voice to correct the area name as “Baliarpur” instead of AminBazar. People used to call the place as AminBazar though its fall under Bangoan Union and area name is Baliarpur. • Another concern was regarding management of waste at the project. Currently the amount of waste and the condition of landfill is worse than ever. If proper waste handling does not occur, it will be devastating. • Collect NoC from Union Parishad along with the trade license for company if they sell electricity and pay tax accordingly. • Give priority to the qualified local people for employment at project. • Union Parishad will always cooperate the company when needed.
Mss. Shema Akter	UP Member (Ward-7,8,9)	30-08-22	• Health safety issues for women and children. She requests to consider health safety issues first. • Employment opportunity for local. • Traffic and transportation control during construction	• During construction and Operation phase of the plant health safety issue should be consider as prior for women and children. • Employment opportunity for the local people should in priority lists based on their qualification. • Deeply monitor and control the traffic and transport of material.
Md Firoz Hossen	UP Member (ward 8) & Committee Member of Mosque	30-08-22	• Concern about agricultural land. • Air, Noise, Water and Soil quality.	• Near-by agricultural land should not be damage due to the proposed project and other relevant work of the project. • Monitor and control the pollution of air noise and water as well as soil of near-by lands.

Key Stakeholder	Office/Department	Date	Key Points Discussion	Responses
			• Impact on heath of the local people.	• Consider the health safety issue of local people during operation phase.
Mst. Kamrunnesa	Head Teacher, Boliarpur Govt. Primary School	25/8/22	• Status of primary education • Knowledge about project • Impact due to the landfill • Expectation from the project • Suggestions	• The status of primary education in this area is very good. Students get a small amount of money from the govt. therefore drop out from primary level is zero. • Just heard about the project form consultant's visit. • Existing landfill is very much annoying in terms of odor and flies. When the wind flows through this area it's difficult to concentrate in teaching, children are also annoyed. • If the proposed project deals with the waste, hope we can be free from this odor and flies. • Proper implementation of the proposed project and waste management can save this area from odors and flies.
Kanai Lal Rajbongshi	Advisor of Local Temple (Hindu)	28/8/22	• Request to consider safety for local and odor management. • Small grant for the development of Temple is requested.	• Odor management should be in top priority during the construction and operation phase of the project. • From CSR activity of the project small grant is requested for the development of the temple.
Administrative				
Mss. Naziat Ahmed	Upazila Agriculture Officer, Savar	24/8/22	• Safety precaution for agricultural land • Waste control from spreading out • Wastewater leakage from plant • Skill based training and other plan for poor farmers of the area	• Make sure that proper safety protocol maintained so that agricultural land remains unharmed. • Control the waste from spreading outside the boundary • Make sure no wastewater came out and fall into the lands and damage crops and soil quality. • If possible, arrange skill-based training and workshop for poor farmers of that area from the CSR perspective.

Key Stakeholder	Office/Department	Date	Key Points Discussion	Responses
Waste Management & Supply Chain				
Shafikur Rahman	Project Director, Waste to Energy Power Plant, DNCC	3/10/22	• Waste Generation • Waste management • Supply chain of waste • Project Benefit • Challenges • Outcome	• Currently DNCC collects 3400 tons of waste per day. • DNCC manages its waste by itself for 28 number of WARD and 26 number of WARD by private company. Overall liaison and reporting have been maintained with waste management department of DNCC. • Four private company engaged in waste management system independently. • 147 vehicles and 3914 cleaners working for waste management. • 52 STS for waste dumping at zone level. • Medical waste and ternary waste is not dumped in the landfill. • Mainly waste supply chain follows 3 stages, these are: **Primary** level or at household level collection by waste collector, **secondarily** it comes to STS from where it goes to different buyers or vendors through waste pickers and finally resin has been created as a material of plastic product from the waste. • Currently inner part of the land fill is full of and cannot be operational. Once the project will run this landfill will produce power from waste and the tension of waste handling will be resolved. • Landfill operated through five major activities **One**-Vehicle Management. **Two**- Disposal management. **Three**-Landfill facility management. **Four**- Safety Management. **Five**- Environmental Management. • Waste segregation at household level is the biggest challenge for us. If people cooperate in this matter waste segregation challenge will not be an issue for resolve.

Key Stakeholder	Office/Department	Date	Key Points Discussion	Responses
				• This project will help tremendously to control our waste and produce energy which will contribute to the national grid.
Farid Ahmed	Manager, Multi Waste Management and Engineering Ltd.	3/10/22	• Waste management • Future plan • Waste supply chain	• Company is responsible for 13 ward of DNCC to manage waste • In future we will introduce more technical instrument for waste handling and management. • Some newly introduced vehicle for waste collection has already been started and it will increase by near future. • Waste generated from different source and designated collators collect the waste and it goes to STS after some segregation the ultimate destination of waste is the landfill of Aminbazar.
Kazi Ahmed Kabir	General Manger, Clean Tech, Waste Management, DNCC	22/09/22	• Waste segregation • Proper waste collection • Target based amount of waste • Proper monitoring at local level • Train up waste collectors • Maintain liaison with ward waste committee	• Most challenging part of waste management is the segregation part. • Make a proper target that needs to be achieved for burning. • Need to monitor waste collection and dumping properly to get burnable waste from local level to plant. • Arrange training for the collectors on waste handling and reaching out to the destination. • Maintain liaison with ward level waste committee for proper waste collection.
Md Siraj Mia	Supervisor, Sector waste management	22/09/22	• Waste collection Chain • Waste collection system	• Mainly the waste collected from household level by locally recruited waste collector, and they carry the waste to secondary transfer station, after some segregation the waste taken by DNCC waste picking vehicle to the landfill. • Each word of DNCC have box type non-motorized van and pickup for carrying waste from household level.

Key Stakeholder	Office/Department	Date	Key Points Discussion	Responses
				Based on the area and population waste collector may vary from ward to ward.
Rasel Mia	Waste Buyer/Vendor	22/09/22	• Supply chain • Process of waste buying • Ultimate destination of waste • Manpower involvement	• Mainly waste was collected from household level by van, and it comes to the STS. During the transfer from household level to STS some sorting of waste has been done by the pickers and it comes to the vendor or buyer. • Vendor/buyer buy the waste of weight and the price was determined by the type of waste. • Mainly general plastic sold to 30–35-taka kg based on the quality, poly bag and rubber material are sold to 40–45-taka kg and aluminum or silver or metal item sold at higher price up to 60–70-taka kg. • Some buyers from old town and savar buy the collected and segregated waste from the vendor and they make chips from that plastic in a small factory which was bought by the plastic company after cleaning and drying. • Each secondary transfer station (STS) has more or less 100-120 people involved in the entire waste buy sell and carrying process.
Md Kalam	Waste Vendor/Buyer	22/09/22	• Employment status • Business condition • Future of waste business • Opinion	• He has 16 employees working with his shop as a waste segregator and other purpose regarding waste. Even more than 100 people are involved from different perspective with a • This business is good if govt. gives them loan and training it could be better and country can earn revenue from waste • Proper management and guidance are required to grow this business. There is huge opportunity in waste business.

Source: EQMS, August 2022

7.3.3 Focus Group Discussion

During the preliminary site visit, the following focus group discussion was conducted to disseminate and disclose the information of proposing the waste to energy project and to know their opinions about the project. Focus Group Discussion was conducted near the proposed project site with the participants where the consultant team discusses the proposed project details and noted their perceptions. following groups were consulted:

7.3.3.1 Summary of FGD with Landowner

The key findings of the focus group discussion with landowner are as follows:

- Landowner and the community peoples know about the project from the consultants visit. They welcome the proposed project and agree to support the project.
- The major livelihood activity of the community is business and agriculture. They generally practice mixed farming in their land.
- The major crops in the area are rice, vegetable, etc. They sell their products in the local market.
- The major livestock reared by the community is cattle, sheep, and goat. Poultry rearing is also seen in families. Some of the participants raised issues of grazing and farming land.
- Land compensation is preferred in cash. They also believe that employment opportunities will be created according to their skills and experiences.
- People are happy with the determined piece for their land.
- Some of them claim additional compensation for the loss of their crop production due to waste.
- Mainly the ownership is inherited, and some are from buying through deeds and cash payment.
- People are aware of the project and concern about any further pollution to their land.
- Lands are sold based on oral conversation and deeds with cash payment at a time or through installment with or without any involvement of any third party or broker.
- People have issues with odor management and any further pollution by the waste.

7.3.3.2 Summary of Consultation with Women Group

Women in Baliarpur area are mostly engaged in household chores such as cooking, children rearing, animal caring etc. Daily activities of women start between 6.00 AM to 7.00 AM, involve cooking and cleaning, taking care of children, feeding the cattle and other livestock, etc. Besides household work, some of the women reported they are involved in business and private job. 80% of the female have completed primary level of education. Girls drop out in the area is very common. The major reason for girl's dropout is majorly poor family economic condition and high cost of education. Girls drop out mostly after completing secondary education, post which they got married. The most common age of marriage for girls is between 19 to 20 yrs. As per consultation, there are no cases of domestic violence and rape reported in the project area. Women in the area are not involved in community-level decision-making activity. Most of the participants opined that gender-wise employment opportunities for males and family members would benefit the local community from jobs created by the project. The women also expressed interest in receiving vocational training like tailoring, boutique, animal husbandry, etc. The women groups also requested to control the odor generated from the waste.

7.3.3.3 Summary of Consultation with Non-title Business owners

During the site visit and socio-economic survey of ESIA study the study team member have conducted consultation with each of the non-title business owners to obtain their views regarding the project and

the anticipated impacts on their business and livelihoods due to the displacement. It was evident that the five non-title business owners chose the place for availability of customer from bus depot and associated facilities within it. Their business and economic activity completely rely on the existence of bus depot. Following key points were captured during the consultation:

- All of the non-title business owners heard about the project and it's anticipated impacts on them.
- Though there will be impact on their business, they welcome the project for betterment of the country and proper management of waste within the landfill.
- The construction activity and the sand filling in the site have evicted their structures and they had to move from the place where they were doing their business.
- Two of the owners just shifted at the edge of project boundary, two shifted at newly built bus depot (opposite side of current depot) and one business owner move to the newly constructed access road for project.
- All the businesses owners live nearby or within 2km distance from the landfill.
- As they anticipated the construction activity will enhance business opportunity due to the labor influx, they want to continue their business at the nearby area of project without any further disturbance from the project authority.
- Each of the business' owners are responsible for earning and they are the only member of the family who earns.
- The nature of their business is small tea shop with some locally made snacks which are three, one who sell rice and curry along with some snacks and one mobile recharge shop along with some primary medicine or first aid items within it.
- The average income from the shop is around 15000-30000 and varies month to month.
- None of the owners have paid rent to the depot owner only the electricity bill which is around 300-500 BDT based on the usage of light and fan in the shop.
- Only one owner has a trade license and the rest of the owners done have any kind of legal papers.
- Alternative income source or employment within the project can be their alternative income source in case of completely shut down of their business.
- A detail of their business profile has been annexed.

7.3.3.4 Summary of Consultation with Waste Pickers

Waste pickers of the landfill site have also been consulted as part of the stakeholder consultation process for the ESIA to obtain their views regarding the project and impacts on their livelihood due to the project intervention. Following points were noted from the discussion with waste pickers:

- Rag picking in this landfill was not so easy due to the restriction and armed guards, yet some of the respondents made it happen sometimes.
- A group of male and female in different ages are involved in rag picking from the landfill which are nearly forty in number.
- The collected items from the landfill are meant to sell in different prices as per the rate decided for per kilogram.
- Mostly plastic, broken glass, metal pieces and damaged items from household level were found in the landfill.
- On average 200-300 BDT can be earned daily, from the sold item if they work at least 5-6 hours.
- During the monsoon its very hard to collect wastage material and that time they do not come often in the landfill site.
- The construction of the project may dim the chances of entering the landfill site and the income activity will hamper.
- Sanitation and other hygiene are not maintained while collecting waste materials from the site.

- No child or under 18 respondents were found during the consultation those who are involved in rag picking, some children have occasionally accompany their parents.
- An alternative income source can be better in terms of the income from rag picking, as it is a hazardous area and physical injury occurs often in the site.
- Women waste pickers also face difficulties regarding health hygiene and sanitation facilities as its lacked within the landfill site, only drinking water can be consumed from the landfill office area.
- Some of the respondents show interest to work in the project if the authority can consider joining the construction team.
- Women have no clue regarding any employment within the project as none of them have any experience of such.
- Almost every one of the waste pickers lives in the slum which is 5-7km away from the landfill site, they took rickshaw or use bus for coming in the landfill.
- An alternative income generating work will be better for them, and they welcome if any attempt were made to make it happen.

As long as the waste pickers can access the landfill site, they will be happy to do the rag picking unless any obligation put on them to entering the site.

7.3.3.5 Summary of Consultation with Local youth

The youth group of the adjacent area of project are mainly involved in the study, mostly they are at higher secondary and undergrad level students. There is one high school in the village and most of them are studying that school. 1/2 student reports that they go to study at the Mirpur which is 6-8 km from their village. During the consultation it was stated that, some of the youths are involved in small scale business (mainly online based clothing) and private job at Ready-Made Garment (RMG) sector. This youth group is one of the largest groups in consideration of age-based grouping of population in that area. The youth also expressed interest in receiving vocational training like digital marketing, entrepreneurship, mechanical or electrical training etc. The youth group also requested to consider them for employment in the project.

7.4 Public Consultation

7.4.1 Introduction

The objective of the meeting was to inform and obtain opinions of the public from the proposed project area about the proposed Waste to Energy Power project, its potential environmental and social impacts and mitigation measures. Public consultation was held on 30th August 2022 at Jamuna Natural Park, Baliarpur, Savar, Dhaka.

The proceedings commenced at 10:30 am and was presided by Md Saiful Islam, Chairman Bangoan Union of Savar Upazila. The meeting was attended by a total of 65 people (Attendance sheet have been attached in **Appendix D-2**), which represent the elected representatives of Bongaon Union, non-government organization, land affected people, local people including women and senior citizen, local businessman, employees, and shopkeepers of project area.

Mr. Najmul Hossen, Senior Consultant, EQMS Consulting Limited welcomed the participants in the consultation meeting. Mr. Najmul gave a presentation about the proposed Waste Energy Power Project. After a concise presentation about the project, the floor was opened for opinions and suggestions from the participants.

DNCC representatives give answers to the queries and questions raised from local people. Also, consultants give feedback on behalf of WTE Power Plant North Dhaka Private Limited regarding some queries about the project. Mr Lucas also gives thanks to the participants for their spontaneous participation.

After the completion of the opinions and suggestions session, Mr. Modin Mia UP member of Bongaon Union conclude the meeting with thanking everyone for their participation and conclude the public consultation.

7.4.2 Methodology

7.4.2.1 Consultation

Prior to the notice, EQMS Consulting Limited consulted with the union chairman about the date and time. Consultant requested to conduct the consultation/meeting at a convenient place, where there is enough space for more than 100 people under the shadow with sufficient electricity facilities. The venue was selected in terms of easy accessibility from villages near to the project area, and invitees as well.

7.4.2.2 Invitation

After the confirmation of date, time, and venue, EQMS's team visited the project area and invited the nearly residing persons to present in the consultation meeting. They also invited project interested persons from the Baliarpur, Kunda Villages and businessman of project adjacent area.

7.4.2.3 Announcement

After finalization of date and venue, UP members of the respected Wards informed local people to attend PCM.

7.4.3 Meeting Outcome

The key points raised by the stakeholders with responses provided by the project sponsor and consultant are summarized in the following table. presents the outcome of public consultation.

Table 7-4: Public Consultation Outcome

Name	Occupation	Views/Responses
Md. Saiful Islam	Chairman, Bongaon UP, Savar, Dhaka	• Mr Chairman mentioned that the place name should be use as "Baliarpur" instead of Amin Bazar in any project related document and Signboard. As the project area comes under Baliarpur of Savar, Dhaka. • He expresses his cooperation for the project and expect same from the project authority. • Mr Chairman suggests maintaining proper waste management system and taking all relevant NOC from respective department and trade license as well. • He also expects employment opportunity for the qualified local. • Mr. Chairman ask for cooperation and open discussion from all and he concludes his speech with thanking the arranging committee and WTE Power Plant North Dhaka Private Limited. • Local people should get opportunity to work during construction and operation of the power plant based on their skill. • As an elected representative I will be available at your service any time if requires for the development of this area.
Chandan Ghosh.	Director, Shaymoli Food & Beverage	• How long they can stay in the project area? • Company asks for 3-4 months' time for evacuating the place

Name	Occupation	Views/Responses
		• For removing and displacing heavy machinery is time consuming and critical and employment of so many peoples are depending on the factory, what will be the steps to minimize such kind of impacts? • For displacing factory and other equipment, they need electricity connection, shed, land preparation, which is time consuming and costly, so they need that time from both DNCC and WTE Power Plant North Dhaka Private Limited for smooth removal of machineries. • Interim period of relocation, company can't produce any product and without that how they can provide salary for employees? What will be the steps to mitigate such loss of the company?
Jogodish Gosh	Businessman and landowner	• Plot no 3324 (BS) has half of it under acquisition, if authority buy the entire plot or left the acquired half will be better for the owner. • Plot no 3323 (BS) has been impacted due to waste from the land fill, and no agricultural activity is performed due to waste materials. What will be the steps from authority to compensate that damage?
Mohiuddin Mia	Shopkeeper	• 4 Shops (tea stall, mobile recharge and mobile banking, restaurant) are going to be impacted due to the project and those shops are very small tin and wood made. All the shop owners are poor, and the families run through the money came from selling of the shop. • The owners ask for relocation assistance of their shop so that minimum damage will happen, and they can bear that amount of loss.
Nitesh Gosh	Landowner	• Some of my land has been damaged by waste from the landfill and I could not grow any crops in that land. • He proposes compensation for the loss of his productive land.
Tofayel Ahmed	Plant Engineer Shyamoli Water	• The water plant is a big industry with heavy machinery that is automated and cannot relocate without proper precaution and place. • Company needs time for proper relocation • Any compensation will be better to minimize the loss of production during the shifting time.
Responses against the question from DNCC, WTE Power Plant North Dhaka Private Limited and Consultants		
DNCC's response		• Company will take necessary steps to avoid and control any kind of odor that can be created from the waste during project life cycle.

Name	Occupation	Views/Responses
		• Govt. give satisfactory amount of money for the procured land and there will be no more compensation regarding land or any other facilities • All of the landowners have been notified to collect their compensated amount from DC office, if any complexity arises DNCC will cooperate. • Those who are doing business in the project area are requested to remove all the facilities timely as they are already notified several times to evacuate the place. • Due to project timeline no additional time will be given to the persons for staying within the project boundary.
WTE Power Plant North Dhaka Private Limited response		• Company will take necessary steps to manage the odor • Company will ensure no waste will go outside the boundary, and no more damage will occur to any land • A proper safety protocol will be taken to control any kind of hazard to the environment and to the people as well • Company has no provision to give any money to anyone regarding their claimed issue, DNCC or DC office may look after this.
Consultant response		• Adequate time given to the landowners and other associated facilities to remove and vacate the place. Due to the time and project deadline no additional time will be given for staying within the project boundary. • Waste and wastewater will be treated as per the DoE's guideline and safeguard policy of landers and national policy. No harm or issue will arise from the project. • This project will use very much advance technology so that no environmental pollution will occur and no fly ash or any harmful material will affect the community. • Cooperation is requested from the people of community for smooth run of the project.
Concluding the meeting		• Union Parishad Member Mr Madin Mia who helped in every aspect to arrange the meeting and inviting local people to attend has given thanks to all the participants and the arrangement committee. He concludes the meeting with thanking DNCC, WTE Power Plant North Dhaka Private Limited and Consultants for their valuable time and response to all the raised issue. • The meeting was concluded with food and water for all the participants

7.4.4 Forward Looking Stakeholder Engagement Strategy

The stakeholder consultation and engagement are an ongoing process and will continue throughout the project's construction as well as operation and maintenance phases. The ongoing consultation process

could be scheduled on monthly or quarterly basis with the stakeholders including but not limited to the concerned government departments, local administration, and the community representatives from the proposed project area.

The overarching goal of consultations and community engagement is to support and facilitate the project's design and implementation, to reduce conflicts and project opposition, and to increase project's acceptability. Stakeholder consultations and participation will take place during implementation through the following means:

- Discussion (FGD and Individual Consultation) will be conducted with the project affected people during the project implementation stage and the preparation of ESDD.
- Awareness campaign for all stakeholders
- Formal interactions through periodic workshops, consultation sessions with wider stakeholders especially institutional ones such as other Government Department relevant NGOs,
- Informal interactions during the construction phase and also during the operation.
- Series of discussion through FGD and individual level consultation with the community people and women as well as people living near to the project area and doing cultivation will be consulted.

Periodically, the Project may also hold formal workshops to consult a wide range of stakeholders on project activities. These workshops will involve PAPs from communities, DoE, DNCC, W2E and representatives of other relevant departments/entities to share the progress and elicit the views of all the stakeholders for the improvement. Following Table 7-5 illustrates the needs of the key stakeholders for engagement in the project implementation and the project activities.

Table 7-5 Stakeholder Engagement Needs

Community	Stakeholder group	Key characteristics	Language needs	Preferred Methods	Frequency of Consultation	Specific needs/Topic to discuss in the consultation
Project Area	• Local Community • Poor Household • Elderly and disabled	• Approximately 10 households. • The affected group directly or indirectly impacted due to the project intervention.	Bengali	• FGD • Public Consultation • Case Study	• Monthly	• Project knowledge/update • Any specific objection or observation regarding project activity or construction/operation. • Any changes in health status? • Have any of the surrounding lands are newly impacted due to this project? • Is there any employment opportunity you notice from the project in this locality? • Any Suggestions or opinion
	• Groups dependent on specific livelihood • Women • Youths				• Monthly	
	• Landowners • Non-titled PAPs				• Monthly	
Contractor	Project employees and Project's subcontractors	Important partners of the project implementation	Local language and English	• FGD • Meetings • Consultations	• Quarterly	• Status of ongoing work • Ensure regulatory compliances and licenses • Number of workers currently working in the project? • What's the status of their health, accommodation, leisure, and other basic amenities? • Is there any major injury occurs? • Grievance redressal mechanism. • Suggestions and opinion
Upazila/Union and District Level	Administration of respective District/Upazila/Union	Legal and Administrative supportive/regulatory authority	Local language and English	• Key Informant Interviews	• Half-Yearly	• Dissemination of project information • Project related discussion • Obtain suggestions and opinion

8 GRIEVANCE REDRESS MECHANISM

This section describes the need of establishment of a grievance redress mechanism to receive and facilitate resolution of complainants (project affected people, local community, and workers) concerns and grievances regarding the project's performance in the constructional, operational, and decommissioning phases. The mechanism should be able to address the aggrieved parties concerns and complaints promptly by using an understandable and transparent grievance addressing process which is readily accessible by all segments of the population including workers in a workplace environment.

The GRM has been developed with the intention of it being an effective tool for early identification, assessment, and resolution of complaints during project entire life cycle of the project. It is a means through which acceptance, assessment and resolution of community and workers complaints concerning the performance or behavior of the project proponent are ascertained and addressed.

There can be a range of issues arising during a project phase. Some of these issues could be related to

- Compensation payment (if any PAPs is not satisfied with the given compensation can raise grievance to the project authority through GM process),
- Issues related to non-titled holder (structures owners) regarding their relocation and shifting cost
- Any issues raised by non-titled holder (structures owners)
- Failure to fulfil commitments,
- Poor management of construction activities,
- Accidents due to the inappropriate planning of vehicle movement,
- Cultural conflicts between migrant workers and local communities,
- Disturbance due to excessive noise or other nuisance during construction or operation to unfair treatment of workers or unsafe working conditions.
- Community health and safety related issues.
- Gender based violence and Child Labor
- Workers from the contractor part may be issued to raise

Hence, a robust GR is required that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution.

8.1 Grievance Mechanism Development and It's Requiring Steps

The Developers/EPC while developing the Grievance Mechanism are required to adhere to the following steps:

8.1.1 Development of Procedures

The developers/EPC should ensure that procedures for lodging and registering of grievances are in place before the plan is implemented at the site level. The procedures of Grievance Mechanism should comprise of identifying the personnel (Grievance Officer at the Site level) who will be responsible for receiving and addressing the grievances at the site level and handling the cases at the escalation level. The procedures to be developed should include assessment procedures, the procedure to determine the appropriate resolution process, procedures for making decisions on proposed settlements, appropriate time frames for each step in the grievance resolution process and notification procedure to the complainant about eligibility, assessment results, proposed settlements and the like.

8.1.2 Develop Resolution Options and Response

Once Developers/EPC developed procedures, formal and informal resolution options should also be developed along with the preparation of formulating a response. General approaches to grievance

resolution many include proposing a solution, reaching a resolution through discussion or negotiation, using the third party to either informally or formally resolve the matter through mediation and through traditional and customary practices.

8.1.3 Publicize the Grievance Mechanism

Once the procedures for the Grievance Mechanism have been developed by the developers/EPC, it has to be publicized through various stakeholder engagement activities as detailed out in the Stakeholder Engagement Plan and should be disseminated to the developer(s) as well. The Developers/EPC should inform the local community in the first instance and then remind them of this mechanism on a regular basis during the project construction and operation phases. Various communicative methods can be adopted in disseminating information like printed materials, displays, face to face meetings and website updating. The grievances redress mechanism (GR) shall be documented in English and Bangla and copies shall be kept at the project site office and corporate office. The GR is also to be displayed at notice board at the project site office, and training on the GR shall also be provided during orientation. Developer(s) is to ensure that the contractor would keep the workers informed about the grievance mechanism at the time of recruitment and make it easily accessible to them. All the relevant contact numbers need to be made available to them.

8.1.4 Training/ Workshops on Grievance Redress Mechanism

A separate training/ workshop should be undertaken by the Developers/EPC at the community and worker level to discuss the process of how a grievance gets registered, the local contact person's/grievance officer details of receiving grievances, the significance of grievance boxes, the timelines for addressing the grievances and the personnel's involved in the redressal process.

These training should be held every half yearly, and feedback/suggestions from the community should be acknowledged, and changes to the GRM should accordingly be undertaken to make it more user-friendly.

8.1.5 Recording of Grievances

Once the stakeholders are aware of the mechanism and access it to raise grievances, the developer(s) is required to acknowledge the same and keep the complainant's identity anonymous. Consequently, the developer(s) is required to collect grievances by checking the grievance boxes once every fifteen days, record and register the grievances that have come in as per the identified formats and track them throughout the redressal process to reflect on their status and important details. A Grievance Log or database emphasizing the records and status of the grievance is to be maintained by the identified Grievance Officer at the site level. The Grievance Log can be used to analyze information about grievance and conflict trends, community issues and project operations to anticipate the kinds of conflicts that the project proponents might expect in the future both to ensure that the grievance mechanism is set up to handle such issues and to propose organizational or operational changes.

8.1.6 Appeal

If the grievance redressal solution is not acceptable or agreed by the complainant, the complainant should be offered to an appeal process. Circumstance revolving around when an appeal can be made should be set by the developers/EPC so that accountability and transparency are promoted by them in every step.

8.1.7 Resolve and Follow Up

Once the corrective action has been agreed upon, a good practice is to collect proof of those actions in terms of taking photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation. In addition, monitoring and follow-up on the resolution agreed upon should be conducted once to close the case accordingly. Developers/EPC are required to

provide regular (yearly) reports to WTE Power Plant North Dhaka Private Limited that track the number of complaints received, resolved, not resolved, and referred to a third party. In addition, the funding agency also needs to be constantly apprised of the yearly reports in order to support the identification of developing risks.

8.1.8 Proposed Grievance Mechanism for WTE Power Plant North Dhaka Private Limited /Developer

The Grievance Redress Mechanism outlines the process for lodging of grievances, steps to be taken for subsequent action and the time limit within which the issue would be resolved to the satisfaction of the complainant (community members, project affected persons and workers). All complaints shall be recorded and addressed in a uniform and consistent manner. There are two main GRMs under the Project:

1. GRM for APs
2. GRM for Workers

8.1.8.1 GRM for APs

Stage-1: Site Level Committee: If an AP is dissatisfied with the compensation and resettlement program, or any safety or environmental aspect at construction or operation stage, he/she may file a written or oral grievance to the community committee or contractor. In case of an oral grievance, the community committee or contractor should keep a written record. The community committee or contractor will:

1) stop the relevant activity (e.g., construction with noise impact on nearby residents) immediately;
2) do not resume activity until the grievance is resolved and closed;
3) notify the PIU of the grievance received and the proposed solution;
4) give a definite reply to the AP within two days; and
5) close the grievance within 5 days after receipt where possible.
6) The written decision will be delivered to the complainant and one copy will be submitted to the PIU.

Stage-2: Project/PIU Level Committee: If the AP is dissatisfied with the decision of Stage 1, he/she may file a grievance to the Project/PIU level GRC orally, by telephone or in writing, which will call the original grievance record, hold a meeting with the main stakeholders (including the respondent and AP) to develop a solution accepted by all. The respondent should implement such solution immediately and close the grievance within 7 days. All measures and results should be recorded in written forms.

The GR for the proposed project is presented below with time-bound schedules and specific persons to address grievances.

8.1.8.2 Grievance Redress Committee

A site level approach is proposed to be developed for redressing all cases of grievances. All grievances are to be redressed at this stage. The representatives proposed for the grievance committee is provided below,

The functions of Governance, Risk, and Compliance (GRC) are as follows:

- To provide support to affected communities on problems arising from environmental or social impacts.
- To record grievances of the affected community by categorizing and prioritizing them, and provide solutions within a stipulated time period; and
- To report to the aggrieved parties, developments regarding their grievances and decisions of the GRC.

The steps of grievance redressal for Developer have been provided below:

8.1.8.2.1 Project/PIU Level Grievance Redress Committee

Project/PIU level approach is proposed to be developed for redressing all cases of grievances including the referred cases by the Site level GRC. All grievances are to be redressed at this stage. The representatives proposed for the grievance committee is provided below,

The functions of Governance, Risk, and Compliance (GRC) are as follows:

- To provide support to affected communities on problems arising from environmental or social impacts.
- To record grievances of the affected community or referred by the site level GRC; and
- To report to the aggrieved parties, developments regarding their grievances and decisions of the GRC.

8.1.8.3 GRM for Workers

An effective grievance mechanism can enhance the efficiency of the workers by ensuring importance and value of his/her concerns and complaints. It will also help the contractor to understand if any concern or dissatisfaction arises among its construction site workers and other employees. During the construction periods, any worker or employee can raise a grievance if he/she finds anything impacting him/her adversely such as if the living conditions are badly degraded, they are not paid according to the agreement, or basics, such as potable water, are not supplied as per need, etc. The workers' grievance protocol also includes issues of gender discrimination, and gender violence and sexual exploitation and abuse by contractor's employees, labor suppliers or others against workers particularly against female workers.

8.1.8.3.1 Receive and Register a Complaint

The developers/EPC in order to implement the Grievance Redress Mechanism is required to nominate a Grievance Officer for registering the grievances, initiating the process of registering and action taken thereon for the resolution of the grievance and the timeline required in each step. The contact details

of the Grievance Officer shall be maintained and updated in the following format displayed at prominent places available to the public and the project area.

Table 8-1: Contact Details of Grievance Officers

Sl. No	Name of the Grievance Officer	Telephone No.

- Any stakeholder such as worker, a person from the local community or any other stakeholder, with concerns pertaining to on-site work such as community health and safety, local employment, community risk, migrant labour or any issues etc., may register their complaint in writing to the nominated person/grievance officer at the site level.
- All grievances will be addressed by the developers/EPC during the construction and operation phase. For any unresolved grievances or any grievances related to land (N/A for this project as land is acquired voluntarily), the developer/EPC will forward the grievances to WTE Power Plant North Dhaka Private Limited who in turn will subsequently forward them to appropriate authority for redressing.
- Secured grievance boxes shall be placed at the entrance of the site office.
- If any stakeholder or community member wishes to remain anonymous, he/she can write down the grievances and drop in the available complaint box; and
- Once a complaint has been received, it shall be recorded in the grievance log register or data system.

Details of grievance received shall be maintained by the Grievance Officer in a register as per the following format presented in the Table 8-2.

Table 8-2: Records of Grievance Received

Particulars of Complainant						Particulars of Grievance			
Sl.	Date of Receipt	Name	Address	Contact No	Acknowledgment is given at the time of receipt	Subject of the Grievance	Office	Brief	Subject of the Grievance

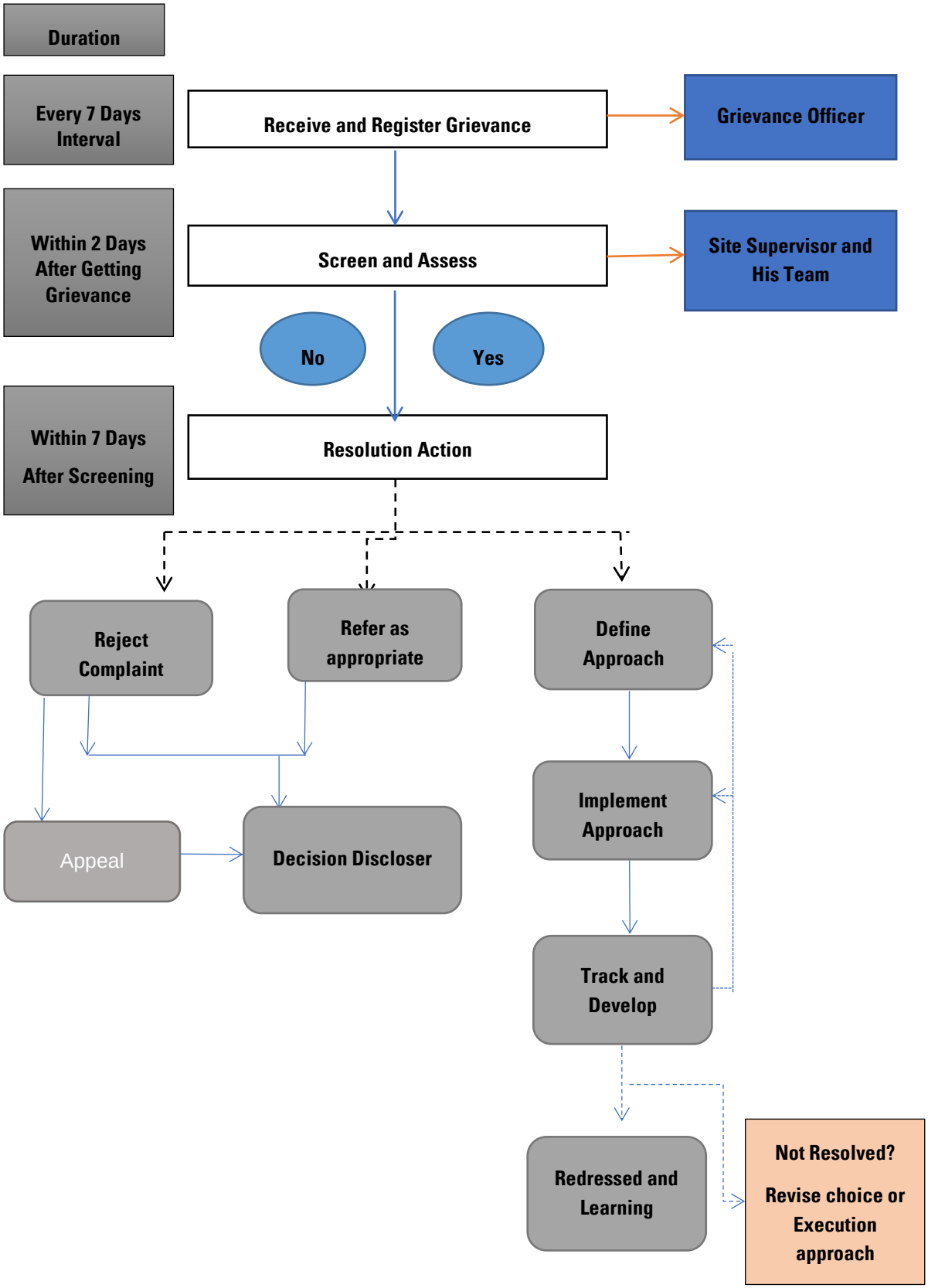
8.1.9 Assessment and Address of Complaint

- The EHS/Grievance Officer/CLO as per organogram will open the grievance boxes once every week and register the grievance in the Grievance Log Register as per the format provided above.
- The Grievance Officer will then forward the grievances after registration to the Site Supervisor for further action.
- The grievance will be assessed by the Site Supervisor within two (2) working days to determine if the issues raised by the complaint fall within the mandate of the grievance mechanism or not.
- During the assessment of complaints, the GRC team (EHS Manager, Admin Officer, Site Supervisor & Safety Officer) will gather information about the key issues and concerns and help determine whether and how the complaint might be resolved.
- The grievances will be redressed at the Site Level by the GRC within seven (7) working days.

- If the grievance fails to be addressed at this level the complainant will have the option to approach the appropriate court of laws for redress; and
- The complainant will have the opportunity to be present at the committee meetings and discuss the grievance faced by him/her.

The Grievance Mechanism proposed for Developer to consider, and implement has been provided in below Figure.

Figure 8-1 Proposed Grievance Mechanism



8.1.10 Documentation

- The Grievance Redress Mechanism will be documented in English and Bangla and copies will be kept at the project site office.
- The GRM will also be displayed at notice board at the project site office and labour campsites and will be included in worker documentation.
- The developers/EPC should inform the local community and workers about Grievance Redress Mechanism during the project construction and operation phases. Various communicative methods can be adopted in disseminating information like printed materials, displays and face to face meetings.
- The Contractor or Admin Officer will inform the workers about the grievance mechanism at the time of recruitment or induction training and make it easily accessible to them.
- The Grievance Officer's contact number will be made available to them. The project office phone number will be posted in public areas within the project area.
- The mechanism will address concerns promptly, using an understandable and transparent process and provide timely feedback to the concerned stakeholder.
- Verifiable records of implementation of corrective action like dated photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation should be kept.
- A Grievance Log or database emphasizing the records and status of the grievance shall be maintained by the Grievance Officer at the site level.

8.1.11 Resources Required for Grievance Mechanism Implementation

A Grievance Mechanism becomes successful if adequate resources are assigned in its implementation. Adequate resources here refer to people, systems and processes and associated financial resources. In order to incorporate the responsibility of designing, implementing, and monitoring the grievance mechanism, the senior management of the Developers/EPC at the corporate level should be involved in executing the various tasks. For a grievance mechanism to function effectively, it is important to establish a governance structure and assign responsibilities for the mechanism's implementation. The following roles and responsibilities have been identified for grievance mechanism implementation:

8.1.11.1 Nominated Grievance Officer

Admin Officer based at the Site Level is to be nominated as the Grievance Officer. The incumbent is to work in tandem with the Site Supervisor, EHS Manager and Safety Officer. They cumulatively form the Grievance Committee at the site level.

8.1.11.2 Engagement of Third Party

To maintain ultimate transparency and accountability for the grievance mechanism process, third parties such as local governments, local community etc. can at times be involved in the grievance redress process. These parties can serve as process organizers, places to bring a complaint to be passed on to the company or as facilitators, witnesses, advisors, or mediators. Third parties can assist in enhancing the trust level from communities as well as overcome limitations of the project-level mechanism.

Through the involvement of third parties as facilitators, the community's confidence in project-level grievance mechanism can be increased, and the project proponent can gain a better reputation with and greater trust from stakeholders. In addition, cost-efficiency and supplement of internal resources can also be achieved if this step is contemplated upon.

8.1.12 Monitoring and Reporting

Monitoring and reporting are requisite tools of measuring the effectiveness of the grievance mechanism, the efficient use of resources, determining broad trends and acknowledging recurring problems so that

they can be resolved before they reach a higher level of contention. They also create a base level of information that can be used by the project proponent to report back to the stakeholders.

8.1.12.1 Monitoring

Depending on the extent of project impacts and the volume of grievances, monitoring measures like internal (by identified Developers Corporate level staff) and external audits (third party consultants) every once in a year based on the complexity of the nature of grievances can be adopted by the Developers/EPC. Grievance records maintained should provide background information for these regular monitoring exercises. Through the review of each grievance and analysis of its effectiveness and efficiency, Developers/EPC can draw on the complaints to evaluate systematic deficiencies. In addition, monitoring of the grievance mechanism helps to ensure that the design and implementation of the mechanism are adequately responding to stakeholder's comments in a cost-effective manner.

8.1.12.2 Reporting

All grievances registered have to be recorded and regularly updated. The site management or Grievance Officer is responsible for discharging this responsibility, and he should be able to produce this document whenever any audits take place. All minutes of meetings with stakeholders, complainants and Grievance Committee are to be recorded and documented regularly for reference purposes. In addition, through the process of monitoring and the reports produced thereafter, assurance of continual improvement of the company's operations is guaranteed. The company can also use these monitoring reports to report back to the community on its implementation of the mechanism, and the modification/ changes proposed to make it more user-friendly.

- To explain the proposed development project to the local community.
- Obtaining reliable local information of conditions and issues that may affect the proposal.
- To reduce conflicts amongst all stakeholders by disclosing information and giving them the opportunity to express their opinions.
- Increase local confidence in the proposal and to give a sense of ownership

8.2 AIIB's 2022 Policy on the Project-affected Peoples Mechanism (PPM) applies to this Project

The PPM has been established by AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement the ESP in situations when their concerns cannot be addressed satisfactorily through the GRM or the processes of AIIB's Management.

Project-affected People's Mechanism. People who believe they have been or are likely to be adversely affected by a failure of the Bank to implement the ESP may submit complaints to the Bank's PPM in accordance with the Policy on the PPM, when their Project related concerns cannot be addressed satisfactorily through Project-level GRMs or the Bank's management processes. The Bank requires all Clients to inform Project-affected people about the availability of the PPM. Information on the availability of the PPM is provided in an accessible and understandable manner in locally appropriate language(s), including on the Client's (or beneficiary's) Project-related website.

Use of Co-financier's Independent Accountability Mechanism. If the Project is cofinanced with another MDB, bilateral development organization or other development finance institution, and the Bank agrees to the application of the environmental and social policies and procedures of the co-financier (in lieu of the ESP) to the Project, the Bank may also agree to rely on the IAM of such co-financier (in lieu of the PPM) to handle submissions from Project-affected people

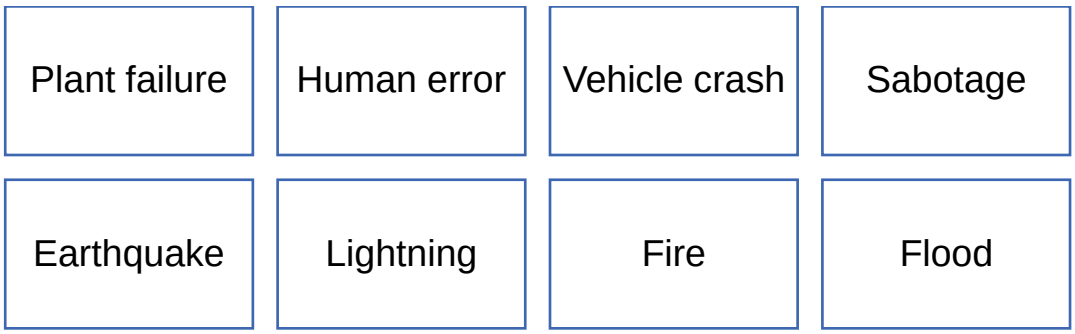
9 EMERGENCY RESPONSE PLAN

9.1 Introduction

An industrial accident causes significant financial and personal loss. Managing these accidental risks in today's environment is the concern of every industry because either real or perceived incidents can quickly jeopardize the financial viability of a business. Many facilities involve various manufacturing processes that have the potential for accidents that may be catastrophic to the plant, workforce, environment, or public. An Emergency Response Plan (ERP) is a written document that is required for an organization according to occupational health and safety standards and must be displayed at every job site with a certain number of employees (usually five to ten). It is a structured, step-by-step process to adhere to emergencies like severe accidents or fires. An emergency response plan also specifies who to alert, what to do, and where to store emergency supplies. The Emergency Response Plan includes any measures that should be in place at all facilities to combat an accident resulting from fire, explosion, or due to any natural calamities (e.g., earthquakes, thunderstorms, flood).

9.2 Definition of Emergency

A major emergency can be defined as an accident/incident that has the potential to cause serious injuries or loss of life. It may cause extensive damage to property, serious disruption both in production and working of the factory and may adversely affect the environment. The following factors may cause a major emergency:



Potential causes of a Power plant Accident: The potential causes of a power plant accident are as follows:

- Fire and explosion: explosives, flammable material.
- Snapping of cables, ropes, chains, slings.
- Managing heavy objects.
- Electricity (electrocution).
- Falls from height inside industrial units or on the ground.
- Slipping on wet surfaces.
- Sharp objects.
- Lack of PPE, housekeeping practices, and safety signs.
- Cranes, winches, hoisting, and hauling equipment.

9.2.1 Objectives of Emergency Planning

When an emergency occurs, the main concern is to preserve life and safeguard property and the environment. Therefore, an Emergency Response Plan, catering to both minor and major emergencies need to be designed with the following objectives:

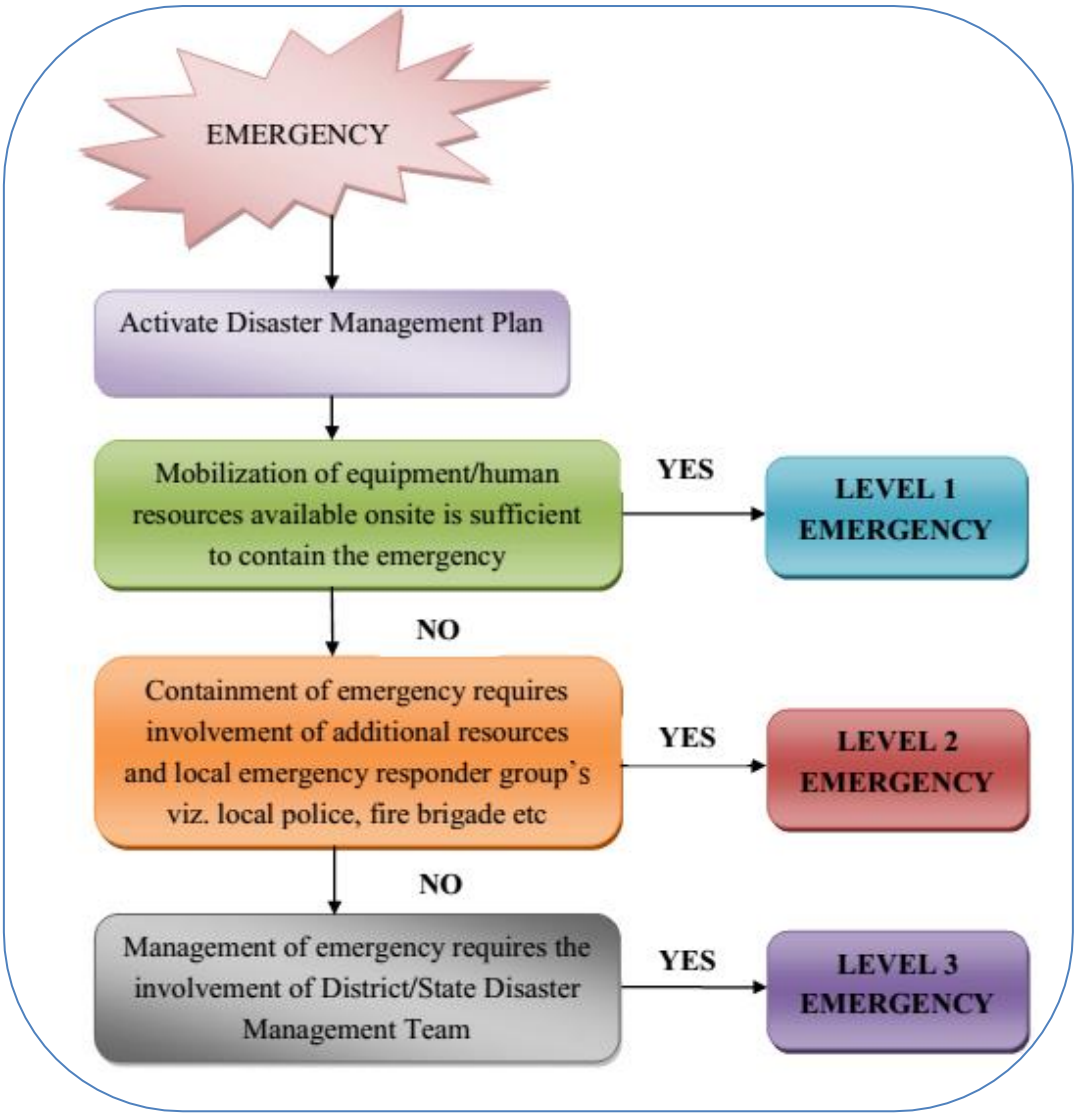
- Rescuing people.
- Treating the injured.
- Safeguarding others.
- Minimizing damage to property and environment.
- Controlling the incident, removing the hazard, and preventing escalation.
- Maintaining the welfare of personnel involved in controlling the occurrence.

- Identifying casualties.
- Informing and assisting relatives.
- Informing the news media.
- Informing/collaborating with the authorities and emergency services.
- Preserving records.

9.2.2 Emergency Classification

Due consideration is given to the severity of potential emergencies that may arise as a result of the power plant operation. Not all emergencies call for the mobilization of the same resources or emergency actions and therefore, the emergencies are classified into three levels depending on the severity and potential impact, so that appropriate emergency response procedures can be effectively implemented by the WTE Power Plant North Dhaka Private Limited Emergency/Crisis Management Team. The emergency levels/tiers defined with respect to this project based on their severity have been discussed in the subsequent sections with the 'decision tree' for emergency classification being depicted in Table 9-1.

Figure 9-1: Emergency Classification "Decision Tree"



9.2.2.1 Level 1 – Emergency

This is an emergency or an incident which

i. Can be effectively and safely managed and contained within the site, location, or installation by the available resources.
ii. Has no impact outside the site, location, or installation.

9.2.2.2 Level 2 – Emergency

This is an emergency or an incident which-

i. Cannot be effectively and safely managed or contained at the location or installation by available resources and additional support is alerted or required.
ii. Is having or has the potential to have an effect beyond the site, location, or installation and where external support of mutual aid partner may be involved.
iii. Is likely to be a danger to life, environment, industrial assets, or reputation.

9.2.2.3 Level 3 – Emergency

This is an emergency or an incident with an off-site impact that could be catastrophic and is likely to affect the population, property, and environment inside and outside the installation, and management and control are done by district administration. Although the Level-III emergency falls under the purview of district authority till they step in, it should be the responsibility of the unit to manage the emergency.

Note: Level-I and Level-II shall normally be considered onsite emergencies and Level-III as off-site emergencies. In case of any emergency in RoW, it will be considered offsite.

9.2.3 Emergency Management Plan

This project is a power plant, with the incineration of solid waste as fuel, but in case of external emergencies, the plant shall take necessary measures to avoid accidents and cope with external changes.

When the equipment of an incineration plant fails, it is necessary to quickly find out failure points and causes and take necessary emergency measures. Main faults and countermeasures include:

- In case of failures of the circulating water pump, feed water pump, and other equipment, the standby equipment shall be quickly started to avoid affecting the operation.
- In case of failures and hidden safety problems of the turbine, measures such as reducing loads and shutting down should be taken, and the steam is recovered after passing through the pressure reducer and attemperator.

In case of failures of incinerator and waste heat boiler, measures such as reducing loads, shutdown and emptying can be taken.

9.3 Potential Hazards and Risk During Different Stages

A major potential hazard has been identified for the proposed power plant. The potential hazards and risks during pre-construction, construction, and operation of the proposed power plant are given in **Table 9-1** and **Table 9-2**.

Table 9-1: Potential Hazards and Risk During Pre-Construction and Construction Phase

Location of hazard	Project Activities	Potential Hazard	Root Causes	Consequences
Pre-construction				
• Machinery and equipment	• Bringing in machines, equipment, and vehicles for site clearance activities	• Trips and fails • Cuts and bruises	• Fatigue or prior sickness • Mechanical failure • Lack of safety training • Not abiding by general health and safety and traffic rules	• Health injury • Disability • Life loss
Construction and Erection				
• Construction site	• Construction of the building, steel structures and its foundation, cutting, welding, painting works, drilling work, etc	• Accidents (burns), electric shocks, etc) • Injuries from falls and slips • Cuts and bruises	• Fatigue or prior sickness • Electric failure • Equipment failure • Lack of safety protocols (e.g. not putting up warning signs or enclosing the area to prevent the entry of outside people) • Not maintain a designated place for backfilling storage • Not maintaining enough lighting during the night (for that working overtime)	• Physical injury • Disability • Life loss
	• Work at heights	• Accidents • Injuries from falls and slips (e.g., broken bones, fractures, traumas, etc.) • Fatalities	• Fatigue or prior sickness • Lack of safety protocols (e.g. not putting up warning signs or enclosing the area to prevent the entry of outside people) • Not maintain a designated place for backfilling storage • Not maintaining enough lighting during the	• Health injury • Disability • Life loss
	• Vehicles movement	• Noise generation • Accident • Emission from vehicles	• Running engine, hydraulic horns, sirens, etc. • Mechanical failure • Old engine or engine parts/lack of maintenance	• Injuries • Health problems • (e.g. respiratory, hearing, and/or cardiac problems)

Location of hazard	Project Activities	Potential Hazard	Root Causes	Consequences
		• Spread of dust and minute particles due to vehicle movement		• Fatalities • Disabilities
	• Chemical storage area • Handling of hazardous chemical	• Accidental release of chemicals • Acute/chronic toxicity from exposures to chemicals • Fire/explosion	• Lack of safety protocols • Carelessness (e.g. smoking near chemical storage area) • Not proper bounding of chemical storage area • Improper chemical storage (e.g. faulty/leaky containers, improper containers, improper sealing of containers, etc.)	• Health injuries (burns, anxiety, depression, etc.) • Disabilities • Fatalities • Loss of properties
	• Occupational Hazard	• Cuts, bruises, and burns • Falls, slips, and tips • Health injuries • Sickness and illness	• Lack of safety awareness • Carelessness in maintaining safety protocols • Use of faulty machinery and equipment • Improper hygiene • Prior sickness or illness • Heavy workload	• Health injuries (burns, anxiety, depression, etc.) • Disabilities • Fatalities

Table 9-2: Potential Hazard and Risk During Operation Phase

Location of hazard	Project Activities	Potential Hazard	Root Causes	Consequences
• Machinery and equipment	• Plant operation	• Mechanical hazard • Fire hazard/explosion • Electrical hazard • Noise generation	• Mechanical failure • Lack of sound buffers	• Health injury • Fatalities • Property damage • Environmental pollution
• Boilers and pressure parts • Compressed air system and pipeline • Live steam line	• Operate pressure valve, switch, and control system • Flows live high-pressure steam from the boiler to the distillation unit	• Fire • Release of high-pressure steam • Explosion	• Failure of water pumps • Electric failure • Equipment failure • Mechanical failure of safety valves • Steam pipe crack	• Incomplete combustion • Equipment damage • Health injury • Loss of life • Environmental pollution • Disability • Life loss

Location of hazard	Project Activities	Potential Hazard	Root Causes	Consequences
			• Accidental leakage, lack of heat sink for the combustion process, and non-functional safety and bypass valve.	
• Chemical Storage	• Use for water and leachate treatment in different phases of demineralized water, cooling water, and potable water	• Toxic accidental releases due to malfunction of equipment. • The carelessness of the operator.	• Chemical spillage • Chemical fires • Mishandling and operational error	• Health injury • (chronic or acute toxicity) • Disabilities • Loss of life • Environmental pollution
• Tank farm	• Storing fuel oil and raw material	• Explosion • Pool fire • Toxic vapor cloud • Shock wave	• Lack of safety awareness • Carelessness in maintaining safety protocols • Instrumental malfunction • Improper maintenance	• Health injuries • Disabilities • Fatalities • Environmental pollution
• Effluent treatment plant	• Wastewater treatment	• Toxic chemical release	• Spillage/accidental release • Improper management	• Impact on health • Loss of life • Environmental pollution
• Occupational hazard	• Plant operation	• Cuts, bruises, and burns • Falls, slips, and tips • Health injuries • Sickness and illness	• Lack of safety awareness • Carelessness in maintaining safety protocols • Use of faulty machinery and equipment • Improper hygiene • Prior sickness or illness • Heavy workload	• Health injuries • Disabilities • Fatalities • Sickness • Anxiety and depression

9.3.1.1 Elements of an Emergency Plan

The main elements of an emergency plan are as follows:

Leadership and Administration	Communication
Role and Responsibilities of Key	Medical care/First Aid
Emergency action	Public relation
Emergency Light and Power	Protection of vital records
Source of energy control	Training
Protective and rescue equipment	Periodical revision of the plan

9.3.1.2 Emergency Action Plan at the project site

The action plan should consist of the following:

- Emergency Control Centre/Room; and
- Key Personnel.

It is especially important to establish an emergency control center at the plant site for managing any kind of emergency. This center will be the main center from where the operations to manage the emergency will be directed and coordinated. After establishing the control center/room, the following facilities are to be made available in the emergency control center/room:

- Internal and external communication system.
- Computer and other essential records.
- Daily attendance of workers employed in the plant/factory.
- Records of the storage of hazardous material and manufacturing.
- Pollution records.
- Walky-talky.
- Plan of the plant showing:
    - Storage area of hazardous materials.
    - Storage of safety equipment.
    - Firefighting system and an additional source of water.
    - Site entrance, roadway, and emergency exist.
    - Assembly points.
    - Truck parking area; and
    - Surrounding location.
- Notebook, Pad, and Pencil; and
- List of Key Personnel with addresses, telephone numbers, etc.

9.3.1.3 Assembly Points

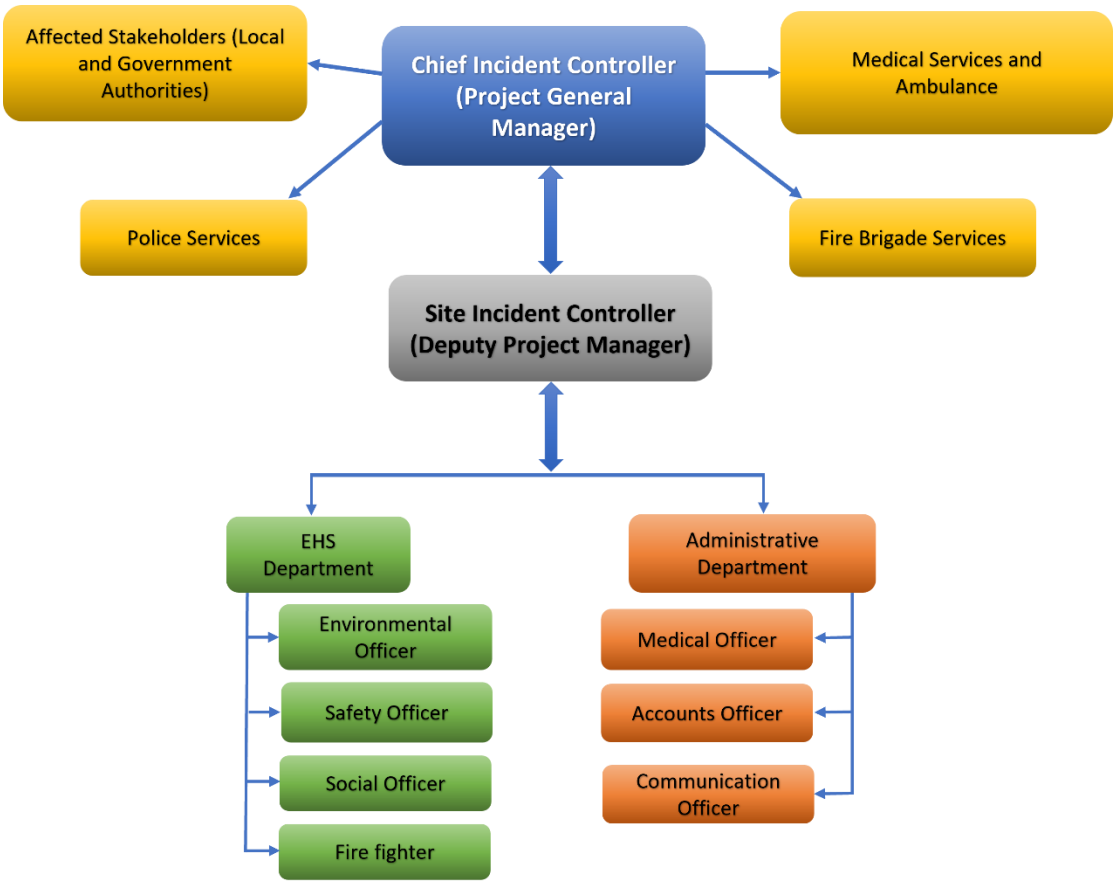
A safe place far away from the risk area of the plant should be pre-determined as an assembly point where, in the case of an emergency personnel evacuated from the affected areas are to be assembled.

The plant workers, contract workers, and visitors should assemble at the assembly point in case of emergency and the time office clerk should take their attendance to assess the missing persons during an emergency.

9.3.1.4 The Key Personnel for Emergencies in the plant

The following key personnel will be played a vital role during the emergency in the plant. Figure 9-2 depicts a detailed organogram for managing emergencies.

Figure 9-2: Organogram of Emergency Response Plan



Their roles and responsibilities for emergency management are also given below:

a. Chief Incident Controller.
b. Site Incident Controller.
c. EHS Department
   - Environmental Officer
   - Safety Officer
   - Social Officer
   - Firefighter
d. Administrative Department
   - Medical Officer
   - Accounts Officer
   - Communication Officer

a. Chief Incident Controller

The Project General Manager of the plant should function as the Chief incident controller. His duties are to:

- Assess the magnitude of the situation and decide whether the evacuation of staff

from the plant is needed.
- Liaison with Police, Fire Service, Medical Services, Deputy Project Manager, and other Government Agencies.
- Direct and control the rehabilitation of the affected area after an emergency; and
- Ensure that evidence is preserved for inquiries to be conducted by statutory authorities.

The Chief Incident Controller will declare the emergency and he will instruct the Site Incident controller to call the gate office to operate the emergency siren after assessing the gravity of the situation.

b. Site Incident Controller

The Deputy Project Manager should function as the site incident controller. He is the next responsible officer after the Chief incident controller. Generally, in the plant, a manager is designated as the site incident controller. In case of an emergency, he will rush to the place of occurrence and take overall charge and report to the Chief Incident Controller by personnel communication systems like cell phones or walky-talky and inform about the magnitude of the emergency. His duties are to:

- Assess the situation and consider the magnitude of the emergency he will take decision and inform the EHS Department and Administrative Department for further action.
- Give directions to stop all operations within the affected area.
- Take the charge of Chief incident controller till the Cheif Controller arrives.
- Order for shutdown and evacuation of workers and staff from the affected area.
- Ensure that all non-essential workers/staff are evacuated to the assembly point and areas searched for casualties.
- Report all significant development to the administrative department; and
- Advise preserving evidence of emergency into the cause of the emergency.

c. EHS Department

1. Environmental Officer

On hearing the emergency siren/alarm:

- He will proceed to the control center and communicate with the site incident controller.
- He will collect information from the emergency affected area and send correct message to the site incident controller for a declaration of emergency.
- He will take stock of the meteorological condition from local meteorological department.
- He will communicate all information as directed by the site incident controller.

2. Safety Officer

On hearing the emergency alarm/siren, the role of the safety officer will be the following:

- He will reach the incident area with fire and security staff.
- He will inform through telephone or walky-talky to the EHS department.
- He will inform the site incident controller through the EHS department about the situation and requirements for outside help like Fire Service and other mutual aid members.
- At the site, the entire fire squad member will respond to the advice and information given by the site incident controller; and
- Security will control the visitors and vehicle entry.
- He will contact all essential departments.

3. Social Officer

The social worker will be able to help during an emergency by:

- Comforting workers who may become anxious or worried about events.
- Contacting families to assure them that workers are in good care and answering questions.
- Contacting additional volunteers to assist workers, if staff are unable to get to the facility assisting staff in caring for workers as needed.

4. Firefighter

The firefighter will be able to help during an emergency by:

d. Administrative Department

The administrative department should work as a liaison officer consulting with the site incident controller to contact the essential departments such as Police, Press, and Statutory authorities. His responsibilities shall include:

- To ensure that casualties receive adequate attention to arranging additional help if required and informing relatives.
- To control traffic movement into the factory and ensure that alternative transport is available when needed.
- When the emergency is prolonged, arrange for the relief of personnel and organize refreshments and catering facilities.

1. Medical Officer

Medical Officer with his team will report to the site incident controller upon hearing the fire/emergency siren immediately. The ambulance will be parked nearest to the site of incident. Name of injured and other casualties carried to the Hospital will be recorded and handed over to Site Incident Controller. The ambulance will carry the injured to the nearest hospital for treatment.

2. Accounts Officer

He needs to play a vital role in the Life-insurance maintenance, policy review and getting support from the insurance company for the employees, workers, and the factory after an emergency.

3. Communication Officer

The role of the communication officer will be the following:

- Dispatch all patrol units to calls for service.
- Provide Communications Support to Emergency Agencies
- Monitor Fire/EMS calls of adjacent jurisdictions.
- Retrieve sensitive information

9.4 Emergency Procedure

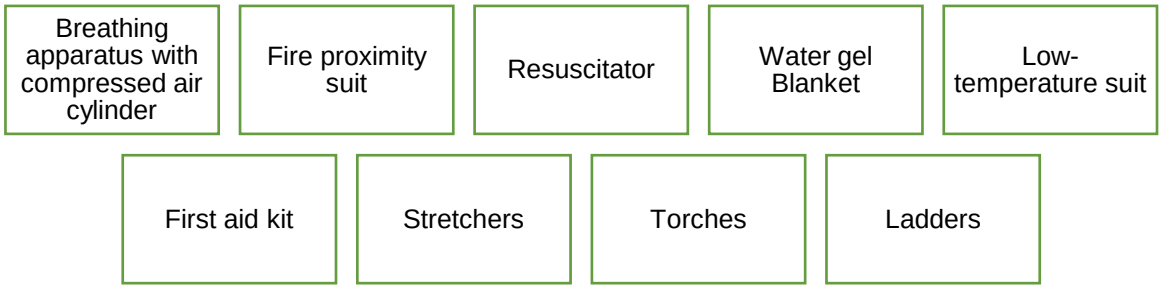
The Safety Operating Procedure of an Emergency Response Plan means executing a step-by-step operation in any Emergency which can occur inside the plant.

Typical actions during an Emergency are:

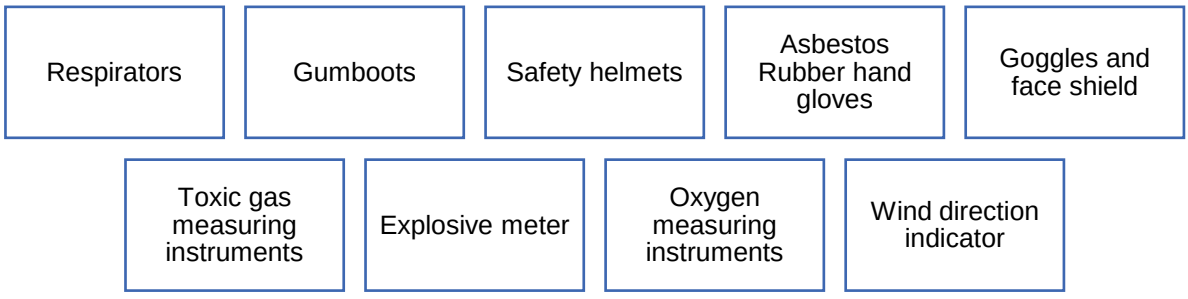
9.5 Emergency facilities

The following facilities should be provided in the plant to tackle any emergency at any time:

- Fire protection and firefighting facilities.
- Emergency lighting and standby power.
- Emergency equipment and rescue equipment:



- Safety Equipment:



9.5.1 Alarm System

The alarm system varies and will depend on the size of the works - a simple fire bell, hand operated siren -break open type, fire alarm, etc.

9.5.2 Communication System

Communication is a key component to controlling an emergency. The following communication system may be provided in the plant:

- Walky-Talky.
- Telephone (internal and external).

- Cell Phone.
- Intercom.
- Runners (verbal or written messages).

Initially, the management needs to call **999** (National Emergency Service No) and inform the emergency services clearly to seek help. The following communication will be initiated immediately after calling 999 as per requirement.

Table 9-3: List of Emergency Contacts (Offsite)

SL No.	Items	Address	Contact Number	Distance from the project site
1	Police Stations	1. Savar Model Police Station 2. Darussalam Police Station	1. 01713373327 2. 08032333/999	1. 8.91 km 2. 5.63 km
2	Fire Brigades	3. Fire Service & Civil Defence Station – Savar 4. Kallyanpur Fire Service & Civil Defence Station	1. 01730002250 2. 01813573418	1. 7.68 km 2. 5.60 km
3	Hospital	1. Enam Medical College and Hospital 2. Bangladesh Specialized Hospital	1. 01716358146 2. 09666700100	1. 9.35 km 2. 7.28 km
4	UP Chairman	1. Md. Saiful Islam Chairman, Baliarpur Union Parishad	01731802580	

Source: Google Maps

A list of offsite emergency contacts is given in below table

Sl	Designated Person	Contact Number
1	Project General Manager	TBA
2	Deputy Project Manager	TBA
3	Environmental Officer	TBA
4	Safety Officer	TBA
5	Social Officer	TBA
6	Medical Officer	TBA
7	Accounts Officer	TBA

TBA-To be announced

9.5.3 Siren for Emergency

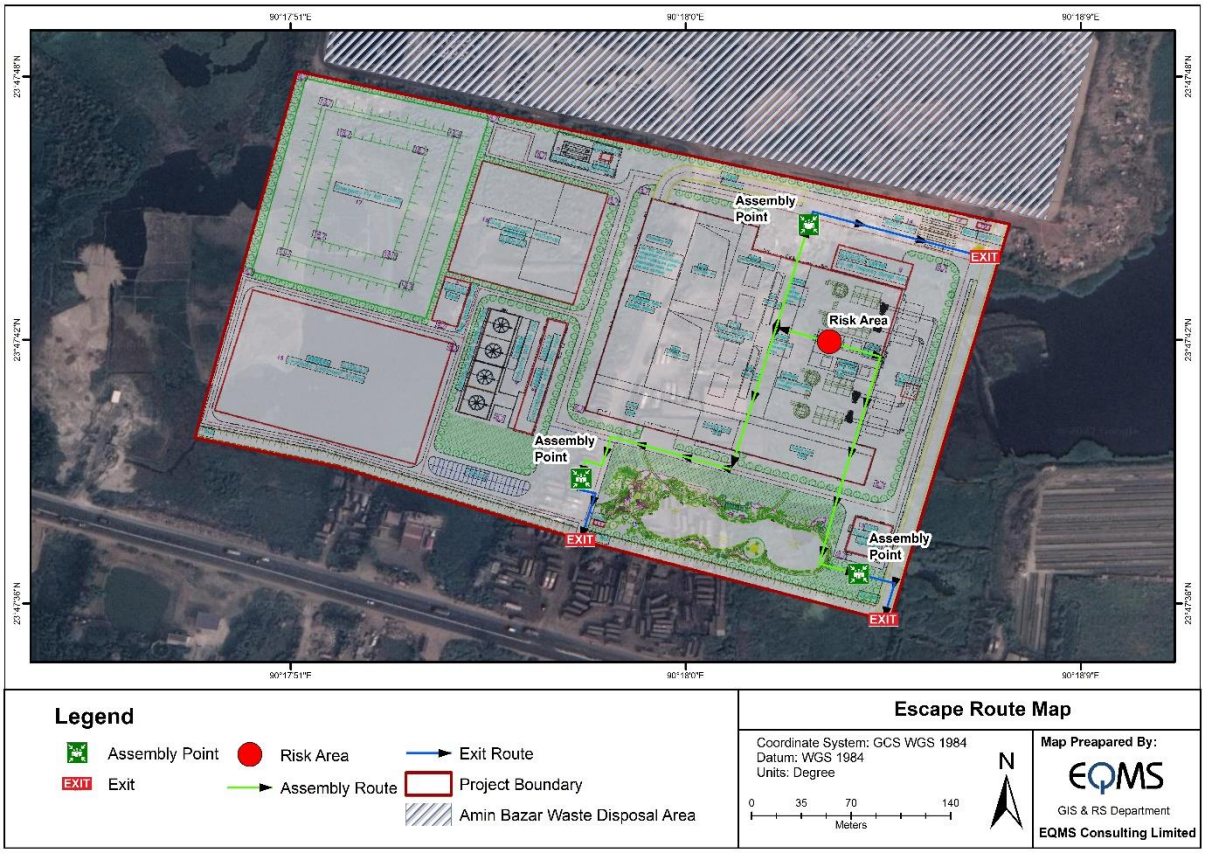
The siren for an emergency should be different from the normal siren. The emergency siren should be audible within a 2 KM radius. The emergency siren should be used only in case of an emergency.

9.5.4 Escape Route

The escape route from the plant should be marked clearly. The escape route should be the the shortest route to reach out of the plant area to the open area, which leads to the assembly point. This route should be indicated on the layout plan attached to the Emergency Plan. All non-essential staff should be evacuated from the emergency site. As soon as the emergency siren rings the workers must shut down the plant and move to the assembly point. The plant shutdown procedure in case of emergency should be prepared and kept ready and responsible people should be nominated for the

purpose. Figure 9-3 represents the escape route of the Waste to Energy Power Plant in case of incidence.

Figure 9-3: Emergency Escape Route Map



9.5.5 Counting of Personnel

All personnel working in the plant should be counted. Time office persons should collect the details of personnel arriving at the assembly point. These should be checked with the attendances of regular workers; contract workers present on the site on the day of emergency. The accident control should be informed, and arrangements should be made for searching missing persons in the emergency-affected area. The employees' addresses and contact numbers should be maintained in the time office so that during emergency relatives of those affected due to an emergency may be informed accordingly. Information in respect for an emergency should be given to the media and other agencies.

9.5.6 All Clear Signal

After control of the emergency, the site incident controller will communicate to the chief incident controller about the cessation of emergency. The chief incident controller can declare all clear by instructing the time office to sound "All Clear Sirens."

9.5.7 Mutual Aid System

Mutual aid scheme should be introduced so that in case of emergency necessary help from mutual aid partner may be extended. Essential elements of this scheme are:

- Mutual aid must be a written document signed by the Chief Executive of the plant concerned.
- Specify key personnel who are authorized to give requisition of materials from other industries.

- Specify the available quantity of material/equipment that can be spared.
- Mode of requisition during an emergency.
- Mode of payment/replacement of material given during an emergency.
- May be updated from time to time based on experience gained.

Mock drills in emergency planning should be conducted once in 6 months and the sequence of events should be recorded for improvement of the exercise. Exercises on Onsite Emergency Planning should be monitored by the Factory Inspectorate and the high officials of the organization, and the plan is reviewed every year.

9.6 Activities to address Emergency

- Attendees of the incident place shall inform the Control Room & Emergency Response Team in case of emergency.
- Stop work immediately and vacate the workplace.
- Shut down the electrical connection.
- All employees will go to the designated Assembly Point located & mark in the specific area.
- Any Emergency Response Team member or designated person shall notify the EHS department and fire brigade and important people by phone.
- Once the EHS department has been notified and it is safe to do so, a trained Fire Fighting team may attempt to extinguish small fires. All fires need to be reported to the senior authority.
- When the incident place has been evacuated a head count shall be done by the designated person accounting for all employees in place including those who may be trying to extinguish the fire.
- A List of personnel in place, updated and current will be kept in the Personnel office.
- The Emergency Response Team is responsible for ensuring the requirement of the EHS department and giving all pertinent information.
- Facilities should provide first aid attendants as well as medical equipment suitable for the people if any injury took place during the incident and quickly react to give maximum medical facility.

9.6.1 Record Keeping

A record is a combination of information and helps employers and workers to understand industrial hazards and their causes and the implementation of the proper task.

Recordkeeping of any incident shows require steps that need to be taken and the weakness of the previous incident. For proper recordkeeping need to maintain some regular procedures as-

- Emergency Response Plan
- Emergency training records
- Previous incident record
- Module and materials used for training
- Emergency preparedness drill/rehearsal
- Evaluation feedback from training and emergency drills
- Records and information about previous incidents.

9.6.2 Responsibility

ERP Coordinators: Any person in Emergency Response Team can function as a responsible person during the working day. They are responsible for managing any type of emergency individually and follow up on all preventive procedures followed by the respective team. They communicate with all local administrative personnel or offices during emergencies occur.

Shift Executive: Shift Executive is acting as a site controller during night shift operation and will be continuing the role till any above-mentioned persons come to the factory. The security supervisor is to assess all types of emergency work with the shift executive**.**
Security supervisor: Security supervisors assume the role of site controllers during hokidays or weekly off days, and they will continue in this capacity until one of the aforementioned individuals arrives at the factory

First Aid Team: The member of the first aid team is responsible for managing any type of personal injury/accident and communicate the same to the crisis management team and follow up on their guidance and procedure as illustrated below**.**

9.7 Emergency Response for Natural Hazards

9.7.1 Earthquake

- Isolate electrical supply wherever it is possible.
- Do not use elevators.
- All electric connections of the plant should be cut off at that time. And the important thing is that everybody will go to a safe place near the building.
- Ensure fire and siren alarm systems are on all floors. During an earthquake, all the employees will come down to a safe place in a row through the stairs after hearing the alarm.
- Must follow the instruction regarding earthquake
- Must evacuate as per the evacuation plan
- Should have a Rescue Team to help the injured employees or who get down. And they will also take the injured employees to a safe place.
- Isolate all pipelines of steam, compressed air, fuel, and CO2 when they are not in use.
- Check the availability of security personnel and have a chat with them in view of the likely immediate action to be taken.
- Empty such tanks which are installed in vertical and relatively unstable conditions.
- Take a review of material storage and ensure that the maximum amount of such material is removed from places where it can fall. Uniform Material distribution at the lowest height from the floor is the safest way of storage.
- Ensure caps on all compressed gas cylinders,
- Immediately ready all Emergency equipment like stretchers, breathing equipment, PPEs, Dewatering, portable welding gas cutting equipment, emergency lights, Battery-operated public-address equipment, Ropes, lifting tackles, trolleys, emergency medical equipment, etc.
- Emergency transport vehicles shall be parked in the open area so that it is free from any falling object.
- Identify critical and weak areas of the building and organize them to support them adequately to prevent collapse.
- Check storage of Hazardous Chemicals to comply with normal storage safety requirements.
- Keep Fire Hydrant accessible, Keep the newest and best conditioned fire hoses and Fire extinguishers readily available.
- Remove unwanted combustible material.
- Review that room heaters, electric hot plates, and other sources of ignition that are normally used in winter situations are operated, managed, and stored safely.
- Ensure that flammable liquids i.e., Petrol, Diesel, and other petroleum products are stored under secondary containment with due precautions.
- Over and above ensure that personnel are alert and do not panic.
- Ensure the average six feet height of raw materials and finish is good.

9.7.2 Lightning

For avoiding any risk from lightning, there will be some specific measures for avoiding any kind of injuries or fatalities from lightning. These will be:

- Installing thunder arresters at the project sites.
- Stop all work activities if there are any dark patches of cloud over the sky.
- For the land section yard, all the workers will move to the site offices.
- First aid signage will be available at sites for any such kind of emergency.

9.7.3 Flood

The project area is located in the Aminbazar landfill area in Savar Upazila in Dhaka. At the north side of the project a river has been flowing named “Karnatali River” and it originated from the Dhaleswary River. The Distance between the river the project area is nearly 600m. The project location is a low-lying area and in monsoon season due to proper drainage system water logging condition have been observed there.

Around 6 km downstream of the project area, there is a confluence of the Turag and Karnatali river and possess flood water and has some contribution to the water logging condition in the karnatali and nearby water bodies, within the monsoon season, water is flowing downing to the Turag River. Flood protection and mitigation measures have been pointed out in the later section.

Flood zoning and risk condition mapping has been shown in the below figure based on the satellite image analysis and BARC referred documents. Less severity of flooding and water logging conditions mitigation measures have also been delineated.

The water logging and flooding can occur due to heavy monsoon season stormwater flooding along with upstream river discharge. The upstream flooding levels have been mentioned in the below Table, this flood level measuring gauge station lies 6km of the upstream and at the downstream of the confluence of Dhaleshwary and Karnatali River.

Table 9-4: Historical max and minimum water level have been considered for the last 20-years available data from the gauge station.

Year	Water level (mMSL)	
	Max	Min
2000	6.02	0.54
2001	5.45	0.74
2002	6.41	0.78
2003	6.04	0.93
2004	5.5	0.42
2005	5.34	0.8
2006	4.59	0.32
2007	6.84	0.19
2008	3.64	0.51
2009	5.25	0.53
2010	5.69	0.9
2011	6.01	1.22
2012	5.8	1.23
2013	4.92	0.56
2014	5.43	0.63

Year	Water level (mMSL)	
	Max	Min
2015	5.17	3.65
2016	4.12	0.96
2017	4.08	0.56
2018	x	x
2019	x	x
2020	5.54	1.22
2021	5.92	0.66
2022	3.94	0.05
Max	6.84	3.65
Min	3.64	0.05

From the above Table, it has been observed that the max water level is 6.84 m(MSL), and min water level is 0.05m (MSL) at the downstream condition. Near the project area combined flood action of Karnatali and Turag River flooding and flood frequency analysis have been shown in the below Table.

Table 9-5: Flood frequency analysis for the project area.

Flood Return Periods (Years)	Flood Level (mMSL)
2	5.64
10	6.74
50	7.74
100	8.04

From the above table, 50-years and 100-years flood return periods can occur at 7.74m (MSL) and 8.04m (MSL) level respectively. The designed elevation for the Waste-to-Energy (WTE) project in Amnbazar of Savar area is about 8.6 meters high, and the estimated elevation can meet the flood control requirements.

Mitigation Measures and Recommendations

- Flood protection structure like dike wall/retaining wall can be established around the project area considering the max flood level plus freeboard height. Flood embankment area slope protection can be established.
- Project land elevation must be established within the project boundary area. Land development will also impede the leaching wastewater to the groundwater and pollute the nearby soil and sediments of land and river.
- Sloping of the project land area along with proper drainage improvement condition have to maintained according to the recommendations from the topographic report. Slope and drainage will also help in the rainstorm water drainage of the project area.
- Outside of the project boundary, land proper drainage and water congestion conditions have improved through proper landscape and topographic measurement, thus avoiding any additional water logging by the WTE project, as the project surrounding area is a low-lying and below the max flood level. Outside drainage establishment will also help in this regard.
- River erosion at the project site area and project land erosion protection measures like geobag with grass-turfing can be adopted, it will also help the slope protection and sustain the land and embankment area.

9.8 Emergency Response Plan for Other Hazards

9.8.1 Fire

- Evacuate the people from the Fire that occurred surrounding area and send them through a safe exit direction.
- Remove unwanted combustible material.
- Keep cool and do not panic.
- Inform the substation and electrician to get the affected area isolated from the power supply.
- Keep Fire Hydrant accessible.
- Keep the newest and good conditioned fire hoses and Fire Extinguishers readily available.
- Ensure one operator is always present in the Hydrant system area when using the fire Hydrant system.
- If the fire is exceedingly small, use the correct Fire Extinguisher for extinguishing the fire.
- Try to isolate the fire by removing the surrounding inflammable material from within reach of the fire.
- In case of a big fire use a local Hydrant system for extinguishing the fire.
- If the fire is beyond the control inform the security or higher authority to call the local fire Brigade and Inform the Senior manager (Plant In charge) or Emergency Response Team.
- On arrival at the fire, the brigade paved way for them to reach the exact site of the fire.
- In case of any accident in human life please call the first aid team and get medical attention as quickly as possible.

9.8.2 Fatal Accidents

- During emergency operations, if there is an injured person, call the First Aid Team and conduct first aid with the help of the first aid item.
- Inform Emergency Response Team.
- If the accident is severe then call an emergency vehicle and immediately rush the injured person to a local hospital or company-recommended nursing home.
- Fill in the accident report form with the help of a witness and deposit the same to the Emergency Response Team.

9.8.3 Utility Failure

Examples of utility failures that may occur are electrical outages, plumbing failure/flooding, natural gas leaks, steam line breaks, ventilation problems, and/or elevator failure. In the event of a failure, immediately notify the Emergency Response Team.

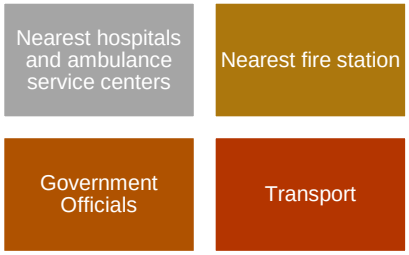
- For emergencies and potential danger or after hours call the Control room.
- In a situation where a building needs to be evacuated, please proceed to the building-specific evacuation area.
- Turn off equipment, machines, and computers.
- Assist disabled persons as needed.
- Do not use elevators.
- Stay at the designated evacuation area until the fire department or designated representative has given the “all clear” to re-enter the building.

9.9 Assumption

Waste to Energy power plant authority will prepare immediately an emergency plan before the starting of commercial production. In this emergency plan following matters will be considered:

- Site plan and Topographic plan.

- Plan to show the firefighting facilities.
- Plan showing hazardous material storage area.
- Material safety data sheets for hazardous chemicals.
- Facilities are available in the main control center.
- List of emergency equipment.
- List of safety equipment's.
- List of important telephone numbers and addresses.



- Names and addresses and contact telephone numbers of Key Personnel.

The emergency plan shall be documented in a printed form in sufficient copies to give all concerned knowledge, study, and easy follow-up. The emergency plan shall be rehearsed and practiced at regular intervals to assess the efficiency of personnel and equipment coordinated efforts and to increase confidence and experience to operate such a plan. The plan so prepared should be updated annually and uploaded to the factory website for easy reference.

Production must be safe and be promoted by safety. Following the policy of "safety first, prevention first", this project uses mature and reliable equipment and strives to improve the mechanization and automation of the production process, thus greatly reducing the factors endangering workers' health and potential safety hazards. At the same time, according to the characteristics of waste incineration in this project, the prevention of waste odor, leachate, and foul smell has been thoughtfully designed, and preventive and active measures have been taken in fire prevention and personal casualties' prevention. It can be anticipated that after the project is put into production, the labor safety and hygiene of workers in the production process has been ensured while obtaining environmental protection benefits, social benefits, and economic benefits.

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 Introduction

The Environmental and Social Management Plan is concerned with the implementation of the measures necessary to minimize or mitigate adverse impacts and enhance beneficial impacts. All mitigation and monitoring measures would be as per the World Bank EHS Guidelines, AIIB E&S Framework, and Bangladesh national standards.

The ESMP is prepared to minimize or mitigate adverse environmental impacts identified in the E&S Risk and Impact assessment report as specified in Chapter 6 during the pre-construction, construction, and operation stages. The ESMP outlines mitigation and monitoring requirements that would ensure compliance with the GOB environmental laws and regulations and comply with the Environmental and Social standards and guidelines of Funding Agency AIIB. Unless the mitigation and benefit enhancement measures that are identified in the ESIA are fully implemented, the prime function of ESMP cannot be achieved. The key indicator for measuring the success of mitigation measures/action plans in compliance with the Statutory EQS of Bangladesh.

10.2 Objectives of the Environmental and Social Management Plan

The main objective of the ESMP and Environmental and Social Monitoring Plan is to ensure the implementation of the mitigation measures planned to reduce the environmental impact of the implementation of the waste-to-energy power plant project and to verify and record the environmental impact. Thus, the objectives of ESMP are to formulate Mitigation measures and to minimize or eliminate negative impacts arising from the proposed activities.

The ESMP and Monitoring Plan are worked out based on the following:

- To reduce the environmental impact to the permissible level by the mitigation measures during the period of construction and operation, so that a hazardous impact would not occur.
- To configure a responsible organization for the implementation of the mitigation measures.
- To implement the ESMP and Monitoring Plan adequately during the period of construction and operation.

The ESMP includes a list of actions for curbing environmental and social adverse impacts, monitoring, and also formulating budgetary costs for implementation of the ESMS. In case any non-compliance, change in scope, or unanticipated impact arises during project implementation, corrective action would be taken accordingly as per statutory requirements and funding agencies' environmental and social guidelines and standards.

10.3 Management Plan

The management plan for the proposed ESMP program ensures efficient implementation and monitoring of environmental and social safeguards, promoting sustainable practices and community engagement. It focuses on proactive measures to mitigate impacts, uphold compliance and foster long-term environmental stewardship and social responsibility. Towards the effective and environment-friendly operation of a project, a set of guiding tools and suggestions are necessary which need to be followed at various stages of plant installation, operation and maintenance. This plan generally has various components of management depending on the type of project or plant activity and types of discharge and their pollution potential. This ESMP once prepared, forms the basis of environmental management actions from the part of the project authority and may need modification or upgradation because of changes in the plant operation or accurate pollution load/environmental problems detected afterward. All beneficial and adverse impacts which may likely to occur at different phases of the project have been identified.

10.3.1 During Pre-Construction and Construction Phase

The possible environmental and social impacts during the pre-construction and construction phases have been already identified and assessed in Chapter 6 of this ESIA report. For mitigating the possible environmental and social impacts, mitigation measures for the pre-construction and construction phases are proposed in relocationTable 10-1.

relocationTable 10-1: Environmental and Social Management Plan during Pre-Construction and Construction Phase

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Impacts on Natural Drainage Pattern	• Increased risk of flooding and waterlogging • Erosion and sedimentation affecting water quality • Disturbance to local aquatic ecosystems • Impacts on agricultural land and local communities' livelihoods • Alteration of groundwater recharge patterns	• Avoid construction activities within the river's natural drainage path. • Ensure proper channelization and maintenance of existing drainage lines to prevent obstruction of water flow. • Design and implement a temporary drainage management plan. • Implement erosion and sediment control measures, such as silt fences, sediment traps etc. • Schedule construction activities during dry seasons to minimize impact on drainage. • Create buffer zones around the river to protect riparian vegetation. • Regularly monitor and clear any debris or silt accumulation in the drainage channels to maintain uninterrupted water flow.	DNCC/CMEC	WTE Power Plant North Dhaka Private Limited
Impacts on Land Use	• The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about 850,000 cubic meters.	• Land development will be confined within the project boundary, and special care needs to be taken as the earth filling material cannot move to the adjacent land. • Avoidance of productive land and far from the nearest settlement area is preferable. • Avoidance of encroachment of waterbodies is preferable. • Complete the landfill and soil compaction as soon as possible before starting the construction activities for the power plant. • Landfilling and site development activities can be continued during dry season only to avoid drainage congestion/waterlogging in the project site and its surrounding area.	DNCC/CMEC	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	• The land used for the proposed power plant is mostly fallow land and low land. The project area has no permanent water body and hill. This project will not fill any pond/canal/other water bodies, and no hill needs to be cut for this project. • The land use pattern of the project site will be changed from fallow land and low land to industrial category.	• Adequate storm water drainage plan should be ensured by the project proponent during the pre-construction stage of the proposed project; • Trees/Vegetation clearance should be reduced as much as possible; • Greenbelt development as early as possible after completion of the construction activities immediately; • Proponent should take tree plantation program whereas possible in the project boundary or along the roadside or any vacant forest land with collaboration of forest department. • Parking of vehicles and stockpiling of materials/excavated earth should be done in systematic way to avoid the damaging of aesthetics of the site; and • Regular monitoring of the drainage condition and waterlogging situation in the project area.		
Air Quality	• Fugitive dust generation from the earthworks, operation of construction machinery, movement of vehicles, civil construction, handling and stocking of construction material.	• The EPC contractor should develop and implement a Construction Environment Management Plan (with reference to the management of air quality during the construction phase) once detailed information relating to the construction methodology and the schedule is available (prior to commencement). • The EPC contractor will be compacted access roads and kept clean, free from mud and slurry and spray with water to minimize the dust generated from the vehicles and trucks. • The EPC contractor should consider minimization of groundworks when high winds are present. • The EPC contractor should undertake land grading, improvement or moving of materials during periods of low winds.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Sand and other materials will be stored in specifically designated areas and will be properly stored at the site and will be water-sprayed or covered. • Implementation of regular watering and sprinkling dust suppression regime, during the dry season. • The concrete batching plant will be located within the protected site to keep it away from sensitive receptor/s. • Stockpiles will be maintained at the site only, which is a fenced area. No stockpiles will be maintained outside, and the maximum possible distance between the stockpiles and receptors will be maintained. • Material transport will be totally enclosed with impervious sheeting, and wheel washing will be carried out at the site. • Waste from construction will not be burned. • The movement of construction vehicles will be minimized, and a 20 km/hr speed limit will be enforced around the construction site. • The Ambient Air quality monitoring should be carried out by the contractor following the National Air Pollution Control Rules 2022 (Schedule-1: Standards for Ambient Air Quality).and • Lorries and trucks engines should be turned off while waiting on site to minimize the exhaust emissions.		
	• Exhaust Emissions due to the operation of Construction machinery	• Exhaust vent of DG set will be kept at proper height to ensure quick dispersion of gaseous emissions; • Low Sulphur diesel (S<O.5%) will be used in diesel-powered equipment in collaboration with best management practices. • All diesel-powered equipment will be regularly maintained, and idling time reduced to minimize emissions. • Vehicle/equipment air emissions will be controlled by good practice procedures (such as turning off equipment when not in use).	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Vehicle/equipment exhausts observed emitting significant black smoke in their exhausts will be serviced/ replaced. • Periodic checking of vehicles and construction machinery to ensure compliance to emissions standard following the National Motor Vehicles Standard (Schedule-2: Standards for emission from motor vehicles, APCR, 2022);		
	• Offensive odor will be generated from waste generated during the plant construction. • Sewage sludge will generate odor from toilets. • Odor may generate from solid waste and slurry	• A brief odor management plan shall be developed that outlines the strategies to be used to minimize or eliminate odors during the construction period. • A community liaison team shall be established to communicate with local residents about the project, including any odors that may arise during construction. • The sewage sludge generated from stationary toilets in offices, workers' accommodations, and construction yards should be managed with sanitary pit and shall not be released in open environment. • Odor-neutralizing agents shall be used to minimize the release of odors during land preparation and clearing work. • Solid waste and slurry should be covered and disposed of properly to minimize odors. • Adequate ventilation and air filtration systems shall be installed in enclosed spaces, such as mobile and stationary toilets and other work areas, to minimize the buildup of odors.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited
Noise	• Noise level will increase due to the construction activities and movement of vehicles and equipment	**Mitigation Measures due to Noise within the Project Site** • The EPC contractor should develop and implement a Construction Environment Management Plan (with reference to the management of air quality during the construction phase) once detailed information relating to the construction methodology and the schedule is available (prior to commencement);	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	• Impact on workers, settlement and terrestrial fauna.	• Normal working hours of the contractor will be between 06:00 and 21:00 hours from Saturday to Thursday. If work needs to be undertaken outside these hours, it should be limited to activities that do not exceed the noise criteria at nearby noise sensitive receptors. • The machinery and vehicles should be equipped with mufflers, silencers, foam, rubber, and other sound soundproofing materials, whatever is necessary, to reduce operation noise; the diesel generators should be covered with a canopy. • Only well-maintained equipment will be operated on-site. • Regular maintenance of equipment such as lubricating moving parts, tightening loose parts, and replacing worn-out components should be conducted. • Machinery and construction plants that may be in intermittent use (e.g., trucks) shall be shut down or throttled down during non-work periods. • The EPC contractor should conduct regular inspection and spot checks of all noise generating equipment. • Construction vehicles and machinery will be well maintained and not kept idling when not in use. • Mobile noise sources such as cranes and earth moving equipment shall be routed in such a way that there is minimum disturbance to receptors. • Low-noise equipment shall be used as far as practicable. • The amount of equipment operating simultaneously shall be reduced as far as practicable. • The EPC contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work.		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• The personnel involved in high noise-generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels. • The contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work (this is a requirement of OSHA 2007); • Adopt the vehicle speed (20 km/hr) limit in the access road • All loud and sudden noises will be avoided wherever possible and fixed noise sources shall be located at least 50m away from the site boundary. • Temporary noise barriers shall be provided surrounding the high noise generating construction equipment. • Stone breaking machine should be confined within a temporary shed so that noise pollution could be kept minimum. • Periodic checking of vehicles to ensure compliance to sound standard following the National Motor Vehicles Standard (Standards for sound originating from motor vehicles or mechanized vessels, Noise Pollution Control Rules, 2006); and • The Noise level monitoring should be carried out by the contractor following the Noise Pollution (control) rules 2006). **Mitigation Measures for E&S sensitive receptors outside of the project boundary** • Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby NSRs as far as practicable. • Noisy plants (such as breakers and rollers) shall be located as far away from receptors as practicable. • Only limited construction activities shall be carried out during night-time.		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Restrict the nighttime vehicle movement through the access road. • Adopt the vehicle speed (20 km/hr.) limit on the access road. • Temporary noise barriers shall be provided surrounding the high noise-generating construction equipment.		
Vibration	• Construction activities may generate vibration • Pile foundation work, compaction work also generate vibration which can impacted local community. • Heavy vehicle and equipment movement also generates vibrations.	• Appropriate equipment and machinery shall be used such as low-vibration pile drivers and hydraulic hammers, to minimize the generation of ground-borne vibration. • A Schedule for construction activities shall be prepared that generate significant vibration during daytime hours to minimize the potential for sleep disturbance. • Vibration-absorbing materials, such as rubber mats and pads shall be used to isolate equipment and machinery from the ground and reduce vibration transmission • Vibration levels shall be monitored regularly during construction activities	Appointed EPC Contractor	
Water Resources	**Surface Water** • It is anticipated that about 2320 workers will be on site during the peak period of construction. At an average water use by one person of 0.1 m^3/day, it is estimated that 232 m^3/day of wastewater will be generated. This is a significant amount of	• Regulate water abstraction to avoid over-extraction by monitoring river water levels and flow rates. • Ensure water extraction is within sustainable limits to protect the river ecosystem. • Adhere to all local and national regulations regarding water abstraction and usage. • Phase dust-generating activities such as land clearance, earthworks, and building construction to minimize the area of ground exposed and the volume of soil and construction material handled at any one time. • Waste management measures should include provisions to contain and dispose of construction wastes, prohibit waste discharge on the ground or any surface watercourse, and practice recycling as far as practicable.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	sanitary wastewater that without proper treatment and disposal methods could be discharged off-site with detrimental impacts on the environment. • Surface water will be sourced from Karnatali River for the proposed project is 347.7 m3/hr. The major water demand for the proposed power plant is cooling water system and it has been estimated 16991.6 m3/hr. • Improper management of waste from construction camps and construction sites can deteriorate the surface water quality. • Oil spillage from the workshop, rainwater runoff, water vessels may contaminate surface water.	• Implement a regular maintenance program for all equipment and machinery to prevent fuel spillage or leakage during construction activities. • Properly store and manage hazardous materials during construction activities. Strategically locate areas for the temporary storage of hazardous materials away from surface water resources and preferably down the topographic gradient of watercourses. Chemicals and fuels must be properly labeled and stored in a bunded area. Storage of hazardous materials on-site should be limited to minimize the impacts of any spillage or mitigation failure. • Spill kits should be provided and all personnel managing hazardous materials should be adequately trained in hazardous materials handling and disposal. Such spill kits should be available where equipment and machinery are temporarily stored and used. • Oil and grease separators shall be used for wastewater generated from cleaning activities. • Refueling, oil changing, and engine maintenance of machinery, equipment, and vehicles should be undertaken in designated areas with containment to prevent any oil spills from washing away, at a distance of at least 100 m from any water course. • Cover temporary stockpiles with tarpaulin when not in use. • Wherever reasonable and practicable, re-vegetate exposed ground as soon as possible to stabilize surfaces. • Control water suppression during excavation and earth handling to minimize excess water and sediment disposal into surface water. • Discharge of wastewater from excavation to the surface water bodies will be strictly prohibited due to ecological sensitivities. • Disposal of construction wastes into the waterbodies will be strictly prohibited.		

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			Implementation	Supervision
	• Increase the TSS in the surface water	• Vehicle maintenance and mechanical repairs are to occur in dedicated, designed locations, bunded to capture and control oil, grease, and other spills to prevent flow into surface water resources. • To ensure adequate sanitary facilities for construction workers and mitigate the environmental impact of water abstraction, provide sufficient portable or permanent toilets with regular maintenance, and handwashing stations. Implement water-saving fixtures, rainwater harvesting, and recycling systems. Develop a water use management plan, monitor usage, prevent contamination, and train workers on best practices. Ensure compliance with local regulations and adjust strategies based on ongoing monitoring and site-specific needs. • . • Workers trained in the use of designated areas/bins for waste disposal and encouraged to use toilets. • Monitoring the surface water by testing in the designated laboratory should be done by the Contractor following the National Water Quality Standard (Schedule-2: Standards for Water, ECR, 2023). • All sewage and liquid effluent will be treated to meet the standards specified in Schedules 3, 4 and 5 of the ECR, 2023.		
	Ground Water • Improper management of waste from construction camps and construction sites can deteriorate the ground water quality. • Groundwater contamination during	• Ensure proper spill control and management at the site. • Ensure storage of hazardous material and waste in proper manner and dispose of the waste in a hazardous waste landfill site. • The surface runoff or extracted groundwater contaminated by silt and suspended solids will be collected by the on-site drainage system and discharged into storm drains. • The EPC contractor should monitor the ground water aquifer condition periodically.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	the construction phase may occur from unplanned events such as leaks and spills of oil, lubricants, fuel from heavy equipment, and improper handling of sewage.	• Monitor groundwater from time to time to detect any contamination. • Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water; • Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers is necessary for efficient utilisation of water; • Blending of low-quality water with fresh water for construction uses to ensure efficient use of natural resource; • Recycling/reusing to the extent possible; • Hazardous material should be kept on impervious layer with secondary containment; • In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste; • Maintain logbook for water consumption; and • Prepare and implement water conservation scheme e.g., rainwater harvesting at the project site. • Monitoring the groundwater by testing in designated laboratory should be done by the Contractor following the National Water Quality Standard (Schedule-2: Standards for Water, ECR, 2023).		
Soil Quality	• The original elevation was between -1.69m and 7.91m. Based on the flood control data provided by the geo-team, the design elevation of the plant area is 8.6m. The total quantity of sand for land development is about	• The area to be cleared must be clearly demarcated and this footprint strictly maintained. • Soil conservation measures will be implemented such as stockpiling topsoil or gravel for the remediation of disturbed areas. • Scheduling activities (as far as possible) to avoid extreme weather events such as heavy rainfall and high winds. • Work areas will be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

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			Implementation	Supervision
	850,000 cubic meters which will change the characteristics of top soil. • The transport of materials and equipment will involve additional movement of vehicles; construction machinery which will also lead to some degree of compaction within the site premises.	• Construction vehicles will remain on designated and prepared compacted gravel roads		
	• Loose of topsoil due to excavation, leads to reduction of fertility. • Construction wastes, such as metal cutting, debris, packaging materials, may contaminate soil. • Soil pollution from liquid and solid wastes from the construction labor camp facilities. • Accidental spillage or inappropriate management of fuels,	• Fuel, lubricating oil and used oil storage areas will be contained in bunds of 110 percent capacity of the stored material. • Spill containment and clean-up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of. • Construction vehicles and equipment will be serviced regularly and off-site. • The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel, or chemicals. • Surface run-off from bunded areas will pass through oil/water separators prior to discharge to the stormwater system. • Ensure storage areas have impermeable floors and containment. • The contractor will restore tower footprints and other areas disturbed by construction as soon as practicable once major construction activity in that area is complete, and while construction is continuing at other sites, and not to wait until construction is complete along the entire corridor.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

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	engine oil and hazardous chemicals.	• The construction contractor will implement a training program to familiarize staff with emergency procedures and practices related to contamination events.		
Waste generation	• Hazardous wastes such as solvents, thinners, cleaners, cutting oils, paints, contaminated rags, packaging and containers, adhesives, light bulbs, and batteries. • Non- hazardous wastes such as food and canteen waste, scrap metal waste, wastepaper, wood, and cardboard packaging. • Other wastes such as glass, uncontaminated soil and rubble, plastics, and rubber. • Construction debris can also contaminate wells, agricultural land, etc. in the proximity of the activity. • The debris generated from construction activities can be	• Establishment of the waste management plan at the project construction site. • Construction wastes that will be generated during construction stage should be dump primarily in a specific area in the project site and immediately remove to the approved site. • Ensure proper collection and disposal of solid wastes within the construction camps and construction site. • Solid waste burning in the construction site is strictly prohibited. • Insist waste separation by source; organic wastes in one container and inorganic wastes in another container at sources. • The organic wastes should be always covered with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats, etc. are not attracted. • Any construction debris generated at the site will be removed from the site immediately after the completion of construction activities and the site will be leveled as the original. • All storage areas must also be properly demarcated and, if the material is hazardous, there should be adequate labeling and security at the facility. • Properly store and manage hazardous materials during construction activities. Chemicals and fuels must be properly labeled and stored in a bunded area. Storage of hazardous materials on-site should be limited to minimize the impacts of any spillage or mitigation failure. • Dispose of debris and waste in designated areas. Workers will be strictly instructed about the random disposal of any waste generated from the construction activity. Arrangements will be made to collect and prevent littering by workers on site.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	contaminated the river flowing near to the plant.	• Waste will be segregated according to type and stored in a separate bin with a label. • Regular monitoring will be carried out by the contractor to record of generation and disposal of waste in daily basis. • Hazardous solid waste should be sold to the authorized vendors.		
Terrestrial Flora	• Vegetation clearance • Hampering plant growth and causing diseases	• Trees/Vegetation clearance should be reduced as much as possible. • Tree felling, if unavoidable, shall be done only after compensatory plantation of at least three saplings for every tree cut is done. • Dust mitigation measures i.e., water spraying, covering stockpiles during transportation, etc. should be followed. • Greenbelt development around the project site and surrounding area as early as possible. • Workers should be aware of the importance of natural resources and should not unnecessarily break branches, twigs, flowers, etc. of adjacent vegetation; and • Diesel and other oils used for machinery should be stored carefully and use drip pans to avoid mixing with soil and water. • Reduce unnecessary clearance of vegetation cover. • Workers should be aware of the importance of natural resources and should not unnecessarily break branches, twigs, flowers, etc. of adjacent vegetation.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited
Terrestrial Fauna	• Habitat degradation • Disturbance to movement of wildlife • Death or harm to wildlife	• Dust mitigation measures should be followed. • Noise mitigation measures should be followed and machinery with lesser noise production should be used. • Machinery with lesser noise production should be used as far as practicable. • Noisy equipment such as breakers and rollers should be located as far away from receptors.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Directional lighting facility should be followed at project site to avoid disturbance of the movement of nocturnal wildlife species. • Workers should be aware of the importance of natural resources and should not do any harm or death to wildlife. • Nighttime work should be limited and the use of lights at night should not disrupt the movement of nocturnal wildlife species;		
Aquatic Flora and Fauna	• Degradation of habitats for aquatic resources	• Oil leakage or spillage from land filling, levelling, and compacting associated machinery will be contained and cleaned up regularly. • Waste oil will be collected and stored for recycling or disposal. • Designated area shall be established for disposal of construction waste and shall ensure that no waste is disposed of in water bodies. • No disturbance for aquatic animal and keep provision for the fish movement. • Regularly monitor and assess the construction activities and their impact shall be conducted on aquatic resources. • Training and awareness to workers shall be provided on the importance of protecting aquatic resources and the potential impacts of construction activities on these resources. • Workers shall be trained on how to handle hazardous materials safely and to prevent accidental spills. • Turn off all unnecessary lighting to avoid attracting and disturbance of fishes and wildlife; and • Regular monitoring the fish death and disturbance of fish and aquatic animals in the Karnatali River.	Appointed EPC Contractor	WTE Power Plant North Dhaka Private Limited
Impacts due to Land Acquisition: Physical and	• A total of 29.6485 Acres private land will be required for the project with 0.3515 acre of	• Compensation should be provided to all land owners according to the CCL. • Any grievance from the affected landowners should be heard and act accordingly if they are not happy with the given price for their land.	DNCC/DC office	WTE Power Plant North Dhaka Private Limited in collaboration with

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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Economic Displacement	khas (government owned fallow land, where nobody has property rights.) land with the said amount of land in the proposed project boundary. • Approximately 242 landowners have been affected by the project interventions ae per the joint verification list of the DC office. • A total of 59.36% amount of compensation has been disbursed among the awardee of this proposed project.	• Stakeholder Engagement Plan and Grievance Redressal Mechanism should be implemented. • The Concessionaire has to establish an effective grievance redress mechanism, which should be properly communicated to all the affected persons and stakeholders; this will be a platform to raise their concerns and complaints. • Preference to the PAH's for direct/indirect project employment opportunities. • Updated status of payment disbursements should be included in the SEP and disclosed accordingly. • An adequate timeline for relocation as compensation (including shifting allowances, right to salvage materials, and additional transitional assistance for the loss of business) has been suggested for titleholders. • Reassessment is required if there is a loss of income. Specifically, after a designated period, income loss should be re-evaluated within 6 months of relocation time. If income loss is confirmed, appropriate measures must be implemented. If no loss is identified, this should be documented and reported. • Project Proponent needs to ensure the disbursement of compensation against remaining landowners who have not yet received any compensation as per award book during construction phase.		DNCC, DC's Office and local administration.
Impact on structures	• During the land acquisition a total of 5 structures were affected. As per joint verification survey of the DC Office, it was found that business structures of two bus depot, along with one	• Ensure the given time frame was enough to shifting business through the continuous consultation process. • Any grievance relating to structure should be heard and redressed through the proper mechanisms. • Ensure not to create any further impact on the remaining business activities as both of the bus depots are still functioning at the very edge of the project boundary.	DNCC/DC office	WTE Power Plant North Dhaka Private Limited

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			Implementation	Supervision
	cow farm and one drinking water plant have been impacted by the project intervention. • The impacted structures are mainly from Pucca (6 nos), Semi-pucca (8 nos), steel structure (1 no) and tin (11 nos) made category	• A grievance box should be in place in any nearby area of the existing bus depot to obtain any form of grievance created from project construction.		
Impacts on non-titled holders	• Five tin made temporary structure owned by the non-titled person were shifted due to the project site preparation. • None of the non-titleholders were compensated or even considered for compensation made by DC and DNCC as well	• Affected non-titleholders should be paid for the relocation grant as 3 of them were found vulnerable in terms of income criteria. • Assistance for impacted structures and business loss should be provided to the non-titled as per the entitlement. • Assistance should be provided to the 5 employees of non-titled as per the eligibility and entitlement criterion. • Project authorities may consider them (non-titled) for any suitable job based on their interest and skill. • Relocation assistance as per the real-life cost can be given if the PAPs agreed. • An adequate timeline for relocation as the compensation (including shifting allowances, right to salvage materials, and additional transitional assistance for the loss of business) has been suggested for non-titleholders. • Each employee of business enterprises of non-title will be given Tk 10,500: Tk 350*30days based on the local wage on similar employment. • Reassessment is required if there is a loss of income. Specifically, after a designated period, income loss should be re-evaluated within 6 months of relocation time, particularly for non-titled holders (NTH). If income loss is	DNCC/CMEC	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		confirmed, appropriate measures must be implemented. If no loss is identified, this should be documented and reported. • Monitoring is required for non-titled PAPs. Income loss should be reassessed after relocation. If income loss is confirmed, appropriate measures must be taken. If no loss is found, this should be documented and reported. • The SEP and GRM for the project will be applicable to the non-titled holders. • A separate study on LIA/LRP is proposed for identified impacted non-titled holders aligning with AIIB's guidelines.		
Impact on Waste Pickers	• A total of 40 people combination of male and female will be impacted during the construction activity of the Power Plant to collect waste from the landfill site. • Construction work will impede access for waste pickers in the landfill area, as the project authority will construct fencing surrounding area of the power plant.	• Ensure an alternative income source for them based on their willingness and their physical health. • Site preparation and construction activity will require many unskilled work force, which may be appointed from the waste pickers based on their interest and best fit for the task. • A permanent solution to the issue may result in a significant change in their livelihood, which should be considered by the project proponent. • The operation phase of the power plant will require waste pickers, which also can be a choice for the employment of currently found waste pickers. • To restore their livelihood a Livelihood Restoration Plan should be prepared. • A separate study on LIA/LRP is proposed for identified impacted waste collectors aligning with AIIB's guidelines. • The SEP and GRM for the project will be applicable to the waste pickers • In the meanwhile, the project company will conduct CSR to improve surrounding waste pickers living level and to gradually transform them to ordinary citizens, which will include: - Hiring certain of them for entry-level jobs of the project company; - Providing necessary train for improving their skills. - Donating food, water and necessary living material;	DNCC/CMEC	WTE Power Plant North Dhaka Private Limited

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		• Closely work with local community, charity, government to provide necessary support.		
Traffic	• An increase in traffic volume on a national highway (N5) may cause traffic congestion and accidents.	• All vehicles would undergo routine repair and maintenance to keep the vehicle in good operating condition. • Drivers and operators with valid licences would be checked for fitness and any driver/operator impaired due to any reason, including but not confined to the influence of drugs and/or alcohol would not be allowed to drive. • A speed limit of 20 km/hr. within the site would be followed and the use of mobile phones while driving would be prohibited • Implementation of a safety program (signage, speed restrictions, lights on trucks, truckload restrictions, etc.) within the construction area • All drivers shall follow the speed limit, the direction of the signalman, sensitive locations, horn usage restrictions, etc.	Appointed EPC Contractor	Designated person from WTE Power Plant North Dhaka Private Limited
Local conflict of interest	• Construction workers and staff may have conflicts with the community.	• Job opportunities should be provided in a fair and tansparent way. • Clear information about the needs of labor (number and qualification) should be provided with local people. Ensure no labor will engage any function and any local argument. • The job skills and the priority for the affected people shall be taken into account and the workers can be chosen as per their interest and existing skills.. • Priority to be given to local people while recruiting employees for the project. • A strong network with local community needs to be nurtured by the project proponent to avoid any local conflict of interest. • GRM should be implemented at the community level to address any local conflict of interest.	Plant EHS Team and operations	Designated person from WTE Power Plant North Dhaka Private Limited
Gender Based Violence (GBV)/ Sexual	• Community women adjacent to the proposed project site,	• Project will ensure no gender-based violence to l occur due to the project. • Women will be heard if any issue raised by them and will be mitigated with high priority without any biasness.	Plant EHS Team and operations	Designated person from WTE Power Plant

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Exploitation and Abuse (SEA)/ Sexual Harassment (SH)	promote their participation in project planning and activities (if applicable) and ensure safer and healthier living conditions for them. • Female workers involved during the construction work. • Harassment of women and young girls by workers, such as honour crimes in extreme cases. • Disturbance of women and young girls' mobility around the Project area. • Discrimination against women in terms of employment. • Women group from waste pickers.	• Announce employment opportunities and recruitment notices widely, targeted at women as well as men. • Technical training can be provided to the local workforce, especially women for inclusion in the operation and maintenance phase. • Ensure basic facilities (separate toilets, clean water, drinking water facilities, resting place) are provided for female as well as male workers at the construction site. • Women are to be trained and empowered to be part of household energy solutions – their understanding and knowledge about their household energy need to be translated into defining the way forward on access to clean, affordable, and sustainable energy. • Workers should be informed and alert regarding gender related sensitivity. • Prepare a Code of Conduct and insert it in the induction training to be provided to all workers. • Grievance Mechanism (GM) should be in place at site and community level. A GM box needs to be installed in a visible place with a signboard with some basic info, contact address, contact number. GM must include some info on sexual harassment. • GM register needs to be maintained at site. • An acknowledgement slip should be given to the complained person against the grievance for the tracking. • GBV/SEAH should be confidential, and more options should be created to submit the grievance against GBV/SEAH. • Conducting periodic meetings with local community for understanding their grievances.		North Dhaka Private Limited
Children's rights	• As the labor influx will occur during the	• EHS manager will keep close monitoring regarding any appointment of child as labor	Plant EHS Team and operations	Designated person from WTE

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	construction there might be a chance to appoint of child labor	• Restriction signs should be affixed regarding child labor • Give proper guidance to say no to recruiting any child as a labor • Assign a traffic attendant to supervise crossing for school children near the project vicinity, ensuring their safety and smooth traffic flow. • Conduct traffic awareness campaign at nearby school on periodic basis		Power Plant North Dhaka Private Limited
Infectious Disease	• As the labor influx will occur during the construction there might be a chance to spread of infectious diseases. During Construction, in general, a lot of migrant workers flow into the sites, who may have the possibility with HIV/AIDS.	• Prevention of illness among workers by undertaking health awareness and education initiatives and by conducting immunization programs for workers. • To provide treatment through standard case management in on-site and community health care facilities as necessary. • Educating project personnel and area residents on risks, prevention, and available treatment. • Promoting collaboration with local authorities to enhance access of worker's families and the community to public health services and promote immunization as necessary. • Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites. • Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements. • Elimination of unusable impounded water. • Establish linkages with local hospital nd health facility in addressing any threat of infectious or contagious diseases among the employees across the project life-cycle. • Regular health check-up will be ensured to maintain personal healtand hygiene. • The Contractor will prepare and implement a Safety Plan related to infectious diseases prior to commencing work. This plan will include method statements for working methods, construction sequence, and safety arrangements.	Plant EHS Team and operations	Designated person from WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Prepare and disseminate Infectious Diseases related information (flayer/brochure) among the workers for awareness purpose.		
Occupational Health safety	• Health Impacts due to Changes in environmental conditions. • Increased prevalence of disease.	• Adequate provision of healthy living conditions should be ensured in the labor camp. • The contractor should prepare Emergency Preparedness and Response Procedure (EPRP) and Occupational Health and Safety Management Plan. • Training in Health and Safety policy for the workers (both regular and contractual) should be provided. • Establish a grievance mechanism in place, to allow the employees and workers to report any concern or grievance related to project activities. • Child labor and forced labor during project construction should be prohibited. • Adequate training should be provided to staff about raising awareness about the use of PPE and EPRP. • It shall also be ensured that good housekeeping at the construction site is maintained to avoid slips and falls. • Excessive waste debris and liquid spills should be cleaned up regularly. • Safety signs should also be marked at appropriate places on the construction site and access road. • Regular health check-up camp to be organized to promote better health of all employees across the project life-cycle. • Health and Safety Sign needed in all the places in Local, English and Chinese Language. • Any accidental record including cause must be maintained on site. • Toolbox Talk (TBT) must be ensured daily by keeping records. • All the construction workers must wear PPE during construction.	Plant EHS Team and operations	EPC Contractor and EHS manager

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• All the construction workers must use a face mask, ear plugs, hand gloves, helmet, safety vest. • Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment must be engaged for work at height. • Workers handling electricity and related components must be provided with shock- resistant gloves, shoes, and other protective gear. • First aid box/arrangement to be ensured. • Adequate sanitary facilities, i.e., toilets and showers, must be provided for the construction workforce. • Toilet hygiene and sleeping arrangement should be improved as per applicable criteria.. • All the lifting equipment must be calibrated by the authorized company. • Licenses, fitness and clearances of heavy equipment and operators need to be verified. • Vehicles and Equipment drivers having valid licenses should be employed in the project. • An Environmental Health and Safety (EHS) manager, Two to Three (2-3) Safety and Security Officers should be hired to monitor the Environmental and Social Condition of the construction site.		
Community Health and Safety	• Possible sources of impacts to community health and safety during the construction phase are Changes in environmental quality due to construction activities. Increased	• Dust control measures should be taken by the contractor along the site approach road and dust generation site. • Traffic sign reflecting the maximum permitted speed needed within the Plant area as well as nearest community area. The speed of vehicles on site and approach road will be limited to 15-20 km/hr. • A traffic management plan should be followed by the contractor for the project.	Plant EHS Team and operations	Designated person from WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	prevalence of disease arising from the influx of construction workers; and additional traffic movement.	• Health and Safety Sign needed in all the places in Local, English and Chinese Language. • Periodic health check-up to be condjucted to promote better of the workers throughout the project life-cycle. • Training on community health and safety issues should be provided to the drivers. • Notify the local area responsible person before starting the construction work and put signage near the educational and religious institutes and instruct the driver to carefully drive close to the sensitive area. • Traffic controllers need to be assigned in the high-volume traffic movement area. • Only drivers having valid licenses should be employed in the project. • Adequate sanitation facilities at labor camps should be ensured by the contractor to maintain hygiene and minimize the spread of diseases. • Wage discrimination between male and female workers should be minimized through a proper monitoring system. • An active grievance mechanism should be developed. • Grievance Mechanism (GM) should be in place at site and community level. A GM box needs to be installed in a visible place with a signboard with some basic info, contact address, contact number. GM must include some info on sexual harassment. • GBV/SEAH should be confidential, and more options will be created to submit the grievance against GBV/SEAH. • Creating awareness about local traditions and culture among outside migrants and encouraging respect for them. • Collaboration with local communities and responsible authorities to improve signage, visibility, and awareness of traffic and pedestrian safety.		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Providing awareness training regarding sexually transmitted diseases among the workers. • The contractor will prepare and conduct induction and training on the project's Code of Conduct for all site personnel regarding do's and don'ts in relation to interaction with locals.		
Community Health and Safety	• The construction phase activities, laying down of transmission line towers and construction of switchyard and movement of material and personnel may result in impacts on the health and safety of the community	• Develop and implement site specific community health and safety plan; • Ensuring that the sub-contractor agreements that the developer enters into require all contractors to possess a Community Health and Safety plan with provisions for monitoring of the EHS performance of contractors and their workers (including for managing COVID 19 related risks); • As part of the stakeholder engagement and information disclosure process, providing an understanding to the community concerning the activities proposed to be undertaken and the precautions being adopted for safety; and • Putting in place a grievance redressal mechanism to allow community members to report any concern or grievance related to project activities. The contractors engaged shall also be contractually required to put in place a similar mechanism to deal with concerns raised by the community (or external stakeholders) and the workers engaged during construction phases. • Proper fencing around Project boundaries • Water sprinkling on roads leading to Project site to avoid dust related impacts on the community • Communicating to the local community about the accidental risks and safety features of the transmission line and controls put in place • Construct sanitation facilities for labourers inside the Project area boundaries along with septic tanks to avoid contagion in the adjacent land; • Involving the district disaster management cell and the nearest fire service station while preparing for emergency situations;	Plant EHS Team and operations	Designated person from WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Obtain an adequate third party insurance cover to meet the financial loss to any third party due to such emergencies and • With respect to managing COVID-19 in particular, the Project should ensure adequate waste management, mandatory PPE usage, social distancing in labour accommodation, regular disinfection and screening of workers. Local regulations should be monitored and their compliance will be incorporated.		
Labor Influx	• Labor requirement from the locality, increase of local business and opportunity, requirement for use of local resources.	• Prevention of massive movement within the locality for workers. • Proper safety protocol should be taken under the labor management plan by EPC. • Alert the migrant workers regarding GBV, local harmony and other socio-cultural aspects to avoid any kind of collision between labor and local people. • Promoting collaboration with local authorities to enhance access of workers for their basic necessities that can be collected from the locality. • Promoting use of local goods and other materials to make a balance between workers and local people. • International (Chinese) workers must follow both national and international regulations while roaming around. • Waste to Energy Power Plant North Dhaka Limited will be able to influence the EPC contractor to set up labor camps in accordance to requirements of international standards. • Improved waste segregation and regular garbage collection along with other safety within the labor camp and residential areas. • Toolbox training, health safety protocol and other essential guidelines should be followed by the workers and EPC should follow the OHS guidelines in this regard. • Worker's grievance should be taken care of, and grievance boxes must be displayed in and within the plant and workers accommodation area.	Plant EHS Team and operations	Designated person from WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• The Project will develop a Labor and Influx Management Plan (LIMP) that addresses how the Project will seek to minimize the influx related impacts.		
Transmission Line				
Land purchase	• Loss of land at tower footing area • Loss of trees and building • The proposed transmission line will require approximately 89.063 decimal (0.89 acres) of land for tower footing construction. • Approximately 50 different sizes of trees may need to be cut during the construction of transmission line.	• During construction, if any crops, structures or any other assets are affected, will be compensation according to the entitlement proposed in the RP. • After conducting the market assessment, the proponent will be ensured that the compensation is equivalent to or greater than the Replacement Cost to meet AIIB's ESF guidelines. • The landowner can use the land after TL construction without damaging Tower and Its equipment as per Electricity Rules 2020 Section 10, Subsection 6. • Construction is to be undertaken during the lean agricultural season after the harvests are over. • Use of village roads and earth bunds between agricultural plots for movement of equipment and workers, wherever possible. • WPPNDPL will pay full compensation to the affected persons for any damage or inconvenience caused by this project, as per the provisions of the Electricity Rules 2020 (amendment 2022). For compensation related to crop damage, the Scheduled Rates of the Agricultural Department will be followed. For compensation related to damage to trees, a valuation will be undertaken by the forest department and the derived value will be followed. Compensation for the damage should be paid before the construction work. • In the case of private land acquisition, a Resettlement Action Plan (RAP) would be prepared with a Livelihood Restoration Plan (LRP) and the same would be implemented. • In case private land is procured through negotiated purchase, on a willing buyer and willing seller basis, the minimum price of land would be determined at market price (replacement cost of the land in the same area).	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• In the event of short-term income loss due to the installation of the transmission line, a Resettlement Action Plan (RAP) shall be developed. This plan shall encompass both titleholders and non-titleholders, ensuring that all affected parties are compensated for their income loss during the disruption period. The RAP aims to mitigate the financial impact on landowners and sharecroppers, providing them with the necessary support to manage the temporary interruption in their agricultural activities. • The project will also provide additional livelihood restoration measures to mitigate the impacts due to the reduction in landholdings through the Livelihood Restoration Plan for the project. • Identify and provide additional social and livelihood support to especially vulnerable families. • The SEP and GM for the project will be applicable to the landowners and users impacted.		
Air Quality	• Dust resulting from construction work • Exhaust gas from construction machinery and vehicles used for mobilization of equipment • Air pollution arising from incineration of construction materials and waste (if any)	**Dust prevention** • Watering access roads and construction site, especially in the dry season • Using cover sheet on trucks for the transportation of soil (if required) **Gas emission prevention** • Periodic maintenance and management of all construction machinery and vehicles **Waste management** • Prohibit open burning and illegal dumping	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Water Quality	• Run-off water from construction area • Domestic wastewater of workers • Inappropriate disposal o f waste • The primary water use requirement will be for dust control. • Water is required for foundation work and domestic requirements of workers.	• Transmission line route shall select avoiding steep sloped areas. • Preventing soil loss by stabilizing any slopes of the construction area with concrete as necessary based on geological survey • At all construction sites chemicals and oils should be stored in secure designated areas with temporary impermeable bunds at a distance of at least 100 m from any water course or drinking water source. • Take permission for the installation of a bore well from the relevant authority. • Periodical training is needed to provide to workers for the best utilization of water. • Recycle/reuse to the extent possible.	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Noise and Vibration	• Noise and vibration caused by construction machinery. • Noise caused by vehicles used for mobilization of equipment and workers	• Use Diesel Generator set with an acoustic enclosure. • Adopt the vehicle speed limit on the access road. • Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged. • Temporary noise barriers shall be provided surrounding the high noise-generating construction equipment. • Mobile noise sources such as cranes and earth moving equipment shall be routed in such a way that there is minimum disturbance to receptors. • The personnel involved in high noise- generating activities shall be provided with PPE to minimize their exposure to high noise levels. • The contractor should ensure that all construction equipment and Construction vehicles are fitted with silencers, where possible. • Only well-maintained equipment should be operated on the construction site.	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Ecosystem	• Removal of vegetation for transmission tower bases and cutting of tall vegetation in the RoW to maintain necessary conductor clearances.	**Vegetation** • Tower construction area should be re-vegetated with native plant species **Protected species** • Consult with specialist about moving individual animals if any protected species are discovered	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Topography and Geology	• Soil runoff • Establishment of TL tower, foundation, access roads, internal roads, temporary laydown area, and buildings, transformer platform.	• Transmission line route should be selected avoiding any steep sloped areas • Preventing soil loss by stabilizing any slopes of construction areas with concrete, as necessary based on geological survey. • Demarcating routes for the movement of heavy vehicles and equipment. • All areas of excavation shall be closed and compacted before the rainy season to prevent soil erosion. • Building small bunds in areas with slopes to prevent soil erosion.	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Soil Contamination	• Handling, storage, and disposal of wastes (liquid, solid Disposal of waste by licensed contractors. • Implementation of construction materials inventory management system to minimize over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period.	• Design processes to prevent/minimize quantities of waste generated, and hazards associated with the waste generated. • Proper storage of the construction materials and wastes to minimize the potential damage or contamination of the materials. • Storage of waste systematically to allow inspection between containers to monitor leaks or spills. • Storage of wastes in closed containers away from direct sunlight, wind, and rain. • Segregation of hazardous and non-hazardous waste and provision of appropriate containers for the type of waste type (e.g., enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimize odor nuisance). • Disposal of waste by licensed contractors.	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	• Ensuring that storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container. • Training laborers for waste disposal in designated areas and use of sanitation facilities.and hazardous)	• Implementation of construction materials inventory management system to minimize over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period. • Ensuring that storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container. • Training laborers for waste disposal in designated areas and use of sanitation facilities.		
Deterioration of Local Economy such as losses of Employment and Means of Livelihood.	• Loss of farmlands, being kept out of construction zones.	• Employ local residents on the basis of expertise • Use the services (i.e., laundry and catering, etc.) and products offered by the local community	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Disturbance of water usage, water rights etc.	Water pollution is caused by soil runoff.	• Transmission line route should be selected avoiding any steep sloped areas • Preventing soil loss by stabilizing any slopes of construction areas with concrete, as necessary based on geological survey • Re-greening in construction area	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Cultural Heritage	• Impact on cultural heritage (if found)	• Stop construction work if any cultural heritage area is discovered and immediately consult with specialists.	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Spreading infectious diseases	• Temporary influx of migrant labor during construction may increase risk of infection	• Implementation of periodic medical check-ups • Education and training on workers' health care	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Work Conditions (including work safety)	• Labor accidents • Health impacts are associated with environmental conditions and changes in environmental quality, arising from water pollution and noise generation from construction activities as well as from storage and handling of waste, particularly hazardous waste.	• Prepare a manual for labor accident prevention including safety education and training • Provide workers with appropriate protective equipment • Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads • Keep lifting devices well maintained and perform maintenance checks as appropriate during the construction period • Use facilities and equipment that protects against electric shocks	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Accidents	• Soil runoff and tower breakages	• Transmission line route should be selected avoiding any steep slopped areas • Preventing soil loss by stabilizing any slopes of the construction area with concrete, as necessary based on geological survey	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

10.3.2 During Operation Phase

The possible environmental and social impacts during the operation phase have been already identified and assessed in Chapter 6 of this ESIA report. For mitigating the possible environmental and social impacts, mitigation measures for the operational phase are proposed in Table 10-2**.**

Table 10-2: Mitigation Measures during Operation Phase

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Air Quality	• High air emissions of air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, dioxins, volatile organic compounds, and the greenhouse gas carbon dioxide.	• The flue gas is to be exhausted at 100m stack height. • Ensuring the standard of Bangladesh (MoEF) where emissions always should be lower due to nearly presence of any sensitive area. • The plant equipment must be performance tested during the commissioning phase to ensure standard has been maintained. • A continuous Emission Monitoring System (CEMS) will be installed to detect the emission of pollutants from the flue gas. • Automatic monitoring process and presenting on the real-time Web Pages should be implemented • Ambient air quality monitoring stations are to be installed within the project site to obtain such measurable parameters, while periodic air quality monitoring using high/low volume samplers is to be conducted at other locations. • Install instruments to record meteorological data such as wind speed, direction, solar radiation, relative humidity, and temperature shall be established so that the operating power plant can record these parameters at regular intervals. • Regular maintenance and overwhelming as per design specification. • Regular inspection and maintenance of boiler, pressure parts, FD and ID fans bag filter and ash separation and handling system, and other ancillaries.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Particulate Matter emission concentration will be controlled by a bag filter. • Selective Non-Catalytic Reduction-SNCR (urea water injection in the furnace) will be adopted for nitrogen oxides control and space for Selective Catalytic Reduction (SCR) will be reserved to cope with the possible improvement of denitrification standards in the future since the airshed is already degraded. • Combination mode of "SNCR (urea water injection in the furnace) + semi-dry method (lime pulp solution) + dry method (Ca (OH)2 dry powder) + activated carbon injection + bag filter + (reserved SCR) will be adopted to control acidic gases (HCl, SO2 and HF); • Control the residence time of flue gas in the furnace above 850°C to ensure adequate decomposition of dioxins. • Maintain the more stringent emission standard of the European Union Pollutant Emission Standard (European Union 2010/75/EU) since the project location airshed already degraded and • It is highly recommended to conduct a validation run after 1 to 3 months during the operations stage using actual CEMS, stack testing, and ambient air monitoring results. **Measures taken to prevent excessive emission of flue gas components from domestic waste incineration:** • Optimize the incineration process: adjust the combustion conditions, such as temperature, oxygen supply, combustion time, etc., to ensure that the waste is fully burned and reduce the generation of incomplete combustion products. • Improve equipment performance: Regularly maintain, overhaul and upgrade incinerators, waste heat boilers, flue gas purification equipment, etc. to ensure their normal operation and efficient work.		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Strengthen feed management: reasonably control the feed amount, composition and humidity of garbage to avoid uneven combustion. • Improve the flue gas purification system: adopt more advanced and efficient flue gas purification technologies, such as increasing the amount of activated carbon injection, optimizing the filtration efficiency of the bag filter, and improving the desulfurization and denitrification device. • Real-time monitoring and data analysis: Install high-precision online monitoring equipment to monitor flue gas emission indicators in real time, conduct in-depth analysis of monitoring data, find problems in time and take targeted measures. • Personnel training and operation specifications: Strengthen the training of operators to familiarize them with the incineration process and equipment operation specifications, so as to avoid excessive emissions due to improper operation. • Establish an emergency response mechanism: Formulate an emergency plan for sudden emissions exceeding the standard, and take timely measures to reduce emissions, such as suspending feeding, adjusting operating parameters, etc. • Regular environmental protection testing and evaluation: Conduct regular environmental protection testing in accordance with the regulations to evaluate the flue gas emission compliance and provide a basis for improvement measures. **Measures taken for domestic waste incineration flue gas component emissions exceeding the standard:** • Optimize the incineration process: adjust the combustion conditions, such as temperature, oxygen supply, combustion time, etc., to ensure that the waste is fully burned and reduce the generation of incomplete		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		combustion products; Reduces combustion compliance and reduces pollutant emissions. • Adjust the flue gas purification system: increase the amount of activated carbon injection, increase the frequency of bag filter cleaning, and increase the injection amount of reactants of the desulfurization and denitrification device, so as to reduce the emission of pollutants until the standard is reached.		
Odor	• Odorous gas is produced by waste bunkers. • Odorous gas is produced in the leachate ditch corridor and asphalt collection tank. • The Discharging Hall produces odor due to the entry and exit of waste trucks. • Leachate treatment station deodorization. • Malodorous substances in waste (including Stench concentration, Ammonia, Hydrogen sulfide, Methylthiol, Methyl sulfide,	• The waste loading ramp shall be capped to control the malodorous diffusion caused by the dissipation of leachate from the waste truck. • An Air curtain shall be set up at the inlet and outlet of the tipping hall to prevent malodor escape. • Negative pressure shall be maintained inside the waste tank to prevent the spread of malodor inside the waste tank. • Aiming at the characteristics that malodor can be decomposed at high temperatures, the gas in the pit is extracted from the upper part of the waste tank by PA fan and fed into the incinerator after preheating, which is used as a secondary air for combustion. • In the incinerator and maintenance, in order to ensure the negative pressure in the waste tank, the odor in the waste tank will be pumped out by the deodorizer and fed into the activated carbon adsorption deodorizer. The odor pollutants are adsorbed and filtered by the activated carbon and discharged into the atmosphere after reaching the malodor discharge standard. • In abnormal operation (when the shutdown state or the negative pressure is not enough), the deodorizing fan of the deodorizing system feeds the odor of the waste tank into the activated carbon deodorizing device located in the deodorizing room for adsorption and filtration and	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	Dimethyl sulfide, Trimethylamine, Acetaldehyde, and Styrene) can possess health risks to the workers and staff working during the operation phase. • Respiratory problems, nausea, headache, and psychological stress could be the main impacts of waste odor.	then drains it to the upper air, so as to ensure the air quality in the incineration power plant area. • The waste leachate collection chamber is composed of a leachate sump, leachate pump room and corridor, and these areas will produce a large amount of odor. Therefore, the air supply and exhaust outlets will set in the space of the leachate collection room, the air supply fan feeds fresh air, and the exhaust fan introduces the odor generated in this space into the waste tank and burns and decomposes in the PA fan inhalation incinerator.		
GHG Emission	• Potential source of greenhouse gas emissions due to the inherent combustion processes involved in plant operations. • This GHG emission poses a potential impact on endangered species and habitats. • The annual average carbon emission reduction during the period is 361,700 tons of CO2, which is	• The project proponent has to utilized high-efficiency combustion systems to ensure complete burning of waste, reducing carbon dioxide and other emissions. • Pre-treat waste to remove recyclable and hazardous materials, reducing the volume and toxicity of incinerated waste. • Monitoring and recording of CO2 emissions from the stacks • Ensure that all equipment and machinery are maintained in accordance with the manufacturer's specifications; and • Improved efficiency of auxiliary drives.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	equivalent to 0.332 t CO2 of carbon emission reduction per ton of waste.			
Noise	• Noise pollution from boiler, Turbine generator set, Fan, Air blower, Air compressor, Mechanical ventilation cooling tower, circulating water pump are continuous. Garbage transport vehicles are also another source of noise pollution. • About 280 people will be engaged during operation phase. Staff and workers who will be working proximity to the several high noise generating facilities could affect in hearing, productivity and other could create other sickness.	• Use of PPEs like ear mufflers, earplugs etc. by the workers working in high noise zones. • Equipment shall be selected with low noise as far as possible. • The high-noise equipment, such as air compressors, machine repair equipment and incineration system in the general layout, is centrally arranged in the incineration power plant room. • For equipment with the higher noise level, such as fan, sound insulation, sound elimination and vibration reduction under different circumstances shall be adopted • Comprehensive control measures shall be adopted such as low noise equipment and sound absorption, for example, PA and SA fan and ID fan set up mufflers and vibration damping devices to make the noise in the workplace and environment reach the standard. • Where it is still difficult to reach the control standard for the workplace after treatment, such as the place where Turbine Hall and other equipment are continuously operated, the measures for setting sound insulation Control Room shall be taken. • Flexible connection measures shall be taken for the pipeline that may generate noise, especially the pipeline connected with the pump and fan outlet, so as to control the vibration noise. • Noise attenuation provisions such as air intake silencers and acoustic insulation around noisy equipment shall be installed • Buildings shall be designed with improved acoustic performance, and sound insulation shall be provided.	WTE Power Plant North Dhaka Private Limited Study by 3rd Party agency /experts.	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• The diesel generator unit shall be arranged in an outdoor box, and attention shall be paid to sound insulation and noise reduction. • Periodic monitoring shall be ensured of work-zone during the operation phase.		
Water Resources	**Surface water intake** • It is planned to use river water as the source of industrial water for this project, as the standby source of industrial water. • Surface water will be sourced from Karnatali River for the proposed project is 349.5 m3/hr. • The abstraction of surface water may disrupt the natural balance of river ecosystems, impacting fish populations, and other aquatic organisms. Furthermore, abstraction of surface water may exacerbate water temperature fluctuations and increase the	• Records will be maintained to monitor the quantity of water being used. • Efforts shall be made to ensure that the reuse of processed water is carried out to reduce the net water requirement. • The Water will not be used for other purposes except the approved case i.e. Plant's operation, daily uses for the employees etc. • The wastewater emanating from cleaning operations shall be recycled for plantation and greenbelt development around the project. The rest of the wastewater will be deposited in a rainwater harvesting pond. • Groundwater should be used for industrial operations as a temporary alternative source in case of emergency, specially, in dry season when the surface water flow become minimum. • Advanced water recycling and reuse systems should be implemented to minimize surface and ground water intake. • Installing efficient cooling technologies like closed-loop cooling systems to reduce water consumption. • Conducting regular monitoring of water quality and quantity to ensure compliance with regulations and minimize environmental impact. • The filtration plant or water purification system should be designed in such a way that it can accept low-quality water. • To reduce the pressure on Karnatali River, it is strongly encouraged to identify the alternative source of Surface Water and to use it in different purposes. • The project developer will not change the natural flow of the river.	WTE Power Plant North Dhaka Private Limited Study by 3rd Party agency /experts.	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE/ WARPO

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	concentration of pollutants due to reduced dilution capacity.	• In case of any adverse impact on the nearby community due to surface water abstraction by company, immediate mitigation measures and compensation must be ensured. • If there is any negative impact to surrounding local caused by plant's water usage, the proponent will make reasonable countermeasures to reduce the impact, such as help locals to dig a new well, providing drinking water in dry season. • There should be adequate green space with vegetation around the plant area. • Extensive awareness needs to be built regarding water use and impact to the employees of the company and the nearby community of project area. • The permit from WARPO that allows water intake will be valid for a period of two years starting from the date it is issued. Project proponent must apply to renew this permit within 30 days before the two-year validity period expires. .		
	Ground water Abstraction • According to BBS data, Bonogaon Union covers 4,460 acres. It has a population of 33,627 people living in 7,742 households. Most residents, about 92.5%, use tube-wells for drinking water. approximately 4500	• The Water will not be used for other purposes except the approved case i.e., plant's operation, daily uses for the employees etc. • The wastewater emanating from cleaning operations shall be recycled for plantation and greenbelt development around the project. • A rainwater harvesting system has been recommended in the plant and the harvested water can be used for different purposes. • It is suggested the design of plant should comply with the requirement in WAPRO • Advanced water recycling and reuse systems should be implemented to minimize ground water intake.	WTE Power Plant North Dhaka Private Limited Study by 3rd Party agency /experts.	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE/ WARPO

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	Tube-well has been counted in Bonogaon union. • Due to abstraction of groundwater, the ground aquifer will decline. Therefore, the local villagers will not get the water during the dry season which may create social conflict. • To facilitate groundwater extraction, three boreholes will be established within the project boundary, with two designated for emergency use and one serving as an auxiliary well. The total depth of the groundwater wells is 260 meters.	• Installing efficient cooling technologies like closed-loop cooling systems to reduce water consumption. • The project will ensure transparent communication and a robust grievance redress mechanism to address social impacts, particularly water accessibility concerns for local communities. It will comply with environmental regulations and obtain necessary permits for bore/tube well drilling and operation. • Conducting regular monitoring of water quality and quantity to ensure compliance with regulations and minimize environmental impact. • To reduce the pressure on ground water, it is strongly encouraged to identify the alternative source of Ground Water and to use it in different purposes. • A standalone study will be conducted on "water resources availability and impact due to abstraction, use and discharge to the project area and surroundings considering the shallow and deep aquifer. • A monitoring well must be installed at the project site to continuously measure the groundwater level. • The proponent will ensure continuous monitoring arrangements for groundwater aquifers to assess the impacts on groundwater levels as per Environmental & Social Monitoring Plan in Table 10-6. • In case of any adverse impact on the nearby community due to groundwater abstraction by the company, immediate mitigation measures and compensation must be ensured. • If there is any negative impact to surrounding local caused by plant's water usage, the proponent will make reasonable countermeasures to reduce the impact, such as help locals to dig a new well, providing drinking water in dry season.		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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		• There should be adequate green space with vegetation around the plant area. It is recommended to build a water reservoir for recharge to Groundwater. However, it is strictly prohibited to inject contaminated water or wastewater into the underground aquifer. • The Company have to arrange the Training Programme regarding 'Water Governance and Compliance Monitoring' from time to time for their employees. • Extensive awareness needs to be built regarding water use and impact on the employees of the company and the nearby community of project area. • The Depth of Deep Tube well, Diameter of Pipe, Horsepower (HP) of Pump cannot be changed without permission of WARPO Authority. • The Distance between the two Deep Tube wells should be followed as per national regulations. • The WARPO permit would be valid for 2 (two) years from the date of issue and will require renewal before 30 days of the end period.		
	Water contamination • The leachate treatment system is engineered to handle up to 1,500 tons per day during peak rainfall periods. • It is anticipated that about 280 workers will be on site during the operation period. At an average water use by	• Monitoring of temperature at the discharge point at a frequency of every 15 days. • Discharge system shutdown in event that the discharge temperature of effluent exceeds the standard. • Leak-proof oil transfer mechanism from oil tanker to oil storage tank. • Sanitary effluent should be deposited in the septic tank. • Liquid waste such as waste oil, etc. will be collected and stored for recycling in cemented areas. • All drainage/tanks, etc. will be positioned on concrete hard standing to prevent any seepage into the ground.	WTE Power Plant North Dhaka Private Limited Study by 3rd Party agency /experts.	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE/ WARPO

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	one person of 0.1 m3/day, it is estimated that 28 m3/day of wastewater will be generated. • Flushing water about 1 m3/hr or 24 m3/day, Unforeseen water & water leakage is approximately 17.3 m3/hr or 415.2 m3/day etc. • Surface and groundwater may be contaminated due improper management of leachate, fly ash, flushing water, sanitary sewage and slag generated from the power plant operation.	• Wastewater of similar nature from different units will be treated in accordance with GOB Environment Conservation Rule (2023) Schedule 4 (Standards for Waste from Industrial Units or Project Waste). • Implementing emergency response plans to address any accidental spills or contamination events promptly. • All chemicals will be stored in primary containers that have in-built secondary containment of capacity that is at least 110% of primary containment. • Regularly testing groundwater quality for contaminants and implementing remediation measures if contamination is detected. All the waste that would be produced during the power plant operation units and workers facilities must be treated in the ETP and STP plant. • Increase the efficiency of water reuse and recycling. • Water conservation plans should be implemented on a broader scale. • The direct emission of any harmful effluents and waste from power plants must be restricted. • The oily sludge shall be reused or disposed offsite through an authorized agency. • Landfills must be treated against seepage to prevent contamination of groundwater and surface water, while preventing groundwater from entering the landfill area. The permeability coefficient of natural clay lining, and modified clay lining shall not exceed 1×10-7 cm/s, and the thickness of field bottom and four-wall lining shall not be less than 2m. • Details of slag treatment system are described in section 3.12.4 • Details of the leachate treatment process are described in section 3.12.5		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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Waste generation	• Estimated fly ash output fromj the whole plant is about 73.6 m3/d. • The sludge in this project is obtained from the feed water Treatment System and the leachate treatment system. • The project will produce about 500t/d wet slag per day and 182,500 t/a wet slags per year. • Around 280 workers would be employed. Waste generated per person per day averages 0.74 kg. It is estimated that around 207.2 kg/day of municipal solid waste would be generated. • The leachate treatment system is engineered to handle up to 1,500 tons per	• The Contractor would ensure that the hazardous waste plan is based on national as well as WB/IFC EHS guidelines for all solid and hazardous waste and implemented adequately. • Establishment of the waste management plan and hazardous material handling plan at the project construction site. • Recyclable Waste will be sold to the authorized recycler and the other solid wastes will be disposed of to a local designated landfill facility. • Adequate sanitary facilities, i.e. toilets and showers, will be provided for the construction workforce. • Oily waste and chemicals would be stored in tanks/containers that have sufficient secondary containment (~110% more than its capacity). • All hazardous waste should be properly leveled with information including the Name & type of waste, and the amount of waste. The waste will be removed from the site at regular intervals for safe disposal at the designated site through authorized vendors. • The Contractor would have a Spill Management plan in place delineating plans and procedures for preventive and corrective actions against any potential spillage of harmful materials and provision of adequate spill kits. • It would be ensured that activities involving oil handling is carried out at impermeable surfaces and training of workers would be undertaken to manage spill management. • The wastewater in the plant area after treatment may be used for car washing, ground washing, residue cooling, and greening. • Prevent the indiscriminate discharge of untreated effluent from the process, equipment/vehicle washing, and chemical/fuel storage areas into the unpaved and open ground.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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	day during peak rainfall periods. • Flushing water about 1 m3/hr or 24 m3/day, Unforeseen water & water leakage is approximately 17.3 m3/hr or 415.2 m3/day etc. • Improper storage, handling and disposal of solid and hazardous waste may lead to contamination of the land and water bodies nearby. In addition, waste can generate odor and cause health hazards to employees and communities nearby. • Also, fuel and chemicals like acids/alkali for water treatment purposes can be generated during the operation phase.	• A spill response plan and emergency plan will be prepared to address accidental spillages or release of hazardous wastes. • Wastewater containing high concentrations of inorganic chlorine salts and heavy metals can only be discharged after treatment. • Bottom ash will be managed separately from fly ash and other flue gas treatment residues to avoid contamination of the bottom ash for its potential recovery. • Will Separate remaining ferrous and non-ferrous metals from bottom ash as far as practicably and economically viable, for their recovery. • Bottom ash will treat on or off-site (e.g., by screening and crushing) to the extent that is required to meet the specifications set for its use or at the receiving treatment or disposal site (e.g., to achieve a leaching level for metals and salts that is in compliance with the local environmental conditions at the place of use); • Bottom ash and residuals would be managed based on their classification as hazardous or non-hazardous materials. Hazardous ash should be managed and disposed of as hazardous waste. Non-hazardous ash may be disposed of in an MSW landfill or considered for recycling in construction materials. • Construction camp wastewater (both grey and black water) will be stored in soaking pits/ septic tanks and treated in STP. • All liquids effluent will be treated to meet the standards specified in Schedules 3 and 4 of the ECR, 2023 prior to discharge. • The project developer should follow details of flying ash collection and treatment system are described in section 3.12.2 • The project developer should follow details of slag treatment system are described in section 3.12.4		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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	• Various types of hazardous and non-hazardous wastes would be generated during normal operation of the power plant which has the potential to degrade soil quality and sediment quality if not stored and handled properly.	• The project developer should follow details of the leachate treatment process are described in section 3.12.5 • The project developer should follow details of the effluent treatment process are described in section 3.12.6		
Soil Quality	• Estimated fly ash output from the whole plant is about 73.6 m3/d. Compared with the original waste, the content of toxic elements in urban waste incineration fly ash is 10 to 100 times higher than that in general soil. • The project will produce about 500t/d wet slag per day and 182,500 t/a wet slags per year.	• Wastes will be stored in a manner that will prevent contact between incompatible wastes, i.e. post compatibility checks, • Proper labelling of hazardous wastes. • Waste oil will be collected in MS drum and stored on paved platforms with proper labelling. the waste will be sold to DoE approved vendors. • Special care will be taken in the storage areas to prevent any spillage of hazardous wastes and restrict access (except for trained staff) to such areas. • Periodic audits will be carried out for such areas and containers; also, on the segregation and collection systems and the findings will be documented and appropriate action taken against irregularities. • A spill response plan and emergency plan will be prepared to address accidental spillages or release of hazardous wastes. • A proper manifest record will be maintained of waste travelling/ removed from the site. • Awareness growing to use the by-product of the power plant efficiently.	WTE Power Plant North Dhaka Private Limited Study by 3rd Party agency /experts.	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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	• Compaction of soils from increased leveling and grading of areas within the site will result in lower permeability and therefore, decreased infiltration and increased runoff. • Improper storage, handling and disposal of solid and hazardous waste may lead to contamination of the soil. • The defunct/damaged equipment will also be generated and storage/disposal on the unpaved ground can lead to contamination of soil is hazardous waste.	• Monitoring not only inside but also outside the land areas free from any kind of waste disposal or potentially to be polluted lands. • Increase the facilities of ash marketing through infrastructure development, creating awareness and formulating policies. • Landfills must be treated against seepage to prevent contamination of soil, while preventing soil from entering the landfill area. The permeability coefficient of natural clay lining, and modified clay lining shall not exceed 1×10-7 cm/s, and the thickness of field bottom and four-wall lining shall not be less than 2m. • The hazardous waste such as spent oil as well as non-hazardous wastes shall be disposed of off to DoE authorized vendors only. • Disturbance to soil from repair and maintenance activity will be limited and will ensure proper restoration of soil wherever excavation is undertaken.		
Terrestrial Flora	• Hampering plant growth and causing diseases. • Particulate matter from fly ash will settle on plant leaves, twigs,	• A plantation plan shall be implemented for greenbelt development with appropriate indigenous species. Extensive plantation of pollutant-resistant trees in and around the project area will serve as a pollution sink and noise barrier. • Plant health monitoring shall be conducted regularly.	WTE Power Plant North Dhaka Private Limited	Designated Team comprising of representation from EHS and Operations of

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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	and stems, potentially disrupting photosynthesis, respiration, and other physiological processes, thereby hindering plant growth and causing diseases. • Stack emissions, such as sulfur dioxide, nitrogen oxides, carbon monoxide, and heavy metals (e.g., mercury), can contribute to acid rain, which corrodes plant surfaces and acidifies terrestrial ecosystems, impairing plant growth.	• Suppression of fugitive dust emissions through spraying water in the construction area. • Covering dust generates loose materials with tarpaulin sheets during transportation to the site. • Restrict vehicle movement within site to a speed less than 20 km/hour at site to minimize potential for dust generation in the surroundings. • Supply fuel to the workers for cooking and train them not to use wood as a fuel which will reduce the impacts on vegetation in the surrounding of the project site. • Construction activities should be planned and undertaken in a phased manner. • Greenbelt development around the project site and surrounding area as early as possible; and • Plantation of local species for stabilization of the filled in material and plantation in surrounding areas. • The project developer should follow details of flying ash collection and treatment system are described in section 3.12.2. • The project developer should follow the details of Flue Gas Treatment Process described in section 3.12.1.		WTE Power Plant North Dhaka Private Limited
Terrestrial Fauna	• Impact on health, behavior, and reproduction of terrestrial fauna • The high noise levels from these activities may disturb and alter the behavior of faunal species, including	• Disturbance on wildlife shall be monitored regularly • Rescue, rehabilitation, and relocation shall be done for terrestrial fauna when necessary • Comply with the existing rules and regulations of the Department of Environment regarding air and noise which will also ensure less/no impact on the migratory birds in the National Botanical Garden, Mirpur. • The construction activities should be scheduled in such a way that it minimizes noise and vibration.	WTE Power Plant North Dhaka Private Limited Study by 3rd party agency/experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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	birds, around the project site. • Increased vehicle operation for transporting workers will raise dust and exhaust emissions from burning fossil fuels. Dust emissions from these activities might affect the respiration of both fauna and avifaunal species. • Collision and Electrical hazards from Power Transmission Infrastructure	• The noise generating activities should be scheduled during the daytime only. • Provide acoustic enclosures and noise barriers in areas of high noise generating sources to avoid discomfort to local wildlife. The barriers should be erected in such a way that it does not interfere with the natural movement migratory and bird roosting, and foraging ground. • Dust suppression measures should be implemented to minimize dust pollution during operation work. • Use low-intensity lighting, which reduces the brightness of the lights and helps to reduce the glare. • Movement of waste transport vehicles should be restricted to dedicated paths to minimize any harm to small mammals near to proposed site. • Traffic management plans shall be developed to minimize the impact of operation traffic on wildlife, such as by limiting the speed of vehicles (20 km/hr) or the number of vehicles on site at any given time to avoid roadkill. • Strict prohibition will be implemented on trapping, hunting or injuring wildlife within the subcontractors and should bring a penalty clause under contractual agreements. • Regular checking of the transmission towers to avoid nesting by any of the birds; • Marking overhead cables using diffractors/diverters;		Dhaka Private Limited
Aquatic Flora and Fauna	• Accidental discharge of surface runoff with high sediment load, spilled oil, etc into the river have the potential to affect the water	• Leaching of hazardous chemicals in adjacent waterbody must be controlled • Regular monitoring of aquatic ecosystem health and fish production in monsoon shall be done	WTE Power Plant North Dhaka Private Limited	Designated Team comprising of representation from EHS and

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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	quality by leading to an increase in turbidity, organic matter content, oil content etc. • Impact on movement, growth, and reproduction of aquatic flora and fauna • High thermal exposure will directly and indirectly impact the aquatic organism's biology. Most aquatic organisms have specific temperature needs and are unable to survive sudden changes. • Organic matter decomposes faster in warmer temperatures, depleting dissolved oxygen and local aquatic life may be forced to migrate from the area, relocating to a more suitable location.	• Monitoring of temperature at the discharge point at a frequency of everyday. • A log of all dangerous chemicals be kept, how to be used, transported stored and disposed of; • Keep all dangerous chemicals, oils, greases, solvents, and residues in a secure room. • Have a standard operating procedure on how to deal with spills. • Have a spill response team readily available to respond. • Train workers on spills and how to deal with them. • Restricting the night lighting during operation where not necessary. • Have a containment and disposal plan for all hazardous material (where to dispose). • Collect and separate the spilled water from runoff water then store and treat separately. • All oils and hazardous materials to be disposed of after proper treatment satisfying Environmental Conservation Rules 2023. • The water supply pipeline intake point should be provided with sufficient screening to filter out larger aquatic organisms (e.g., fish, frogs, and toads) and foreign matter, preventing this material from being drawn into the pumps. • Drum screens need to be adopted in order to limit the entrainment of fish in the cooling water system, and intake velocities should be as low as possible. • The intakes for the water pumps in the main pump-house will meet the IFC guidelines, including recommended intake velocity less than 0.30 m/s and a mesh size of 9.5 mm.	Study by 3rd party agency/experts	Operations of WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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		• The channel can be built for water channelization rather than a direct abstraction from the river. • Monitoring should continue to ensure that the deterrents are working effectively. • On-site wastewater should be treated to achieve maximum reuse and recycling rather than ultimate disposal to the river. • Regular consultation, training and stakeholder meetings should be arranged with the local bodies and project personnel. • Use of bio-indicator for pollution measurements like benthic community, plankton or sensitive organisms. • Avoid the area where the dolphin and other aquatic wildlife in abundant • Awareness building activities should be carried out continuously. • No trapping and killing of Dolphin.		
Traffic	• Increase in traffic number for this project may add extra traffic pressure that can result in obstruction of traffic near site and around site. The inflow of waste transporting and carrying workers during operation is likely to generate noise and dust emissions.	• The Project Company will implement a staggered schedule for garbage trucks entering and exiting the site. Assign specific time slots to different trucks to avoid congestion during peak hours. • The Project Company will install clear and visible signage for directions, speed limits, and entry/exit points to guide the truck drivers efficiently. • The Project Company will restrict truck movement on certain roads during peak traffic hours or in sensitive areas to reduce congestion and disturbances. • The Project Company will implement use of GPS and tracking systems to monitor truck movements and optimize routes to reduce travel time and congestion. • The Project Company will create temporary holding areas for trucks within the site to manage overflow and prevent trucks from waiting on public roads.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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		• The Project Company will implement a real-time monitoring system to manage the holding areas efficiently and direct trucks as needed, • Collaboration shall be undertaken with local communities and responsible authorities to improve signage (e.g., pedestrian crossings, speed limits, etc.), visibility and awareness of pedestrian safety. • The transportation of waste shall be carried out in the covered condition. • Adoption of Stakeholder measures for avoidance of traffic incidents like display of educational materials and signboards to ensure elderly and children are aware of the increased traffic risk and safety measures. • The Project Company will establish a feedback mechanism for residents to report traffic issues and concerns, and address them promptly. • The Project Company will appoint flagman at the entry point from the highway. Also, engage security guards and flagman in the main gate of the power plant to manage the flow of traffic and ensure smooth entry and exit.		
Occupational Health and safety	• Accidents or incidents are more likely to be an increase • Physical trouble, Noise, vibration, lighting, electrical, heat and cold, nuisance dust, fire/explosion, machine grinding, working space, Chemical, Gases, dusts, fumes, vapors, liquids are the major	• Provide adequate health care facilities and first aid within the project sites. • Provide OHS training program and information of basic site rules of work, basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures. • Provide adequate lavatory facilities for the number of people expected to work in the facility. • Adequate preventive measures from negative factors such as fire precautions, lighting, safe access, work environment temperature, area signage, labeling of equipment, communication Hazard codes, and electrical.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

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	hazards that are harmful for worker's health. • Road Accidents	• Periodic health check-up to be conducted for employes across the project life-cycle. • Linkages with local administration, hospital, fire brigade and police station to be developed to address any occupational health and safety issue throughout the project cycle. • Establish rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction. • Identify and provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors. • Proper maintenance of PPE and the instruction of proper use. • Conduct safety manual classes or orientation on a regular basis • Monitor and report safety protocols and incidents • Maintain a register for occurred incidents and take measures to prevent it in future • OPs need to be developed for the operation and maintenance of the Plant.		
Community Health safety	• This is a possibility to increase the risks of infectious diseases due to influx of workers of the industries and the semi-urbanization of the project area and its surroundings area.	• The machinery and vehicles should be equipped with mufflers, silencers, foam, rubber, and other soundproofing materials necessary to reduce operation noise; the diesel generators should be covered with a canopy. • Only well-maintained equipment will be operated on-site. • Regular maintenance of equipment, such as lubricating moving parts, tightening loose parts, and replacing worn-out components, should be conducted. • Machinery and construction plants that may be in intermittent use (e.g., trucks) shall be shut down or throttled down during non-work periods.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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		• Low-noise equipment shall be used as far as practicable. • The number of equipment operating simultaneously shall be reduced as far as practicable. • Periodic health check-up to be conducted for employes across the project life-cycle. • Linkages with local administration, hospital, fire brigade and police station to be develped to address any community health and safety issue throughout the project cycle. • • Developing a Disaster Management Plan (DMP) to charter proper protocol to be followed in the event of a disaster in order to limit the impact on the local community. • Disclose potential disasters and potential risks from the plant to the local community as well as the plan of action on the emergency protocol in the event of these accidents. • Disclose and generate awareness on the DMP as well the measures and protocols prescribed by the same. • Train employees and plant personnel in health and safety as well as handling and managing disasters and emergency events. • Proper combustion along with appropriate air pollution control devices can reduce emissions of these substances to acceptable levels. • Appropriate and suitable technological solutions can reduce the impact of gaseous pollution. • Maintain harmonious relations with the community and create a feedback system. • Maintain sound labor and management relations to avoid conflict and disruption in operation.		

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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		• Firefighting systems, such as sprinklers, portable extinguishers (appropriate to the flammable hazard in the area), and automated fire extinguishers will be provided at strategic locations with clear labeling of the extinguisher type. The main hydrant will also be available around the buildings. An automated fire detection system will be in place on all floors.		
Gender Based Violence (GBV)/ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)	• 10 Chinese and 50 local female laborers will be employed. • Safety and security protocols should be robust, addressing any concerns that might disproportionately affect women. • Harassment of women and young girls by workers, such as honor crimes in extreme cases. • Disturbance of women and young girls' mobility around the Project area. • Discrimination against women in terms of employment.	• Project will ensure no gender-based violence will occur due to the project. • Women will be heard if any issue raised by them and will be mitigated with high priority. • Announce employment opportunities and recruitment notices widely, targeted at women as well as men. • Technical training can be provided to the local workforce, especially women for inclusion in the operation and maintenance phase. • Ensure basic facilities (separate toilets, clean water, drinking water facilities, resting place) are provided for female as well as male workers at the operation site. • Women are to be trained and empowered to be part of household energy solutions – their understanding and knowledge about their household energy need to be translated into defining the way forward on access to clean, affordable, and sustainable energy. • Workers should be informed and alert regarding gender related sensitivity. • Prepare a Code of Conduct and insert it in the induction training to be provided to all workers. • Grievance Mechanism (GM) should be in place at site and community level. A GM box needs to be installed in a visible place with a signboard	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

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		with some basic info, contact address, contact number. GM must include some info on sexual harassment. • GM register needs to be maintained at site. • An acknowledgement slip should be given to the complained person against the grievance for the tracking. • GBV/SEAH should be confidential, and more options should be created to submit the grievance against GBV/SEAH. • Conducting periodic meetings with local community for understanding their grievances.		
Labor Influx	• Labor requirement from the locality will create the opportunity of technically sound labor from the local work force, increase of local economy, requirement for use of local resources.	• Proper safety protocol should be taken under the labor management plan by plant management. • Alert the migrant workers regarding GBV, local harmony and other socio-cultural aspects to avoid any kind of collision between labor and local people. • Periodic health check-up to be conducted for employes across the project life-cycle. • International (Chinese) workers must follow both national and international regulations while roaming around. • Toolbox training, health safety protocol and other essential guidelines should be followed by the workers and plant management should follow the OHS guidelines in this regard. • Grievance system should be established and maintained within the plant and workers accommodation area.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Infectious Disease such as HIV/AIDS	• During operation, in general, about 280 persons will be involved in the plant	• Inform workers of the risk of disease and the need for adhering to all preventative and control measures. • Recommend a specific medical assessment of workers for histoplasmosis prior to the start of the project. This may include chest x-	Plant EHS Team and operations	Designated Team comprising of representation

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
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	operation. Infectious diseases could spread among the community and plant as well.	rays, serologic (blood) tests, and skin tests. Also consider pulmonary function tests, fitness to wear a respirator, and immunization against tetanus. • Ensure that hygiene facilities have been installed or are available (for example temporary showers) • Ensure workers are aware of the symptoms of heat stress conditions and the importance of maintaining adequate fluid and salt intake when working in hot conditions. • Periodic health check-up to be conducted for employes across the project life-cycle. • Linkages with local administration, hospital to be develped to address any infectious health issue throughout the project cycle. • • Recommend that arrangements for providing cool drinking fluids, in an uncontaminated area, should be made, especially replenishing fluids and electrolytes like Gatorade. • Posting of signs warning of potential health risks • Emergency procedures/key contact person/phone/fax/cell/e-mail		from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Impact on waste pickers	• Waste pickers rely on scavenging recyclables and other valuable materials from landfills to earn a living. With WtE projects diverting waste away from landfills, their access to these materials	• Ensure an alternative income source for them based on their willingness and their physical health. • A permanent solution to the issue may result in a significant change for their livelihood, which should be considered by the project proponent. • The operation phase of the power plant will require waste pickers, which also can be a choice for the employment of currently found waste pickers.	Plant EHS Team and operations	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North

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	diminishes, directly affecting their income. • With less waste available, competition among waste pickers can increase, leading to lower incomes and potential conflicts. • The transition to new methods of waste collection or finding alternative livelihoods requires adaptation, which can be difficult without proper support and resources.	• Waste pickers can be integrated into WtE projects through formal employment or by setting up cooperatives that supply waste to these projects. • Providing training for alternative livelihoods, financial support, and educational programs can help waste pickers transition to new forms of employment. • The project developer can implement policies to protect waste pickers' rights and ensure they are not adversely affected by the introduction of WtE projects. • In the meanwhile, the project company will conduct CSR to improve surrounding waste pickers living level and to gradually transform them to ordinary citizens, which will include: - Hiring certain of them for entry-level jobs of the project company; - Providing necessary train for improving their skills. - Donating food, water and necessary living material; - Closely work with local community, charity, government to provide necessary support.		Dhaka Private Limited
Transmission Line				
Water Quality	• Run-off water from tower bases	• Preventing soil loss by stabilizing any slopes of the construction area	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Ecosystem	• The movement of birds or bats might be disrupted due to the presence of	• Transmission lines are designed to have ground wire spacing and lightning arresters as safety features to generally protect the public (and birds)	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

Aspect	Key Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	transmission towers. Besides, electrocution of birds and bats might occur in transmission towers and lines.	• To mitigate bird/bat electrocution, distances between electric conductor (or phases), and distances between conductors & grounded hardware should be separated over a larger distance. Spot checks/ocular inspection of wildlife crossing, and bird electrocution (if any) will be included as part of maintenance work along the transmission line.		
Occupational and Community Health and Safety	• The presence of a transmission line may pose potential hazards such as electrocution, lightning strike, etc., due to accidental failure of power transmission. Wind, fire and earthquakes can pose risks to the Project operation.	• Towers will be fitted with anti-climbing techniques. • Transmission towers have been designed as per relevant national building codes which include earthquake resistance and loading requirements related to wind conditions. • Transmission support structures such as tower foundations have also been designed to withstand different combinations of loading conditions including extreme winds. • Clear and visible danger and warning signs will be posted at designated areas to alert the community of the safety risks. • Transmission towers are equipped with danger boards, barbed wire, and galvanized ground wire for earthing purposes.	Appointed Contractor	WTE Power Plant North Dhaka Private Limited
Socio-economic and Environmental Impacts	• Positive Socio-economic and Environmental Impacts	• Employment opportunities will be generated during operation and maintenance phase. • Socio-economic growth by providing power to existing industries and new industrial activities. • The electrification rate will be improving through the provision of connections to industries and rural areas which are currently waiting for power connections	Appointed Contractor	WTE Power Plant North Dhaka Private Limited

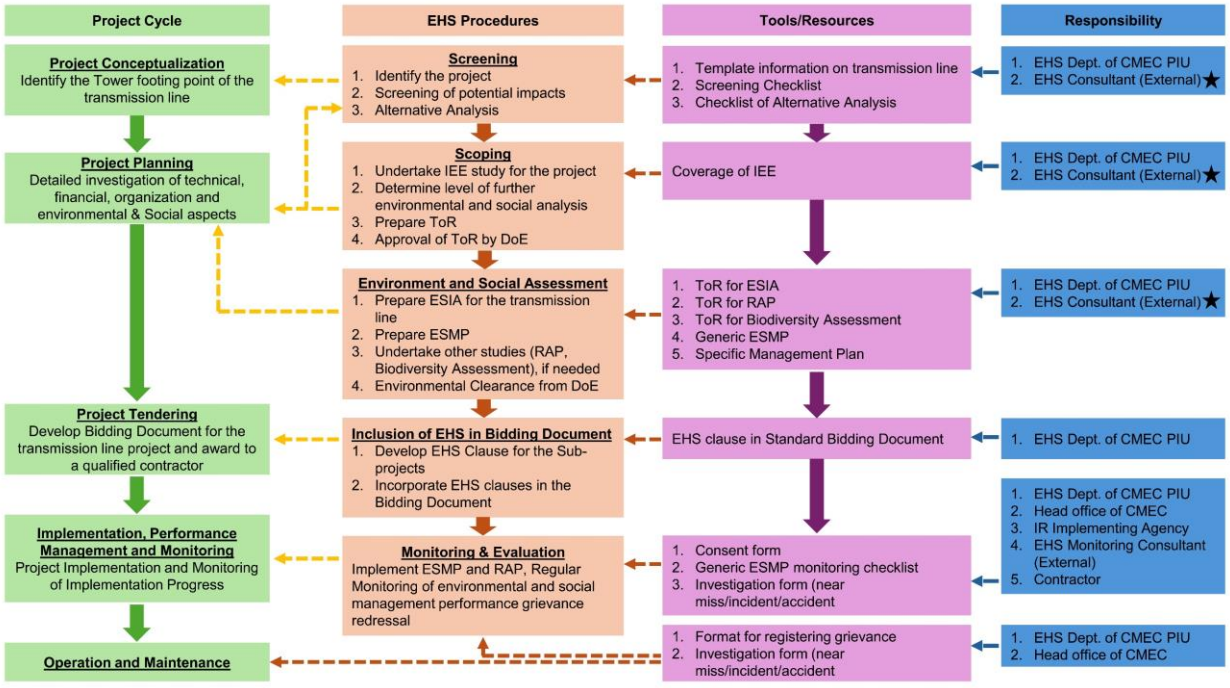
10.4 Environment & Social Management Framework for Transmission Line

The ESMF aims to assist WPPNDPL in identifying and managing the environmental and social impacts through appropriate mitigation measures that may arise due to the installation of the transmission lines. The successful implementation of the ESMF will depend on the commitment of the WPPNDPL and appropriate institutional arrangements in the WPPNDPL. It also requires that the development cycle of the transmission line project align with environmental and social assessment procedures to ensure that there is early engagement between project planners and compliance staff responsible for environmental and social management. This approach will ensure that the material risks and impacts are identified at the planning stages of the project development cycle, thus ensuring that environmental and social studies are appropriately scoped.

Many aspects of the ESMP prepared for the main project of construction of WtE Plant would also be applicable for Transmission Line (e.g. facilities to be provided in labor camps, GRM, etc.). It would, therefore, be desirable to initially state that various measures identified in the ESMP for the Plant will also be applied to TL sub-project, as may be relevant.

Figure 10-1 provides a schematic of the ESMF showing the linkages between project development and environmental and social impact assessment procedures. It highlights the tools that are contained in the ESMF. These various elements of the ESMF are elaborated upon in the Appendix.

Figure 10-1: Schematic of the ESMF



★ Services of the E&S Consultant can be considered in case it is required by WPPNDPL/CMEC

10.5 Flood Adaptation Measures (Construction & Operation Phase)

In low-lying areas like those adjacent to the Karnatali River, implementing flood adaptation measures across construction and operational phases is critical for sustainable development. During construction, thorough site assessments and eco-sensitive planning lay the groundwork by integrating elevated structures, temporary flood barriers, and advanced drainage systems. These initiatives not only mitigate immediate flood risks but also reduce environmental impact, fostering resilience against future climate uncertainties.

In the operational phase, maintaining flood resilience involves upgrading to permanent flood defenses and enhancing green infrastructure for effective stormwater management. Real-time monitoring systems provide early flood warnings, enabling swift response strategies. Community engagement plays a vital role through education programs that raise flood awareness and empower local populations to participate in resilience-building efforts. By embracing these sustainable practices, projects in flood-prone areas near the Karnatali River can thrive resiliently, safeguarding infrastructure and ecosystems while fostering a safe and empowered community.

Flood Adaptation Measure	Construction Phase	Operation Phase
Site Assessment	Conduct detailed hydrological studies and environmental impact assessments to understand flood risks, water flow patterns, and potential ecological impacts.	Continuously monitor and assess changes in flood risk, integrating new data into flood risk management strategies. Implement sustainable land use planning and floodplain management practices.
Elevated Construction Zones	Design buildings and critical infrastructure with elevated foundations above projected flood levels, considering future climate change scenarios.	Retrofit existing structures with flood-proofing measures such as raised electrical systems, waterproofing, and flood barriers. Integrate green roofs and permeable pavements to enhance water absorption.
Temporary Flood Barriers	Install temporary flood barriers using reusable materials like sandbags or modular flood walls that can be easily disassembled and stored for future use.	Transition to permanent flood barriers such as vegetated swales, bioswales, or porous pavements to enhance stormwater management and reduce flood risk.
Drainage Systems	Implement temporary drainage systems that promote water infiltration and reduce runoff during construction, using natural filtration systems where feasible.	Upgrade drainage systems with sustainable drainage solutions (SuDS) that mimic natural water retention and filtration processes, reducing flood risk and improving water quality.
Flood-Resilient Materials	Use sustainable building materials with low environmental impact, such as recycled and locally sourced materials, that are also flood-resistant and durable.	Incorporate resilient building materials like flood-resistant concrete, bamboo, and reclaimed wood in construction and maintenance practices to enhance building resilience.

Flood Adaptation Measure	Construction Phase	Operation Phase
Scheduling Considerations	Schedule construction activities during dry seasons to minimize soil disturbance and runoff, and consider phased construction to reduce overall flood risk during the build phase.	Develop and implement a flexible operational schedule that allows for adaptive responses to changing weather patterns and flood events, ensuring minimal disruption to operations.
Emergency Response Plan	Develop and train workers on emergency response plans specific to flooding events, integrating ecological and cultural sensitivity into evacuation and response protocols.	Conduct regular drills and simulations to ensure the effectiveness of emergency response plans, involving local communities and authorities in disaster preparedness efforts.
Equipment and Material Storage	Store construction equipment and materials in designated flood-proof areas or on elevated platforms to minimize flood damage and contamination risks.	Implement inventory and asset management systems that include flood risk considerations, ensuring essential equipment and materials are protected and accessible during floods.
Real-time Monitoring Systems	Install real-time monitoring systems for early detection of flood risks and water levels, integrating data into construction planning and emergency response strategies.	Enhance real-time monitoring capabilities with advanced technologies (e.g., IoT, AI) to provide accurate and timely flood alerts, supporting adaptive management and decision-making.
Erosion Control	Implement erosion control measures such as silt fences, erosion blankets, and native plantings to stabilize soils and prevent sedimentation into waterways.	Maintain natural buffers and vegetative cover along waterways and flood-prone areas, enhancing erosion control and promoting biodiversity through sustainable landscape management.
Worker Safety Training	Provide comprehensive training on flood safety and emergency procedures, including cultural competence and resilience training, to ensure worker safety and well-being.	Foster a culture of safety and resilience through ongoing training and community engagement, empowering employees and residents with knowledge and skills for flood preparedness.
Coordination with Local Authorities	Establish partnerships with local authorities, indigenous communities, and stakeholders for collaborative flood risk management and emergency response planning.	Engage in joint flood risk assessments and planning exercises with local authorities and communities, integrating traditional ecological knowledge and practices for sustainable flood management.

Flood Adaptation Measure	Construction Phase	Operation Phase
Flood-Resistant Design	Integrate flood-resistant design principles into architectural plans and specifications, considering both aesthetic and functional aspects of flood resilience.	Retrofit existing infrastructure with green infrastructure features like rain gardens, green roofs, and permeable pavements to enhance water absorption and reduce urban flooding.
Permanent Flood Barriers	Construct permanent flood barriers using natural and resilient materials that blend with the local environment, minimizing ecological impacts and enhancing flood protection.	Maintain and upgrade existing flood defenses with eco-friendly materials and techniques, ensuring long-term resilience against increasing flood risks and climate variability.
Green Infrastructure	Incorporate green infrastructure to manage stormwater, enhance biodiversity, and reduce flood risks.	Expand green infrastructure initiatives related to sustainable drainage systems, promoting ecosystem services and climate resilience.
Improved Drainage Systems	Develop advanced drainage systems that integrate natural drainage patterns and incorporate ecological restoration principles to enhance flood resilience.	Implement SuDS that mimic natural hydrological processes, enhancing flood resilience while improving water quality and promoting biodiversity in urban and rural landscapes.
Flood Evacuation Routes	Designate and maintain clear evacuation routes and safe havens that consider local topography and community needs, incorporating cultural and historical considerations.	Develop and update flood evacuation plans and communication systems that prioritize safety, inclusivity, and accessibility for vulnerable populations and diverse communities.
Regular Maintenance	Schedule routine inspections and maintenance of flood defenses, drainage systems, and green infrastructure to ensure functionality and resilience over time.	Establish long-term maintenance plans for flood infrastructure and green spaces, integrating community stewardship and adaptive management practices for sustainable flood resilience.
Community Awareness Programs	Engage in educational outreach programs that promote flood risk awareness, cultural preservation, and community resilience, fostering a shared responsibility for flood preparedness.	Collaborate with local schools, community groups, and cultural institutions to develop and implement tailored flood education programs that integrate traditional knowledge and modern science.

Flood Adaptation Measure	Construction Phase	Operation Phase
Post-Flood Assessment	Conduct comprehensive post-flood assessments that evaluate environmental impacts, community resilience, and infrastructure performance to inform adaptive management strategies.	Implement ecosystem-based approaches to post-flood recovery and restoration, fostering natural regeneration and community-led resilience building initiatives for sustainable flood management.

10.6 Greenbelt Development

One of the favored strategies for reducing pollution is to increase vegetation in the form of greenbelts. Pollutants are absorbed by plants, which also act as a windbreak and a place for dust and other particles to settle. Additionally, it contributes to some degree of noise reduction. The primary goal of the green belt is to act as a buffer or barrier between the pollutant sources and the nearby regions. In addition to enhancing the area's aesthetic value, the green belt aids in the collection of fugitive emissions and the reduction of noise. The goal of installing a greenbelt would also be to maximize both ecological functionality and scenic beauty of the project area. WTE Power Plant North Dhaka Private Limited has designed to develop 7.35-acre (29753.90 m^2) land as greenbelt in the plant premises and surrounding of the plant.

WTE Power Plant North Dhaka Private Limited has earmarked more areas for the development of greenbelt. Apart from this, the plantation will also be carried out along new internal roads, around office buildings, and other site infrastructure. A survival rate of more than 75% will be maintained.

Criteria for Selection of Tree Species

Local or indigenous species will be preferred and the species those have dust and noise-tolerant capacity, enhance aesthetics, and develop a habitat for wildlife especially for avifauna will be introduced.

Species suitable for greenbelt development need to be selected based on the following criteria:

- Tolerance to specific conditions alternatively wide adaptability to eco-physiological conditions.
- Plants suitable local/native fast-growing trees.
- Low water demands and resistance to extreme climatic conditions.
- Species that can minimize noise level, absorb dust, and maintain ecological, land, and hydrological balance of the region.
- Different heights and growth habits.
- Pleasing appearances.
- Dense canopy cover.
- Ability to fix atmospheric nitrogen.
- Improving soil quality.

In the context of air pollution attenuation, greenbelts will be developed around the project in a manner so as to effectively reduce the pollution caused by project activities. The design of effective greenbelts involves consideration of meteorological, physico-chemical, biological, and horticultural aspects relevant to pollutant source and the area where greenbelt has to be established. The green belt would consist of native perennial green and fast-growing trees. The following species can be planted in the proposed project site for Green Belt Plantation in the project area.

Table 10-3: Species Recommended for Green Belt Plantation

Sl.	Local Name	Scientific Name
1.	Bottle brush	*Callistemon viminalia*
2.	Chandramalika	*Chrysanthemum coronarium*
3.	Chimul	*Bombax ceiba*
4.	Kathal/Jackfruit	*Artocarpus heterophyllus*
5.	Krishnochura	*Delonix regia*
6.	Mahogany	*Swietenia mahagani*
7.	Mango	*Mangifera indica*
8.	Neem	*Azadirachta indica*
9.	Pabon Jhau	*Casuarina equisetifolia*
10.	Tetul	*Tamarindus indica*

10.7 Dos and don’ts for wildlife

Dos:

- **Awareness Programs**: Conduct educational sessions for contractors and workers about the presence and conservation status of local wild species.
- **Management of Species**: Manage the presence of any local wild species during both construction and operation phases.
- **Raptor Safety Measures**: Implement measures to deter raptors such as vultures and Black kites from scavenging in unsafe areas of the landfill.
- **Snake Awareness and Safety**: Conduct snake awareness programs for workers and implement protocols to safely relocate any snakes found within the project site to minimize human-wildlife conflict.
- **Signage:** Place signs within and around the project area to raise awareness about local wild species and prohibit hunting.
- **Barricading:** Temporarily barricade construction areas to prevent grazing animals from entering.
- **Pit Safety:** Barricade and permanently close pits dug during construction to prevent animals from falling in.
- **Water Sources**: Take precautions around water sources to prevent animals from being disturbed.
- **Restricted Area Usage**: Ensure the area around the construction site is only used for project purposes.
- **Equipment Safety**: Fence equipment like generators to prevent accidental harm to wildlife.
- **Vegetation Management**: Keep a buffer zone clear to deter grazing animals from approaching.
- **Training Security**: Train security guards to manage wildlife during project operations.
- **Monitoring**: Maintain records of wildlife presence throughout all seasons during operation.

Don'ts:

- **No Hunting:** Hunting or killing of wildlife is strictly prohibited under the Wildlife (Conservation and Security) Act, 2012
- **No Construction Without Awareness**: Ensure no construction begins without educating workers about local wildlife.

- **No Disturbance of Raptors**: Avoid activities that disturb raptors, such as vultures and Black kites, during their natural scavenging behavior at the landfill.
- **No Harm to Snakes:** Ensure no harm comes to snakes found within the project site, and avoid disturbing their habitats whenever possible.
- **No Stone Throwing**: Workers should not harass any local wildlife species with objects.
- **Prohibited Hunting:** Specifically prohibit hunting of any local wild species.
- **Noise Regulations**: Use DG sets with acoustic covers to reduce noise impact during construction.
- **Uncovered Pits**: Do not leave pits uncovered within or near the project boundary.
- **Insufficient Fencing**: Ensure fencing is properly insulated to prevent wildlife electrocution.
- **Unsafe Cables**: Avoid loose electric cables during project operation to prevent hazards.
- **Nighttime Construction**: Preferably avoid construction activities at night to minimize disturbance.
- **Waste Disposal**: Dispose of kitchen waste carefully to avoid attracting scavenging species.

10.8 Environmental and Social Monitoring Plan

The monitoring plan is one of the important tools of implementing the mitigation plan for the proposed waste-to-energy power plant project. The Monitoring plan provides guidance regarding environmental issues/parameters, location, frequency, and means of monitoring.

The aim of environmental monitoring during the pre-construction, construction, and operation phases of the project is to compare the monitored data against the baseline condition collected during the study period (particularly during the detailed design stage) to assess the effectiveness of the mitigation measures and the protection of environmental components (e.g., air, water, soil, sediment noise, etc.) based on the national environmental standards (e.g., ECR 2023). Since the project is likely to have an impact on various components of the environment, a comprehensive monitoring plan covering soil quality, air quality, water quality, noise, ecology, workers and community health and safety, and so on needs to be developed.

An Environmental and Social Monitoring Plan (ESMoP) has been prepared along with this ESIA for execution as a means to mitigate or minimize the adverse impacts associated with the construction and operational activities of the project on the natural and social environments.

10.8.1 Objectives

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

- Monitor the actual impact of the works on physical, biological, and socioeconomic receptors within the project area to indicate the adequacy of the ESIA.
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the ESIA.
- Ensure compliance with legal and community obligations including safety on the project site.
- Ensure the safe disposal of excess construction materials and other wastes.
- Appraise the adequacy of the ESIA with respect to the project's predicted long-term impacts on the physical, biological, and socio-economic environment.
- Evaluate the effectiveness of the mitigation measures proposed in the ESMP and recommend improvements, if and when necessary

10.8.2 Performance Indicators

Physical, biological and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator has been prepared for all phases of the Project and is presented below Table 10-4, Table 10-5, Table 10-6 & Table 10-7. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, and responsibilities for implementation and supervision.

10.8.3 Indicator and Monitoring Schedule

Environmental and Social Monitoring would form an integral part of the Environmental and Social Management Plan implementation procedure. During the pre-construction and construction phase, the Contractor (and their sub-contractor) shall be entrusted with carrying out the environmental monitoring, while in the operation phase WTE Power Plant North Dhaka Private Limited or its Contracting Operating agency would hire third-party agencies for environmental monitoring at periodic interval. The monitoring also aims to ascertain whether activities are in progress as per the schedule and the timelines are being met and evaluate whether project-affected entities (households and local community) have been compensated and that PAPs have at least the standard of living are no worse off than it was before the project.

WTE Power Plant North Dhaka Private Limited Management would allocate a dedicated budget for environmental and social management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring, and capacity building.

10.8.3.1 During Pre-Construction and Construction Phase

The proposed environmental and social monitoring program during the pre-construction and construction phase of the project is given in the following Table.

Table 10-4: Environmental Monitoring Plan during Pre-Construction and Construction Phase

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
General	Inspection of mitigation compliance	Construction site and surroundings	Visual inspection of all active work area	Monitoring	Daily	Appointed EPC Contractor	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Ambient Air Quality	Dust	Project activity areas	Visual inspection of all active work areas	Monitoring	Daily	Appointed EPC Contractor	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
	$PM_{2.5}$, PM_{10}, CO, NO_x, $SO_{2,\ Odor}$	Project site and nearest receptors (5 Locations) as per baseline monitoring points	Onsite measurement and analysis	Air quality standard as per Air pollution (Control) Rules 2022 and WHO standard	Quarterly	Appointed EPC Contractor Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
Noise	Noise levels in Leq, Leq day, Leq night	Project site, adjacent sensitive receptors (6 locations) as per baseline monitoring points	Onsite measurement and analysis	Noise Pollution Control Rules (2006), Bangladesh and IFC EHS guidelines[41]	Quarterly	Appointed EPC Contractor Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Water Quality	DO, BOD, Temperature, Electric Conductivity (EC), Turbidity, pH, TDS, Salinity, Iron, Arsenic, Phosphate, Zinc, Chromium, Nitrate, Magnesium, Aluminum, Coper, COD, Hardness (as CaCO3), Ammonia, Ammonium, Color, TSS, Oil and Grease.	2 samples (upstream and downstream of Karnatali River)	Surface water sampling and laboratory analysis	National Water Quality Standard (Schedule-2: Standards for Water, ECR, 2023)	Quarterly	Appointed EPC Contractor Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE/ WARPO
	Temperature, Electric, Conductivity (EC), Turbidity, Ph, TDS, DO, Salinity, Iron, Fluoride, Arsenic, Total Coliform, Fecal Coliform, Chloride, Total Alkalinity, Total Hardness	2 Locations Project site, Adjacent village.	Ground water sampling and laboratory analysis	National Water Quality Standard (Schedule-2: Standards for Water, ECR, 2023) and WHO guideline	Quarterly	Appointed EPC Contractor Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE/

[41] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
							WARPO
Soil Quality	Texture, Particle Size Distribution (Sand, Slit, Clay), Salinity, pH, Cation Exchange Capacity, Nitrogen (Total), Potassium, Magnesium, Sodium, Phosphorus, Iron, Chromium Cadmium	2 samples (Project Site and adjacent agriculture land)	Soil sampling and laboratory analysis	Standard analytical methods	Quarterly	Appointed EPC Contractor Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Sediment Quality	pH, Nitrogen (Total), Potassium, Calcium, Magnesium, Sodium, Phosphorus, Iron Zinc (Zn), Cadmium	2 samples (upstream and downstream of Karnatali River)	Sediment sampling and laboratory analysis	Standard Analytical methods	Quarterly	Appointed EPC Contractor Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Waste (Solid and liquid waste)	Solid waste: Quantity, volume, and waste management Liquid waste: Waste management	Construction site	Visual inspection of all active work areas, Audits, photographic documentation	Monitoring and record keeping	Daily	Appointed EPC Contractor	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Terrestrial Flora	Plant Health Monitoring (Plant Growth, Canopy Coverage, Disease, etc.)	5 sample plots within 2	Sample Plot Survey, Visual inspection	Monitoring and Reporting	Once	Appointed EPC Contractor or	Designated Team comprising of representation from

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
		km Buffer Area				Study by 3rd party agency/experts	EHS and Operations of WTE Power Plant North Dhaka Private Limited
Terrestrial Fauna	Death/ disturbance of wildlife	Construction Sites and adjacent areas	Visual observation	Monitoring and Reporting	Monthly	Appointed EPC Contractor or Study by 3rd party agency/experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited

Table 10-5: Social Monitoring Plan during Pre-Construction and Construction Phase

Affected components.	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
Land acquisition	Loss of land, income, livelihoods etc. as per ESIA/ESDD report	Land acquisition area	According to ESIA/ESDD report	Monitoring and record keeping	Half yearly	DNCC	WTE Power Plant North Dhaka Private Limited/Implementing NGO/Social officer
Business Structure of non-title holder	Loss of income from business, livelihoods etc. as per	Project area	According to ESIA/ESDD report	Monitoring and record keeping	Half yearly	DNCC	WTE Power Plant North Dhaka Private Limited/Implementing NGO/Social officer

Affected components.	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
	ESIA/ESDD report						
Traffic	Traffic safety	Project adjacent road (Dhaka-Aricha highway (N5), approach road	Visual inspection	Monitoring and record keeping	Daily	Appointed Contractor	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Occupational Health and Safety	Accidents, incidents, diseases, and community complains	Construction site	Visual inspection	Monitoring and record keeping	Monthly	Appointed Contractor	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited/ Social Safeguard Specialist
Community Health and Safety	Number of accidents, first aid, PPE	Construction site and surroundings	Visual inspection	Monitoring and record keeping	Monthly	Appointed Contractor	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited/Social Safeguard Specialist
Project Adjacent lands	Impact due to waste and other materials	Surrounding land of project	Visual inspection and protection measures to avoid	Monitoring and record keeping	Daily	Appointed Contractor	Designated Team comprising of representation from social safeguard personnel and Operations of WTE Power Plant North Dhaka Private Limited/ Social Safeguard Specialist

Affected components.	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
			any harm to those lands				

10.8.3.2 During Operation Phase

The proposed environmental and social monitoring program during the operation phase of the project is given in the following Table.

Table 10-6: Environmental Monitoring Plan during Operation Phase

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
Compliance monitoring	ESIA, mitigation measures, condition of environmental approval	All areas	-	Environmental and Social Management and Monitoring Plan	Monthly	O & M Unit	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Meteorology	Wind speed, wind direction, temperature, humidity, rainfall, solar radiation, cloud cover	Project site	Establishment of weather station	-	Continuous	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Air Quality	$PM_{2.5}$, PM_{10}, CO, SO_2, NOx, O_3	Project site	Onsite measurement and analysis	Air Pollution Control (Rules), 2022	Continuous Monitoring	O&M Unit WTE Power Plant North	Designated Team comprising of representation from EHS and

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
						Dhaka Private Limited	Operations of WTE Power Plant North Dhaka Private Limited /DOE
	$PM_{2.5}$, PM_{10}, CO, SO_2, NOx, O_3	Project site and nearest receptors (8 Locations) as per baseline monitoring points	Onsite measurement and analysis	Air Pollution Control (Rules), 2022	Once in a month	Study by 3rd Party agency /experts.	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Stack Emission	Temperature, pressure, flow, dust, SO2, NOx, O2, CO, CO2, HCL, HF, NH3	Stack	Continuous Emissions Monitoring System (CEMS)	Air Pollution Control Rules-2022 and 2010/75/EU standard	Continuous Monitoring	O&M unit WTE Power Plant North Dhaka Private Limited	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
	Temperature, pressure, flow, dust, SO2, NOx, O2, COCO2, HCL, HF, NH3	Stack	Onsite monitoring	Air Pollution Control Rules-2022	Quarterly	3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
Noise	Leq values in dB(A)	Project site, adjacent sensitive receptors (6 locations) as per baseline monitoring points	Onsite measurement and analysis	Noise Pollution Control Rules (2006)	Quarterly	O & M Unit Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Surface Water Quality	Turbidity, pH, DO, Total dissolved solids, oil & grease, total coliform, heavy metals	2 sampling sites (100 m upstream and downstream of Karnatali river close to the project area)	Surface water sampling and laboratory analysis	National Water Quality Standard (Schedule-2: Standards for Water, ECR, 2023)	Quarterly	O & M Unit Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Groundwater Quality	Temperature, Electric, Conductivity (EC), Turbidity, Ph, TDS, DO, Salinity, Iron, Fluoride, Arsenic, Total Coliform, Fecal Coliform, Chloride, Total Alkalinity, Total Hardness	2 Locations (Project residential deep tube well and adjacent village)	Groundwater sampling and laboratory analysis	Drinking water quality standard as per Schedule 2 of ECR 2023	Quarterly	O & M Unit Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
	Ground water aquifer level measurement	Project Site monitoring well.	Groundwater level measure using Sounders/Electric water level	Standard analytical methods	Continuous	O&M Unit WTE Power Plant North Dhaka Private Limited	Designated Team comprising of representation from EHS and Operations of WTE Power Plant

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
			meters and Flow meters.				North Dhaka Private Limited /DOE
Wastewater	Temperature, pH, Chlorine, BOD5, COD, oil & grease, heavy metals, FC, TC, TDS, EC	Outlet of discharge channel	Sampling and laboratory analysis of effluent	National Standards for Waste (Schedule-4: Standard for waste from Industrial units or Projects waste)	Monthly	O & M Unit Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Slag Quality	pH, EC, Heavy metals: Pb, Cd, Hg, Cr, As Other elements: Si, Al, Ca, Fe, Mg, and S.	Project Site	Slag sampling and laboratory analysis	EPA Method 3050B/EN 14899/ EN 14899:2005 - Characterization of waste	Monthly	O & M Unit Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Fly Ash	Concentration of hazardous components in the leachate, Moisture content, Dioxin, Hg, Cu, Zn Pb, Cd, Beryllium, Barium, Ni, As, Total Chromium, Hexavalent chromium, Selenium	Project Site	Fly ash sampling and laboratory analysis	Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB16889-2008)	Monthly	O & M Unit Study by 3rd Party agency /experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Soil Quality (Contamination of Soil)	Texture, Particle Size Distribution (Sand, Slit, Clay), Salinity, pH,	2 samples (Project Site and nearest	Soil sampling and laboratory analysis	Standard analytical methods	Annually	O & M Unit	Designated Team comprising of representation

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
	Cation Exchange Capacity, Nitrogen (Total), Potassium, Magnesium, Sodium, Phosphorus, Iron, Chromium Cadmium	agriculture land)				Study by 3rd Party agencies/experts	from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Solid waste (domestic and office waste)	Quality, quantity, collection system and disposal locations	Disposal site in project premises	Visual checks to assess the situation	Monitoring and record keeping	Daily	O & M Unit	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Solid waste (Fly ash, bottom ash)	Types, quantity, storage, associated hazards, disposal method	Fly ash, bottom ash generating sources and disposal points	Visual checks to assess the situation	Monitoring and record keeping	Monthly	O & M Unit	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Liquid Waste	Types, quantity, storage, associated hazards, disposal method	Storage and discharge point	Visual checks to assess the situation	Monitoring and record keeping	Monthly	O & M Unit	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Sediment Quality	pH, Nitrogen (Total), Potassium, Calcium, Magnesium, Sodium,	2 samples (upstream and	Sediment sampling and	Standard Analytical methods	Annually	O & M Unit	Designated Team comprising of representation

Affected components	Parameters/Units	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
	Phosphorus, Iron Zinc (Zn), Cadmium	downstream of Karnatali River)	Laboratory analysis			Study by 3rd Party agencies/experts	from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Terrestrial Flora	Plant Health Monitoring (Plant Growth, Canopy Coverage, Disease, etc.)	5 sample plots within 2 km Buffer Area	Sample Plot Survey, Visual inspection	Monitoring and Reporting	Yearly	O & M Unit Study by 3rd Party agencies/experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Terrestrial Fauna	Diversity and abundance of birds	Project site and adjacent areas	Visual observation	Monitoring and Reporting	Quarterly	O & M Unit Study by 3rd Party agencies/experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE
Aquatic Flora and Fauna	Fisheries Resources-diversity, abundance, habitat suitability, etc.	2km upstream and 2km downstream from the adjacent project Area in Karnatali River	Boat to boat Survey, Stakeholder consultation	Monitoring and Reporting	Yearly (End of monsoon) for 2 years	O & M Unit Study by 3rd Party agencies/experts	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited /DOE

Table 10-7: Social Monitoring Plan during Operation Phase

Affected Components	Parameters	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
Traffic	Traffic management plan in the project area and disturbance in approach road	Entry and exit routes of the plant and approach road	Visual inspection	Traffic Management Plan	Daily	O & M Unit	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Green belt development	Number of trees are planted	Project premises and surrounding area	Plantation of trees and record keeping	Monitoring	Periodic and need based	O & M Unit	Designated Team comprising of representation from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Community health and safety	Respirable disorders, Heart diseases, Child health etc.	Surrounding villages around the project	Health check-up (half-yearly)	Monitoring and Record Keeping	Half-yearly	WTE Power Plant North Dhaka Private Limited	WTE Power Plant North Dhaka Private Limited
Occupational health and safety	Accidents, PPEs, Diseases (respirable disorders, heart	Operational areas (all places where there	Health check up , follow all the regulatory guidelines and use of pPE	Health and Safety Policy of WTE Power Plant North	Weekly	O & M Unit	Designated Team comprising of representation

Affected Components	Parameters	Monitoring Location	Means of Monitoring	Applicable Standards	Frequency	Responsibility	
						Implementation	Supervision
	diseases, diabetes, reproductive and Child health, ENT problems, etc.)	is presence of workers all the time)		Dhaka Private Limited			from EHS and Operations of WTE Power Plant North Dhaka Private Limited
Corporate Social Responsibility (CSR) Activities	Community Development	Adjacent villages	No. of beneficiaries and outcome of the activities	CSR /HR Policy	Periodic and need based	CSR department	Designated officer of CSR deparment and f representation from HR and Admin of WTE Power Plant North Dhaka Private Limited

10.8.4 Reporting Mechanism for Environmental and Social Monitoring Program

A reporting system would provide the Project with the necessary feedback mechanisms to ensure the quality and timely implementation of the work. The reporting system would ensure a regular flow of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system would provide a mechanism to ensure that the measures proposed in the Project's ESMP are implemented.

Before the civil works start, the HSE Division of WTE Power Plant North Dhaka Private Limited would finalize the format for reporting on the status and progress of environmental monitoring. The format would be designed to meet all the compliance conditions associated with the environmental clearance from the Department of Environment and the Government of Bangladesh and AIIB's Guideline. The contractor will be required to submit the duly filled-up reporting form on a monthly basis. A further report, detailing the results of pollution monitoring for air, stack emission, noise, soil, sediment, waste, slag, fly ash, and surface water and groundwater and ecosystem and biodiversity, occupational and community health safety would be submitted quarterly as envisaged in the monitoring plan. A health and safety incident/accident report would be prepared and submitted in the event of an incident or accident. Independent verification of the effectiveness of the mitigation measures by the EPC (Engineering, Procurement, and Construction) contractor during the construction phase can be done with a periodic third-party audit.

During the operation phase of the project, the EHS personnel will monitor the effectiveness of the ESMP implementation. Quarterly Progress Reports that can be submitted to the regional office and head office of the DoE required as a part of environmental clearance process shall also be prepared and submitted based on the necessary monitoring and reporting formats. WTE Power Plant North Dhaka Private Limited will be responsible for submitting the quarterly report to DoE and Lenders. The below table indicates the types of report and corresponding actions to be taken.

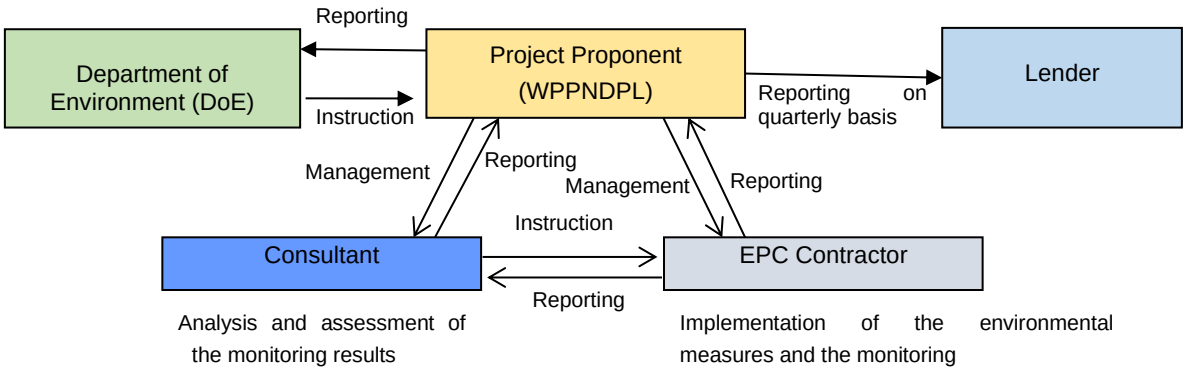
Table 10-8: Summary of Report Type

SL#	Report Type	Frequency	Responsibility	Submitted to
1.	Environmental Quality Performance	Monthly	Contractor/Consultant	DoE/Lenders
2.	Environmental Quality Performance	Quarterly	Contractor/Consultant	DoE/Lenders
3.	Annual Environmental Report	Annual	Contractor/Consultant	DoE/Lenders

10.9 Institutional Setting and Implementation Arrangement

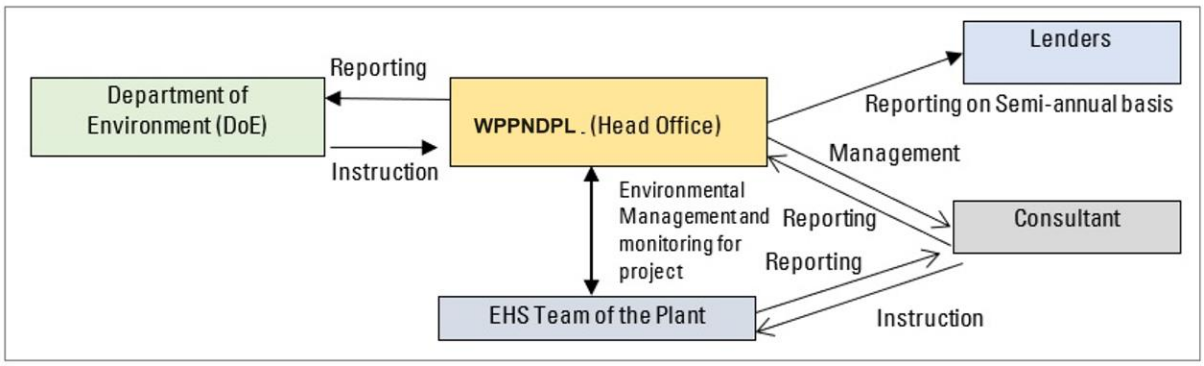
The main purpose of this environmental assessment is to delineate the correct measures to enhance the environmental sustainability of the proposed project through providing suggestion on design considerations, implementation, management and operation as suggested in the ESMP. The effective implementation and operation of ESMP depends on regular monitoring. The organogram of the proposed Environmental management & monitoring during construction phase directorate is presented in **Figure 10-2.** Contractor will implement Environmental and Social Management Plan (ESMP) and Environmental and Social Monitoring Plan (ESMoP) and submit the environmental monitoring report to WTE Power Plant North Dhaka Private Limited (WPPNDPL) and Consultant based on the ESIA. WPPNDPL will submit the monitoring report to DoE and lender based on the results of implementation of ESMP and ESMoP. The EHS officer of contractor will be responsible for implementation of the environmental and health safety aspect as per ESMoP of the project during construction phase. The EHS manager and officer of WPPNDPL and consultant will supervise the ESMP and ESMoP.

Figure 10-2: Implementation Structure of Environmental Management and Monitoring during Construction Phase



Environmental management will require specific approach to handle the issues effectively. Manager EHS of WPPNDPL will assign the roles and responsibilities to be performed during the operation stages of the power plant. It is expected that a certain degree of redundancy is inevitable across all management levels but should be in order to ensure that compliance with the environmental management plan can be cross-checked. The suggested organizational structure for environmental management during operation stage is given below in **Figure 10-3**.

Figure 10-3: Suggested Organizational Structure for Environmental Management during Operation Stage



Compliance with ESMP will be the responsibility of WPPNDPL project management at each stage of the project. WPPNDPL management will ensure that all executive activities during pre-construction and construction stage do not create adverse environmental effects. All environmental and social officers will work in an environmentally friendly manner under the supervision of EHS department of WPPNDPL. All the regulatory agencies, including DoE will be contacted as and when required to get advice for environmental management and they will be kept informed of the environmental conditions of the area periodically by WPPNDPL management. Some of the approaches to be followed during the environmental management practices are given below:

- Complying with the relevant legislation and regulations of Bangladesh.
- Regularly reviewing of the impacts on the environment in the project site.
- Developing appropriate indicators to monitor core impacts.

- Setting appropriate annual objective, targets and publicly reporting on progress.
- Monitoring supplier's environmental and social management arrangements.
- Using sustainable materials for office supplies and environmentally and socially safe raw materials with recycling options where appropriate; and
- Communicating openly with internal and external stakeholders on environmental issues.

The ESMP (mitigation plan) will be included in the construction contract and the contractor will be responsible for the implementation of the measures associated with design and construction. The overall management and coordination of the Project will be the responsibility of the Project General Manager of WTE Power Plant North Dhaka Private Limited. The project-level activities will be managed at the Deputy Project Manager and Chief Engineer. At the project level, implementation of management plans and corrective actions are the responsibilities of EHS Department in coordination with other departments. In the construction and operational phase, EHS Manager will supervise the Contractor environmental and health safety performance to implement the management action plans. The roles and responsibilities of the Project Developer (WTE Power Plant North Dhaka Private Limited) and EPC Contractor for implementation and monitoring have been outlined in Table 10-9. The flow diagram depicting the institutional arrangement for the implementation of the ESMP is presented in Figure 10-4.

Table 10-9: Roles and Responsibilities of Project Developer and EPC Contractor

Project Developer (WTE Power Plant North Dhaka Private Limited)	EPC Contractor
Obtaining statutory clearances required during the pre-construction stage of the Project	Obtaining permits required during the construction stage
Overall project coordination and management through EPC and supported by the third-party environmental consultant/s	Joint verification with Project Developer and Third-Party Environmental Consultant for review of ESMP implementation
Interaction and reporting to the respective department of GOB	Interaction with Project Developer and appointed supervision consultant if any
Interaction and reporting to lenders	Filling of reporting formats as per the reporting schedule and submission to Project Developer
Effective implementation of ESMP and monitoring of ESMP implementation	Environmental monitoring through Third Party Environmental Laboratory
Carryout verification/ supervision exercises during the construction phase of the Project for the implementation of ESMP	Preparation of various plans for effective implementation of ESMP as detailed out in the "Specification Manual" by the Project Developer
Keeping records of all permits obtained by EPC Contractor	Identification of site for labor camp, batch mix plant, laydown areas
Overall supervision of ESMP implementation	Management of labor camp and to provide drinking water, sanitation facility
Approval of plans prepared by EPC Contractor	
Addressing grievances of the local community and information dissemination	
Environmental monitoring through laboratory	

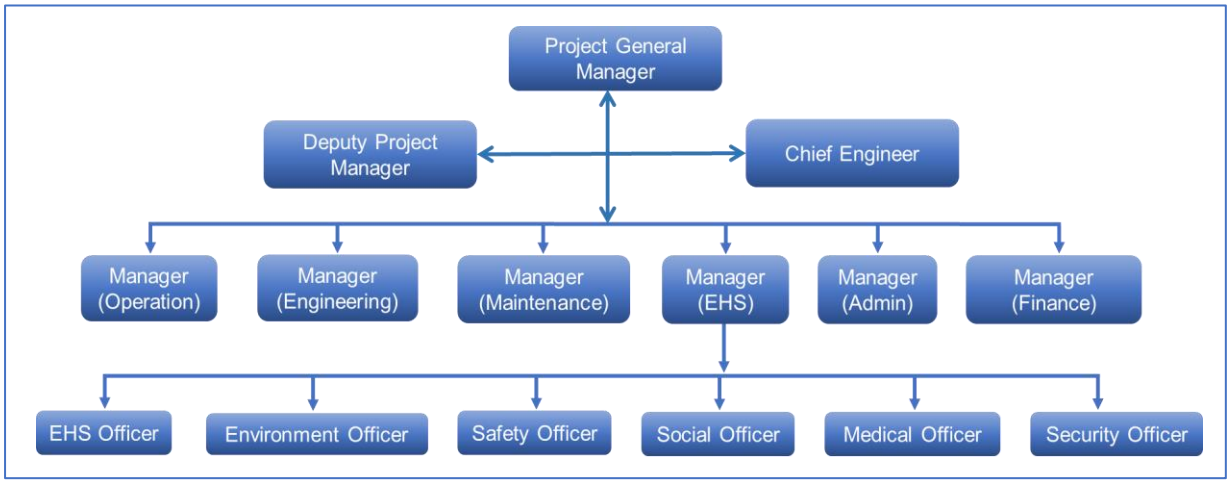
While the contractor or a particular party is responsible for the physical implementation of the mitigating measures, the whole implementation process requires supervision, checking, documentation, and verification so that problems are identified and properly addressed before they get out of hand.

In order to ensure proper execution of the ESMP, implementation reviews will be conducted by the project engineer such as the weekly construction meetings, construction logbook, monthly and other construction reports, etc.

Records of these minutes of the weekly meeting, monthly reports, and special reports on the implementation of the mitigating measures will also be maintained and available for review by the Project management. It is suggested to identify documents and records that require templates and accordingly suitable templates shall be developed, which shall include but not be limited to policies, procedures and work instructions, meeting minutes, monitoring results, training attendance records, emergency contact lists, action plans, etc. Further, all these templates shall be communicated to all potential users. All these records will be archived at the Project office and will be maintained by the EHS officer. All documents and records shall be archived with a unique identifier so that they can be distinguished from any other material and can be easily retrieved. WTE Power Plant North Dhaka Private Limited will document the process for creating, allocating and approving unique identifiers and will communicate this to relevant staff.

The Contractor shall ensure that the ESMP (for the project) is implemented, the performance of which will be evaluated by WTE Power Plant North Dhaka Private Limited from time to time. The Contractor shall also be responsible for provisioning adequate arrangements and resources for implementing the corrective action developed as part of the internal and external audit reports developed from time to time. Implementation shall be time and responsibility bound in the contractor project organogram. As the project is being developed on some private land also; It is envisaged that the Developer needs to appoint an onsite Admin officer to manage social (including labor and community) issues. The name and contact number of the appointed person should be displayed at the site office. The environment and social management organogram of WTE Power Plant North Dhaka Private Limited is shown in Figure 10-4 below.

Figure 10-4: Organization Chart for Environmental and Social Management



10.9.1 Roles and Responsibilities

This section describes the roles and responsibilities of the key persons responsible for the management of environmental and social activities for the proposed project:

Project General Manager

The Project Manager of WTE Power Plant North Dhaka Private Limited is responsible for the overall management of the project and ESMP implementation during the construction and operation phase. The following tasks will fall within his/her responsibilities:

- To consider and react to issues and solutions proposed by the HSE Department of WTE Power Plant North Dhaka Private Limited.
- To cooperate and consult the relevant environmental agency to perform better.
- To evaluate the progress of development and implementation of ESMP; and
- To approve any change in decision-making and authorities in consultation with Manager EHS, if appropriate

EHS Manager

The success of ESMP depends on proper and effective management provided by the EHS manager. The roles and responsibilities assigned to Manager EHS are given below:

- To ensure that the points of views of staff, contractors and EHS officers are considered and placed likewise in the ESMP.
- To identify issues and propose solutions for inclusion in the EMP review process.
- To improve coordination and exchange of information between top management, employees, and contractors.
- To contribute to actions required to deliver the management plan and ensure its continued development.
- To review EMP every year, tracking issues and changing ESMP in accord with the solutions and suggestions; and
- To monitor the progress of development and implementation of the ESMP.

EHS Officer

The role of EHS officer will be authorized by the EHS manager. The responsibilities of HSE officer will include:

- To integrate, as far as possible, the aims and objectives of different users within an agreed plan.
- To maintain a balanced, holistic approach to the solution of concerned issues in accordance with and compliance with legislative requirements.
- To provide professional guidance on questions relating to the environment management and issues raised by contractors/relevant personals; and
- To develop the ESMP process by its implementation

Environmental Officer

The role of Environmental Officer will include.

- Advising on environmental legal requirements regarding issues that may arise during the project
- To identify environmental issues and implement environmental management with the help of HSE department
- Regular auditing with the view of ensuring that all activities on the site are undertaken in accordance with the ESMP.

Social Officer

The Assistant Manager (Social) will be responsible for the following scope of work:

- Acting as a point of contact for residents and community members.
- To meet the labor requirements during the construction phase of the Project.
- To involve in Grievance Redressed Committee and will actively participate in addressing issues raised by workers and the community.
- To conduct independent social audits.

- To Address training needs for social and community issues.
- To conduct periodic meetings with the local community for understanding their grievances.
- To involve in CSR activities with the community people.

Safety Officer

The major responsibilities of Safety Officer will include

- To stay at ground levels on a daily basis and will coordinate with the Contractor's representatives for all construction activities.
- To provide toolbox training to labor and will also issue relevant PPEs to them.
- To develop formats for work permit system and will ensure its implementation.
- Submit audit reports to the EHS Manager of respective Modules.
- Training and Capacity Development

10.9.2 Construction Phase

Prior to the commencement of major civil works at the site, a suitably qualified in-house/ external expert will be appointed by the EPC contractor in consultation with WTE Power Plant North Dhaka Private Limited to develop and deliver a training program on the implementation of the ESMP, environmental monitoring and reporting in line with the applicable reference framework for the Project. The training will include the following topics:

- Environment, Health, and Safety Policy of the EPC contractor.
- Environment and fundamentals of environmental pollution in relation to the Project.
- EHS management plans prepared by the EPC Contractor.
- Do's and Don'ts for the construction workers;
- Safety procedures and guidelines.
- Internal reporting and response system.
- Hazardous chemicals and waste handling.

In addition, specific training will be provided to the team involved in environmental monitoring and reporting, which will include:

- Applicable environmental guidelines and standards.
- Sampling site selection guidelines in line with the environmental monitoring plan.
- Sample collection, storage, transportation, and analysis procedures.
- Solid and hazardous waste management.
- Quality assurance and quality control.
- Environmental monitoring report preparation

The training will help in capacity building and implementation of the ESMP during the construction phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental performance of the Project. The reporting and verification during the construction phase will be semi-annual and the reports will be submitted to the DOE and the Lenders.

10.9.3 Operation Phase

Prior to the commencement of the Plant operation, a suitably qualified in-house/ external environmental expert will be engaged by WTE Power Plant North Dhaka Private Limited to develop and deliver a training program on operation phase environmental monitoring and reporting. The topics will be mostly the same as that during the construction phase. However, it will also include the following modules, which are specific to the operation phase:

- Daily emission monitoring.
- Wastewater and thermal discharge monitoring.

- Aquatic ecology monitoring.
- Hazardous chemicals and waste management.
- Occupational health and safety programs.

The training will help in capacity building and implementation of the ESMP during the operation phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental performance of the Project. The reporting and verification during the operation phase will be annual and the reports will be submitted to the DOE and the Lenders.

10.10 Entitlement Matrix

Intervention of this project has required land of which 29.6485 acres were acquired from the private owners and 0.3515 from govt. Moreover, structures are located within the proposed project boundary, these have also been displaced along with land. Moreover, PDPs were displaced in the process. In addition to affected private properties as aforesaid, common/community properties like, mosque, graveyard and school were not affected on implementation of the project. In compliance with the AIIB policies, a proposed broad entitlement is given in the matrix in Table 10-10:

Table 10-10: Entitlement Matrix

Type of Loss	Category of Affected PDPs	Type of Entitlement
Land of all Types (Null, Viti and Homestead)	Legal owner(s) as identified by Deputy Commissioner (DC) in the process of CCL payment	• Cash compensation under law (CCL) which includes 200% premium (ARIPA 2017, Section 9). • 7.5% of CCL as dislocation allowance (stamp duty, registration fees and other cost), no matter whether the APs purchase alternative land or not.
Structures of all types primary and secondary (Loss of commercial structures with title to land)	Legal owner(s) as identified by Deputy Commissioner (DC) in the process of CCL payment	• Replacement Value (RV) of Structures as determined by the Public Works Department (PWD). • Cash compensation under law (CCL) which includes 100% premium or RV whichever is higher on the market price/PWD scheduled rates. (ARIPA,2017, Section 9). • 12.5% of RV as Structures Transfer Grant (STG) • 12.5% of RV as Structures Reconstruction Grant (SRG) • Owners is allowed to take away all salvage free of cost with the approval of the authority.
Structures (non-title to land)	Owners of the structures identified during the Census.	• Replacement value of the structures as per the schedule rate of Public Works Department (PWD). • Owners will be allowed to take away all salvage free of cost.
Trees	Legal owner(s) as identified by Deputy Commissioner	• Compensation in cash at CCL as per ARIPA-2017 calculated on

Type of Loss	Category of Affected PDPs	Type of Entitlement
	(DC) in the process of CCL payment or socially recognized owners	the basis of type, age, and productive value of affected trees. • Cash compensation under law (CCL) which includes 100% premium for title holder (ARIPA, 2017). • Owners will be allowed to fell and take away the felled trees within the stipulated time notified by DNCC.
Income loss from business	Title holder	• One-time transitional allowance for the business loss.
Income loss from business	Non-title holder	• One-time transitional allowance for the business loss on the basis of local context and consultation with the APs.
Employment loss (Employees of non-title)	Employees of non-title holder	• Each employee of business enterprises of non-title will be given Tk 10,500: Tk 350*30days based on the local wage on similar employment.
Vulnerable project displaced persons (PDP)	Female Headed HH with income below poverty line, Indigenous, Old Age, Fully Disable and Very Poor (based on their income).	• For each type of vulnerability, each PDP will get Tk 8,000 as onetime cash grant.
Tax on compensation money	Title holder PDPs	All the compensations and grants will be exempt from all types of GoB taxes.

10.11 Budget Plan for Environmental and Social Mitigation Measures and Monitoring

WTE Power Plant North Dhaka Private Limited will allocate a separate budget for environmental and social management plan implementation, training, environmental and social monitoring, analysis and reporting, verification monitoring, and capacity building.

Cost estimates are prepared for all the mitigation and monitoring measures proposed in the ESMP. The environmental and social management and monitoring budget estimation for the construction and operation phase of the Project is provided in, Table 10-11, and Table 10-12. The cost estimates for mitigation and monitoring measures are given yearly. The cost estimates include the budget for environmental and social enhancement/compensation measures and environmental and social monitoring, but not include the budget for consultants for ESMP implementation, institutional strengthening, and capacity building of the plant staff.

The preconstruction and construction stage environmental management budget are 6.3 million (BDT)/year and operation stage environmental and social management budget is 10.8 million (BDT). Environmental and Social Monitoring Cost during construction and operation stage/year are estimated 5.256million (BDT). This budget does not include the decommissioning stage since the minimum operation period is 20 years and the rate will vary largely from the present cost.

Table 10-11: Environmental and Social Management Cost (A) for Pre-construction/Construction Stage

No.	Description of Item	Unit	ESMP Cost (BDT million)
Pre-construction/Construction Stage/year			
1.	Dust pollution control (sprinkling)	LS	1.0
2.	ESMP for air pollution control	LS	0.5
3.	ESMP for controlling noise pollution	LS	0.5
4.	ESMP for controlling surface water resources	LS	0.5
5.	ESMP for controlling groundwater resources	LS	1.0
6.	ESMP for controlling impacts on Soil	LS	0.5
7.	ESMP for controlling waste generation and mitigating impacts	LS	0.5
8.	ESMP for Occupational health and safety	LS	1.0
9.	ESMP for Community health and safety	LS	0.5
10.	ESMP for controlling ecosystem	LS	0.3
Total Environmental Management Cost (A)			**6.3**

Table 10-12: Environmental Management Cost (B) for Operation Stage

No.	Description of Item	Unit	ESMP Cost (BDT million)
Operation Stage (Yearly)			
1.	ESMP for air pollution control	LS	2.0
2.	ESMP for controlling noise pollution	LS	0.5
3.	ESMP for controlling surface water resources	LS	1.0
4.	ESMP for controlling groundwater resources	LS	1.0
5.	ESMP for produced fly ash and slag from the power plant	LS	2.0
6.	ESMP for controlling the impact of wastewater generation	LS	0.5
7.	ESMP for controlling impacts on Soil	LS	0.5
8.	ESMP for Occupational Health and Safety	LS	0.5

No.	Description of Item	Unit	ESMP Cost (BDT million)
9.	ESMP for Community health and safety	LS	0.5
10.	Tree plantation and green area development plan	LS	0.5
11.	ESMP for enhancing better socioeconomic condition	LS	0.5
12.	ESMP for controlling ecosystem	LS	0.3
13.	CSR activities	LS	1.0
Total Environmental Management Cost (B)			**10.8**

Note: These mentioned costs are tentative at the time of this study and might be changed during detail design of the project.

Table 10-13: Environmental Monitoring Cost (C) during construction and operation stage/year

Component	Stage	Item	Location	Unit	Quantity	Unit Rate (BDT)	Total Costs (BDT million)
Ambient Air Quality	During Construction	Measurement of PM 2.5, PM10, CO, SOx, NOx, Odor	8	No.	32	20,000	0.640
	During Operation	Measurement of PM10, PM2.5, SOx, NOx, CO, Odor	8	No.	32	20,000	0.640
Stack emission	During Operation	Temperature, pressure, flow, dust, SO2, NOx, O2, COCO2, HCL, HF, NH3	1	No.	4	20000	0.08
	During Operation (Continuous Monitoring)	Temperature, pressure, flow, dust, SO2, NOx, O2, COCO2, HCL, HF, NH3	1	No.	1	-	O&M Cost
Water Quality (Surface & Ground Water)	During Construction	**Surface Water** DO, BOD, Temperature, Electric Conductivity (EC), Turbidity, pH, TDS, Salinity, Iron, Arsenic, Phosphate, Zinc, Chromium, Nitrate, Magnesium, Aluminum, Coper, COD, Hardness (as CaCO3), Ammonia, Ammonium, Color, TSS, Oil and Grease	2	No.	8	18,000	0.144
		Ground Water Temperature, Electric, Conductivity (EC), Turbidity, Ph, TDS, DO, Salinity, Iron, Fluoride, Arsenic, Total Coliform, Fecal Coliform, Chloride, Total Alkalinity, Total Hardness	2	No.	8	15,000	0.12
	During Operation	**Surface Water** DO, BOD, Temperature, Electric Conductivity (EC), Turbidity, pH, TDS, Salinity, Iron, Arsenic, Phosphate, Zinc, Chromium, Nitrate, Magnesium, Aluminum, Coper, COD, Hardness (as CaCO3),	2	No.	8	18,000	0.144

Component	Stage	Item	Location	Unit	Quantity	Unit Rate (BDT)	Total Costs (BDT million)
		Ammonia, Ammonium, Color, TSS, Oil and Grease.					
		Ground Water Temperature, Electric, Conductivity (EC), Turbidity, Ph, TDS, DO, Salinity, Iron, Fluoride, Arsenic, Total Coliform, Fecal Coliform, Chloride, Total Alkalinity, Total Hardness	2	No.	8	15,000	0.12
		Ground water aquifer level measurement (one time installation cost)	1	No.	1	15,00,000	1.5
Wastewater	During Operation	Turbidity, pH, DO, Total dissolved solids, oil & grease, total coliform, heavy metals	1	No.	4	15,000	0.06
Noise	During Construction	Noise levels in Leq, Leq day, Leq night	6	No.	24	6000	0.144
	During Operation		6	No.	24	6000	0.144
Fly Ash	During Operation	Concentration of hazardous components in the leachate, Moisture content, Dioxin, Hg, Cu, Zn, Pb, Cd, Beryllium, Barium, Ni, As, Total Chromium, Hexavalent chromium, Selenium	1	No.	12	30,000	0.36
Slag	During Operation	pH, EC, Heavy metals: Pb, Cd, Hg, Cr, As Other elements: Si, Al, Ca, Fe, Mg, and S.	1	No.	12	30,000	0.36
Soil	During Construction	Texture, Particle Size Distribution (Sand, Slit, Clay), Salinity, pH, Cation Exchange Capacity, Nitrogen (Total), Potassium, Magnesium, Sodium, Phosphorus, Iron, Chromium Cadmium	2	No.	8	20,000	0.16
	During Operation		2	No.	8	20,000	0.16

Component	Stage	Item	Location	Unit	Quantity	Unit Rate (BDT)	Total Costs (BDT million)
Sediment	During Construction	pH, Nitrogen (Total), Potassium, Calcium, Magnesium, Sodium, Phosphorus, Iron Zinc (Zn), Cadmium	2	No.	8	30,000	0.24
	During Operation		2	No.	8	30,000	0.24
Total Environmental Monitoring Cost (C)							**5.256**
Grand Total (A+B+C)							**21.876**

10.12 Budget plan for Land Assets and Livelihood

Following the resettlement principles of the Project, all affected households and persons will be entitled to a combination of compensation packages and resettlement assistance depending on the nature of ownership rights on lost assets which is according to ARIPA 2017 and AIIB's ESF guidelines. The non-titled settlers on public land will receive compensation for their lost assets and support from the Project. The following **Table 10-14** illustrates the budget for Land, assets, and livelihood.

Table 10-14: Budget summary cost for land, assets, and livelihood

Sl	Mouza	Land Type	Land Amount in Acre	Price awarded by DC per Acre	Total Price Awarded by DC	Total Price of Land After adding 200% with DC's Price
a	**Boliarpur**	**b**	**c**	**d**	**e =(c*d)**	**f= (e*200%)**
1		Bari	2.039	5,02,85,700	102,532,542.30	307,597,626.90
2		Viti	9.2567	3,83,07,700	354,602,886.59	1,063,808,659.77
3		Null	18.7043	2,16,78,900	405,488,649.27	1,216,465,947.81
Total Cost for Land			**30**		**862,624,078.16**	**2,587,872,234.48**
Primary Structures		**Unit**	**Unit Rate As per PWD's Schedule**	**Affected Unit**	**Estimated Cost**	**Total Price of Structure After adding additional 100% with Estimated Cost**

Sl	Mouza	Land Type	Land Amount in Acre	Price awarded by DC per Acre	Total Price Awarded by DC	Total Price of Land After adding 200% with DC's Price
1	RCC Building	sft	1950	4944	9640800	19281600
2	Semi-Pucca Building	sft	1400	30351	42491400	84982800
3	Tin made/Tin shade	sft	568	23998	13630864	27261728
4	Steel structures	sft	720	34519	24853680	49707360
Sub Total						**181,233,488**
Secondary Structures		**Unit**	**Unit Rate As per PWD's Schedule**	**Affected Unit**	**Estimated Cost**	**Total Price of Structure After adding additional 100% with Estimated Cost**
1	Boundary Wall	Smt	1120	1186	1328320	2656640
2	Car Servicing RAM	Smt	650	49	31850	63700
3	Cattle Feeder	Smt	680	13	8840	17680
4	Falls ceiling	Smt	3410	195	664950	1329900
5	Grill Fencing	Smt	2615	539	1409485	2818970
6	Herring Bone Bond	Smt	892	3680	3282560	6565120
7	Iron Gate	Smt	15417	38.648	595836.216	1191672.432
8	Pucca Floor	Smt	3557	518	1842526	3685052
9	Railing Concrete	Smt	4251	20.71	88038.21	176076.42
10	Railing SS	Smt	19345	9.569	185112.305	370224.61
11	Steel Gate	Smt	19345	3.9	75445.5	150891
12	Thai Glass Wall	Smt	7516	63	473508	947016
13	Varanda	Smt	2421	183	443043	886086
14	Wall Tiles	Smt	1333	513	683829	1367658
15	Steel Cover	Nos/No.	3550	2	7100	14200
16	Brick Made Seater	Nos/No.	430	6	2580	5160
17	Iron Box Angle	Nos/No.	10600	26	275600	551200
18	Iron Pillar	Nos/No.	41500	33	1369500	2739000

Sl	Mouza	Land Type	Land Amount in Acre	Price awarded by DC per Acre	Total Price Awarded by DC	Total Price of Land After adding 200% with DC's Price
19	Iron Beam	Nos/No.	55650	13	723450	1446900
20	Water reservoir	Nos/No.	29016	5	145080	290160
21	Deep Tube well	Nos/No.	89706	3	269118	538236
	Sub Total					**27,811,542.46**
Cost for Primary and Secondary Structures						**209,045,030.46**
1	12.5% of RV as Structures Transfers Grant (STG)					26,130,628.81
2	12.5% of RV as Structures Reconstruction grant (SRG)					26,130,628.81
	Sub Total					**52,261,257.62**
	Total Cost for Primary and Secondary Structures					**261,306,288.08**
Cost Estimation for Trees			**Unit Rate**	**Affected Unit**	**Estimated Cost**	**Total Price of Trees After adding additional 100% with Estimated Cost**
1	Sapling		295	10	2950	5900
Total Cost for Trees						**5900**
Grants to Cover Income Loss of Wage/Employee & Vulnerable PAPs					**Affected Unit**	**Estimated Cost**
1	Employment Loss Grant at BDT 350/day for 30 days (5*350*30)				5	52500
2	Tk.8,000/- as one time grant for Female Headed HH with income below poverty line, Indigenous, Old Age, Fully Disable and Very Poor (based on their income). (3*8000)				3	24000
Total Cost for Wage Loser Employee & Vulnerable PAPs						**76,500**
Relocation Grant for Non-title Structures					**Affected Unit**	**Estimated Cost**
1	Relocation Cost for 5 Non-title structure (63362 for each)				**5**	316810
Total Cost for Non-title structure Relocation						**3,16,810**
Transitional Allowance for Business of Title & Non-title					**Affected Unit**	**Estimated Cost**
1	One-time transitional allowance for 5 Title business.				**5**	1170000
2	One-time transitional allowance for 5 non-title business (15000 for each)				**5**	75000

Sl	Mouza	Land Type	Land Amount in Acre	Price awarded by DC per Acre	Total Price Awarded by DC	Total Price of Land After adding 200% with DC's Price
Total Cost for Business Allowance						**1,245,000**
Total Cost for Land, Structures, Trees, Wage loss, Vulnerability Allowance, Relocation and Transitional business allowance						**2,850,822,732.56**
7.5% Ancillary Cost of Total Budget						**213,811,704.94**
					Total Budget	**3,064,634,437.50**

10.13 Inspection, Monitoring, and Audit

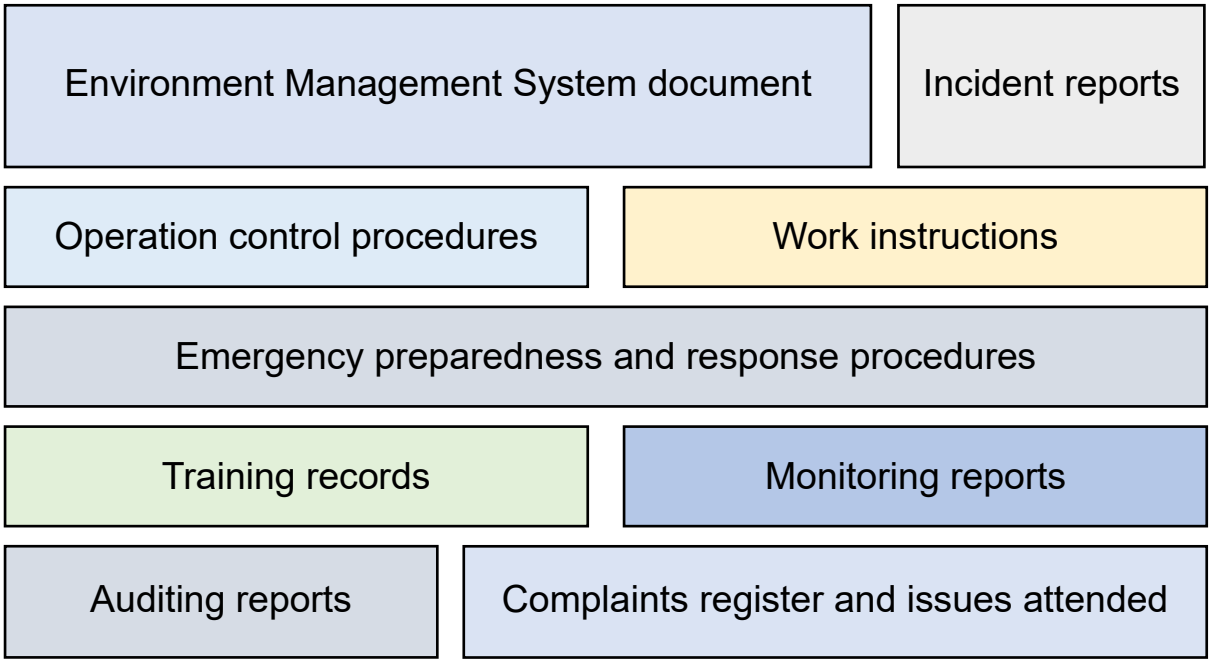
Inspection, monitoring and audits are vital in ESMP perspective as it verifies compliances with applicable environmental and social standards, identify potential impacts and ensure timely corrective actions thereby, promoting sustainable practices and community well-being. This inspection and monitoring of the environmental impacts of the Project activities will increase the effectiveness of ESMP. Through the process of inspection and auditing, WTE Power Plant North Dhaka Private Limited must ensure that the conditions stipulated in various permits comply. The entire process of inspections and audits should be documented. The inspection and audit findings are to be implemented by the site in charge in their respective areas.

10.14 Reporting and Documentation

Reporting and documentation are crucial for transparency, accountability and compliance with regulatory requirements. They provide a comprehensive record of assessments, findings and mitigation measures, supporting an informed decision-making and ongoing project monitoring to ensure environmental and social responsibility. This WTE Power Plant North Dhaka Private Limited will develop and implement a program of reporting through all stages of the project cycle. Assigned personnel shall be required to fully comply with the reporting program in terms of both timely submissions of reports as per an acceptable level of detail. Reporting will be done in the form of an environmental checklist, incident record register, and environmental and social performance reports (monthly, quarterly, yearly, etc.).

10.15 Documentation

Documentation is essential for maintaining an accurate and detailed record of environmental and social assessments, ensuring transparency, accountability and effective management of impacts throughout the project lifecycle and it is also considered as an important step in implementing ESMP. WTE Power Plant North Dhaka Private Limited will establish a documentation and record-keeping system to ensure the recording and updating of documents per the requirements specified in ESMP. The documents should be kept as hard copies as well as in electronic format. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained, and that document control is ensured through access by and distribution to, identified personnel in form of the following:



11 CONCLUSION

The conclusion chapter of the project summaries key findings identifies environmental and social impacts and recommends mitigation measures to ensure sustainable development and regulatory compliance. It outlines the project's potential benefits and emphasizes the importance of ongoing monitoring and stakeholder engagement for effective implementation.

Waste to energy can play a vital role in fulfilling the world's future electricity demands. This provides Bangladesh with a newly opened, huge opportunity to deploy a viable yet sustainable alternative to reduce waste generation and provide power supply to the national grid.

The project is classified **'A'** in accordance with AIIB's environmental and social framework requiring the preparation of an Environmental and Social Impact Assessment Report. As per the Environmental Conservation Act, 1995 and the DoE of Bangladesh.

This environmental and social impact assessment of the Project has been prepared based on an understanding of the technical specifications of the Project, existing studies and reports relevant to the project, a scoping exercise, site visits, stakeholder consultations, baseline environmental monitoring, and socio-economic surveys which were undertaken between July 2022 and August 2022. Through this process, an assessment has been made of the potential environmental and social impacts attributable to the construction and operation phases of the Project. Qualitative and quantitative (where possible) assessments of impacts have been presented with an impact rating against each potential impact and mitigation measures to minimize and reduce the impacts.

Many of the impacts are localized and temporary in nature and can be effectively addressed by some embedded control measures in the engineering design of the Project as well as mitigation measures as suggested in the Environmental and Social Management Plan. The Project received favorable support from local people and other stakeholders during consultations. Stakeholders appreciated that in addition to providing a reliable power supply to the region, the Project will have several other benefits such as supporting economic growth in the region by opening avenues for further development, employment (direct and indirect), improving local infrastructure and existing problems due to the current landfill system such as reducing community health risk, bad odors, impacts on water and soil quality.

A total of 30 acres of which 29.6485 acres are private land and 0.3515 acres of khas land will need to be acquired for the proposed power plant. As per the joint verification list of the DC office, 242 landowners have been affected by the project interventions and out of total landowners, 59.36% landowners have been awarded compensation as per ARIPA,2017 Act and project proponent has taken proactive steps in awarding remaining landowners in collaboration with DNCC and DC office. have been awarded. Two business entities have been identified there with other associated facilities and 5 non-titled holders have been found impacted due to the land acquisition activity. A list of 40 rag-pickers have been shared by DNCC to address the issue of livelihood loss due the project. Under proposed livelihood restoration plan for impacted vulnerable individuals. The effective implementation of GRM and SEP will ensure project success as per project's objectives. The outcome of community consultation has confirmed positive feedback of the community concerning the project. The Project is not located near any protected areas; there are no critical habitats present within Project AOI. No archaeological or protected monuments are located in the Project vicinity. The nearest settlement (Nandonik Housing Society) is located over 200 m from the Project. During the construction phase of the Project, the key environmental issues are noise and dust generation. There is also a risk of contamination of soil, groundwater, and the Karnatali River from accidental spills and leaks of hazardous materials (e.g., oil) during handling, transportation, and storage at the site. The adverse impacts identified are generally manageable through good housekeeping and diligent implementation of the ESMP by the EPC Contractor and its supervision by the Project Developer and their team of consultants. The nearest air quality and noise-sensitive receptors will be a focus for monitoring of any impact arising due to the construction activities.

During the construction phase, there will be an impact from the migration of labor into the project area, construction activities, and increased movement of road traffic. The range of impacts identified includes conflicts with the local community, health and safety issues inconvenience due to vehicle movements, risk of spread of communicable and sexually transmitted diseases, waste disposal, and unhygienic conditions. The magnitude and significance of most of these impacts would be limited to the construction period, with limited spillover to the operation phase. Furthermore, by implementing the recommended mitigation measures the project will minimize the identified risks whereas on-going consultation and engagement will support the maintenance of a harmonious relation with the local community. Community health and safety-related impacts will be managed at the source to reduce the footprint. By adopting the mitigation measures as suggested in the ESMP and systematic participatory approach to involve the community would further minimize these impacts.

During the operation phase, the project will have potential impacts on ambient air quality, odor pollution, water quality, noise, traffic, and occupational and community health and safety. The proposed power plant can be considered located in a mixed area interspersed with residential and commercial uses. There are many brickfields and the Dhaka-Aricha highway roads contributing to emissions within the same airshed (10kmX10km study area). Moreover, air pollution coming outside the project grid, transboundary air pollution and local construction works, paved and unpaved road, residential cooking, river vehicle, and city vehicular movement is contributing to the air pollution of the airshed. The proposed power plant has four sets of incinerators and waste heat boilers. A major source of the plant is NO2, SO2, CO, and Particulate Matter. Besides the criteria pollutants, the plant will also contribute heavy metals (Pb+Cr, Hg), HCL, Hydrogen Fluoride (HF), and Dioxin Furan (DF) to the atmosphere. The project will have different flue gas treatment systems. The flue gas treatment process is to remove pollutants such as soot, acidic gases (HCl, HF, SO2 as well as NO2, etc.), heavy metals (Hg, Pb, Cr, etc.) and dioxins from the flue gas emission according to flue gas standards to meet the emission standards of the project. The generation of flue gas includes different kinds of air pollutants which are harmful to the local air quality. Continuous emission monitoring from the stacks and periodic ambient air quality monitoring throughout operations will confirm compliance to the applicable standards/ guidelines and enable the identification of further measures to reduce the impact. Incremental noise levels due to the operation of the Plant will meet the applicable GOB standards/IFC guidelines for industrial areas. Discharges from the proposed project's operation activities are likely to have an impact throughout the project life, and likely to pose a significant impact on the surface water quality, if discharged without adequate treatment and mitigation measures.

The proposed project necessitates the utilization of three bore/tube wells during the dry season to meet its water requirements. To mitigate potential environmental risks associated with groundwater extraction, such as groundwater depletion, the project will implement a comprehensive set of mitigation measures. These include regulated extraction rates, continuous groundwater monitoring, and the adoption of water conservation practices across all project operations. Potential social impacts, particularly concerning water accessibility for local communities, will be addressed through transparent communication and the establishment of a robust grievance redress mechanism. This will ensure that stakeholder concerns are promptly acknowledged and addressed through appropriate channels. The project will stringently comply with all relevant environmental regulations and obtain the necessary permits for bore/tube well drilling and operation. Ongoing engagement with local communities, promotion of sustainable water use practices, and continuous environmental monitoring will be essential components of the project's implementation strategy. These measures will contribute to ensuring the project's overall success while minimizing environmental impacts.

To mitigate the risks of avian collisions along the proposed transmission line (TL) route, particularly at the locations where it crosses the Karnatali River twice, the project proponent will implement the installation of colored discs/bird diverters. These highly visible diverters, characterized by their bright and contrasting colors, will be strategically placed at regular intervals along the transmission lines. This approach aims to enhance the visibility of the transmission lines for birds, thereby reducing the

likelihood of collisions. Regular maintenance and monitoring activities will be undertaken to ensure the continued effectiveness of the installed bird diverters. The implementation of this mitigation measure will contribute to the protection of local bird populations and ensure compliance with relevant environmental regulations governing avian safety. The project proponent's commitment to adopting effective mitigation strategies, such as the installation of bird diverters, underscores their dedication to minimizing the environmental impacts associated with the project activities and promoting sustainable practices throughout the project's lifecycle.

Given the project's proximity to a landfill area, mitigating potential human-wildlife conflicts is essential, particularly with regard to scavenger species such as vultures, black kites, and snakes that may be attracted to the site. To ensure safety and environmental sustainability, it is recommended to implement a regular wildlife monitoring program. Additionally, the project proponent shall adhere to the prescribed set of **Dos and don'ts for wildlife** to mitigate risks associated with potential human-animal conflicts.

The effective implementation of the ESMP and adherence with the GOB and international guidelines will assist in minimizing the environmental and social impacts to acceptable levels. Post-environmental assessment, surveillance, and monitoring are essential to track and sustain the effectiveness of the mitigation measures suggested. A detailed monitoring plan has been prepared as part of the ESMP. The focus areas of monitoring cover air, surface water quality, groundwater quality, noise, soil and sediment, occupational health, and safety as well as community health and safety. The reporting requirements along with the follow-up actions in case of deviation from the norms have been detailed in the ESMP. The frequency has also been set in consideration of the likely impacts.

The construction phase of the Project will have an important role in the socioeconomic development of the area, whereas the operation phase of the Project will play an important role by supplying power in the region and will reduce the problem associated with the disposal of unprocessed waste as a landfill.

A reliable and expanded power supply will support the future economic development of dependent sectors including agriculture, industry, and manufacturing enabling them to operate and compete. Based on the analysis conducted in this environmental and social assessment, it is concluded that overall, the Project will result in positive socio-economic benefits and the negative environmental impacts that have been identified are mostly short-term and localized in nature, and can be minimized adequately through good design, appropriate application of mitigation measures and regular supervision of implementation.

All the identified issues and gaps associated with the EtE project will be addressed under ESMP aligning with applicable national and AIIB's 2022 guidelines towards sustainable implementation of the project while enhancing environmental and social accountability from development perspective in the project area.

EQMS recommends that WTE Power Plant North Dhaka Private Limited to implement the ESMP outlined in the ESIA report to ensure sustainable development of the WtE Power Plant and safeguard the environment and society in and around the project area.