ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Musa Specialized Hospital Ltd.

P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh.

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Declaration

This Environmental Impact Assessment (EIA) report has been prepared for Musa Specialized Hospital Ltd. by Environest Engineering. The report encompasses various management plans tailored specifically for the hospital, highlighting significant environmental impacts and outlining the necessary mitigation measures. It emphasizes the strategies to minimize, reuse, reduce, and recover different resources throughout the development process, detailing the actions required by the project proponents to address these impacts effectively.

Shamim Ur Rahman has served as the principal author of this EIA report, with comprehensive support and collaboration from the entire team at Environest Engineering. The successful completion of this report was made possible by the collective effort of our team.

We gratefully acknowledge the valuable data and information provided by the Board of Directors of Musa Specialized Hospital Ltd., which has been instrumental in the preparation of this report.

Shamim Ur Rahman
Chief Executive Officer
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Abbreviations

EMP	Environmental Management Plan
DOE	Department of Environment
EIA	Environmental Impact Assessment
DGHS	Directorate General of Health Services
ECR	Environment Conservation Rules
GOB	Government of Bangladesh
ETP	Effluent Treatment Plant
WWTP	Wastewater Treatment Plant
OHSA	Occupational Health and Safety Administration
EPA	Environmental Protection Agency
WHO	World Health Organization
ECA	Environment Conservation Act
DG	Director General
ECC	Environmental Clearance Certificate
NOC	No Objection Certificate
ADB	Asian Development Bank
DPDC	Dhaka Power Development Corporation
DCC	Dhaka City Corporation
OT	Operation Theatre
EQS	Environmental Quality Standard
IEE	Initial Environmental Examination
GPS	Global Positioning System
MOEF	Ministry of Environment and Forests
NGO	Non-Government Organization
SDG	Sustainable Development Goals
TOR	Terms of Reference
UNDP	United Nations Development Program
WASA	Water And Sewer Authority
BMD	Bangladesh Meteorological Department
CEA	Comprehensive Environmental Assessment
IEE	Initial Environmental Examination
EHS	Environment, Health and Safety
ERP	Emergency Response Plan
SDG	Sustainable Development Goals
WWTP	Wastewater Treatment Plant

Physical Units

m	= Meter
he	= Hectares
km	= Kilometers
sq.m	= Square Meters
l	= Liter
sq.ft	= Square Feet
sq.km	= Square Kilometer
435.6 sq.ft	= 1 Decimal
720 sq.ft	= 1 Katha
3 Bigha	= 1 Acre
20 Katha	= 1 Bigha
100 Decimal	= 1 Acres

Executive Summary

Musa Specialized Hospital Ltd. is an established general hospital and diagnostic healthcare facility located at P-2341/A, Road No. 26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh. The project aims to provide comprehensive healthcare, specialized medical treatment and diagnostic services through modern medical infrastructure and associated support facilities.

The hospital has a documented capacity of 250 patient beds and provides a range of medical and diagnostic services, including laboratory investigations, X-ray, CT scan, ultrasonography, MRI, endoscopy, dialysis, outpatient department (OPD), emergency services, operation theatres (OT), intensive care unit (ICU), high-dependency unit (HDU), neonatal intensive care unit (NICU), doctors' chambers, patient cabins and general wards.

The hospital is designed to support a substantial number of patients and healthcare professionals through specialized medical services and modern diagnostic facilities. It is expected to contribute to improved access to healthcare, employment generation and the development of the country's healthcare sector.

The total project land area is approximately 4,012.77 square metres (43,177.4 square feet). The building footprint occupies approximately 2,006.38 square metres, while approximately 1,003.19 square metres are designated as green areas. The facility comprises two basement levels, a ground floor, nine upper floors and a roof floor. The estimated project cost is BDT 150 crore.

The hospital employs approximately 469 personnel, comprising 100 doctors, 164 nurses, 200 staff members and 5 administrative personnel. The facility is supported by electricity supplied by DESCO and standby generator facilities.

Under the Environment Conservation Rules (ECR), 2023, the project is subject to the applicable environmental clearance requirements of the Department of Environment (DoE). The present EIA evaluates the environmental and socio-economic implications of the hospital's activities and establishes measures for effective environmental management and regulatory compliance.

1. Key Features of the Project

Table: Key Features of Musa Specialized Hospital Ltd.

Particular	Project Information
Project Name	Musa Specialized Hospital Ltd.
Project Type	General Hospital and Diagnostic Centre
Project Proponent	Md. Musa Kalim
Location	P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka
Total Land Area	4,012.77 m²
Building Footprint	2,006.38 m²
Green Area	1,003.19 m²
Building Configuration	2 Basements + Ground Floor + 9 Upper Floors + Roof
Patient Bed Capacity	250 Beds
Total Manpower	Approximately 469 Persons
Estimated Project Cost	BDT 150 Crore
Electricity Supply	DESCO
Standby Generator	2 Units
Water Source	Groundwater (Deep Tube-well)
Daily Water Requirement	112.5 m³/day
Daily Wastewater Generation	101.25 m³/day
WWTP Capacity	5.0 m³/hour
WWTP Operating Period	22 Hours/Day
WWTP Treatment Technology	Biological MBBR Process
Medical Waste Management	PRISM Bangladesh Foundation
Daily Medical Waste Generation	Approximately 40–50 kg/day (excluding general garbage)

The hospital's wastewater treatment system has a nominal daily treatment capacity of approximately 110 m³/day, based on 5.0 m³/hour operation for 22 hours. This is intended to accommodate the estimated wastewater generation of approximately 101.25 m³/day, subject to actual hydraulic and treatment performance.

The project includes dedicated medical facilities, patient accommodation, diagnostic sections, parking, water-storage facilities, medical gas systems, generator facilities, fire-protection infrastructure, waste-management arrangements and green areas.

2. Project Activities and Operational Facilities

The major activities associated with Musa Specialized Hospital Ltd. are related to healthcare delivery, medical diagnosis, patient management, laboratory services, surgical procedures and supporting hospital operations.

Major operational activities include:

- Outpatient consultation and patient registration.
- Emergency medical services and patient admission.
- Inpatient healthcare services and patient accommodation.
- Surgical procedures and operation theatre activities.
- Intensive care, high-dependency and neonatal intensive care services.
- Laboratory testing and pathological investigations.
- Radiological and diagnostic services, including X-ray, CT scan, MRI and ultrasonography.
- Dialysis and other specialized treatment services.
- Pharmacy operations and medical-supply management.
- Medical gas supply and utility-system operation.
- Laundry, cleaning, sanitation and housekeeping.
- Healthcare waste segregation, collection, storage and disposal.
- Wastewater treatment and management.
- Generator operation and electricity backup.
- Environmental monitoring, occupational health and safety management.

The hospital operates through a combination of medical, diagnostic, administrative and utility facilities. The basement levels accommodate parking, water storage, firefighting infrastructure, medical gas systems, generator facilities and other essential services. The ground and upper floors accommodate emergency, diagnostic, treatment, inpatient and administrative facilities.

3. Baseline Environmental and Social Conditions

The baseline environmental assessment was conducted to establish the existing physical, biological and socio-economic conditions surrounding Musa Specialized Hospital Ltd. The assessment considered land use, geological characteristics, meteorological conditions, surface-water quality, groundwater quality, ambient air quality, noise levels, ecological conditions, traffic and transportation, settlement patterns and socio-economic characteristics.

Environmental sampling and laboratory investigations were conducted by Environmental Alliance BD Limited (EABDL) during October 2026. The assessment included eight surface-water sampling locations, four groundwater sampling locations, eight ambient air-quality monitoring locations and four ambient noise-monitoring locations.

Land Use and Existing Site Conditions

The hospital is situated within an established urban area of Bashundhara, Dhaka, characterized by residential buildings, commercial establishments, institutional facilities, local roads and other urban infrastructure.

The eastern side of the project is surrounded by residential areas, while the western side is connected to a 50-foot road and residential developments. The northern and southern sides are bordered by 25-foot roads, residential buildings and some undeveloped land.

The surrounding area benefits from established infrastructure, including electricity, transportation, water supply and communication facilities. The project site is designated for healthcare services and associated facilities.

Surface Water Quality

Surface-water quality was assessed through eight representative sampling locations covering upstream and downstream sections of a nearby canal, two existing drainage locations and four nearby pond locations.

The samples were analyzed for pH, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD_5), Lead (Pb) and Chemical Oxygen Demand (COD).

The results indicated pH values ranging from 7.6 to 9.2. TDS concentrations ranged from 261 to 527 mg/L, while TSS concentrations ranged from 50 to 87 mg/L. The recorded TSS values exceeded the reported standard of 25 mg/L at all eight sampling locations.

Dissolved Oxygen (DO) concentrations ranged from 3.1 to 5.3 mg/L, indicating that six sampling locations recorded values below the prescribed minimum of 5 mg/L. BOD_5 concentrations ranged from 17 to 29 mg/L, exceeding the reported standard of 6 mg/L. The results also indicated elevated COD concentrations at the sampling locations compared with the applicable standard.

Lead concentrations were comparatively low, with the recorded values remaining within the reported applicable standard.

These findings indicate that the nearby surface-water bodies and drainage channels are already experiencing water-quality pressures. Therefore, proper treatment of hospital wastewater, prevention of untreated discharge and regular monitoring of treated effluent are essential.

Groundwater Quality

Groundwater quality was assessed through four samples collected from deep tube-wells, including one within the hospital premises and three nearby locations.

The samples were analyzed for pH, TDS, iron, alkalinity, hardness, chloride, lead and arsenic.

The measured pH values ranged from 7.4 to 7.6, while TDS concentrations ranged from 150 to 173 mg/L. Iron concentrations varied between 0.38 and 0.54 mg/L, and chloride concentrations ranged from 25 to 31 mg/L.

Lead concentrations were recorded at 0.001 mg/L at all four locations, while arsenic concentrations ranged from 0.002 to 0.003 mg/L. These parameters remained within their respective reported Bangladesh groundwater standards.

However, hardness concentrations ranged from 31 to 38 mg/L, below the standard range of 200–500 mg/L presented in the laboratory report. This parameter requires verification against the applicable groundwater quality criterion. Alkalinity values ranged from 137 to 144 mg/L, for which no corresponding standard was provided in the laboratory report.

Overall, the groundwater results provide a baseline characterization of the existing groundwater conditions. Continued monitoring and proper management of healthcare waste, wastewater and chemical storage are necessary to protect groundwater resources.

Ambient Air Quality

Ambient air quality was monitored at eight representative locations surrounding the hospital premises. The monitoring covered $PM_{2.5}$, PM_{10}, Suspended Particulate Matter (SPM), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO).

The monitoring was undertaken on 01–02 October 2026 by Environmental Alliance BD Limited (EABDL).

The results indicated that all six monitored parameters remained within the respective Bangladesh DoE standards at all eight sampling locations.

The recorded concentrations were:

- $PM_{2.5}$: 27–42 µg/m³, against a standard of 65 µg/m³.
- PM_{10}: 46–57 µg/m³, against a standard of 150 µg/m³.
- SPM: 87–135 µg/m³, against a standard of 200 µg/m³.
- SO_2: 7.9–9.1 µg/m³, against a standard of 80 µg/m³.
- NO_2: 9.9–11.2 µg/m³, against a standard of 80 µg/m³.
- CO: 0.49–0.72 ppm, against a standard of 5 ppm.

The results indicate that the existing ambient air quality around the hospital was generally within the applicable standards during the monitoring period.

Ambient Noise

Ambient noise monitoring was conducted at four locations around the hospital boundary during daytime and nighttime conditions.

The assessment covered Equivalent Continuous Sound Level (Leq), Maximum Sound Level (Lmax) and Minimum Sound Level (Lmin).

The recorded daytime Leq values ranged from 43.11 to 50.32 dB, while nighttime Leq values ranged from 33.28 to 44.32 dB.

All four locations were categorized as Silent Areas in the laboratory report. Against the Bangladesh silent-area standards of 50 dB during daytime and 40 dB during nighttime, a slight exceedance was recorded at NL-04 during daytime (50.32 dB) and at NL-02 during nighttime (44.32 dB).

However, all recorded Leq values remained within the World Bank/IFC residential, institutional and educational area limits of 55 dB during daytime and 45 dB during nighttime.

These results indicate localized noise-level variations along the southern and western boundaries. Regular maintenance of generators and mechanical equipment, acoustic enclosure and periodic noise monitoring are therefore recommended.

Biological and Ecological Environment

The project is situated within a developed urban environment where the surrounding ecological characteristics are influenced by residential development, roads, commercial establishments and other urban activities.

The ecological assessment considered the existing vegetation and terrestrial and aquatic fauna in the project-influence area. The implementation of appropriate green-area management, plantation and pollution-control measures is important to maintain the environmental quality of the hospital premises and its surroundings.

Social and Economic Environment

The surrounding area is characterized by residential and commercial activities, institutional establishments, transportation infrastructure and associated urban services.

The hospital is expected to contribute positively to the local economy through employment generation, improved healthcare accessibility and increased demand for associated services. The project employs approximately 469 personnel, including doctors, nurses, administrative and supporting staff.

The hospital is also expected to create indirect economic opportunities for pharmaceutical suppliers, medical equipment providers, transportation operators, food suppliers, maintenance service providers and other supporting businesses.

No significant displacement of existing settlements has been identified in the project description.

4. Key Environmental and Social Impacts

The EIA assessed the potential environmental and socio-economic impacts associated with the hospital's construction and operational activities. The assessment considered both adverse and beneficial effects on the surrounding environment and local communities.

The principal environmental and social components considered include:

- Surface-water and groundwater quality.
- Water consumption and wastewater generation.
- Ambient air quality and generator emissions.
- Noise and vibration.
- Healthcare and general solid-waste generation.
- Hazardous and infectious waste management.
- Soil and drainage conditions.
- Occupational health and safety.
- Community health and safety.
- Traffic and transportation.
- Fire, accidental incidents and emergency situations.
- Employment and local economic development.

Table: Key Environmental and Social Risks and Impacts

Project Activity	Environmental/Social Issue	Sensitive Receptor	Potential Impact
Hospital wastewater generation	Water pollution	Nearby canal, drainage and surface-water bodies	Deterioration of surface-water quality due to untreated or

Project Activity	Environmental/Social Issue	Sensitive Receptor	Potential Impact
			inadequately treated wastewater
Groundwater abstraction	Water-resource management	Groundwater resources and surrounding users	Increased pressure on groundwater resources
Healthcare waste generation	Medical and hazardous waste	Hospital personnel, patients and surrounding communities	Risk of infection, contamination and occupational exposure
General solid-waste generation	Solid-waste management	Hospital premises and surrounding environment	Littering, odour and drainage blockage
Generator operation	Air pollution and noise	Hospital occupants and neighbouring residents	Exhaust emissions and elevated noise levels
Medical and diagnostic activities	Chemical and hazardous materials	Healthcare workers and patients	Chemical exposure, accidental spills and contamination
Laboratory and pathological activities	Biological hazards	Laboratory personnel and hospital workers	Exposure to infectious materials and biological agents
Operation of mechanical equipment	Noise pollution	Patients, hospital personnel and nearby residents	Disturbance and occupational noise exposure
Ambulance and other vehicle movement	Traffic and community safety	Road users and neighbouring residents	Traffic congestion, noise and accident risks
Healthcare operations	Occupational health and safety	Doctors, nurses, technicians and support staff	Exposure to infectious materials, sharps and workplace hazards

Project Activity	Environmental/Social Issue	Sensitive Receptor	Potential Impact
Fire and emergency incidents	Public and occupational safety	Patients, visitors and employees	Injury, property damage and disruption of healthcare services
Hospital operation	Employment and economic development	Local population and businesses	Positive employment generation and increased economic activity

The major operational environmental concerns identified in the EIA are wastewater management, healthcare waste disposal, groundwater use, generator emissions, noise pollution, occupational exposure, traffic management and emergency preparedness.

5. Summary of Mitigation Measures

The project will implement appropriate mitigation measures to prevent, minimize and control potential environmental impacts. The mitigation approach will focus on pollution prevention, waste minimization, treatment, safe disposal, resource conservation, monitoring and corrective action.

Table: Summary of Major Mitigation and Enhancement Measures

Activity	Likely Impact	Proposed Mitigation/Enhancement Measures	Expected Residual Impact	Responsibility
Wastewater generation	Surface-water and soil pollution	Treat all hospital wastewater through the proposed WWTP; prevent untreated discharge; monitor treated effluent quality	Low, subject to treatment performance	Hospital Management/WWTP Operator

Activity	Likely Impact	Proposed Mitigation/Enhancement Measures	Expected Residual Impact	Responsibility
Healthcare waste	Infection and environmental contamination	Segregation at source, colour-coded bins, safe storage, internal transportation and disposal through authorized service providers	Low	Waste Management Officer
Pathological and anatomical waste	Biological contamination	Appropriate deep-burial arrangements for placenta and body parts in accordance with applicable DoE requirements	Low	Hospital Management
Cytotoxic waste	Hazardous chemical contamination	Return cytotoxic waste to the respective medicine supplier through documented arrangements	Low	Pharmacy/Waste Management Officer
General solid waste	Littering and drainage blockage	Apply the 3R principles, segregate recyclable materials and ensure proper collection and disposal	Low	Housekeeping Department
Groundwater consumption	Pressure on groundwater resources	Water conservation, efficient fixtures, monitoring of abstraction and reuse of treated wastewater where feasible	Low–moderate	Utility/Maintenance Department

Activity	Likely Impact	Proposed Mitigation/Enhancement Measures	Expected Residual Impact	Responsibility
Generator operation	Air emissions and noise	Regular maintenance, adequate exhaust arrangements, proper ventilation and acoustic enclosure	Low	Utility/Maintenance Department
Mechanical equipment	Noise pollution	Preventive maintenance, noise-control measures and periodic monitoring	Low	Maintenance Department
Chemical storage and handling	Spill, leakage and occupational exposure	Proper labelling, safety data sheets, compatible storage, secondary containment, spill kits and PPE	Low	Store/EHS Department
Healthcare occupational hazards	Biological and physical exposure	PPE, staff training, vaccination, safe sharps handling and regular health examinations	Low	Hospital Administration
Fire and emergency situations	Injury and property damage	Functional firefighting equipment, emergency exits, evacuation arrangements, staff training and periodic drills	Low, subject to preparedness	Fire and Safety Department
Traffic movement	Congestion and road accidents	Designated vehicle access, ambulance movement arrangements, parking management and traffic control	Low	Administration/Security

Activity	Likely Impact	Proposed Mitigation/Enhancement Measures	Expected Residual Impact	Responsibility
Green-area management	Reduction of environmental quality	Maintain designated green areas and undertake plantation within available open spaces	Positive	Hospital Management

The hospital will also implement additional environmental protection requirements identified through the approved EIA Terms of Reference and DoE queries. These include appropriate management of radioactive waste, maintenance of relevant radiation-safety requirements, management of used hospital linen through an agreement with an approved washing facility, and implementation of the Reduce, Reuse and Recycle (3R) Policy.

6. Environmental Management Plan (EMP)

A comprehensive Environmental Management Plan has been developed to ensure that the identified environmental impacts are effectively managed throughout the project lifecycle.

The EMP incorporates the following management components:

1. Occupational Health and Safety Management Plan (OHSMP).
2. Emergency Response and Fire Management Plan.
3. Hospital Waste Management Plan (HWMP).
4. Wastewater Treatment and Disposal Plan.
5. Air Pollution Management Plan.
6. Noise Management Plan.
7. Disaster Management Plan.
8. Environmental Monitoring and Reporting Plan.

The Hospital Waste Management Plan emphasizes segregation of waste at source, separate collection of general and healthcare waste, safe temporary storage, appropriate transportation and disposal through authorized service providers. PRISM Bangladesh Foundation has been identified as the third-party organization responsible for healthcare waste management.

The waste-management system will address infectious waste, pathological waste, sharps, pharmaceutical waste, cytotoxic waste, chemical waste, radioactive waste, general waste and recyclable materials, as applicable to hospital operations.

The proposed WWTP has a treatment capacity of 5.0 m^3/hour and is designed around a biological Moving Bed Biofilm Reactor (MBBR) process. The system is intended to operate for 22 hours per day, providing a nominal daily capacity of 110 m^3. Against the estimated wastewater generation of 101.25 m^3/day, the proposed capacity provides a nominal hydraulic margin of approximately 8.75 m^3/day. The treatment system must be properly operated and maintained to ensure that treated wastewater complies with the applicable discharge standards before being released into the local drainage system leading to the nearby canal.

The Occupational Health and Safety Management Plan will address workplace hazards arising from infectious materials, sharps, chemicals, radiation, medical equipment and other healthcare-related activities. The hospital management will ensure appropriate PPE, employee training, first-aid facilities, health examinations, safe work procedures and incident-reporting arrangements.

The Emergency Response and Fire Management Plan will establish appropriate fire-prevention and emergency-response arrangements, including firefighting equipment, emergency exits, evacuation procedures, emergency communication and periodic training and drills.

The Noise Management Plan will focus on minimizing noise from generators, HVAC systems, mechanical equipment, vehicles and general hospital operations through proper equipment maintenance, acoustic controls and periodic monitoring.

7. Environmental Monitoring Requirements

Environmental monitoring is an essential component of the EMP to verify the effectiveness of mitigation measures and ensure compliance with applicable environmental standards.

The proposed monitoring programme will cover wastewater quality, ambient air quality, noise levels, drinking-water quality, surface-water quality, groundwater quality, workplace environmental conditions and healthcare waste management.

Table: Environmental Monitoring Requirements

Environmental Component	Main Parameters/Indicators	Monitoring Location	Frequency
Medical wastewater	pH, BOD_5, COD, temperature, TSS and other applicable effluent parameters	WWTP inlet and outlet	Quarterly
Ambient air quality	$PM_{2.5}$, PM_{10}, SPM, SO_2, NO_2 and CO	Hospital boundary and relevant emission sources	Half-yearly
Noise	Daytime and nighttime Leq, Lmax and Lmin	Hospital premises and boundary locations	Quarterly
Drinking-water quality	pH, TDS, alkalinity, hardness, arsenic, iron, chloride and coliform	Drinking-water outlets	Half-yearly
Surface water	pH, TDS, TSS, DO, BOD_5, COD and lead	Nearby canal, drainage and surface-water locations	Half-yearly
Groundwater	pH, TDS, iron, alkalinity, hardness, chloride, lead and arsenic	Project and nearby deep tube-wells	Annually
Workplace environment	Lighting, air quality, sound level, temperature and humidity	Hospital workplaces	Quarterly
Healthcare and general waste	Waste quantity, segregation, storage, collection and disposal records	Hospital floors, operation theatres and designated storage areas	Daily internal monitoring
Environmental compliance	EMP implementation, monitoring records and regulatory compliance	Entire hospital premises	Annually

The proposed annual environmental monitoring budget is estimated at BDT 453,000 (Four Lac Fifty-Three Thousand Only), excluding regular WWTP operation and maintenance and third-party healthcare waste disposal charges.

The hospital management will maintain appropriate environmental records, including laboratory reports, wastewater treatment records, healthcare waste-transfer documents, inspection reports, occupational health and safety records and corrective-action documentation.

Any deviation from applicable environmental standards or approved environmental conditions will require investigation, corrective measures and follow-up monitoring.

8. Summary of Stakeholder Engagement

Public consultation was conducted on 10th October 2026 at Bloc M, Bashindhara, Dhaka, with approximately 50 participants, including local residents, community representatives and other interested stakeholders.

The consultation aimed to obtain community opinions regarding the proposed healthcare facility, its potential environmental and socio-economic impacts and the mitigation measures incorporated into the EIA.

The overall response to the hospital project was generally positive. Participants recognized the potential benefits of improved healthcare accessibility, employment opportunities and associated economic activities.

The major issues discussed during the consultation and disclosure process included:

- Improvement of local healthcare services.
- Employment opportunities for local residents.
- Proper management of medical and general solid waste.
- Prevention of surface-water and groundwater pollution.
- Effective wastewater treatment and water reuse.
- Implementation of waste reduction, reuse and recycling practices.
- Prevention of environmental pollution and protection of community health.

Stakeholders also emphasized the importance of sustainable waste management and appropriate environmental safeguards throughout hospital operations.

The EIA recognizes the importance of maintaining continuous communication with the surrounding community and ensuring that environmental concerns are appropriately addressed through the Environmental Management Plan.

9. Recommendations

Based on the project characteristics, existing environmental conditions, laboratory investigations, impact assessment and stakeholder consultations, the following recommendations are proposed for Musa Specialized Hospital Ltd.:

Environmental Compliance: The hospital shall maintain compliance with the Environment Conservation Act, 1995, Environment Conservation Rules, 2023, and other applicable environmental legislation and regulatory requirements.

Wastewater Treatment: The proposed 5.0 m^3/hour WWTP shall be properly operated and maintained. Treated wastewater shall be tested regularly to ensure compliance with applicable discharge standards before discharge.

Healthcare Waste Management: All medical and hazardous waste shall be segregated at source, safely stored and transferred through authorized waste-management arrangements. Proper documentation of collection and disposal shall be maintained.

Anatomical and Pathological Waste: Placenta and body parts shall be managed through appropriate deep-burial arrangements in accordance with the applicable DoE requirements.

Cytotoxic Waste: Cytotoxic waste shall be returned to the respective medicine supplier through documented arrangements.

Radioactive Waste: Radioactive materials and waste shall be managed in accordance with the requirements of the Bangladesh Atomic Energy Regulatory Authority (BAERA), including applicable radiation-safety and licensing requirements.

Laundry Management: Hospital linen and reusable textiles shall be managed through an appropriate agreement with a DoE-approved washing facility, as required by the applicable environmental conditions.

Water Conservation: The hospital shall implement water-saving measures, monitor groundwater consumption and promote reuse of treated wastewater wherever technically feasible and legally permissible.

Air and Noise Management: Generator emissions, mechanical equipment and other noise-generating sources shall be controlled through regular maintenance, appropriate exhaust arrangements, acoustic enclosures and periodic environmental monitoring.

Occupational Health and Safety: Adequate PPE, staff training, vaccination, occupational health examinations, safe sharps handling and emergency-response arrangements shall be ensured.

Fire and Emergency Preparedness: Firefighting systems, emergency exits, evacuation arrangements, emergency communication and periodic fire drills shall be maintained.

Environmental Monitoring: The proposed monitoring programme shall be implemented regularly, and all results shall be documented and reviewed by the hospital management.

Green-Area Maintenance: The designated green area of approximately 1,003.19 m² shall be maintained through appropriate plantation and landscaping.

3R Policy: The hospital shall implement the Reduce, Reuse and Recycle (3R) Policy to minimize waste generation and improve resource efficiency.

Community Engagement: The hospital shall maintain communication with surrounding communities and establish an accessible mechanism for receiving and resolving environmental complaints.

10. Conclusion

Musa Specialized Hospital Ltd., located at P-2341/A, Road No. 26/A, 27/A, Block M, Bashundhara, Dhaka, is an important healthcare development intended to provide specialized medical treatment, diagnostic services and improved healthcare accessibility.

The Environmental Impact Assessment has evaluated the existing environmental conditions and potential environmental and socio-economic impacts associated with hospital operations. The baseline investigations indicate that ambient air quality was generally within the applicable Bangladesh DoE standards, while certain surface-water quality parameters showed existing

deterioration. Groundwater quality was generally satisfactory for the tested parameters, although the reported hardness results require verification. The noise assessment identified localized exceedances of the Bangladesh silent-area standards at two monitoring locations.

The assessment identifies wastewater generation, healthcare waste management, groundwater consumption, generator emissions, noise pollution, occupational health and safety and emergency preparedness as the principal environmental management priorities.

The implementation of the proposed WWTP, effective healthcare waste-management arrangements, appropriate pollution-control measures, occupational health and safety provisions and regular environmental monitoring will be essential to minimize adverse environmental impacts.

Overall, the environmental impacts associated with Musa Specialized Hospital Ltd. are considered manageable, provided that the Environmental Management Plan and additional regulatory conditions are effectively implemented. Continued environmental monitoring, proper documentation, institutional responsibility and compliance with the requirements of the Department of Environment will be necessary to maintain the hospital's environmental performance and protect the surrounding community.

Chapter One: Introduction

1.1 Project Background

The healthcare sector plays a pivotal role in improving human well-being and supporting socio-economic development. Recognizing the importance of accessible healthcare services, the Government of Bangladesh has undertaken various initiatives to strengthen the healthcare system. Nevertheless, the growing population and increasing healthcare demands continue to place significant pressure on existing medical facilities. In response to this need, the proposed Musa Specialized Hospital Ltd. has been planned to provide quality healthcare services with 100 Doctors, 164 Nurses & 600 Administration staff while supporting the country's overall health infrastructure development.

Healthcare Sector Overview:

Bangladesh's healthcare industry has experienced substantial expansion in recent years, driven primarily by private-sector investment in hospitals, clinics, and diagnostic centers. Despite this growth, healthcare facilities remain inadequate in many areas to meet the rising demand for modern medical services. The increasing prevalence of chronic diseases, population growth, and higher healthcare awareness have created a strong need for additional healthcare infrastructure capable of delivering efficient and affordable treatment services.

Project Overview

Musa Specialized Hospital Ltd. is a specialized healthcare facility located at Plot P-2341/A, Road 26/A and 27/A, Block-M, Road 37, Dhaka, as documented in the project information. The hospital has a reported capacity of 250 beds and is supported by approximately 100 doctors, 169 nurses, and 600 staff members. The facility is designed to accommodate substantial patient demand, with an estimated outpatient load of approximately 2,000 patients per day. Its medical infrastructure includes intensive care facilities, high-dependency and neonatal intensive care units, paediatric intensive care, coronary care, dialysis services, operating theatres, diagnostic facilities, and other specialized treatment and support departments.

Socio-Economic Contributions:

Musa Specialized Hospital Ltd. is expected to contribute to healthcare service delivery by providing inpatient treatment, outpatient consultations, diagnostic investigations, and specialized medical services. The hospital's operational activities also support employment opportunities for doctors, nurses, medical technologists, administrative personnel, and other support staff. In addition, the demand for medicines, laboratory supplies, equipment maintenance, transportation, and other related services may support economic activities in the surrounding area. Through the provision of healthcare services and the engagement of a substantial workforce, the hospital has the potential to contribute to improved community well-being and local economic development.

Healthcare Waste Management Challenges:

Hospital operations generate different categories of waste, including general solid waste, infectious waste, sharps, pathological waste, pharmaceutical waste, and wastewater from medical activities. If these wastes are not properly segregated, collected, stored, transported, treated, and disposed of, they may pose risks to public health and the surrounding environment. Wastewater from healthcare activities may also contain contaminants requiring appropriate treatment before discharge. Consequently, effective healthcare waste management, wastewater treatment, occupational safety, and environmental monitoring are important components of the hospital's environmental management framework.

Environmental Management Initiatives:

Recognizing the environmental risks associated with healthcare waste, regulatory authorities have introduced guidelines and regulations to improve waste management practices. Modern healthcare facilities increasingly adopt waste segregation systems, color-coded collection methods, controlled disposal procedures, and partnerships with specialized waste management organizations. These measures are intended to minimize environmental contamination and promote safer healthcare operations.

Project Justification:

The proposed Musa Specialized Hospital Ltd. has been developed to address existing gaps in healthcare services by providing affordable, high-quality medical treatment that meets international standards. Located at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka,

Bangladesh, the facility will serve both diagnostic and treatment needs while enhancing healthcare accessibility for the surrounding population. As a modern healthcare institution, the hospital aims to improve service quality, patient care, and operational efficiency.

Environmental Considerations:

Healthcare facilities can potentially impact the surrounding environment through the generation of medical waste, wastewater, and other operational emissions if not properly managed. Therefore, environmental sustainability has been incorporated into the planning and design of the proposed hospital. Appropriate mitigation measures and waste management systems will be implemented to ensure compliance with environmental regulations and minimize adverse impacts on land, air, and water resources.

1.2 Environmental Impact Assessment (EIA) and Its Significance

An Environmental Impact Assessment (EIA) is a systematic process used to evaluate the potential environmental effects of a proposed project before its implementation. The primary objective of an EIA is to identify, assess, and mitigate any adverse environmental impacts associated with a project throughout its lifecycle, including design, construction, operation, and decommissioning (Glasson, Therivel, & Chadwick, 2013). This process ensures that potential environmental concerns are addressed early in the project planning stages, allowing for effective mitigation measures to be developed.

The EIA process consists of several key stages. Screening determines whether a full EIA is necessary based on the potential impacts of the project (Burdge, 2004). Scoping involves identifying the main environmental issues and concerns that need to be addressed (Wood, 2003). During the impact assessment phase, the potential environmental impacts are evaluated, including both positive and negative effects (Petts, 1999). Mitigation measures are then proposed to avoid, reduce, or offset adverse impacts (Morgan, 2012). The findings are documented in an Environmental Impact Statement (EIS), which is reviewed to make decisions regarding project approval and additional requirements (Glasson et al., 2013).

The significance of an EIA lies in its ability to provide a comprehensive understanding of the potential environmental consequences of a project. By integrating environmental considerations into the decision-making process, an EIA supports informed decision-making that balances development needs with environmental protection. It enables early identification of potential impacts, allowing for the development of strategies to address issues before they

become significant problems (Wood, 2003). Additionally, the EIA process often includes public consultation, which helps to address community concerns and enhance project transparency (Petts, 1999).

Conducting an EIA also ensures regulatory compliance by adhering to environmental regulations and standards, thereby reducing legal and financial risks (Morgan, 2012). Moreover, by considering environmental factors in project planning, an EIA supports the principles of sustainable development, contributing to the conservation of natural resources for future generations (Morrison-Saunders & Partidário, 2013). Overall, the EIA is a crucial tool for managing and mitigating environmental impacts, promoting sustainable development, and ensuring that projects are executed in an environmentally responsible manner.

1.3 Aims and Objectives of the EIA

The primary aim of the Environmental Impact Assessment (EIA) for Musa Specialized Hospital Ltd. is to systematically identify, evaluate, and mitigate the potential environmental impacts associated with the establishment and operation of the proposed healthcare facility. This EIA report is designed to ensure that the project is developed in an environmentally responsible manner, balancing the need for advanced healthcare services with the protection and preservation of the surrounding environment.

To achieve this aim, the EIA report has several key objectives and they are as follows,

a. Assess Environmental Impacts: To comprehensively assess the potential environmental impacts of the proposed healthcare facility on the surrounding land, air, water, and ecosystems. This includes evaluating both direct and indirect effects related to the construction, operation, and decommissioning phases.
b. Identify Key Environmental Issues: To identify and analyze key environmental issues and concerns specific to the site located at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh. This involves assessing potential impacts on local communities, natural resources, and infrastructure.
c. Develop Mitigation Measures: To propose effective strategies and measures to mitigate adverse environmental impacts identified during the assessment. This includes developing plans to address waste management, pollution control, and resource conservation.
d. Enhance Positive Benefits: To enhance the positive environmental and social benefits of the healthcare facility. This involves identifying opportunities for improving local environmental conditions and contributing to sustainable development goals.

e. Ensure Regulatory Compliance: To ensure that the project complies with all relevant environmental regulations and standards. The EIA report will outline how plans to meet legal requirements and obtain necessary permits and approvals.

f. Facilitate Public Engagement: To provide a transparent and inclusive process by engaging with local communities and stakeholders. This includes incorporating feedback and addressing public concerns regarding the environmental impacts of the project.

g. Support Informed Decision-Making: To provide decision-makers with comprehensive and accurate information to support informed decisions regarding the approval and implementation of the healthcare facility. This includes evaluating the potential trade-offs between environmental protection and project benefits.

h. Document Findings and Recommendations: To document the findings of the environmental assessment in a clear and structured report, including recommendations for managing environmental impacts and monitoring the effectiveness of mitigation measures.

1.4 Methodology

The methodology for the Environmental Impact Assessment (EIA) for Musa Specialized Hospital Ltd. is systematically designed by Environest Engineering to meet the requirements of the Environment Conservation Rules (ECR), 2023. The process began with assembling a skilled EIA team comprised of professionals from environmental science, engineering, and social sciences. This team was tasked with overseeing the entire assessment process.

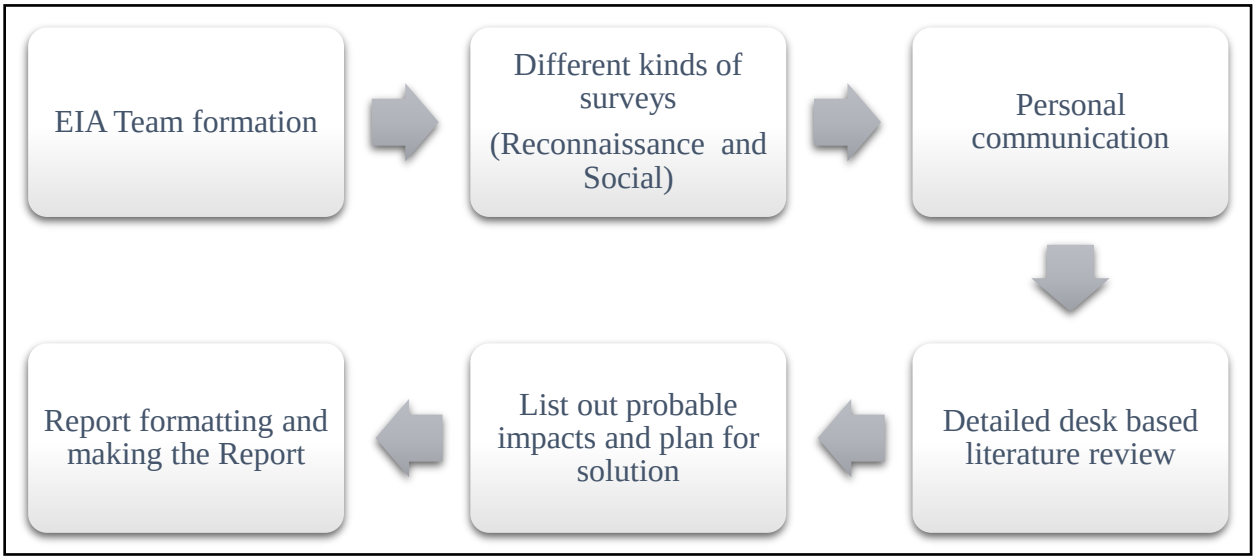

Figure 1.1: Schematic diagram of methodology

Initially, the existing environmental conditions of the project site and its surrounding areas were assessed to establish a baseline. This baseline is crucial for comparing potential

environmental impacts resulting from the project's implementation. A reconnaissance survey was conducted to identify key environmental and social issues in the project area.

Data collection followed a structured approach. This included a detailed desk-based literature review to gather background information from existing studies and reports. Personal communications with stakeholders, including local community members and government officials, provided additional insights into the local context and concerns.

Social surveys helped to understand the socio-economic and cultural aspects of the community. These surveys were complemented by consultations with various government departments and agencies to ensure comprehensive data gathering.

The EIA assessed potential environmental impacts during both the construction and operational phases of the project. This involved evaluating direct and indirect effects on the environment and local communities. Based on this assessment, a comprehensive Environmental Management Plan (EMP) was developed.

The EMP includes measures to mitigate adverse impacts, enhance positive effects, and provide recommendations for monitoring throughout both construction and operational phases. Additionally, the EIA identified issues that may require further study to address any uncertainties or gaps in the assessment.

Finally, the EIA report was prepared following prescribed formats and guidelines set by the Department of Environment (DoE). This ensures that all potential environmental impacts are thoroughly assessed and managed, aligning with regulatory requirements and best practices.

In addition to the Environmental Impact Assessment (EIA) report, several specialized management plans are included to address specific project impacts. These plans encompass the Occupational Health & Safety Management Plan (OHSMP), which ensures worker safety; the Emergency Response and Fire Management Plan (EFMP), which outlines protocols for emergencies; the Hospital Waste Management Plan (SWMP), which details procedures for medical waste handling and disposal; and the Noise Management Plan (NMP), which focuses on mitigating noise pollution. All these plans are integrated into the EIA report to ensure a comprehensive approach to managing the project's environmental and operational impacts.

1.5 Organizing of the Report

This report consists of a total of twelve chapters.

- Chapter One provides an introduction to the report and Musa Specialized Hospital Ltd., outlining the purpose and scope of the Environmental Management Plan (EMP), and the methodologies used in the report.
- Chapter Two covers the relevant Acts, Policies, Rules, and Regulations that govern environmental management and compliance for healthcare facilities.
- Chapter Three provides a detailed description of the project, including information on project location, infrastructure, and operational characteristics.
- Chapter Four discusses the existing environment, including aspects such as flora and fauna, air quality, water resources, land use, and noise levels in the vicinity of Musa Specialized Hospital Ltd.
- Chapter Five identifies the potential environmental impacts associated with the project operations and outlines mitigation measures to address these impacts.
- Chapter Six presents the Environmental Management Plan (EMP), detailing the strategies and actions to be implemented to manage environmental impacts during the project's lifecycle.
- Chapter Seven outlines the Environmental Management Policy and Monitoring Plan, specifying how will monitor and manage environmental performance and ensure compliance with environmental standards.
- Chapter Eight provides an analysis of alternatives, evaluating different scenarios and approaches to achieve the project's objectives while minimizing environmental impacts.
- Chapter Nine describes the Decommissioning Plan, including procedures and measures to be taken when ceasing operations to ensure environmental protection and site restoration.
- Chapter Ten details the public consultations conducted as part of the environmental assessment process, summarizing stakeholder inputs and concerns.
- Chapter Eleven concludes the report, summarizing the key findings, policies, and plans that have been adopted to ensure environmental sustainability and compliance with regulatory requirements.
- Chapter Twelve lists all the references used throughout the report.

1.6 Performance of the Assessment

This Phase of EIA consists of the following steps

a. Site Visit: The member of the EIA team has visited the site to determine the possible environmental impacts of the existing project and recorded the prevailing conditions of the environment as they existed prior to the implementation of the project.

b. Identification and Evaluation: The adverse and beneficial effects of the existing project on the environment have been evaluated.

c. Discussion of Alternatives: Various possible alternatives have been discussed.

d. Preparation of Checklist: A checklist has been prepared to ensure complete coverage of all the possible consequences of the existing project so that it can be determined as to what administrative actions should be taken.

e. Developed of Environmental Impact Due to The Project: To identify the impact of the project on the environment, a checklist of environmental attributes has been developed that reflect the impact on the environment resulting from a particular action.

f. Decommissioning Considerations: The assessment includes planning for decommissioning the project, addressing potential environmental impacts, and ensuring proper management of waste and site restoration upon project completion.

1.7 Limitations of the Report

The Environmental Impact Assessment (EIA) report for this project relies predominantly on data provided by the client, insights gathered from discussions with hospital personnel, and observations from various surveys and investigations conducted within the project area. Throughout this study, professional judgment and subjective interpretation have been utilized. It is crucial to acknowledge that any modifications to the project's location, design, or activities could result in variations in the identified impacts. Furthermore, technological advancements during the construction and operational phases may influence the extent and severity of these impacts. As with any environmental assessment report, certain limitations must be recognized:

i. Predictive Uncertainty: Anticipating which potential environmental and social issues will materialize as actual problems in the future is inherently challenging. Environmental regulations and enforcement priorities are subject to frequent changes, which can affect the relevance and applicability of the findings and recommendations outlined in this report (Glasson, Therivel, & Chadwick, 2013). Consequently, unforeseen regulatory changes could necessitate revisions to the impact assessment and the proposed mitigation measures.

ii. Estimation of Liabilities: Estimating the liabilities associated with mitigating identified environmental and social issues is often complex and imprecise. Legal and technological standards for addressing environmental concerns are continually evolving, and liability can be significantly influenced by negotiations with regulatory agencies, which are inherently unpredictable (Wood, 2003). This variability underscores the need for adaptive management approaches to address emerging issues as they arise.

iii. Applicability of Data and Practices: The policies, methods, and plans included in this report are based on data and practices derived from a range of sources, which may not always be directly applicable to this specific project. The report incorporates hypothetical scenarios and predictive modeling, acknowledging that not all proposed measures may be fully effective or relevant in every situation (Canter, 1996). As a result, there is a need for continuous monitoring and adjustment of the environmental management strategies to ensure their efficacy.

iv. Technological and Methodological Evolution: Technological advancements and methodological innovations during the project's lifecycle may influence the environmental impacts and the effectiveness of mitigation strategies. It is essential to remain vigilant about emerging technologies and best practices that could enhance environmental performance and reduce potential impacts (Sadler, 1996).

These limitations highlight the inherent uncertainties present in environmental impact assessments. They emphasize the importance of ongoing review, monitoring, and adaptation as new information, regulations, and technologies become available. Proactive and flexible environmental management practices will be crucial in addressing these uncertainties and ensuring the project's long-term sustainability.

1.8 Scope of the Present EIA

The Environmental Impact Assessment (EIA) for Musa Specialized Hospital Ltd. will be meticulously prepared and submitted to the Department of Environment (DoE) for review and approval to obtain Environmental Clearance. The scope of the EIA study encompasses several critical components.

Firstly, it involves a comprehensive review of relevant environmental legislation, regulatory policies, and guidelines specific to the healthcare sector, ensuring that Musa Specialized

Hospital Ltd. adheres to legal requirements and integrates best practices for environmental management.

Secondly, the EIA will provide an in-depth description of the existing conditions at the proposed site for Musa Specialized Hospital Ltd., evaluating environmental characteristics and assessing the suitability of the location from an environmental perspective. This includes documenting current environmental quality and identifying any pre-existing issues that may impact the project.

The assessment will also involve a thorough evaluation of potential environmental impacts associated with the development, construction, and operational phases of Musa Specialized Hospital Ltd. Standard methodologies and checklists will be employed to analyze the potential effects on environmental quality parameters and identify significant impacts.

Additionally, the EIA will discuss various alternatives to determine the most environmentally sustainable options for Musa Specialized Hospital Ltd.. This evaluation will include assessing the potential impacts of different approaches and recommending strategies for minimizing adverse effects.

The development of mitigation measures is another crucial aspect of the EIA. It will propose strategies to address identified adverse impacts and enhance positive outcomes, incorporating these measures into a detailed Environmental Management Plan (EMP). The EMP will outline monitoring programs and strategies for managing environmental performance throughout the lifecycle of Musa Specialized Hospital Ltd.

Lastly, the EIA will identify any areas requiring further study to address uncertainties or emerging issues that could affect the environmental performance of Musa Specialized Hospital Ltd.. This comprehensive scope ensures that all relevant environmental aspects are thoroughly examined, contributing to the sustainable development of Musa Specialized Hospital Ltd.

1.9 EIA Team

The EIA report for Musa Specialized Hospital Ltd. has been prepared by a highly qualified, knowledgeable, and dynamic team from Environest Engineering. This team comprises experts from diverse fields, including engineering, science, and sociology, ensuring a comprehensive approach to the assessment. Throughout the preparation of the report, the team engaged in collaborative efforts, including round-table meetings, field visits, and discussions with both the

client and local communities near the project site. The collective expertise and collaborative approach of the EIA team have been pivotal in developing a thorough and effective Environmental Impact Assessment. The members of the EIA team are listed as follows.

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Table 1.1: EIA Team Member

SL No	Name	Qualification	Position	Field of Specialization	Year's of Experience	Signature
1	**Shamim Ur Rahman**	• M.Sc. in Environmental Sciences and Management, Jahangirnagar University (JU)	Team Leader	• Environmental Impact Assessment (EIA) • Environmental Management & Monitoring • Environmental Policy & Planning	8	
2	**Dr. Md. Mostafizur Rahman**	• PhD in Environmental Science from Graduate School of Environmental Science, Hokkaido University, Japan	Environmental Expert	• Environmental Specialist (EIA, ESIA, EMP, ETP, CETP, ATP, WTP & STP). • 340 Research articles published in national	16	

SL No	Name	Qualification	Position	Field of Specialization	Year's of Experience	Signature
				and international journals		
3	**Dr. Mst. Mahmuda Parvin**	• PhD in Life and Environment Sciences from Kumamoto University, Japan	Environmental Expert	• Environmental Specialist (EIA, ESIA, EMP). • 28 Research articles published in national and international journals	18	
4	**Dr. Maliha Nowshin**	• MBBS (RU), MPH (NSU), CMU BMDC Reg No: 104796	Public Health Specialist	• Occupational health hazards assessment. • Assessing public health impacts and health management planning	09	
5	**Sudipta Sarker**	• B.Sc. in Civil Engineering, Ahsanullah University of Science & Technology (AUST)	Environmental Engineer	• Environmental Baseline Survey • Specialized in STP, ATP, ETP and WTP. • Specialized in IEE, EIA & EMP	04	
6	**Emtiaz Ibne Easin**	• B.Sc. in Civil Engineering, Ahsanullah University of Science & Technology (AUST)	Environmental Engineer	• Environmental Survey • Environmental Data Analysis • STP, ETP & EIA Support	5	
7	**Shahadat Hossain**	• M.Sc. in Geological Science, Jahangirnagar University	Geologist	• Geological Investigation • Hydrogeological Assessment • Soil & Subsurface Analysis	4	

SL No	Name	Qualification	Position	Field of Specialization	Year's of Experience	Signature
8	**Ehsanul Haque**	• M.Arch., Bangladesh University of Engineering and Technology (BUET)	Architectural Consultant	• Architectural Planning & Design • Building Design & Development	20	
9	**Md. Aminul Islam**	• B.Sc. in Environmental Sciences and Management, Jahangirnagar University (JU)	Environmental Monitoring Specialist	• Expert on Air Quality, Water Quality and Noise Quality Assessment, Sampling, Analysis & Reporting	8	
10	**Fatema Islam Lucky**	• Master of Business Administration (MBA), National University	Senior Executive (Green Economy)	• Green Economy Assessment • Socio-economic Analysis • Sustainability Evaluation	4	
11	**Md. Hayder Hossain**	• Diploma in Mechanical Engineering	Mechanical Engineer	• Mechanical Systems & Utilities • Equipment Assessment • Industrial Support Services	16	

Numerous individuals and agencies contributed valuable data, information, and support in preparing this EIA report for Musa Specialized Hospital Ltd. Their cooperation and openness in discussing environmental issues were crucial to the thoroughness of the assessment. We extend our gratitude to the Department of Environment (DoE) personnel and the Dhaka Metro Office for their assistance and collaboration throughout the study.

Chapter Two: Acts, Policies, Rules & Regulations

2.1. Introduction

Development projects are governed by some legal and institutional requirements. So, considerations of relevant legal provisions, policies, strategies, and institutional issues are very important for any project proponent or developer before they actually execute a program or plan, and obviously at the operational stages of projects, no project can deny these rules which set the boundary limits for each project. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. The following sections review the relevant national legislation and policies along with some international laws.

2.2. Environmental Policy

Environment Conservation Act, 1995 (ECA '95) is currently one of the main legislative documents relating to environmental protection in Bangladesh. Under this act, no industrial unit or project shall be established or adopted without obtaining environmental clearance, in the manner prescribed by the rules, from the Director General. Compliance with the provision of this Act is the responsibility of the Department of Environment (DoE). A set of the relevant rules to implement the ECA'95 had been promulgated in August 1997. The rules mainly consist of:

- Categorized list (green, orange, and red) of the projects.
- Application format to take environmental clearance.
- Ambient standards about water pollution, air pollution, and noise, as well as permitted discharge/emission levels of water and air pollutants and noise by industries.

In accordance with section 20 of The Bangladesh Environment Conservation of Act No. 1 of 1995, the Government in March 2023 passed the Bangladesh Environment Conservation Rules, 2023. This Article discussed various important provisions of the Regulation:

- Categorized list (green, yellow, orange, and red) of the projects.
- Application format to take site clearance and environmental clearance.
- Ambient standards in relation to water pollution, air pollution, and noise, as well as permitted discharge/emission levels of water and air pollutants and noise by industries.
- Procedure for issuance of Environmental Clearance and Location Clearance Certificate.

- Services, fees, and mode of payment Services, fees, and mode of payment.

In light of the categorization made under the above ECR, '23, **Musa Specialized Hospital Ltd.** falls under the "**Red"** category.

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According to ECR'23, industries that fall under the Green and Yellow categories are not required to undertake an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) study. Orange projects are required to undertake an IEE, while Red category projects must undertake an IEE and an EIA and or EMP.

Being committed to environmental protection, Musa Specialized Hospital Ltd. has taken positive actions from the beginning to meet ECA, '95, ECR, '23, and other environmental protection rules and regulations.

2.3. Provisions Under the Environmental Legislation

2.3.1. National Water Management Plan (NWMP), 2001 (approved in 2004)

The National Water Resources Council approved on March 31, 2004, a 25-year National Water Management Plan. The plan provides a framework within which all concerned with the development, management, and use of water resources and water services in Bangladesh can plan and implement their activities in a coordinated and integrated manner. The planned activity programs have been presented in the eight sub-sectoral clusters: i) Institutional Development, ii) Enabling Environment, iii) Main River, iv) Towns and Rural Areas, v) Major Cities; vi) Disaster Management; vii) Agriculture and Water Management, and viii) Environment and Aquatic Resources. Each cluster comprises several individual programs. WARPO was assigned to monitor the NWMP.

2.3.2. Natural Water Bodies Protection Act 2000

- According to this Act, the character of water bodies, i.e., rivers, canals, tanks, or floodplains identified as water bodies, in the master plans or the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of the concerned ministry.
- Anyone disobeying this act will be subjected to a maximum of 5 years of imprisonment or a maximum 50,000-taka penalty or both.

2.3.3. National Water Policy (1999)

The National Water Policy of 1999 was passed to ensure efficient and equitable management of water resources, proper harnessing, and development of surface and groundwater, availability of water to all concerned, and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation, and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

2.3.4. National Agricultural Policy, 1999

The overall objective of the National Agriculture Policy is to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable food security system for all. One of the specific objectives of the National Agricultural Policy is to take necessary steps to ensure environmental protection as well as environment-friendly sustainable agriculture. Through increased use of organic manure and strengthening of the integrated pest management program. The policy also suggests creating awareness so that the chemical fertilizers and pesticides used for increased crop production do not turn out to be responsible for environmental pollution. Water logging and salinity are identified as one of the serious problems in some parts of the country including the coastal areas for agricultural activities and environmental damage. The policy recommends for crop rotation and salt tolerant crop varieties.

2.4. Other Sectoral Policies/Legislation of Relevance

Any industry in the country is also required to comply with the industrial and export/import policy of the country. The industry is also required to comply with the Factories and Establishment Act and to undertake the license from concerned licensing authority.

In addition to the above National rules and regulations in its operational phase must comply with other national acts, policies, and rules, some of which are as follows:

2.4.1. Forest Policy (1994)

The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977 in light of the National Forestry Master Plan. The major target of the policy is to conserve the existing forest areas and bring about 20% of the country's land area under the

forestation Program and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

Amendments to the existing laws (acts, rules, and regulations) relating to the forestry sector and the creation of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forestry Policy also recognizes the importance of fulfilling the responsibilities and commitments under International Conventions, Treaties, and Protocols (ICTPs).

2.4.2. National Fisheries Policy, 1999

The National Fisheries Policy, 1999 was formulated following the review and intent of the East-Bengal Protection and Conservation of Fish Act 1950, which was updated by the Protection and Conservation of Fish (Amendment) Ordinance 1982 and further refined by the Protection and Conservation of Fish (Amendment) Act 1995. These Acts and ordinances provide provisions for the protection and conservation of fish in fresh water and brackish water bodies.

The Fisheries Policy highlights the need to conserve fish breeding grounds and habitats. It intends to promote fisheries development and conservation in all water bodies. The project should consider these policies to protect the habitats, migration, and connectivity of fish and fisheries resources around the project area. Measures to reduce any potential negative impacts on local fish populations will be incorporated into all stages of the Project.

2.4.3. National Land Use Policy, 2001

The National Land Use Policy was enacted in 2001 aims at managing land use effectively to support trends in accelerated urbanization, industrialization, and diversification of development activities. The policy urges that increasing the land area of the country may be not possible through artificial land reclamation process, which is cost-effective only in the long run. The major contents of this policy are the following:

- Stopping the high conversion rate of agricultural land to non-agricultural purposes;
- Utilizing agro-ecological zones to determine maximum land-use efficiency;
- Adopting measures to discourage the conversion of agricultural land for urban or development purposes;
- Improving the environmental sustainability of land-use practice

2.4.4. The Embankment and Drainage Act, 1952

The East Bangle Act No. 1, 1953 was amended in 1953 and was adapted by the People's Republic of Bangladesh, by the Bangladesh Order (adaptation of Existing Laws), 1972 (President's Order No. 48 of 1972). The Act consolidates the laws relating to embankments and drainage providing provision for the construction, maintenance, management, removal, and control of embankments and water courses for the better drainage of lands and their protection from floods, erosion, or other damage by water.

The specific Sections and Articles relevant to the project are mentioned below:

- Section 4 (1) of the Act states that the embankment, watercourse, tow-path, earth, pathways, gates, berms, and hedges of the embankments shall vest in the Government of the Authority (BWDB).
- Section 56 (1) states that the person will be subject to a penalty (500 takas or imprisonment… if he erects, or causes or willfully permits to be erected, any new embankment, or any existing embankment, or obstructs of diverts, or causes or willfully permits to be obstructed or diverted, any watercourse).
- Section 15 allows for the engineer (engineer in charge of Divisional level BWDB) for constructing new embankment or enlarging, lengthening or repairing existing embankments.
- The other sections of the Act give powers and access to the Government or Authority or Engineers to commence necessary project activities, for land acquisition (through the DC), and site clearing activities including removal of trees or houses (if necessary).

2.4.5. Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009

The GOB also prepared the BCCSAP in 2008 and revised it in 2009. This is a comprehensive strategy to address Climate Change (CC) challenges in Bangladesh. BCCSAP built on and expanded the NAPA. It is built around the following six themes:

- Food security, social protection, and health to ensure that the poorest and most vulnerable in society, including women and children, are protected from CC and that all programs focus on the needs of this group for food security, safe housing, employment, and access to basic services, including health.
- Comprehensive disaster management to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.

- Infrastructure to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructure (cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.
- Research and Knowledge management to predict the likely scale and timing of CC impacts on different sectors of the economy and socio-economic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change.
- Mitigation and low carbon development to evolve low carbon development options and implement these as the country's economy grows over the coming decades.
- Capacity building and Institutional strengthening to enhance the capacity govt. ministries, civil society, and the private sector to meet the challenge of CC.

2.4.6. Sound Pollution Control Rules, 2025

Table 2.1: Bangladesh Standards for Noise

SL. No.	Area Category	Standard Values (All values in dB)	
		Day	Night
1.	Silent Area	50	40
2.	Residential area	55	45
3.	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4.	Commercial	70	60
5.	Industrial	75	70

Source: *MOEF, 2006*

Note: **1)** The time from 6 a.m. to 9 p.m. is counted as daytime.

2) The time from 9 p.m. to 6 a.m. is counted as night time

2.5. Compliance with DoE's EIA Guideline

2.5.1. The National Environmental Policy, 2018

The National Environmental Policy (2018) aims to systematically identify and control all forms of environmental pollution and degradation while promoting environmentally sound development across all sectors. It emphasizes the sustainable and long-term use of natural resources, the integration and strengthening of environmental policies within the broader development framework, and the enhancement of regional and international cooperation to support global environmental protection and sustainable development objectives.

2.5.2. The Environmental Conservation Act, 1995 and Amendment of 2010

The Bangladesh Environmental Conservation Act of 1995 and Amendment of 2010, is an umbrella legislation enacted to provide for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. The DOE was created under the Act. The provisions of the Act authorize the Director General (DG) of the Department of Environment to undertake any activity he deems fit and necessary to conserve and enhance the quality of the environment and to control, prevent, and mitigate pollution. The main provisions of the Act have been listed in table 2.2.

Table 2.2: Various Provisions of the Bangladesh Environmental Conservation Act, 1995 and Amendment of 2010

Sections	Provisions
Section 3	A Department of Environment, headed by a Director General (DG), should be established by the government for carrying out the purposes of this Act.
Section 4	The powers and functions of the DG will include taking necessary measures for conservation and protection of environment and issuing directions to concerned persons, to be carried out within a specified time limit, including that of closure after sending a written notice.
Section 4(A)	The DG or any other authorized person may seek assistance from law-enforcing agencies in case of non-compliance with directions of closure. In such cases, the electricity, gas, telephone and water services for the non-compliant party can be discontinued.
Section 5	The government can declare an area ecologically critical, and issue a notice specifying the activities or processes that cannot be initiated or continued in it.
Section 6	This section specifies the restrictions regarding (a) vehicles emitting smoke injurious to environment and (b) manufacture, sale etc. of articles injurious to environment.
Section 7	The DG may seek compensation and/or corrective measures from the concerned person whose act/emission has caused direct/indirect injury to the ecosystem, failing which a civil suit and/or criminal case can be filed in a competent court.
Section 8	This section allows a person affected or likely to be affected by environmental pollution or degradation to apply to the DG for remedy.
Section 9	The person responsible and the person in charge of the place of occurrence of accidental pollution shall take measures to control or mitigate it, expenses for which are payable to the DG.
Section 10	Any person generally or specially authorized by the DG shall have the right to enter any building.
Section 11	A person authorized by the DG may, in the manner prescribed by rules, collect from any factory, premises or other place any sample of air, water, soil or other substance for analysis.

Sections	Provisions
Section 12	An Environmental Clearance Certificate must be obtained from the DG for the establishment and undertaking of an industrial project.
Section 13	The government may formulate and publish environmental guidelines for conservation and improvement of environment and control and mitigation of pollution.
Section 14	This section allows a person aggrieved by a notice, order or direction issued under this Act to appeal to the appellate authority constituted by the government, within 30 days from its issuance.
Section 15	This section specifies the penalty to be paid for various offences.
Section 16	When a company violates any provision of this Act or fails to perform its duties in accordance with a notice issued under this Act or the Rules, it will amount to a violation.
Section 17	This section introduces the grounds for taking cognizance of an offence and claim for compensation by a court.
Section 18	An action taken by the government or the DG, which caused or is likely to cause injury to any person, cannot be legally contested, if taken in good faith.
Section 19	The government may delegate its powers to the DG, who may delegate his to any other officer of the department.
Section 20	The government is vested with the power to make various rules for carrying out the purposes of this Act.

Source: *The Bangladesh Environmental Conservation Act, 1995*

2.5.3. The Environmental Conservation Rules (ECR), 2023

The Environment Conservation Rules, 2023 are the first set of rules promulgated under the Environment Conservation Rules, 2023. ECR, '23 provides additional guidance for specific components of the Act. The rules mainly consist of:

- Categorization of industries, development projects, and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities (Section-1);
- The National Environmental Quality Standards (EQS) for surface water, groundwater, drinking water, and industrial effluents (Section 2);
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP 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;
- Guideline for preparing Environmental Impact Assessment (EIA) report (Section-11).

The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation.

Green: Industries/development projects/activities are considered relatively pollution-free and therefore do not require an environmental clearance certificate from the DoE and no environmental study.

Yellow: Industries/development projects/activities fall in Yellow category are those which are causing medium pollution on the environment and human health. These projects/activities required to submit general information, an IEE report, application to DoE for obtaining environmental site clearance and environmental clearance.

Orange: Industries/development projects/activities fall in Orange category are moderately polluted required to submit general information, a process flow diagram and schematic diagrams of waste treatment facilities, an IEE and EMP along with their application to DOE for obtaining environmental site clearance and environmental clearance.

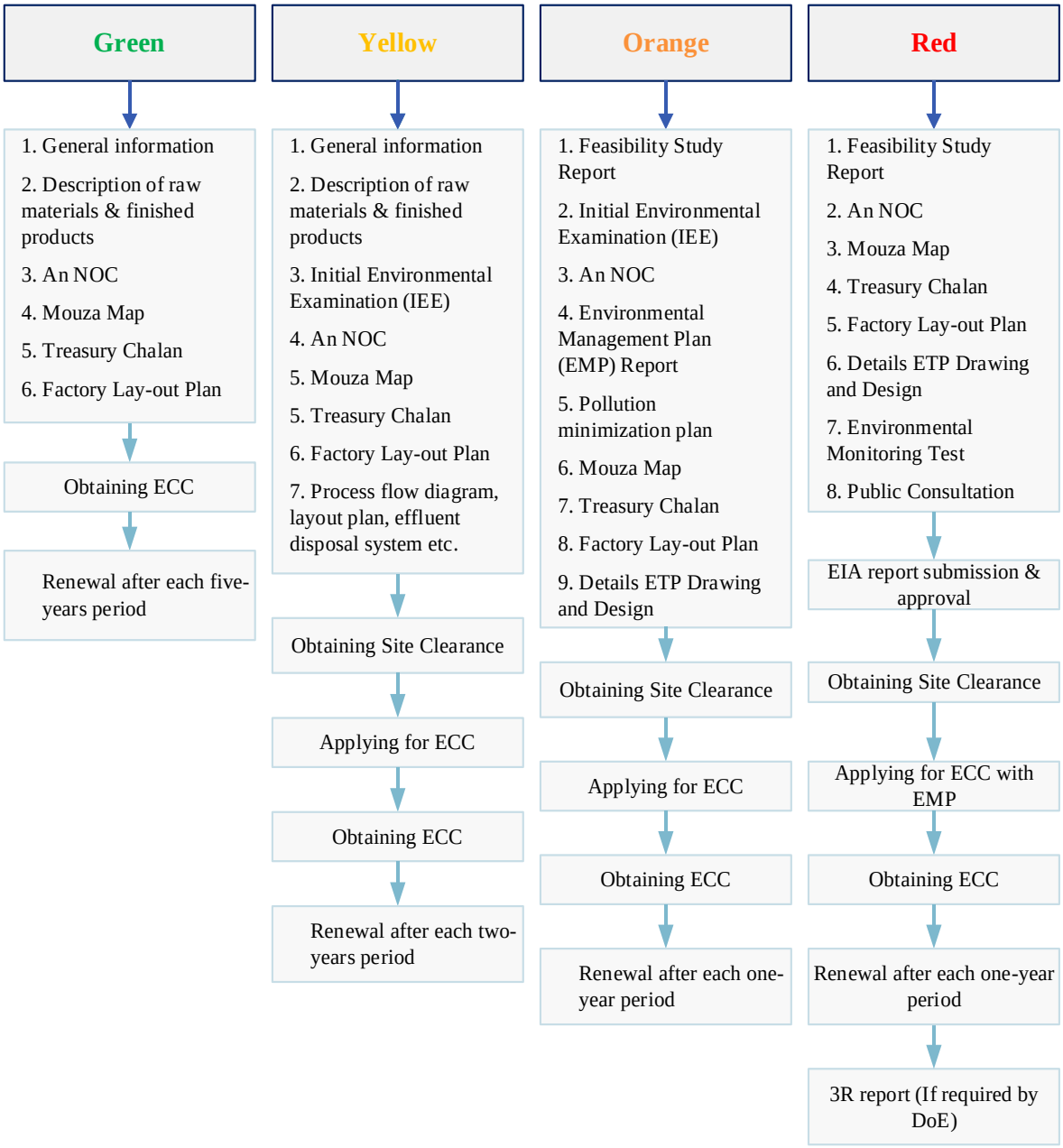
Red: Industries/development projects/activities which fall in RED category are those which may cause significant adverse environmental impacts and are therefore required to submit an EIA report. It should be noted that they might obtain an environmental site clearance on the basis of an IEE report, and subsequently submit an EIA report for obtaining environmental clearance along with other necessary papers.

2.6. Compliance with Legal Requirements

Including ECA, 1995 and the ECR, 2023, depending on applicability, the entrepreneur has to adhere to and may require approvals of other previous and existing policies, ordinances, acts, and rules.

2.6.1. Obtaining Environmental Clearance

APPLICATION TO DOE FOR ENVIRONMENT CLEARANCE CERTIFICATE



N.B. If the industry/project locates inside EPZ, then IEE is not required

Figure 2.1: Process of Getting Environmental Clearance Certificates

2.6.2. Environmental Quality Standards

Bangladesh is one of the least developed countries with a low resource base, a burgeoning population with a very low land-man ratio, often threatened by both natural & anthropogenic stresses. Like all other nations of the world, Bangladesh also acted to the global call for the protection and conservation of the natural environment & ecology. Industrial development significantly contributes towards the economic growth of a country. It brings along with it a host of environmental problems too. It is increasingly being recognized in Bangladesh as in other part of the world that for development to be meaningful & sustainable over a longer period environmental concern must be integrated into all development policies. The Ministry of Environment and Forest is the nodal ministry that supervises the implementation of environmental and forestry programs in Bangladesh. The Department of Environment (DoE) carries out policy analysis, planning and evaluation, program coordination, and monitoring and evaluation of the environmental programs. The Forest Department in the ministry deals with forestry programs.

In Bangladesh, the environmental aspects of any project are mainly governed by: The Environmental Conservation Act, of 1995, the Environmental Conservation Rules, of 1997, the Environmental Conservation Rules, of 2023, and the Forest Act, of 1927 (if forestland has been converted).

The requirement for undertaking environmental studies has been specified under the ECA, 1995, the ECR, 1997, and the ECR, 2023. Section 12 of ECA, 1995 stipulates that "No industrial unit or project shall be established or undertaken without obtaining environmental clearance from the Director General, Department of Environment (DG, DoE) in the manner prescribed by the rules".

2.6.2.1. Air Quality

Table 2.3: Ambient Air Quality Standards

Air Pollutant	Unit	Standards	Average Time
Carbon Monoxide (CO)	mg/m^3	5	8 hrs.
		20	1 hr.
Lead (Pb)	micro gm/m^3	0.25	Annual
		0.5	24 hrs.
Nitrogen di oxide (NO_2)	micro gm/m^3	40	Annual
		80	24 hrs.
Particulate Maters$_{10}$ (PM_{10})	micro gm/m^3	50	Annual
		150	24 hrs.
Particulate Maters $_{2.5}$ ($PM_{2.5}$)	micro gm/m^3	35	Annual
		65	24 hrs.
Ozone (O_3)	micro gm/m^3	180	1 hr.
		100	8 hrs.
Sulphur di oxide (SO_2)	micro gm/m^3	250	1 hr.
		80	24 hrs.
Ammonia (NH_3)	micro gm/m^3	100	Annual
		400	24 hrs.

Source: *Air Emission Control Rules, MOEF, 2022*

Note:

a. In this schedule, air quality means ambient air quality.

b. Average value shall not exceed more than once a year.

c. The target will be achieved when the annual average is within the prescribed standard.

2.6.2.2. Water Quality

Table 2.4: Standards for Inland Surface Water

SL. No.	Best Practice Based Classification	Parameters											
		pH	DO mg/L	BOD mg/L	NO_3-N mg/L	NH_4-N mg/L	PO_4-P mg/L	Total Cr mg/L	Pb mg/L	Hg mg/L	Total Coliform CFU/L	TDS mg/L	TDS mg/L
1	Source of drinking water for supply only after disinfecting	6.5-8.5	6 or above	2 or less	7.0	0.1	0.1	0.02	0.03	0.001	100 or less	1000	10
2	Water usable for recreational activity	6.5-8.5	5 or above	3 or less	7.0	0.3	0.5	0.2	0.05	0.001	50 or less	1000	10
3	Source of drinking water for supply after conventional treatment	6-9	5 or above	5 or less	7.0	0.3	0.5	0.02	0.03	0.001	5000 or less	1000	25
4	Water usable by fisheries	6-9	5 or above	6 or less	7.0	0.3	0.5	0.05	0.1	0.004	5000 or less	1000	50
5	Water usable by various process and cooling industries	6.5-8.5	1 or above	12	-	2.7	-	0.1	0.1	0.05	-	1000	100
6	Water usable for irrigation	6.5-8.5	-	12 or less	5.0	1.5	2.0	0.1	0.1	0.002	50,000 or less	1000	100

Source: *Environmental Conservation Rules, 2023*

Notes:

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

Table 2.5: Standards for Drinking Water

Sl. No.	Parameters	Unit	Standards
1.	Fecal Coliform	CFU/100ml	0
2.	Total Coliform	"	0
3.	Free Residual Chlorine	mg/L	0.20
4.	Nitrate (NO3-)	"	45
5.	Arsenic (As)	"	0.05
6.	Turbidity	NTU	5
7.	Aluminum (Al)	"	0.20
8.	Ammonia (NH3)	"	1.50
9.	Barium (Ba)	"	0.70
10.	Benzine (C6H6)	"	0.01
11.	Boron (B)	"	1.0
12.	Cadmium (Cd)	"	0.003
13.	Calcium (Ca)	"	75
14.	Chloride (Cl)	"	250*
15.	Carbon tetra chloride	"	0.005
16.	1,1 Dichloroethane	"	0.03
17.	1,2 Dichloroethane	"	0.03
18.	Tetrachloroethane	"	0.04

Sl. No.	Parameters	Unit	Standards
19.	Trichloroethane	“	0.02
20.	Pentachlorophenol	“	0.009
21.	2,4,6 Trichlorophenol	“	0.20
22.	Chloroform	“	0.09
23.	Total Chromium	“	0.05
24.	Color	Hazen	15
25.	Copper (Cu)	mg/L	1.5
26.	Cyanide (CN)	“	0.05
27.	Fluoride	“	1.0
28.	Hardness as $CaCO_3$	“	500
29.	Ferrous (Fe)	“	0.3-1.0
30.	Total Kjeldahl Nitrogen	“	1.0
31.	Lead (Pb)	“	0.01
32.	Magnesium (Mg)	“	30-35
33.	Manganese (Mn)	“	0.4
34.	Mercury (Hg)	“	0.001
35.	Nicale (Ni)	“	0.05
36.	Nitrite (NO_2^-)	“	1.0
37.	Odor	-	Odorless
38.	Oil & Grease	mg/L	0.01
39.	pH	-	6.5-8.5
40.	Phenols	mg/L	0.002
41.	Potassium (K)	“	12
42.	Radioactive materials (gross alpha activity)	Bq/L	0.1
43.	Radioactive materials (gross beta activity)	“	1.0
44.	Selenium (Se)	mg/L	0.01
45.	Silver (Ag)	“	0.02
46.	Sodium (Na)	“	200
47.	Suspended Solid (SS)	“	10
48.	Sulfide as H2S	“	0.05
49.	Sulfate (SO_4^{2-})	“	250
50.	Total Dissolve Solids (TDS)	“	1000
51.	Temperature	0C	20-30
52.	Tin (Sn)	mg/L	2.0
53.	Zinc (Zn)	“	5.0
54.	Aldrin/Dieldrin	Micro-g/L	0.03
55.	Anionic detergents	mg/L	0.2

Source: *Environmental Conservation Rules, 2023*

Note: *1000 mg/L for Coastal Area

Table 2.6: Standards for Sewage Discharge

SL No.	Parameters	Unit	Standards
1	BOD_5	mg/l	30
2	Nitrate	,,	50
3	Phosphate	,,	15
4	Suspended solids (SS)	,,	100
5	Temperature	Degrees centigrade	30
6	Total Coliform	CFU/100 ml	1000
7	pH	mg/L	6-9
8	COD	,,	150
9	Oil & Grease	,,	10

Source: *Schedule 3, Environmental Conservation Rules, 2023*

Notes:

a. This limit shall be applicable to discharges into surface and inland water bodies.

b. Sewage shall be chlorinated before final discharge. Residual Chlorine cannot be more than 0.2 mg/L.

2.6.2.3. Noise

Table 2.7: Standards for Sound

SL. No.	Area Category	Standard Values (All values in dB)	
		Day	Night
1.	Silent Area	50	40
2.	Residential area	55	45
3.	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4.	Commercial	70	60
5.	Industrial	75	70

Source: *Noise Control Rules, MOEF, 2006*

Note:

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

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

2.6.3. The National Conservation Strategy

National Conservation Strategy (GoB/IUCN, 1992) was drafted in late 1991 and submitted to the Government in early 1992. For sustainable development in the industrial sector, the report offered various recommendations; some of which are as follows:

- Industries based on nonrenewable resources should be made to adopt technology that conserves raw materials, and existing industries should be given incentives to install technical fixes to reduce the wastage rate
- All industries, especially those based on imported raw materials, should be subjected to EIA and the adoption of pollution prevention/control technologies should be enforced.
- No hazardous or toxic materials/wastes should be imported for use as raw material.
- The import of appropriate and environmentally sound technology should be ensured.
- Complete dependence on imported technology & machinery for industrial development should gradually be reduced so that industrial development is sustainable with local skills and resources.

2.6.4. The National Environmental Management Plan (NEMAP), 1995

The National Environmental Management Plan (NEMAP) was developed as the framework of programs and interventions aimed at implementing NEP. Under this Plan, various program outlines were drawn up and activities incorporated. The main aims of the Plan were:

- Better management of scarce resources;
- Checking the rate of environmental degradation;
- Improving the natural and manmade environment;
- Conserving habitats and biodiversity;
- Promoting sustainable development; and
- Improving quality indicators of human life.

2.6.5. National Environmental Policy (NEP), 1992

In 1992 the National Environmental Policy (NEP) was drawn up with the aim of providing protection and sustainable management of the environment. The objectives of the Policy include:

- Maintaining ecological balance and overall development through protection and improvement of the environment;
- Identifying and regulating polluting and environmentally degrading activities;
- Ensuring environmentally sound development;
- Ensuring sustainable and environmentally sound use of all-natural resources;
- Active association with all international environmental initiatives.

2.6.6. The Environment Court Act, 2010

In 2010, a new law known as the Bangladesh Environment Court Act, 2010 was enacted, replacing the 2000 Act. The objective of the current Act is to establish Environment Courts in each district, presided over by a Joint District Judge. This Judge handles both regular cases and those falling under the jurisdiction of an Environment Court. Notably, the Act doesn't require the creation of entirely separate Environment Courts. Consequently, aside from the former three Courts and an Appellate Court, no additional Environment Courts have been set up. Similar to the prior Act, the 2010 Act also allows for the establishment of Special Magistrate Courts in each District, managed by first-class Magistrates or Metropolitan Magistrates. These courts handle cases with penalties of less than five years imprisonment or fines up to five lakh BDT. Furthermore, the Act involves Executive Magistrates who operate under the Mobile Court Act, of 2009. They can promptly address certain offenses and pass judgments based on the offender's admission of guilt. Environmental laws commonly incorporate provisions for the operation of Mobile Courts.

2.7. International Legal Obligations

2.7.1. The Convention on Biological Diversity (CBD), 1992

The Convention on Biological Diversity (CBD) is an international treaty that was adopted in 1992. The CBD has three main goals:

- Conservation of biological diversity
- Sustainable use of its components
- Fair and equitable sharing of benefits arising from genetic resources

The CBD applies to all types of biological diversity, including land-based ecosystems. Land development projects can have a significant impact on biological diversity, both positive and negative. The CBD provides a number of tools and mechanisms to help countries manage the impacts of land development projects on biological diversity. These tools include:

National Biodiversity Strategies and Action Plans (NBSAPs): NBSAPs are national plans that set out the goals and objectives for the conservation and sustainable use of biological diversity in a particular country.

The Prior Informed Consent (PIC) procedure: The PIC procedure requires countries to obtain the consent of the country providing genetic resources before using those resources in a land development project.

The Access and Benefit-sharing (ABS) regime: The ABS regime provides a framework for countries to share the benefits arising from the use of genetic resources.

The CBD is an important tool for protecting biological diversity and ensuring that land development projects are carried out in a sustainable manner. By following the CBD's guidelines and procedures, countries can minimize the negative impacts of land development projects on biological diversity and maximize the positive impacts.

2.8. Medical Waste Management Act-2008

Medical Waste Management Act, 2008 was laid down by the Ministry of Environment, Forest and Climate Change through a Gazette notification dated November 5, 2008.

চিকিৎসা-বর্জ্যের শ্রেণীগত বৈশিষ্ট্য

শ্রেণী বিভাগ	বর্জ্যের শ্রেণী	কতিপয় উদাহরণ
শ্রেণী-১	সাধারণ বর্জ্য (অক্ষতিকারক/ জীবাণুমুক্ত/ অসংক্রামিত)	ব্যবহার্য কাগজ/মোড়ক, প্লাস্টিক বা ধাতব কৌটা, ঔষধের স্ট্রিপ, খালী বাক্স ও কার্টুন, প্যাকিং বাক্স, পলিথিন ব্যাগ, মিনারেল পানির বোতল, কাঁচের খালী বোতল, বিস্কিটের মোড়ক, ইনজেকশনের খালী ভায়েল, অসংক্রামিত ব্যবহার্য স্যালাইন ব্যাগ ও সেট, অসংক্রামিত ব্যবহার্য সিরিঞ্জ, অসংক্রামিত কাপড়/গজ/তুলা, অসংক্রামিত রাবার দ্রব্য/কর্ক, ফলমূলের খোসা, উচ্ছিষ্ট খাবার, রান্না ঘরের আবর্জনা, ডিমের খোসা, ডাবের মালা, প্রেশারাইজ খালী কৌটা ইত্যাদি ।
শ্রেণী-২	এনাটমিক্যাল বর্জ্য	মানব দেহের কাটিয়া ফেলা বিভিন্ন অঙ্গ, প্রত্যঙ্গ, টিস্যু, কাটিয়া ফেলা টিউমার, গর্ভফুল, গর্ভপাত/গর্ভসংক্রান্ত বর্জ্য ইত্যাদি ।
শ্রেণী-৩	প্যাথলজিক্যাল বর্জ্য	ল্যাবরেটরি কালচার, মজুদ অথবা বিভিন্ন টিকার নমুনা, বায়োলজিক্যাল টক্সিন, পরীক্ষার জন্য দেওয়া রক্ত/কফ/মল/ সিরাম/শরীরের নিঃসরণ ইত্যাদি ।
শ্রেণী-৪	রাসায়নিক বর্জ্য	বিভিন্ন প্রকার রিএজেন্ট, ডেভলপার, ডায়ালাইসিস এ ব্যবহার্য ও রাসায়নিক দ্রব্য ইত্যাদি ।
শ্রেণী-৫	ফার্মাসিউটিক্যাল বর্জ্য	বাতিলকৃত, মেয়াদ উত্তীর্ণ, সংক্রামিত বা ব্যবহার উত্তীর্ণ ঔষধ ইত্যাদি ।
শ্রেণী-৬	সংক্রামক/জীবাণুযুক্ত বর্জ্য	রক্ত/পূজ/দেহ রস দ্বারা সংক্রামিত গজ, বেন্ডেজ, তুলা, স্পঞ্জ, সোয়াব, মব, প্লাস্টার, ক্যাথিটার, ড্রেনেজ টিউব, রক্ত সঞ্চালনের ব্যাগ/টিউব, রক্ত দ্বারা সংক্রামিত স্যালাইন সেট, জমাট বাঁধা রক্ত/দেহ রস, ডায়রিয়া রোগীর সংক্রামিত কাপড় চোপর, সংক্রামিত সিরিঞ্জ ইত্যাদি ।
শ্রেণী-৭	তেজস্ক্রিয় বর্জ্য	রেডিওএকটিভ আইসোটোপ, তেজস্ক্রিয় বস্তু দ্বারা সংক্রামিত সকল বর্জ্য, অব্যবহৃত এক্সরে মেশিনের হেড ইত্যাদি ।
শ্রেণী-৮	ধারাল বর্জ্য (সংক্রামিত ও অসংক্রামিত)	মেডিকেলে ব্যবহৃত সকল প্রকার সুই, সকল প্রকার ব্লেড, ভাঙ্গা স্লাইড, ব্যবহৃত এ্যাম্পুল, ভাঙ্গা বোতল/কাঁচ/টেস্ট টিউব/পিপেট/জার, নেইল, স্টীল এর তার, অর্থোপেডিক কাজে ব্যবহৃত স্ক্রু, স্টীল প্লেট, পিন ইত্যাদি ।
শ্রেণী-৯	পুনঃব্যবহারযোগ্য সাধারণ বর্জ্য (অক্ষতিকারক/ জীবাণমুক্ত/ অসংক্রামিত)	ব্যবহার্য কাগজ/মোড়ক, প্লাস্টিক বা ধাতব কৌটা, ঔষধের স্ট্রিপ, খালী বাক্স ও কার্টুন, প্যাকিং বাক্স, পলিথিন ব্যাগ, মিনারেল পানির বোতল, কাঁচের খালী বোতল, বিস্কিটের মোড়ক, ইনজেকশনের খালী ভায়েল, অসংক্রামিত ব্যবহার্য স্যালাইন ব্যাগ ও সেট, অসংক্রামিত ব্যবহার্য সিরিঞ্জ, অসংক্রামিত কাপড়/গজ/তুলা, অসংক্রামিত রাবার দ্রব্য/কর্ক ।

শ্রেণী বিভাগ	বর্জ্যের শ্রেণী	কতিপয় উদাহরণ
শ্রেণী-১০	তরল বর্জ্য (সংক্রামিত ও অসংক্রামিত)	ব্যবহৃত পানি, পানের পিক, বমি, কফ, সাকশন করা তরল, পূজ, দেহ রস, সিরাম, তরল রক্ত, গর্ভের পানি, তরল রাসায়নিক দ্রব্য, অব্যবহৃত তরল ঔষধ, ড্রেনেজ ব্যাগের তরল বর্জ্য ইত্যাদি ।
শ্রেণী-১১	প্রেসারাইজড বর্জ্য	প্রেসারাইজড কৌটা/ক্যান/কনটেইনার

বর্জ্যের শ্রেণী	বর্জ্যের শ্রেণীর নমুনা	পরিশোধন ও বিনষ্টকরণ
ক্যাটাগরী নং-১	সাধারণ বর্জ্য (অসংক্রামিত/ অক্ষতিকারক বর্জ্য	(ক) প্রাঙ্গন বা গণ আবর্জনা ফেলার স্থানে অপসারণ । (খ) প্লাস্টিক বর্জ্য কাটিয়া টুকরা করিয়া পুনঃব্যবহার বন্ধ নিশ্চিত করা ।
ক্যাটাগরী নং-২	এনাটমিক্যাল বর্জ্য	(ক) প্রাঙ্গন/নিরাপদ স্থানে কংক্রিটের পিট (Pit method) পদ্ধতিতে শোধন/বিনষ্টকরণ । (খ) গভীর মাটি চাপা দেওয়া (পরিমাণে অল্প হলে) (গ) বাষ্প অটোক্লেভিং/মাইক্রোওয়েভ ট্রিটমেন্ট/ ইনসাইনেরেটর এর ব্যবহার ।
ক্যাটাগরী নং-৩	প্যাথলজিক্যাল বর্জ্য	ক্যাটাগরীর নং-২ (এনাটমিক্যাল বর্জ্য) এর মত ।
ক্যাটাগরী নং-৪	রাসায়নিক বর্জ্য	(ক) মেয়াদোত্তীর্ণ রাসায়নিক বর্জ্য সরবরাহকারীকে ফেরত প্রদান (পরিমাণে বেশী হলে) । (খ) প্রচুর পরিমাণে পানি মিশাইয়া তরলীকরণের মাধ্যমে নিষ্ক্রিয় করিয়া পয়ঃনিস্কাশন প্রণালীতে অপসারণ (পরিমাণে অল্প হলে) । (গ) রাসায়নিকভাবে পরিশোধন/নিষ্ক্রিয় করিয়া সুয়ারেজ প্রণালীতে অপসারণ ।
ক্যাটাগরী নং-৫	ফার্মাসিউটিক্যাল	ক্যাটাগরী নং-৪ (রাসায়নিক বর্জ্য) এর মত
ক্যাটাগরী নং-৬	সংক্রামক/ জীবাণুযুক্ত বর্জ্য	(ক) প্রাঙ্গন/নিরাপদ স্থানে কংক্রিটের পিট (Pit method) পদ্ধতিতে শোধন/বিনষ্টকরণ । (খ) গভীর মাটি চাপা দেওয়া (পরিমাণে অল্প হলে) (গ) বাষ্প অটোক্লেভিং/মাইক্রোওয়েভ ট্রিটমেন্ট/ ইনসাইনেরেটর এর ব্যবহার ।
ক্যাটাগরী নং-৭	তেজস্ক্রিয় বর্জ্য	প্রতি কেজি বর্জ্যে তেজস্ক্রিয়তার মাত্রা ০.১ এম বি কিউ-এর বেশী হইলে উহা অবশ্যই Bangladesh Atomic Energy Comission এর বিধান অনুসারে শোধন ও বিনষ্ট করিতে হইবে ।
ক্যাটাগরী নং-৮	ধারাল বর্জ্য	(ক) প্রাঙ্গণ/নিরাপদ স্থানে কংক্রিটের পিট (Pit method) পদ্ধতিতে বিনষ্টকরণ । (খ) এনক্যাপসুলেসন (Encapsulation) (গ) গভীর মাটি চাপা দেওয়া (পরিমাণে অল্প হবে) । (ঘ) ইনসাইনেরেটর (Incinerator) এর ব্যবহার ।

বর্জ্যের শ্রেণী	বর্জ্যের শ্রেণীর নমুনা	পরিশোধন ও বিনষ্টকরণ
ক্যাটাগরী নং-৯	পুনঃব্যবহার যোগ্য সাধারণ বর্জ্য	ক) বাষ্প অটোক্লেভিং দ্বারা শোধন করে পুনঃ ব্যবহার করা ।
		খ) রাসায়নিক দ্রব্য দ্বারা শোধন করে পুনঃ ব্যবহার করা ।
ক্যাটাগরী নং-১০	তরল বর্জ্য (সংক্রামিত/অসংক্রামিত)	ক) প্রচুর পরিমাণে পানি মিশিয়ে তরলীকরণের মাধ্যমে পয়ঃনিস্কাশন প্রণালীতে অপসারণ ।
		খ) ১% সোডিয়াম হাইপোক্লোরাইড সলিউশন মিশিয়ে, রাসায়নিকভাবে শোধন করে পয়ঃ প্রণালীতে অপসারণ ।
শ্রেণী-১১	প্রেসারাইজড বর্জ্য	ক) সরবরাহকারীকে ফেরত প্রদান (পরিমাণে বেশী হলে)
		খ) পদ্ধতি সম্মত ভাবে ডিপ্রেসারাইজড করে সাধারণ/পুনঃ প্রক্রিয়াজাতকরণ যোগ্য বর্জ্যের সাথে অপসারণ (পরিমাণে অল্প হলে) ।

উপরোক্ত ঐচ্ছিক ক্ষমতা (option) প্রযুক্তির সহজলভ্যতার উপর নির্ভরশীল । দখলদার/অপারেটর অন্য কোন বিশেষ ধরণের প্রযুক্তি ব্যবহার করার ইচ্ছা পোষণ করিলে তদবিষয়ে নির্ধারিত কর্তৃপক্ষকে ক্ষমতা প্রদান মঞ্জুরের বিষয় বিবেচনা করিবার জন্য নির্ধারিত কর্তৃপক্ষের নিকট পেশ করিতে হইবে ।

ক. প্রাঙ্গনে নিরাপদ পিট পদ্ধতি/গভীর মাটিচাপা দেওয়ার জন্য সীমানাচিহ্নিত স্থানের ব্যবহার এবং গণ আর্বজনা ফেলার স্থানের ক্ষেত্রে তফসিল-৬ এ বর্ণিত মানদন্ড প্রতিপালন পূর্বক সংরক্ষিত ও নিরাপদ এলাকা ব্যবহার করিতে হইবে ।

খ. হ্যালোজেন যৌগযুক্ত, যেমন পিভিসি প্লাস্টিকস, বিশাল পরিমাণ রাসায়নিক বর্জ্য চুল্লীতে (Incinerator) পোড়ানো যাইবে না যে পর্যন্ত না শোধন সুবিধায় ধোঁয়া গ্যাস পরিষ্কারের জন্য পর্যাপ্ত যন্ত্রপাতি রহিয়াছে ।

গ. স্টীম অটোক্লেভিং (বা মাইক্রোওয়েভ ট্রিটমেন্ট) অবশ্যই তফসিল-৬ এ বর্ণিত মানদন্ড অনুযায়ী হইতে হইবে ।

ঘ. তরল রাসায়নিক বর্জ্য পয়োঃপ্রণালীতে ফেলিবার পূর্বেই তফসিল-৬ এর মানদন্ড প্রতিপালন করতঃ রাসায়নিকভাবে নিশোধন treatment করিতে হইবে ।

ঙ. ধারাল বর্জ্য অপসারণের পূর্বে রাসায়নিকভাবে নিশোধন treatment করিতে হইবে ।

চ. পুনঃ ব্যবহার রোধকল্পে রাবার/প্লাষ্টিক জাতীয় নল কাটিয়া টুকরা করিতে হইবে এবং বিভিন্ন ব্যাগ (স্যালাইন ব্যাগ, রক্ত ব্যাগ, ইউরিন ব্যাগ ইত্যাদি) ফুটা/কাটিয়া দিতে হইবে ।

চিকিৎসা-বর্জ্যের সংরক্ষণ ও অপসারণের জন্য পাত্র ও কালার কোড

কালার কোড	বর্জ্যের বিভাগ	বর্জ্যের শ্রেণী	বর্জ্যের ধরণ	পাত্র
কাল	সাধারণ বর্জ্য	শ্রেণী-১, ১১	অক্ষতিকারক, অসংক্রামিত, জীবাণুমুক্ত বর্জ্য	ছিদ্রবিহীন প্লাস্টিক বিন
হলুদ	ক্ষতিকারক বর্জ্য	শ্রেণী-২, ৩, ৪, ৫, ৬	এনাটমিক্যাল, প্যাথলজিক্যাল, সংক্রামক/জীবাণুযুক্ত, বর্জ্য	ছিদ্রবিহীন প্লাস্টিক বিন
লাল	ধারাল বর্জ্য	শ্রেণী-৮	সংক্রামিত, অসংক্রামিত, জীবাণুযুক্ত, জীবাণুমুক্ত বর্জ্য	ছিদ্রবিহীন অভেদ্য পুরু প্লাস্টিক বিন, বাক্স
নীল	তরল বর্জ্য	শ্রেণী-১০, ৪	ক্ষতিকারক, অক্ষতিকারক, সংক্রামিত, অসংক্রামিত, জীবাণুযুক্ত, জীবাণুমুক্ত, কেমিক্যাল বর্জ্য	ছিদ্রবিহীন প্লাস্টিক গামলা, বিন
সিলভার	তেজস্ক্রিয় বর্জ্য	শ্রেণী-৬	বিকিরণযোগ্য বর্জ্য	ছিদ্রবিহীন লিড বক্স
সবুজ	পুনঃ ব্যবহার যোগ্য সাধারণ বর্জ্য	শ্রেণী-৯	অক্ষতিকারক, অসংক্রামিত, জীবাণুমুক্ত বর্জ্য	ছিদ্রবিহীন প্লাস্টিক বিন

- তেজস্ক্রিয় বর্জ্য সংরক্ষণ বা পরিবহনের জন্য সিলভার রং এর ছিদ্রবিহীন লিড এর তৈরী বক্স বা বাংলাদেশ আনবিক শক্তি কমিশনের নির্দেশিত নিয়ম অনুসরণ করিতে হইবে।
- তরল ফার্মাসিউটিক্যাল বর্জ্য অল্প পরিমাণ হইলে তরল বর্জ্য রাখার নীল পাত্রে রাখা যাইতে পারে।
- ফার্মাসিউটিক্যাল বর্জ্য অল্প পরিমাণ হইলে ক্ষতিকারক বর্জ্য রাখার হলুদ পাত্রে রাখা যাইতে পারে।
- বিভিন্ন প্রকার কেমিক্যাল বর্জ্য এক সাথে এক পাত্রে রাখা যাইবে না, কারণ রাসায়নিক বিক্রিয়ার জন্য দুর্ঘটনা ঘটিতে পারে।
- পিট পদ্ধতিতে পঁচন প্রক্রিয়া তরান্বিত করার জন্য অল্প পরিমাণ রান্নাঘরের বর্জ্য হলুদ পাত্রে রাখা যাইবে।
- পুনঃ ব্যবহার্য সাধারণ বর্জ্য (শ্রেণী-৯) এর পরিমাণ অল্প হইলে, সাধারণ বর্জ্যের (শ্রেণী-৮) এর সাথে কাল পাত্রে রাখা যাইতে পারে।
- প্রতিটি বর্জ্য রাখার পাত্রে স্পষ্ট বাংলা ভাষায় রং ভেদে বর্জ্যের ধরণ লিখিতে হইবে এবং বিশ্ব স্বাস্থ্য সংস্থা অনুমোদিত সাংকেতিক চিহ্ন/ লেবেল ব্যবহার করিতে হইবে।

Chapter Three: Project Description

3.1. Project Definition

Musa Specialized Hospital Ltd. is a specialized healthcare facility designed to provide modern laboratory, dialysis unit, X-ray, endoscopy, ultrasonography, outpatient department (OPD), doctor's chambers, emergency unit, operating theater, patient cabins, and wards.

Musa Specialized Hospital Ltd. will be a private owned, located at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh. Scheduled to begin operations in 2027, the project aims to offer comprehensive healthcare services to patients across various medical disciplines. Strategically positioned in a mixed residential and commercial area, the hospital enjoys easy access to essential services, including gas, electricity, telecommunications, and transport networks, making it an accessible healthcare hub.

The project will be dedicated to delivering integrated diagnostic and healthcare services to the community, focusing on high-quality care that will be affordable for all patients. The facility will be designed to handle 2000 outpatients daily and has secured all necessary approvals from relevant municipal authorities. In addition to providing top-tier medical care, aims to contribute to the training and development of medical professionals, thereby fostering employment opportunities and supporting the local healthcare workforce.

To address environmental considerations, the hospital will implement several measures to mitigate potential impacts during the construction and operational phases. The hospital has established partnerships with third-party organizations to manage solid and biomedical waste collection and disposal. Furthermore, it will utilize shared Wastewater Treatment Plant (WWTP). This facility, with a total treatment capacity of 3 cubic meters per hour, will treat liquid waste generated by institutions, ensuring safe discharge into a nearby canal that leads to the nearby canal. By adhering to a robust Environmental Management Plan (EMP), Musa Specialized Hospital Ltd. is committed to operating within national environmental standards, minimizing negative impacts, and promoting sustainability.

Advanced Technology

Musa Specialized Hospital Ltd. will be at the forefront of delivering exceptional healthcare services through advanced medical technology and state-of-the-art facilities. The hospital will have a comprehensive range of modern infrastructure, including a fully equipped laboratory,

advanced X-ray and ultrasonography units, a well-organized outpatient department (OPD), specialized dental and emergency units, and sophisticated operating theaters. These facilities enable to provide accurate diagnostics, effective treatment, and high-quality patient care, reflecting its commitment to medical excellence.

The hospital will incorporate the latest medical equipment, reagents, and technologies to ensure that patients and healthcare professionals receive the best support possible. The hospital building is designed to create a healthy and sustainable environment, featuring eco-friendly design elements and a welcoming atmosphere. A dedicated recreation area for children and patient attendants further enhances the comfort and experience of those receiving care at the hospital.

Committed to providing continuous care, it will operate 24/7 with a comprehensive range of emergency services. The hospital will also offer online services, facilitating easy access to medical information and care. A fully stocked on-site pharmacy ensures the availability of a wide variety of medicines and surgical supplies to meet the immediate needs of patients and healthcare providers.

The hospital will offer a reliable ambulance service around the clock to support patient transport and safety. This dedication to advanced technology and patient-centered care underscores 's mission to provide superior healthcare services while adhering to the highest safety standards, quality, and environmental responsibility. Wastewater Treatment Plant (WWTP) demonstrates 's commitment to sustainable and environmentally sound healthcare operations.

3.2. Project Location and Details

Musa Specialized Hospital Ltd will be located at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh. The latitude and longitude of the hospital are 23°49'4"N and 90°27'21.80"E. At the East side of the project is residential area, at the West side of the project is 50’ road & residential area, at the North & South side of the project is 25’ road & residential buildings. It’s distance from Hazrat Shahjalal International Airport is about 8.8 km. The location map, location direction from Google Map and Satellite image have been given in the following figure:



Figure 3.1: The location map of the project (Adopted from Google Maps)

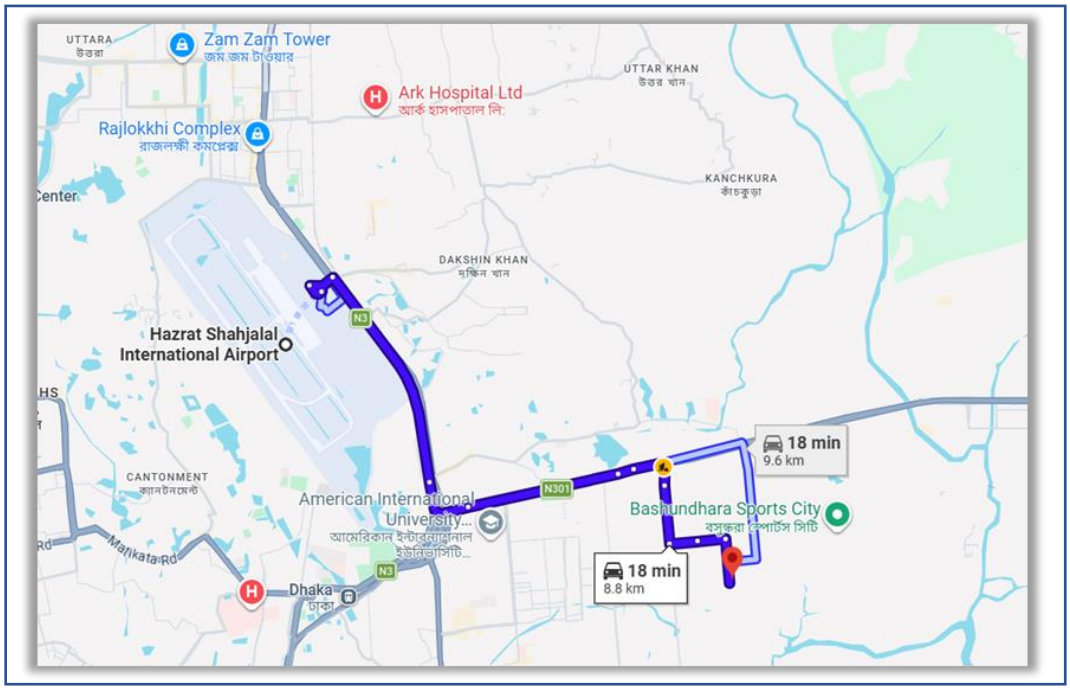


Figure 3.2: The location map of the project (Adopted from Google Maps)



Figure 3.3: 500-meter surrounding area from project location (captured from Google Earth)

The proposed hospital site is strategically located within a developed urban setting. The western, northern, southern boundaries are defined by Bashundhara residential Road, a significant access route in the area. The eastern side is occupied by commercial establishments and associated urban infrastructure. The surrounding land use pattern is predominantly commercial and mixed-use in nature, providing suitable infrastructural support and accessibility for the proposed healthcare facility.

3.3. Basic Information of Project

The EIA Report for Musa Specialized Hospital Ltd. primarily addresses the environmental impacts arising from the operation of the hospital facilities on the surrounding environment.

Table 3.1: Basic Information of Musa Specialized Hospital Ltd.

Basic Information of **Musa Specialized Hospital Ltd.**		
S.N.	**Items**	**Description**
1.	**Name of the project**	Musa Specialized Hospital Ltd.
2.	**Type of project**	General Hospital
3.	**Project Proponent**	Md. Musa Kalim
4.	**Proponent's Contact No**	01715528334
5.	**Email**	musaintl.857@gmail.com
6.	**Patient Bed**	250
7.	**Location of the Project**	P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh
8.	**Total Manpower**	**Doctor: 100** **Nurse: 164** **Staff: 200** **Administration: 05** **Total: 469 persons**
9.	**Total Area**	4012.77 sqm (43,177.4 sqft)
10.	**Total Green Area**	1003.19 sqm (10,794.355 sqft)
11.	**Total Area of the Facility**	2006.38 sqm (24,588.6 sqft)
12.	**Project Cost**	BDT 150 Crore
13.	**Facilities**	Lab, X-ray, Ultrasonography, CT scan, Dialysis, Critical Areas: OPD, Emergency Unit, OT, ICU, HDU, NICU. Doctor Chamber, Cabin, Ward, etc.
14.	**Electricity Requirement**	**Electricity-** 900 KWh, DESCO **Generator-** 900 KWh (2 nos)
15.	**Water Requirement**	112,500 L/day (112.5 m^3/day)
16.	**Wastewater Generation**	101,250 (101.25 m^3/day)
17.	**Disposal Point for Liquid Waste**	Liquid waste generated from medical activities will be treated using Wastewater Treatment Plant (WWTP). The excess treated water will be discharged into the local drainage system, which leads to a nearby canal.

Basic Information of **Musa Specialized Hospital Ltd.**		
S.N.	**Items**	**Description**
18.	**(Proposed) Medical Wastewater Treatment Plant (WWTP)**	WWTP Capacity 5.0 m^3/hr. (110 m^3/day) Operating Time 22 hr. per day.
19.	**Source of Water**	Ground Water (Deep Tube Well)
20.	**Type of Waste Generated**	Medical waste, General Solid Waste, and Liquid Waste
21.	**Solid Waste Generation (without garbage)**	Saline Bag: 180-200 nos. Syringe: 300-400 nos. Vial: 200-300 nos. Gauge, Bandage Cotton, etc. Total: ± 40-50 Kg/day
22.	**Medical Waste Disposal**	Medical waste will be managed by Prism Bangladesh Foundation.

3.4. Floor Detail

Musa Specialized Hospital Ltd. conducts its treatment activities within its own building. The building's floor details are as follows:

Table 3.2: Floor Detail of the Hospital

Sl. No.	Name of the Floor	Floor Functions
1	2nd Basement	26 car parking spaces, 2-wheeler parking, underground fire tank, underground water tank (6,160 cubic feet), fire pump room, vehicle driveways and ramps.
2	1st Basement	36 car parking spaces, 2-wheeler parking, mortuary, STP area, underground water tank, medical air plant, medical vacuum plant, oxygen generator and manifold system, emergency oxygen and N_2O manifolds, generator room, and electrical facilities.
3	Ground Floor	Main reception and entry lobby, emergency entry and emergency ward (11 beds), emergency waiting area, X-ray rooms, CT scan, MRI, mammography and OPG, pharmacy, corporate meeting room, counselling room, cash and admission counters, gift shop, coffee shop, sample collection, minor OT, nurse station and utility rooms, Secondary Transfer Station (STS).

Sl. No.	Name of the Floor	Floor Functions
4	1st Floor	Doctor's chambers, central waiting area, consultant rooms, hearing centre, fundoscopy, visual field analyser, EEG, EMG, laryngoscopy, FibroScan, ECHO, ECG and Holter, ETT, RFT, USG rooms, cash counter and patient facilities.
5	2nd Floor	Doctor's chambers, physiotherapy, endoscopy complex, colonoscopy, dental units, minor OT, dialysis unit (20 beds), dialysis waiting area, nurse stations, medical board room, patient cabins and supporting facilities.
6	3rd Floor	Cardiac OT complex, Cath Lab 01 and 02, cardiac OT, post-operative cardiac ICU, CCU 01 and CCU 02, step-down CCU, patient cabins, reception and waiting, nurse stations and supporting facilities.
7	4th Floor	General OT complex, OT-01, OT-02, OT-03 and OT-04, post-operative zone (10 beds), pre/post-operative support areas, nurse station, sterilisation room, anaesthetist room, instrument and equipment rooms, doctor's lounge, staff changing and locker rooms.
8	5th Floor	Gynaecology OT complex, OT-01 and OT-02, labour room, NICU (14 beds), female ward (10 beds), paediatric ward (14 beds), patient cabins, breast-feeding room, nurse stations, doctor rooms, stores and supporting facilities.
9	6th Floor	Patient cabins, female ward (10 beds), male ward (14 beds), reception and waiting area, information desk, nurse rooms, nurse stations, doctor rooms, stores, linen store and supporting facilities.
11	8th Floor	Administrative department, admin workstation, CEO/Director room, Chairman/MD room, HR department, conference room, hematology laboratory, serology laboratory, laboratory reporting area, apheresis room, delivery room, dining area and supporting facilities.
12	9th Floor	Main dining area, VIP dining area, hot cooking area, food preparation area, dryer and ironing area, delivery area, reception, mini auditorium, green room, bookshelf area and supporting facilities.
13	Roof Floor	Lift machine rooms, lift machine room bottom slab, open-to-sky/void areas and associated rooftop service spaces.

3.5. Hspital Floor Details, List of Equipment and Reagent

Ground Floor:

The Ground Floor serves as the principal entry, reception, emergency care and diagnostic service area of the hospital. It accommodates the main reception and entrance lobby, admission and cash counters, and a dedicated emergency entrance with an emergency ward comprising 11 beds and an associated waiting area. Diagnostic facilities include X-ray rooms, CT scan, MRI, mammography and orthopantomogram (OPG) services. Other facilities include a pharmacy, sample collection area, minor operation theatre (OT), nurse station, counselling room, corporate meeting room, gift shop, coffee shop and supporting utility spaces. These facilities are intended to facilitate patient registration, initial medical assessment, emergency treatment, diagnostic investigations and other essential outpatient services.

Secondary Transfer Station (STS) for Medical Waste

The Secondary Transfer Station (STS) located on the Ground Floor serves as the hospital's centralized temporary medical waste collection and storage facility prior to off-site transportation and final treatment/disposal. Medical waste generated from various departments, including operation theatres, wards, laboratories, diagnostic units, ICUs, and outpatient facilities, is segregated at the source using color-coded containers and transported through designated waste movement routes to the STS. The facility is designed as an isolated and restricted-access room to prevent unauthorized entry and minimize potential exposure to infectious, pathological, pharmaceutical, and sharps waste.

Major activities within the STS include waste receiving, weighing, recording, temporary storage, and preparation for collection by authorized waste management operators. The room is equipped with an impermeable floor, adequate ventilation, washing and disinfection facilities, drainage systems, and appropriate signage to ensure compliance with the Medical Waste Management Rules, 2008 of Bangladesh. The STS operates under strict infection control and occupational health and safety protocols to prevent environmental contamination, odor generation, vector breeding, and risks to healthcare workers, patients, and the surrounding community. The collected medical waste is subsequently transferred to approved treatment and disposal facilities for final management in accordance with regulatory requirements.

1st Floor:

The 1st Floor is primarily dedicated to outpatient consultations, specialist medical services and advanced diagnostic investigations. It accommodates doctors' chambers, consultant rooms and a central patient waiting area. The diagnostic and clinical facilities include a hearing centre, fundoscopy, visual field analyser, electroencephalography (EEG), electromyography (EMG), laryngoscopy, FibroScan, echocardiography (ECHO), electrocardiography (ECG), Holter monitoring, exercise tolerance testing (ETT), renal function testing (RFT) and ultrasonography (USG) rooms. A cash counter and other patient-support facilities are also provided to facilitate consultations, diagnostic examinations and specialist healthcare services.

2nd Floor:

The 2nd Floor is arranged to provide specialist consultation, therapeutic, endoscopic, dental and renal treatment services. It includes doctors' chambers, a physiotherapy unit, an endoscopy complex, colonoscopy facilities and dedicated dental treatment units. A minor operation theatre is also provided for procedures that do not require the full facilities of the major operating theatre complex. The floor accommodates a dialysis unit with a designated capacity of 20 beds, together with a dialysis waiting area, nurse stations, patient cabins, a medical board room and other supporting facilities. These arrangements are intended to support specialised treatment, diagnostic procedures, rehabilitation and renal care services.

3rd Floor:

The 3rd Floor is designated for advanced cardiac care and specialized surgical services. It accommodates a cardiac operation theatre complex, two catheterization laboratories (Cath Lab 01 and Cath Lab 02), a cardiac operation theatre and a post-operative cardiac intensive care unit (ICU). The critical-care facilities include CCU 01, CCU 02 and a step-down coronary care unit (CCU) to support the treatment and monitoring of patients requiring different levels of cardiac care. Patient cabins, reception and waiting areas, nurse stations and associated supporting facilities are also provided to facilitate patient admission, post-operative monitoring and specialized cardiac treatment.

4th Floor:

The 4th Floor is primarily dedicated to general surgical services and post-operative patient care. It accommodates a general operation theatre complex consisting of four operating theatres, designated as OT-01, OT-02, OT-03 and OT-04. The floor also includes a post-

operative care zone with a stated capacity of 10 beds, together with pre-operative and post-operative support areas. Additional facilities include a nurse station, sterilisation room, anaesthetist room, instrument and equipment rooms, doctors' lounge, staff changing rooms and locker facilities. These facilities are designed to support surgical procedures, perioperative patient management, sterilisation activities and the operational requirements of the surgical team.

5th Floor:

The 5th Floor is arranged to provide specialised gynaecological, maternity and paediatric healthcare services. It accommodates a gynaecology operation theatre complex consisting of OT-01 and OT-02, together with a dedicated labour room for maternity-related services. Neonatal intensive care facilities are provided through a NICU with a stated capacity of 14 beds. The floor also includes a female ward with 10 beds and a paediatric ward with 14 beds, along with patient cabins, a breastfeeding room, nurse stations, doctors' rooms and designated storage areas. These facilities are intended to provide maternal healthcare, gynaecological surgical treatment, neonatal care and specialised medical services for children.

6th Floor:

The 6th Floor is primarily allocated for inpatient accommodation and general medical care. It accommodates patient cabins, a female ward with 10 beds and a male ward with 14 beds. The floor also includes a reception and waiting area, information desk, nursing rooms, nurse stations, doctors' rooms, stores and a linen store. These facilities are intended to support inpatient admission, routine medical treatment, nursing services and the provision of essential patient-care and housekeeping support.

7th Floor:

The 7th Floor is designated for inpatient accommodation and supporting patient-care services. According to the hospital's general floor-function schedule, the floor accommodates 18 patient cabins, a doctors' lounge, female and paediatric wards, a housekeeping and linen store, and reception and waiting facilities. These arrangements are intended to provide accommodation for admitted patients while ensuring the availability of medical consultation, nursing support, housekeeping services and other essential inpatient facilities.

8th Floor:

The 8th Floor primarily accommodates the hospital's administrative, management, laboratory and supporting medical service facilities. The administrative section includes workstations for administrative personnel, the CEO/Director's room, Chairman/Managing Director's room, HR department, conference room and other departmental workspaces. The floor also accommodates a hematology laboratory, serology laboratory, laboratory reporting area and apheresis room. Additional facilities include a delivery area, dining facilities and other supporting spaces required for administrative coordination, laboratory investigations, blood-related services and institutional management.

9th Floor:

The 9th Floor is primarily designated for food preparation, dining, staff welfare and recreational activities. It accommodates a main dining area and a VIP dining area, together with a hot cooking section and dedicated food preparation facilities. Other supporting facilities include a washing area, dryer and ironing facilities, delivery area and reception. The floor also provides a mini auditorium, green room and bookshelf area to support institutional meetings, presentations, training activities and other staff-related programmes.

Roof Floor:

The Roof Floor is primarily designated for essential building services and rooftop utility infrastructure. It accommodates lift machine rooms, associated lift machine room bottom slabs, open-to-sky and void areas, and other related rooftop service spaces. These facilities support the operation and maintenance of the building's vertical transportation systems and provide designated spaces for associated rooftop building services.

Basement 2:

The 2nd Basement of Musa Specialized Hospital Ltd. is primarily designated for vehicle parking and essential underground utility infrastructure. It accommodates 26 car parking spaces, designated two-wheeler parking facilities, an underground fire-water storage tank and an underground water tank with a capacity of approximately 6,160 cubic feet. The floor also contains a dedicated fire pump room to support the hospital's firefighting system, along with vehicle driveways and access ramps to facilitate the movement of vehicles between basement levels and the external access points.

Basement 1:

The 1st Basement accommodates parking facilities, essential engineering utilities and supporting hospital infrastructure. It provides 36 car parking spaces, designated two-wheeler parking, a mortuary and an area allocated for the Sewage Treatment Plant (STP). The floor also houses an underground water storage tank, medical air plant, medical vacuum plant, oxygen generation and manifold systems, as well as emergency oxygen and nitrous oxide (N_2O) manifolds. In addition, the generator room and associated electrical facilities are located on this floor to ensure the reliable supply of electricity and essential medical gases required for hospital operations.

3.6. List of Equipment

Musa Specialized Hospital Ltd. is planned to be equipped with a range of modern medical equipment, diagnostic instruments, surgical machinery and critical-care support systems to facilitate the delivery of specialized healthcare services. The equipment inventory includes diagnostic imaging systems, cardiac investigation equipment, endoscopic instruments, dialysis facilities, operation theatre equipment, patient monitoring systems and other essential medical devices. These facilities are intended to support diagnostic investigations, surgical interventions, intensive care, emergency treatment, inpatient management and specialized medical services. The major medical equipment and machinery identified for the hospital are presented in the following tables.

Table 3.2: Diagnostic and Clinical Equipment

Sl. No.	Name of Equipment	Quantity
1	ECHO Machine	02
2	Portable ECHO Machine	01
3	Exercise Tolerance Test (ETT) Machine	01
4	Endoscope Machine	02
5	Bone Mineral Density (BMD) Machine	01
6	FibroScan Machine	01
7	Eye Examination Setup	01
8	ENT Workstation	01

Table 3.3: Radiology and Diagnostic Imaging Equipment

Sl. No.	Name of Equipment	Quantity
1	X-ray FPD 1500	01
2	X-ray FPD 500	01
3	Orthopantomogram (OPG) Machine	01
4	Mammography Machine	01
5	C-arm X-ray Machine	02
6	Portable X-ray Machine	01
7	Fixed Ultrasonography Machine	02
8	Portable Ultrasonography Machine	04
9	CT Scanner (128-Slice)	01
10	MRI Scanner (3.5 Tesla)	01

Table 3.4: Major Hospital and Critical-Care Equipment

Sl. No.	Name of Equipment	Quantity
1	Patient Monitoring System	250
2	Operation Theatre (OT) Facilities	10
3	Anaesthesia Machines	08
4	Dialysis Machines/Units	28
5	Ventilators	30
6	OT Lights	10
7	OT Tables	10
8	Patient Beds	250
9	Operating Microscopes	02

Table 3.5: Angiography and Cardiac Intervention Equipment

Sl. No.	Name of Equipment	Quantity
1	C-arm X-ray Machine	02
2	Fluoroscopy System	02
3	Automated Contrast Injector	02
4	Patient Table	02
5	High-Definition Monitor	02

The above equipment will support the hospital's diagnostic, therapeutic and surgical operations. The diagnostic imaging systems, including X-ray, CT scan, MRI, mammography and ultrasonography machines, will facilitate medical investigations and disease diagnosis. Cardiac diagnostic and interventional equipment, including ECHO, ETT, C-arm X-ray and fluoroscopy systems, will support cardiovascular investigations and specialized cardiac procedures.

Furthermore, the operation theatre equipment, anaesthesia machines, ventilators, patient monitoring systems and operating microscopes will facilitate surgical interventions and critical-care management. The dialysis units will support patients requiring renal replacement therapy. The hospital will also maintain the necessary supporting infrastructure for the installation, operation, maintenance and safe use of medical equipment, including electrical supply, medical gas systems and other relevant utility services.

The procurement, installation, commissioning, operation and maintenance of medical equipment will be undertaken in accordance with applicable technical, safety and regulatory requirements. Radiation-generating equipment, including X-ray, CT scan, mammography, C-arm and other relevant imaging systems, will be operated subject to the applicable licensing, radiation protection and safety requirements.

3.7. Utilities

3.6.1. Water Requirement and Wastewater Generation

The hospital's water supply is sourced from its own deep tube well, which is utilized for various hospital utility needs, including medical purposes, daily household activities, drinking, kitchen use, and washing. Wastewater is generated from medical facilities, sanitary systems, kitchen operations, and the washing of bed sheets and pillows. The details of water consumption and wastewater generation are provided below.

SL No	Name of The Parameter	Calculation	Remarks
1	Total Bed	250 Bed	
2	Water Consumption Rate	= 250 * 450 = 112500 lpcd	As per BNBC 2021, water consumption for over 100 bed hospital is 450 lpcd.

3	Wastewater Generation	= 90% of Water Consumption = 112500 * 0.9 = 101250 lpcd = 101.25 m^3/day	Assumed wastewater generation will be 90% of water consumed daily.
4	Operating hours	22 hours/day	
5	Required WWTP Capacity	= 101.25 m^3/day = 4.6 m^3/hour	
6	Designed WWTP Capacity	5.0 m^3/hour or 110 m^3/day	10% safety is being adopted

Table 3.3: Wastewater Generation Calculation for WWTP

N.B: WWTP Details are attached on Annexure.

3.6.2. Power

Musa Specialized Hospital Ltd. will be utilizing Electricity from two sources:

a. The DESCO will supply the main grid power. The hospital's connecting load will be 900 KWh.
b. Two standby generators, with a capacity of 900 KWh, will be installed. On average, the generators consume 50 to 100 liters of diesel per day.

3.6.3. Safety Provision

Musa Specialized Hospital Ltd. prioritizes fire safety with a comprehensive system that includes fire extinguishers, fire hydrants, and an advanced fire detection system to safeguard against fire-related incidents. These safety measures will be strategically placed throughout the facility to ensure prompt and effective response in case of emergencies. Detailed information on these safety protocols is provided in Chapter Six.

The hospital will be equally committed to the health and safety of its staff and visitors. Regular health screenings will be conducted for employees, who also benefit from primary healthcare services and Group Health Insurance coverage. Certified first aid personnel will be readily available in all key departments to provide immediate medical assistance. Musa Specialized Hospital Ltd. will enforce strict safety protocols, mandating that all employees and visitors wear appropriate Personal Protective Equipment (PPE) in designated operational areas. Hazard warnings and safety instructions are clearly posted in critical locations to enhance awareness and compliance. The hospital will also conduct regular safety training sessions, facilitated by certified trainers, focusing on firefighting techniques, fall prevention, and the safe handling of heavy equipment and flammable materials.

3.6.4. Pollution Control and Waste Disposal

Musa Specialized Hospital Ltd. will implement comprehensive measures for effective pollution control and waste disposal. The hospital will have a formal agreement with PRISM Bangladesh Foundation to oversee the management of medical and solid waste.

A Wastewater Treatment Plant (WWTP) are being installed to treat medical wastewater prior to its safe discharge. Furthermore, the hospital has engaged a third-party organization to ensure the proper disposal of both medical and solid waste, adhering to regulatory standards and mitigating environmental impacts.

3.8. Employment Opportunities

Musa Specialized Hospital Ltd. will be a significant contributor to the local economy, generating numerous employment opportunities and fostering regional economic growth. The facility will employ approximately 469 individuals, including both skilled and unskilled positions.

Skilled roles at will encompass medical and technical professions, such as doctors, medical officers, nurses, and various specialized technicians. These professionals will play a crucial role in delivering high-quality healthcare services and maintaining operational efficiency. They receive targeted training to ensure expertise in their respective fields, which is essential for the smooth functioning of the hospital and adherence to health and safety standards.

Unskilled positions at the hospital will include administrative support, facility maintenance, and other essential support roles. These positions will provide entry-level employment opportunities, offering on-the-job training that equips employees with valuable skills. This not only aids in personal career development but also supports the hospital's operations.

Together, the diverse workforce at the hospital will contribute to a collaborative and efficient environment. The hospital's employment practices also positively impact the community by providing stability and economic benefits. Additionally, the hospital will be involved in community outreach and training programs to further enhance the skills and employability of its workforce.

3.9. Wastewater Treatment Plants (WWTP)

Wastewater treatment encompasses the mechanisms and processes designed to address water contamination resulting from sewage, or healthcare activities prior to its release into the environment or its potential reuse. While many institutions have adopted measures to minimize or recycle wastewater, others continue to produce significant volumes.

Musa Specialized Hospital Ltd. are committed to minimizing their environmental impact through the Wastewater Treatment Plant. These advanced facilities are crucial for treating wastewater generated from both medical and operational activities, ensuring compliance with stringent environmental standards prior to discharge. The WWTP represent a key component of the hospital's commitment to effective pollution control and environmental stewardship.

Table 3.4: Basic Details of Wastewater Treatment Plant

Name of Client	**:**	**Musa Specialized Hospital Ltd.**
Location	**:**	P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh, Bangladesh.
Type of Effluent	**:**	Hospital Wastewater
Treatment Hours	**:**	22 Hr./Day
WWTP Capacity	**:**	5.0 m^3/Hr.
WWTP Treatment Concept	**:**	Biological MBBR Process

Constructing both WWTP systems with a combined treatment capacity of 5.0 m^3/hr will require a 700 ft^2 area (approximately). WWTP details, drawings, and design calculations are attached in **Annexure D**.

Chapter Four: Existing Environment

4.1.General Aspects

Baseline data on the environment is crucial for understanding the physical, biological, cultural, economic, and social characteristics of the project study area. This information serves as the foundation for analyzing the potential impacts of project activities. The primary objectives of examining and defining the existing environment are:

a. To identify environmental and socioeconomic components that may be affected by project activities.
b. To recognize potential environmental impacts on these components.
c. To establish a baseline against which future environmental conditions of the project can be measured.

For this Environmental Impact Assessment (EIA) study, the focus is on key environmental factors such as water, air, and noise quality within the study area. The assessment also considers both the immediate and ancillary areas that may be impacted.

4.2.Land Use

Musa Specialized Hospital Ltd. is located on a dedicated 4012.77 sqm (43,177.4 square feet) within a fully developed area. The hospital is situated at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh. The surrounding 5-kilometer radius includes a mix of residential and commercial buildings, local pathways, roads, and various local establishments. The site benefits from comprehensive infrastructure, including access to power, labor, manpower, and efficient road and water communication systems.

At the East side of the project is residential area, at the West side of the project is 50’ road & residential area, at the North & South side of the project is 25’ road, barren lands & residential buildings.

4.3. Geology and Land

Musa Specialized Hospital Ltd. is located at P-2341/A, Road No. 26/A, 27/A, Block-M, Road No. 4, 7/A, Dhaka, Bangladesh. The project is situated within the greater Dhaka urban area, which forms part of the Bengal Basin and is characterized by Quaternary sedimentary deposits. The regional geological setting of Dhaka is mainly associated with the Pleistocene Madhupur

Terrace and the surrounding Holocene alluvial floodplain deposits. The Madhupur geological formation generally consists of reddish-brown to yellowish-brown clay, silty clay and fine sand, while the more recent alluvial deposits comprise varying proportions of sand, silt and clay. These geological formations represent the principal surface geological units of the Dhaka region.

The geological characteristics of the greater Dhaka area are influenced by the historical depositional processes of the Ganges-Brahmaputra-Meghna river system. The elevated Madhupur Terrace is generally distinguished from the surrounding low-lying floodplain areas by its geological composition and topographical characteristics. Recent alluvial deposits are commonly found in low-lying areas, former river channels, depressions and floodplain environments. The engineering properties of these deposits may vary depending on their composition, depth, degree of consolidation and groundwater conditions.

The total land area of Musa Specialized Hospital Ltd. is approximately 4,012.77 square metres (43,177.4 square feet). Approximately 2,006.38 square metres (21,588.6 square feet) are occupied by the building footprint, while approximately 1,003.19 square metres (10,794.35 square feet) are designated as green areas within the project premises. The remaining land is available for other site requirements, including access, circulation and associated facilities, subject to the approved site layout.

The hospital has been designed as a multi-storey healthcare facility comprising two basement levels, a ground floor, nine upper floors and a roof floor. The development incorporates essential healthcare infrastructure, diagnostic facilities, inpatient accommodation, medical service areas and utility installations. The basement levels accommodate parking, water storage, firefighting infrastructure, medical gas systems, generator facilities and other essential services.

Considering the geological setting of the greater Dhaka region, appropriate attention will be given to soil-bearing capacity, foundation stability, groundwater conditions and the potential for soil settlement. The suitability of the project site for the existing multi-storey hospital structure should be established through the approved structural design and site-specific geotechnical investigation. No project-specific borehole logs, Standard Penetration Test (SPT) results or detailed subsurface soil investigation reports were available in the documents reviewed for this assessment. Therefore, the precise soil stratification and engineering

characteristics of the project plot require confirmation through the relevant geotechnical records.

4.4. Land Use and Soil Composition

The project site of Musa Specialized Hospital Ltd. is located at P-2341/A, Road No. 26/A, 27/A, Block-M, Road No. 4, 7/A, Dhaka, Bangladesh. The project is situated within the developed urban area of Dhaka, where land is predominantly utilized for residential, commercial, institutional and infrastructure-related purposes. The hospital premises have been designated for healthcare services and associated facilities. The total land area of the project is approximately 4,012.77 square metres (43,177.4 square feet), of which approximately 2,006.38 square metres (21,588.6 square feet) are occupied by the building footprint and approximately 1,003.19 square metres (10,794.35 square feet) are designated as green areas. The remaining area is allocated for access, circulation and other supporting site facilities. The project land-use arrangement reflects the development of a specialized healthcare facility within an established urban setting.

From a regional geological and soil perspective, Dhaka is situated at the southern part of the Pleistocene Madhupur Tract and is surrounded by areas containing recent Holocene alluvial deposits. The major soil formations of the region include Madhupur Clay, alluvial silt and clay, and locally occurring marshy clay and peat deposits. Madhupur Clay is generally characterized by reddish-brown to yellowish-brown silty clay, clay and fine sand particles, whereas recent alluvial deposits generally consist of varying proportions of grey clay, silty clay, silt and fine sand. The composition and engineering properties of these soil formations vary according to their geological origin, depositional environment, depth and degree of consolidation.

The soils associated with the Madhupur Tract generally exhibit a clayey texture and may contain iron- and aluminium-rich minerals. The topsoil of the Madhupur soil tract is generally acidic, although its characteristics may vary depending on local geological and environmental conditions. In contrast, the alluvial soils occurring in the surrounding floodplain areas may contain different proportions of sand, silt and clay. These regional soil characteristics are relevant to the assessment of foundation stability, groundwater conditions and subsurface drainage requirements for multi-storey developments.

Considering the nature and scale of Musa Specialized Hospital Ltd., appropriate attention will be given to soil-bearing capacity, foundation stability, subsurface conditions and potential settlement. The hospital's two basement levels and multi-storey structural arrangement require adequate geotechnical assessment and appropriate foundation design. Site-specific soil composition, soil pH, bearing capacity and subsurface stratification should be established through geotechnical investigation and laboratory testing.

4.5. Meteorology

Bangladesh is located at the central part within the Asiatic monsoon region where the climate is tropical. Relatively small size of the country and generally low-lying area cause moderate spatial variation of temperature, precipitation, relative humidity, wind speeds and other climatic variables.

There are two marked seasons: the rainy seasons from May to October, during which more than 85% of the total annual rainfall occurs and the dry season from November to April. The beginning of the rainy season vary from year to year, heavy rains may commence anywhere between mid-April and early June and may end anywhere between the end of September and mid-November. Usually winter season is dry with occasional rains. The early summer season is considered from March-April. During summer the air becomes hot with very low humidity. Early summer is also dominated by Baishaki cyclone and rains.

The climatic variables monitored at the Bangladesh Meteorological Organization, Dhaka station has been assumed to represent the climatic condition of the project area. Different meteorological data like temperature, rainfall, wind speeds and relative humidity monitored at the meteorological station in Dhaka are described in the following sub-sections and summarized in Figure-4.1.

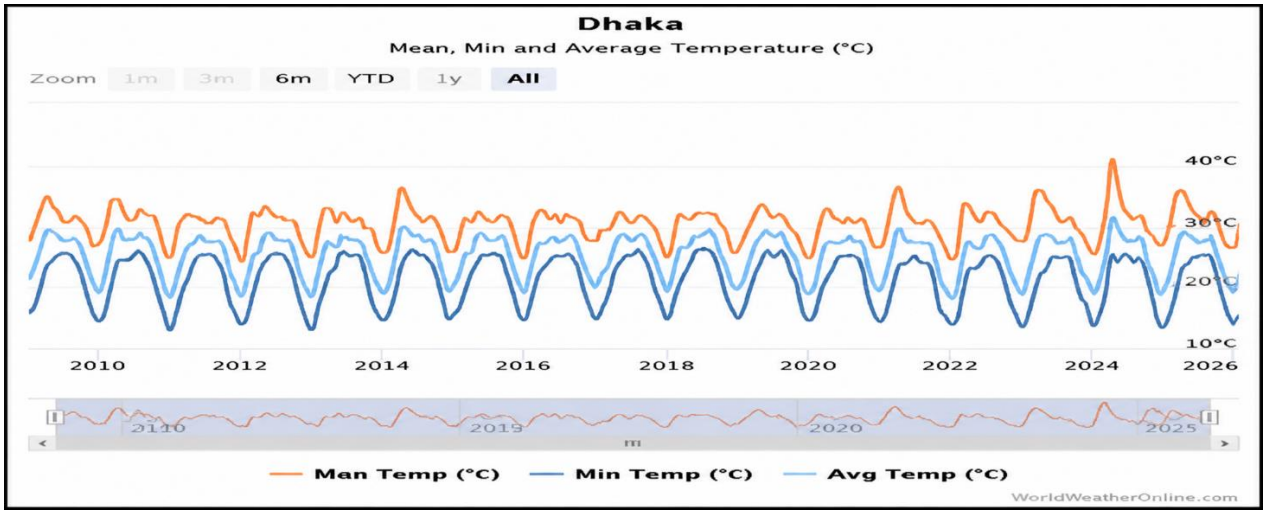


Figure: Yearly Maximum, Minimum and Average Temperature of Dhaka District from 2009-2026

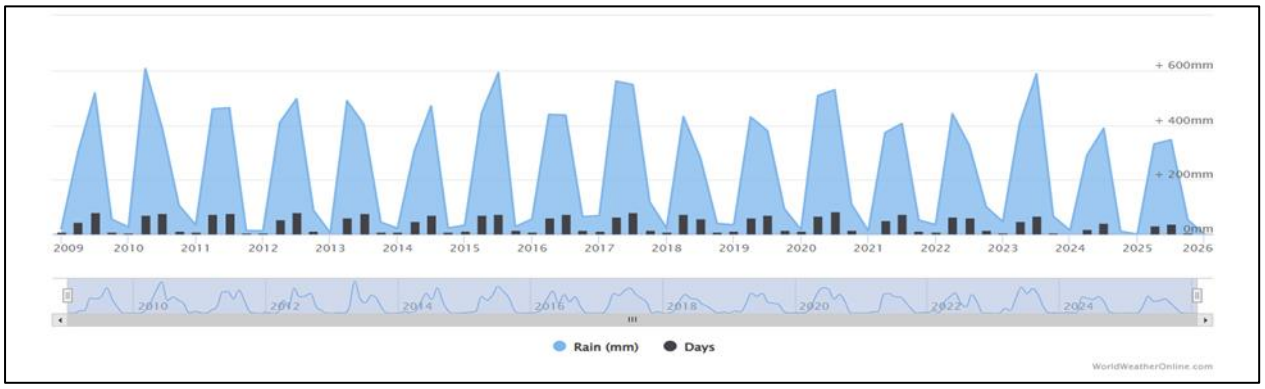


Figure: Yearly average rainfall and Rainy days of Dhaka District from 2009-2026

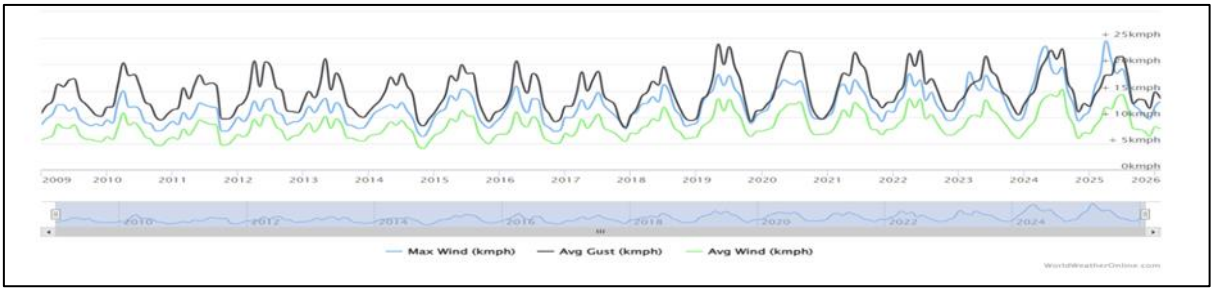


Figure: Yearly average and maximum wind speed and gust (mph) of Dhaka District from 2009-2024

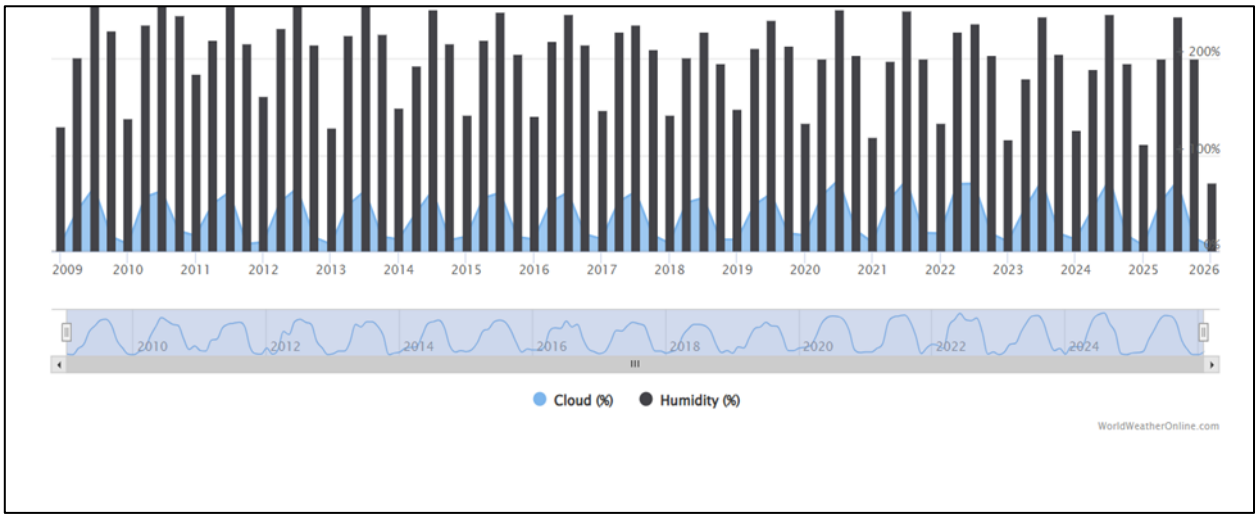


Figure: Average cloud and humidity of Dhaka District from 2009-2026

4.6. Water Quality

Water quality is an important component of the baseline physical environment because the proposed activities of Musa Specialized Hospital Ltd involve substantial water use for washing and associated industrial operations. To establish the existing water-quality condition of the project area, representative surface-water and groundwater samples were collected and analyzed by EABDL. The laboratory test report, No. BD/T(W)/26/017142, is dated 1st October 2026. The monitoring program comprised four surface-water samples, four groundwater samples, and upstream and downstream surface-water sample.

4.5.1 Surface Water Quality

Surface-water quality around Musa Specialized Hospital Ltd. was assessed to establish the baseline condition of the nearby water bodies and drainage system. The assessment covered eight sampling locations, including upstream and downstream locations of a nearby canal, two locations along an existing drain, and four locations at a nearby pond. The samples were analyzed for pH, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD_5), Lead (Pb) and Chemical Oxygen Demand (COD).

Methodology for Data Collection: Surface-water samples were collected by the monitoring team of Environmental Alliance BD Limited (EABDL) on 01 October 2026 from eight representative locations surrounding the project area. The sampling locations were selected to characterize the existing water quality of the nearby canal, drainage channel and pond. The upstream and downstream samples from the canal were included to assess the existing water quality at both locations, while the remaining samples represented the existing drain and nearby pond.

The geographical coordinates of each sampling location were recorded using GPS. The collected samples were subsequently analyzed during the period from 02 October 2026 to 17 October 2026. The laboratory assessment covered seven physicochemical parameters: pH, TDS, TSS, DO, BOD_5, Pb and COD. The reported analytical results were compared with the Department of Environment (DoE), Bangladesh, standards for inland surface water to evaluate the existing water quality conditions.

The sampling and laboratory assessment details are presented below:

- Project: Musa Specialized Hospital Ltd.
- Project Location: P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh.
- Sample Collector: Environmental Alliance BD Limited (EABDL Monitoring Team).
- Sampling Date: 01 October 2026.
- Date of Analysis: 02–17 October 2026.
- Reporting Date: 17 October 2026.
- Total Samples: 08 (SW-01 to SW-08).

The surface-water quality test results are presented in Table 4.2.

Table 4.2: Surface Water Test Report

Sl. No.	Parameters	Unit	SW-01 100 m Upstream Canal	SW-02 100 m Downstream Canal	SW-03 Existing Drain	SW-04 Existing Drain	SW-05 Pond	SW-06 Pond	SW-07 Pond	SW-08 Pond	DoE Standard
1	pH	–	8.8	8.8	9.1	9.2	7.7	7.8	7.9	7.6	6.0–9.0
2	TDS	mg/L	410	409	517	527	261	274	286	312	1,000
3	TSS	mg/L	73	72	84	87	50	53	59	55	25
4	DO	mg/L	4.1	4.3	5.3	5.1	3.8	3.7	3.4	3.1	≥5
5	BOD_5	mg/L	19	20	27	29	17	18	19	18	≤6
6	Pb	mg/L	0.003	0.003	0.010	0.010	0.004	0.003	0.004	0.010	0.1
7	COD	mg/L	91	90	104	102	61	64	73	58	50

Sampling Location and GPS Coordinates

Sample ID	Sampling Location	Latitude (N)	Longitude (E)
SW-01	Upstream water – nearby canal	23.816807	90.459963
SW-02	Downstream water – nearby canal	23.818050	90.461155
SW-03	Nearby existing drain	23.817790	90.455814
SW-04	Nearby existing drain	23.817544	90.455853
SW-05	Nearby pond	23.817660	90.455411
SW-06	Nearby pond	23.817682	90.455671
SW-07	Nearby pond	23.818019	90.456628
SW-08	Nearby pond	23.818054	90.456142

Source: Environmental Alliance BD Limited (EABDL), Laboratory Analysis Report of Surface Water Quality, Lab Codes 10_2026_0969 to 10_2026_0976, dated 17 October 2026.

Test Analysis

The laboratory results indicate variations in physicochemical characteristics among the eight surface-water samples collected from the nearby canal, existing drain and pond surrounding Musa Specialized Hospital Ltd.

The pH values ranged from 7.6 to 9.2. Most samples were within the DoE standard range of 6.0–9.0, except SW-03 (9.1) and SW-04 (9.2), which were slightly above the prescribed upper limit. TDS concentrations ranged from 261 to 527 mg/L, remaining below the DoE standard of 1,000 mg/L at all sampling locations.

The TSS concentrations ranged from 50 to 87 mg/L, exceeding the applicable standard of 25 mg/L at all eight locations. The highest TSS concentration of 87 mg/L was recorded at SW-04, while the lowest concentration of 50 mg/L was recorded at SW-05. These results indicate the presence of suspended particulate matter in the sampled surface water.

Dissolved Oxygen (DO) concentrations varied from 3.1 to 5.3 mg/L against the minimum standard requirement of 5 mg/L. The samples collected from the existing drain (SW-03 and SW-04) recorded DO concentrations of 5.3 and 5.1 mg/L, respectively, meeting the prescribed standard. However, both canal samples and all four pond samples recorded DO levels below the minimum requirement. The lowest DO concentration of 3.1 mg/L was recorded at SW-08.

Biochemical Oxygen Demand (BOD_5) concentrations ranged from 17 to 29 mg/L, exceeding the DoE standard of 6 mg/L at all sampling locations. The highest BOD_5 concentration of 29 mg/L was observed at SW-04, whereas the lowest value of 17 mg/L was recorded at SW-05. Similarly, COD concentrations ranged from 58 to 104 mg/L, exceeding the applicable standard of 50 mg/L across all eight sampling locations. The highest COD concentration of 104 mg/L was recorded at SW-03, while the lowest concentration of 58 mg/L was recorded at SW-08.

Lead (Pb) concentrations ranged from 0.003 to 0.010 mg/L, remaining below the DoE standard of 0.1 mg/L at all sampling locations. The highest reported concentration of 0.010 mg/L was recorded at SW-03, SW-04 and SW-08.

Overall, the laboratory results indicate that TDS and lead concentrations were within the applicable DoE standards at all sampling locations. However, elevated TSS, BOD_5 and COD concentrations were observed throughout the sampled water bodies, while DO concentrations

were below the prescribed minimum at six locations. Slightly elevated pH values were also recorded at the two existing drain locations.

These findings characterize the existing surface-water quality conditions around Musa Specialized Hospital Ltd. at the time of sampling. The elevated BOD_5, COD and TSS concentrations, together with reduced DO levels at several locations, indicate existing water-quality concerns in the nearby surface-water environment. These results represent baseline conditions and should not be attributed to the hospital's activities without further investigation. Appropriate wastewater treatment, controlled discharge, proper drainage management and periodic surface-water quality monitoring are therefore important to prevent additional deterioration of the surrounding water bodies.

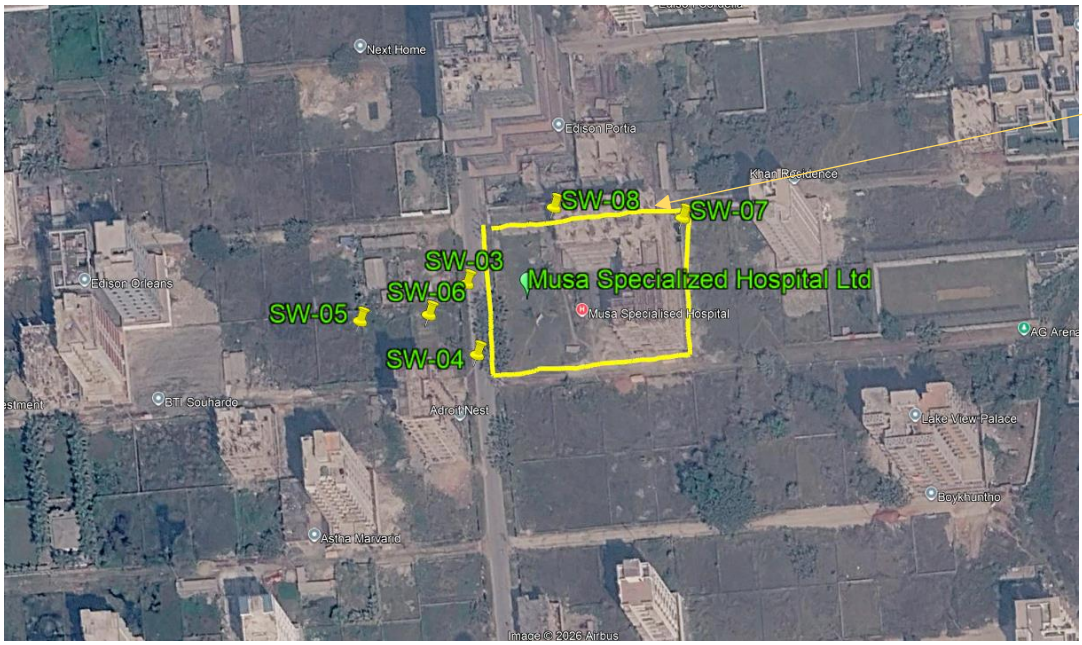


Figure: Surface Water Sampling Points

4.5.2 Groundwater Quality

Groundwater quality around Musa Specialized Hospital Ltd. was assessed to establish the baseline condition of the groundwater resources in and around the project area. A total of four groundwater samples were collected from representative locations, comprising one sample from the project's existing deep tube-well and three samples from nearby deep tube-wells

located outside the project boundary. The samples were analyzed for pH, Total Dissolved Solids (TDS), Iron, Alkalinity, Hardness, Chloride, Lead and Arsenic.

Methodology for Data Collection

Groundwater samples were collected by the monitoring team of Environmental Alliance BD Limited (EABDL) on 01 October 2026. One sample (GW-01) was collected from the deep tube-well within the project premises, while the remaining three samples (GW-02, GW-03 and GW-04) were collected from nearby deep tube-wells outside the project area to characterize the surrounding groundwater conditions.

The geographical coordinates of each sampling location were recorded using GPS. The collected groundwater samples were subsequently analyzed during the period from 02 October 2026 to 17 October 2026. The laboratory assessment covered eight physicochemical parameters: pH, TDS, Iron, Alkalinity, Hardness, Chloride, Lead and Arsenic. The analytical results were compared with the Bangladesh groundwater quality standards presented in the laboratory reports to evaluate the existing groundwater conditions.

The groundwater sampling and laboratory assessment details are presented below:

- Project: Musa Specialized Hospital Ltd.
- Project Location: P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh.
- Sample Collector: Environmental Alliance BD Limited (EABDL Monitoring Team).
- Sampling Date: 01 October 2026.
- Date of Analysis: 02–17 October 2026.
- Reporting Date: 17 October 2026.
- Total Samples: 04 (GW-01 to GW-04).

The groundwater quality test results are presented in Table 4.3.

Table 4.3: Groundwater Test Report

Sl. No.	Parameters	Unit	GW-01 Project Deep Tube-well	GW-02 Nearby Deep Tube-well	GW-03 Nearby Deep Tube-well	GW-04 Nearby Deep Tube-well	Bangladesh Standard
1	pH	–	7.4	7.6	7.5	7.5	6.5–8.5
2	TDS	mg/L	169	150	173	166	1,000
3	Iron	mg/L	0.38	0.39	0.54	0.53	0.3–1.0
4	Alkalinity	mg/L	142	144	137	141	–
5	Hardness	mg/L	34	31	37	38	200–500
6	Chloride	mg/L	25	27	29	31	250
7	Lead	mg/L	0.001	0.001	0.001	0.001	0.01
8	Arsenic	mg/L	0.002	0.003	0.002	0.002	0.05

Sampling Location and GPS Coordinates

Sample ID	Sampling Location	Latitude (N)	Longitude (E)
GW-01	Project deep tube-well	23.817924	90.456611
GW-02	Nearby deep tube-well (outside project)	23.818175	90.457009
GW-03	Nearby deep tube-well (outside project)	23.817266	90.455799
GW-04	Nearby deep tube-well (outside project)	23.817428	90.457655

Source: Environmental Alliance BD Limited (EABDL), Laboratory Analysis Report of Groundwater Quality, Lab Codes 10_2026_0965 to 10_2026_0968, dated 17 October 2026.

Report Analysis

The laboratory results indicate that the groundwater quality at the project site and surrounding sampling locations exhibits relatively consistent physicochemical characteristics.

The pH values ranged from 7.4 to 7.6, remaining within the Bangladesh standard range of 6.5–8.5 at all four sampling locations. This indicates that the sampled groundwater was within the prescribed pH range. Total Dissolved Solids (TDS) concentrations varied from 150 to 173 mg/L, considerably below the applicable standard of 1,000 mg/L. The highest TDS

concentration of 173 mg/L was recorded at GW-03, while the lowest concentration of 150 mg/L was recorded at GW-02.

Iron concentrations ranged from 0.38 to 0.54 mg/L, remaining within the reported Bangladesh standard range of 0.3–1.0 mg/L. The highest iron concentration of 0.54 mg/L was observed at GW-03, whereas the lowest concentration of 0.38 mg/L was recorded at GW-01. Alkalinity concentrations ranged from 137 to 144 mg/L, with the highest value recorded at GW-02. However, no corresponding standard value was provided in the laboratory report for this parameter; therefore, compliance could not be assessed against a specified benchmark.

The measured hardness concentrations ranged from 31 to 38 mg/L. These values were below the range of 200–500 mg/L presented as the Bangladesh standard in the laboratory report. Accordingly, hardness requires further verification against the applicable groundwater quality criterion, notwithstanding the laboratory report's general observation regarding groundwater quality.

Chloride concentrations ranged from 25 to 31 mg/L, remaining substantially below the applicable standard of 250 mg/L. The highest chloride concentration of 31 mg/L was recorded at GW-04, while the lowest concentration of 25 mg/L was observed at GW-01.

Lead concentrations were consistently recorded at 0.001 mg/L across all four sampling locations, which is below the Bangladesh standard of 0.01 mg/L. Similarly, arsenic concentrations ranged from 0.002 to 0.003 mg/L, remaining below the applicable standard of 0.05 mg/L at all sampling locations.

Overall, the laboratory results indicate that pH, TDS, Iron, Chloride, Lead and Arsenic concentrations were within their respective reported Bangladesh groundwater quality standards at all four sampling locations. However, the measured hardness values were below the range specified in the laboratory report and warrant verification. The groundwater quality assessment therefore provides a baseline characterization of the groundwater conditions within and around Musa Specialized Hospital Ltd.

The groundwater quality results also indicate that the tested Lead and Arsenic concentrations were comparatively low at all sampling points. Nevertheless, periodic groundwater quality monitoring is recommended to ensure that the existing groundwater conditions are maintained and to identify any potential changes associated with hospital operations. Particular attention

should be given to the proper management of healthcare waste, wastewater, chemical storage and drainage systems to prevent potential contamination of groundwater resources.



Figure: Groundwater Sampling Points

4.7. Air Quality

Ambient air quality monitoring was conducted at eight representative locations around Musa Specialized Hospital Ltd. to establish the baseline condition of the surrounding atmospheric environment. The monitoring covered the eastern, western, northern and southern boundaries, as well as the four corner locations of the project site. The assessment included particulate pollutants, namely Fine Particulate Matter ($PM_{2.5}$), Particulate Matter (PM_{10}) and Suspended Particulate Matter (SPM), together with gaseous pollutants, namely Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO).

The monitoring was undertaken by Environmental Alliance BD Limited (EABDL) on 01–02 October 2026 as part of the environmental baseline assessment. The measured concentrations were compared with the Bangladesh Department of Environment (DoE) standards for ambient air quality specified in the laboratory report.

Methodology for Data Collection

Ambient air quality monitoring was conducted by the monitoring team of Environmental Alliance BD Limited (EABDL) at eight representative locations along the boundary and corner areas of Musa Specialized Hospital Ltd. The sampling was carried out during 01–02 October 2026 under sunny weather conditions. The monitoring locations were selected to assess the existing ambient air quality around the project premises and characterize the baseline atmospheric conditions in the surrounding environment.

The monitoring covered six air-quality parameters: $PM_{2.5}$, PM_{10}, SPM, SO_2, NO_2 and CO. The concentrations of $PM_{2.5}$, PM_{10}, SPM, SO_2 and NO_2 were expressed in µg/m³, while CO concentration was expressed in parts per million (PPM).

The laboratory report specifies the following analytical methods:

- $PM_{2.5}$: Gravimetric method.
- PM_{10} and SPM: Gravimetric method.
- SO_2: West-Gaeke method.
- NO_2: Jacob and Hochheiser method.
- CO: Electrochemical sensor method.

The monitoring equipment included a respirable dust sampler (Model AAS-217 AL) for PM_{10} and SPM, a fine particulate air sampler (Model APM 250) for $PM_{2.5}$, and a gaseous sampling attachment (LES-Lata Envirotech) for gaseous pollutants. According to the laboratory report, the air-quality monitoring equipment was calibrated by an NABL-accredited laboratory.

The applicable Bangladesh ambient air quality standards presented in the laboratory report are 65 µg/m³ for $PM_{2.5}$, 150 µg/m³ for PM_{10}, 200 µg/m³ for SPM, 80 µg/m³ for SO_2, 80 µg/m³ for NO_2 and 5 PPM for CO. The reported averaging durations were 24 hours for $PM_{2.5}$, PM_{10}, SO_2 and NO_2, and 8 hours for SPM and CO.

The ambient air-quality monitoring details are presented below:

- Project: Musa Specialized Hospital Ltd.
- Project Location: P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh.
- Sample Collector: Environmental Alliance BD Limited (EABDL Monitoring Team).

- Weather Condition: Sunny Day.
- Sampling Date: 01–02 October 2026.
- Date of Analysis: 02–17 October 2026.
- Reporting Date: 17 October 2026.
- Total Monitoring Locations: 08 (AQ-01 to AQ-08).

The ambient air-quality monitoring results are presented in Table 4.4.

Table 4.4: Test Result of Ambient Air Quality Analysis

Sl. No.	Sample ID	Sampling Location	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	SPM (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)	CO (PPM)
1	AQ-01	East side of the project (last wall boundary area)	32	48	101	8.3	10.7	0.69
2	AQ-02	West side of the project (last wall boundary area)	34	51	109	7.9	10.4	0.57
3	AQ-03	North side of the project (last wall boundary area)	31	50	125	8.0	10.2	0.61
4	AQ-04	South side of the project (last wall boundary area)	42	57	135	8.7	11.2	0.72
5	AQ-05	South-east corner of the project	38	53	128	8.4	10.8	0.60

Sl. No.	Sample ID	Sampling Location	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	SPM (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)	CO (PPM)
6	AQ-06	South-west corner of the project	29	46	95	8.6	10.3	0.51
7	AQ-07	North-east corner of the project	27	50	98	8.7	9.9	0.55
8	AQ-08	North-west corner of the project	33	49	87	9.1	11.1	0.49
		Bangladesh (DoE) Standard	65	150	200	80	80	5
		Averaging Duration	24 hours	24 hours	8 hours	24 hours	24 hours	8 hours

Source: Environmental Alliance BD Limited (EABDL), Test Results of Ambient Air Quality Analysis, Lab Code 10_2026_0963, dated 17 October 2026.

Sampling Location and GPS Coordinates

Sample ID	Sampling Location	Latitude (N)	Longitude (E)
AQ-01	East side – last wall boundary area	23.817924	90.456611
AQ-02	West side – last wall boundary area	23.817780	90.455895
AQ-03	North side – last wall boundary area	23.818050	90.456286
AQ-04	South side – last wall boundary area	23.817509	90.456435
AQ-05	South-east corner	23.817566	90.456665
AQ-06	South-west corner	23.817522	90.455962
AQ-07	North-east corner	23.818067	90.456554
AQ-08	North-west corner	23.818020	90.455905

Source: Environmental Alliance BD Limited (EABDL), Ambient Air Quality Analysis Report, dated 17 October 2026.

Result Analysis

The ambient air-quality monitoring results indicate that the concentrations of all six monitored parameters remained below the respective Bangladesh DoE standards at all eight sampling locations surrounding Musa Specialized Hospital Ltd.

The $PM_{2.5}$ concentrations ranged from 27 to 42 µg/m³, compared with the applicable standard of 65 µg/m³. The highest concentration of 42 µg/m³ was recorded at AQ-04, located along the southern boundary of the project, while the lowest concentration of 27 µg/m³ was recorded at AQ-07, situated at the north-eastern corner. All recorded $PM_{2.5}$ concentrations were within the prescribed limit.

The PM_{10} concentrations varied from 46 to 57 µg/m³ against the standard of 150 µg/m³. The highest concentration of 57 µg/m³ was recorded at AQ-04, whereas the lowest concentration of 46 µg/m³ was observed at AQ-06. These results indicate that the monitored PM_{10} concentrations were substantially below the applicable standard at all sampling locations.

The SPM concentrations ranged from 87 to 135 µg/m³, compared with the applicable standard of 200 µg/m³. The maximum concentration of 135 µg/m³ was recorded at AQ-04, while the minimum concentration of 87 µg/m³ was recorded at AQ-08. All eight monitoring locations demonstrated SPM concentrations within the prescribed limit.

Sulphur Dioxide (SO_2) concentrations ranged from 7.9 to 9.1 µg/m³, remaining considerably below the applicable standard of 80 µg/m³. The highest concentration of 9.1 µg/m³ was recorded at AQ-08, whereas the lowest concentration of 7.9 µg/m³ was recorded at AQ-02.

Similarly, Nitrogen Dioxide (NO_2) concentrations ranged from 9.9 to 11.2 µg/m³ against the applicable standard of 80 µg/m³. The highest concentration of 11.2 µg/m³ was recorded at AQ-04, while the lowest concentration of 9.9 µg/m³ was observed at AQ-07. All recorded NO_2 concentrations were within the prescribed limit.

Carbon Monoxide (CO) concentrations ranged from 0.49 to 0.72 PPM, compared with the applicable standard of 5 PPM. The highest concentration of 0.72 PPM was recorded at AQ-04, while the lowest concentration of 0.49 PPM was recorded at AQ-08. The results indicate that CO concentrations at all monitoring locations were well below the applicable standard.

Overall, the ambient air-quality assessment indicates that $PM_{2.5}$, PM_{10}, SPM, SO_2, NO_2 and CO concentrations were within the respective Bangladesh DoE standards at all eight monitoring locations. Although comparatively higher particulate and gaseous pollutant concentrations were recorded along the southern boundary (AQ-04), none of the monitored parameters exceeded the applicable limits.

These results characterize the baseline ambient air-quality conditions around Musa Specialized Hospital Ltd. during the monitoring period. Nevertheless, proper management of generator emissions, vehicle movement, hospital ventilation and other potential emission sources is important to maintain the existing air-quality conditions. Periodic ambient air-quality monitoring is also recommended to identify any significant changes in pollutant concentrations during the operation of the hospital.



Figure: Ambient Air Quality Sampling points

4.8. Noise Quality

Ambient noise level monitoring was conducted at four representative locations along the boundary of Musa Specialized Hospital Ltd. to establish the baseline noise environment surrounding the project premises. The monitoring covered the eastern, western, northern and

southern boundary areas of the project. Noise measurements were recorded during both daytime and nighttime conditions to characterize the existing acoustic environment.

The assessment included Equivalent Continuous Sound Level (Leq), Maximum Sound Level (Lmax) and Minimum Sound Level (Lmin). The monitoring was undertaken by Environmental Alliance BD Limited (EABDL) on 01–02 October 2026 as part of the environmental baseline assessment. The measured noise levels were compared with the applicable Bangladesh standards under the Noise Pollution Control Rules, 2006, and the World Bank/IFC noise standards presented in the laboratory report.

Methodology for Data Collection

Ambient noise level monitoring was conducted by the monitoring team of Environmental Alliance BD Limited (EABDL) at four representative locations along the boundary of Musa Specialized Hospital Ltd. The sampling locations were selected to assess the existing noise environment around the project premises and characterize the baseline acoustic conditions.

The monitoring was carried out on 01–02 October 2026 under sunny daytime and clear nighttime weather conditions. Noise measurements were recorded during both daytime and nighttime periods at each of the four monitoring locations. The assessment covered three noise parameters:

- Equivalent Continuous Sound Level (Leq): Represents the average sound level over the monitoring period.
- Maximum Sound Level (Lmax): Represents the highest recorded sound level during the monitoring period.
- Minimum Sound Level (Lmin): Represents the lowest recorded sound level during the monitoring period.

The recorded noise levels were expressed in decibels (dB). The laboratory report classified all four monitoring locations under the Silent Area category. Accordingly, the results were assessed against the applicable daytime and nighttime noise standards for silent areas under the Bangladesh Noise Pollution Control Rules, 2006. The World Bank/IFC standards for residential, institutional and educational areas were also considered for comparison.

The ambient noise monitoring details are presented below:

- Project: Musa Specialized Hospital Ltd.
- Project Location: P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh.
- Sample Collector: Environmental Alliance BD Limited (EABDL Monitoring Team).
- Weather Condition: Sunny (Day) and Clear (Night).
- Sampling Date: 01–02 October 2026.
- Date of Analysis: 02–17 October 2026.
- Reporting Date: 17 October 2026.
- Total Monitoring Locations: 04 (NL-01 to NL-04).

The ambient noise level monitoring results are presented in Table 4.5.

Table 4.5: Test Result of Ambient Noise Level Assessment

Sl. No.	Sample ID	Monitoring Location	Daytime Leq (dB)	Daytime Lmax (dB)	Daytime Lmin (dB)	Nighttime Leq (dB)	Nighttime Lmax (dB)	Nighttime Lmin (dB)	Category
1	NL-01	East side – last wall boundary area	47.52	52.7	42.5	34.46	38.9	31.9	Silent
2	NL-02	West side – last wall boundary area	48.43	58.5	40.5	44.32	50.6	35.1	Silent
3	NL-03	North side – last wall boundary area	43.11	55.9	34.8	33.28	36.6	31.3	Silent

Sl. No.	Sample ID	Monitoring Location	Daytime Leq (dB)	Daytime Lmax (dB)	Daytime Lmin (dB)	Nighttime Leq (dB)	Nighttime Lmax (dB)	Nighttime Lmin (dB)	Category
4	NL-04	South side – last wall boundary area	50.32	59.2	42.1	35.01	38.3	32.3	Silent

Applicable Noise Standards

Area Category	Bangladesh Standard – Day (dB)	Bangladesh Standard – Night (dB)
Industrial Area	75	70
Commercial Area	70	60
Mixed Area	60	50
Residential Area	55	45
Silent Area	50	40
World Bank/IFC Area Category	**Day (dB)**	**Night (dB)**
Industrial Area	70	70
Residential, Institutional and Educational	55	45

Source: Environmental Alliance BD Limited (EABDL), Ambient Noise Level Assessment Report, Lab Code 10_2026_0964, dated 17 October 2026. Bangladesh standards are based on the Noise Pollution Control Rules, 2006.

Sampling Location and GPS Coordinates

Sample ID	Sampling Location	Latitude (N)	Longitude (E)
NL-01	East side – last wall boundary area	23.817924	90.456611
NL-02	West side – last wall boundary area	23.817780	90.455895
NL-03	North side – last wall boundary area	23.818050	90.456286
NL-04	South side – last wall boundary area	23.817509	90.456435

Source: Environmental Alliance BD Limited (EABDL), Ambient Noise Level Assessment Report, dated 17 October 2026.

Result Analysis

The ambient noise monitoring results indicate variations in noise levels among the four sampling locations surrounding Musa Specialized Hospital Ltd. during daytime and nighttime conditions. According to the laboratory report, all four monitoring locations were categorized as Silent Areas. Therefore, the applicable Bangladesh noise standards for silent areas, which are 50 dB during daytime and 40 dB during nighttime, have been considered for the baseline assessment.

The daytime Equivalent Continuous Sound Level (Leq) ranged from 43.11 to 50.32 dB. The highest daytime Leq of 50.32 dB was recorded at NL-04, located along the southern boundary of the project, while the lowest value of 43.11 dB was recorded at NL-03, along the northern boundary. The recorded daytime Leq values at NL-01, NL-02 and NL-03 remained within the Bangladesh silent-area standard of 50 dB. However, the value at NL-04 slightly exceeded the prescribed limit by 0.32 dB.

The nighttime Leq values ranged from 33.28 to 44.32 dB. The highest nighttime Leq of 44.32 dB was recorded at NL-02, located along the western boundary, whereas the lowest value of 33.28 dB was recorded at NL-03, along the northern boundary. Compared with the Bangladesh silent-area nighttime standard of 40 dB, the recorded noise levels at NL-01, NL-03 and NL-04 remained within the prescribed limit. However, the value at NL-02 exceeded the standard by 4.32 dB.

The maximum daytime noise levels (Lmax) ranged from 52.7 to 59.2 dB, with the highest value recorded at NL-04 and the lowest at NL-01. The minimum daytime noise levels (Lmin) varied from 34.8 to 42.5 dB. During nighttime, the Lmax values ranged from 36.6 to 50.6 dB, with the highest value recorded at NL-02 and the lowest at NL-03. The nighttime Lmin values ranged from 31.3 to 35.1 dB.

For further comparison, the World Bank/IFC noise standards for residential, institutional and educational areas specify limits of 55 dB during daytime and 45 dB during nighttime. The recorded daytime and nighttime Leq values at all four monitoring locations remained within these respective limits.

Overall, the ambient noise assessment indicates that the recorded noise environment around Musa Specialized Hospital Ltd. was generally within the World Bank/IFC standards for residential, institutional and educational areas. However, when assessed against the more stringent Bangladesh silent-area standards, a slight exceedance was observed at NL-04 during daytime, while NL-02 recorded a nighttime noise level exceeding the prescribed limit. These results indicate localized noise-level variations along the project boundary, particularly at the western and southern sides.

The measured noise levels represent the baseline acoustic conditions during the monitoring period and should not be attributed solely to hospital activities without further investigation. Potential noise sources in the surrounding environment, as well as operational sources within the hospital, may influence the recorded noise levels. Therefore, appropriate noise-control measures, including regular maintenance of generators and mechanical equipment, proper acoustic enclosure of noise-generating equipment, controlled vehicle movement and avoidance of unnecessary honking, should be implemented. Periodic noise monitoring at the project boundary is also recommended to ensure that the surrounding acoustic environment is maintained within the applicable standards.



Figure: Noise Sampling Points

4.9. Climate and Meteorological Condition of the Project Area

In Dhaka, the wet season is oppressive and overcast, the dry season is humid and mostly clear, and it is hot year-round. Over the year, the temperature typically varies from 57°F to 94°F and is rarely below 52°F or above 100°F.

Based on the beach/pool score, the best times of year to visit Dhaka for hot-weather activities are from late February to early April and from late October to mid-November.

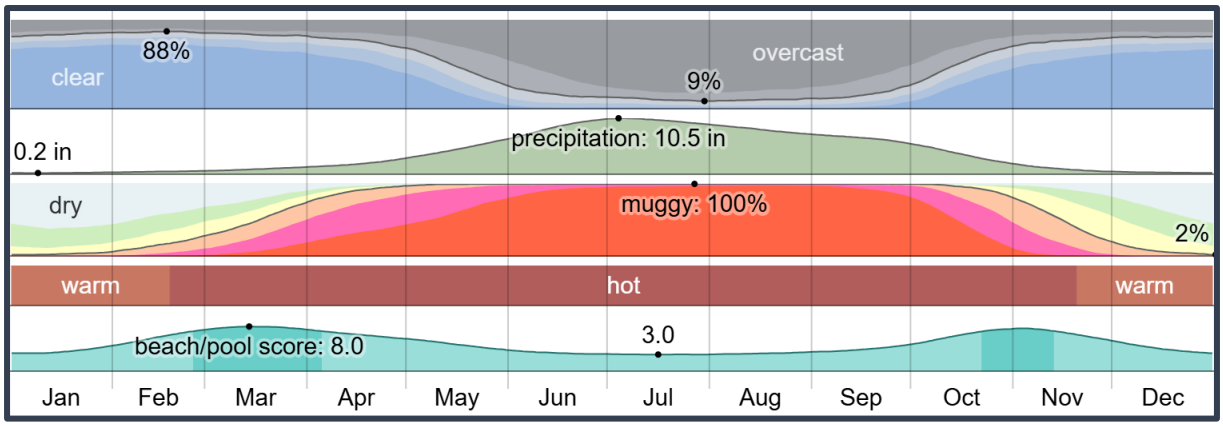


Figure 0-1.1: Climate graphs of Dhaka Division

The hot season lasts 3.0 months, from March 12 to June 12, with an average daily high temperature above 91°F. The hottest month of the year in Dhaka is May, with an average high of 93°F and a low of 79°F. The incredible season lasts 1.5 months, from December 12 to January 30, with an average daily high temperature below 81°F. The coldest month of the year in Dhaka is January, with an average low of 57°F and a high of 78°F.

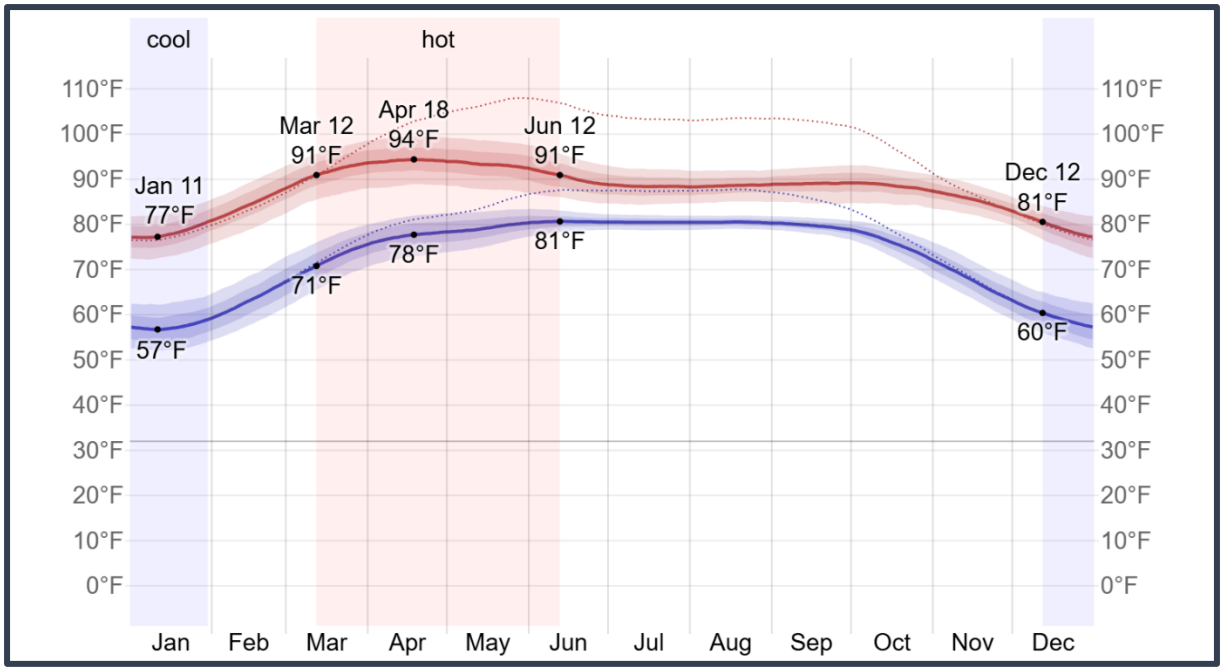


Figure 4.2: Average High and Low Temperature in Dhaka

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	78°F	84°F	92°F	94°F	93°F	90°F	88°F	89°F	89°F	88°F	85°F	80°F
Temp.	66°F	73°F	81°F	85°F	86°F	85°F	84°F	84°F	84°F	82°F	76°F	68°F
Low	57°F	63°F	72°F	77°F	79°F	81°F	80°F	80°F	80°F	76°F	67°F	60°F

The figure below shows you a compact characterization of the entire year of hourly average temperatures. The horizontal axis is the day of the year, the vertical axis is the hour of the day, and the color is the average temperature for that hour and day.

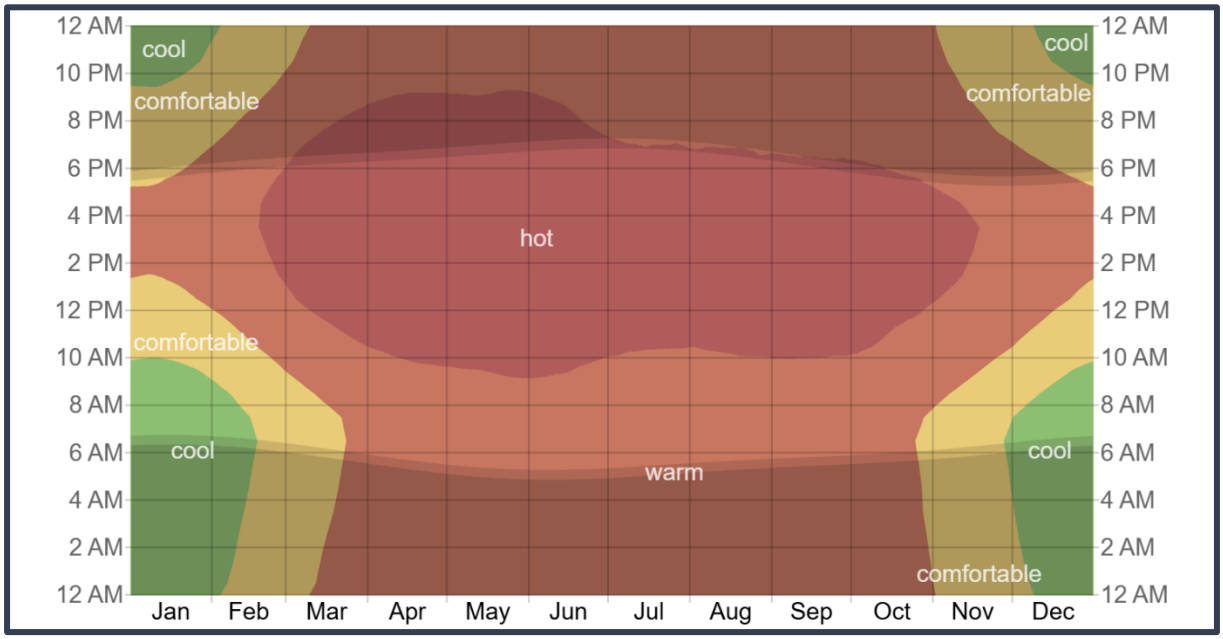


Figure 4.3: Average Hourly Temperature in Dhaka

In Dhaka, the average percentage of the sky covered by clouds experiences extreme seasonal variation over the year. The clearer part of the year in Dhaka begins around October 13 and lasts for 7.1 months, ending around May 16. The clearest month of the year in Dhaka is February, during which on average the sky is clear, mostly clear, or partly cloudy 87% of the time. The cloudier part of the year begins around May 16 and lasts for 4.9 months, ending around October 13. The cloudiest month of the year in Dhaka is August, during which on average the sky is overcast or mostly cloudy 90% of the time.

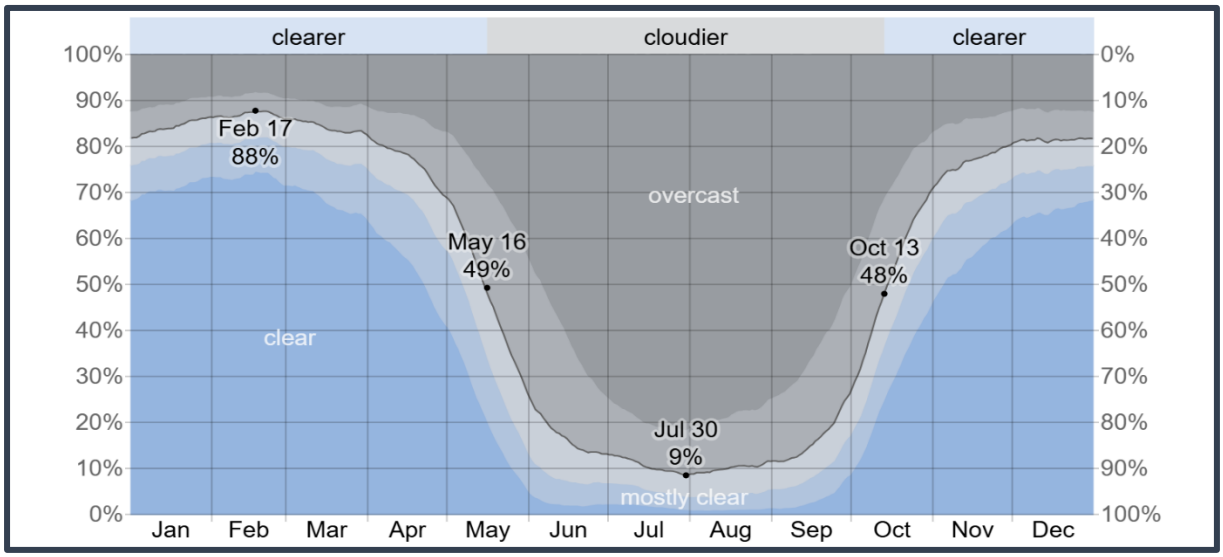


Figure 4.4: Cloud Cover Categories in Dhaka

A wet day is one with at least 0.04 inches of liquid or liquid-equivalent precipitation. The chance of wet days in Dhaka varies very significantly throughout the year. The wetter season lasts 5.1 months, from May 6 to October 10, with a greater than 38% chance of a given day being a wet day. The month with the most wet days in Dhaka is July, with an average of 22.5 days with at least 0.04 inches of precipitation. The drier season lasts 6.9 months, from October 10 to May 6. The month with the fewest wet days in Dhaka is December, with an average of 0.9 days with at least 0.04 inches of precipitation. Among wet days, we distinguish between those that experience rain alone, snow alone, or a mixture of the two. The month with the most days of rain alone in Dhaka is July, with an average of 22.5 days. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 74% on July 8. To illustrate the variation in rainfall throughout the year, we present data accumulated over a sliding 31-day period centered on each day of the year.

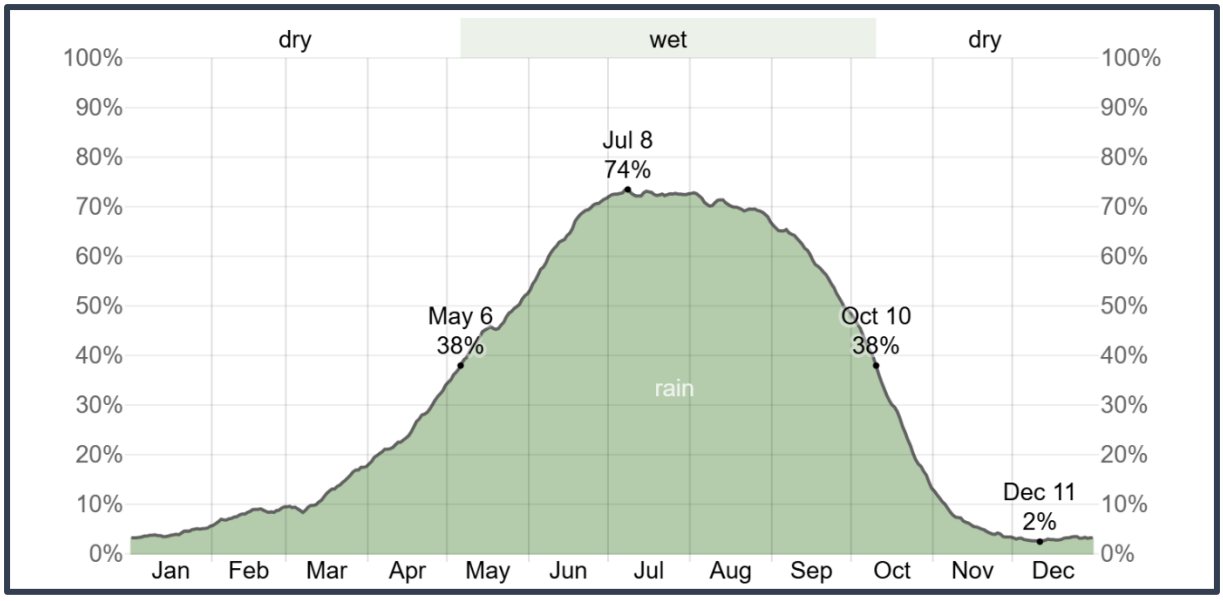


Figure 4.5: Daily Chance of Precipitation in Dhaka

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31-day period centered around each day of the year. Dhaka experiences extreme seasonal variation in monthly rainfall. The rainy period of the year lasts for 9.6 months, from February 14 to December 1, with a sliding 31-day rainfall of at least 0.5 inches. The month with the most rain in Dhaka is July, with an average rainfall of 10.2 inches. The rainless period of the year lasts for 2.4 months, from December 1 to February 14. The month with the least rain in Dhaka is January, with an average rainfall of 0.3 inches.

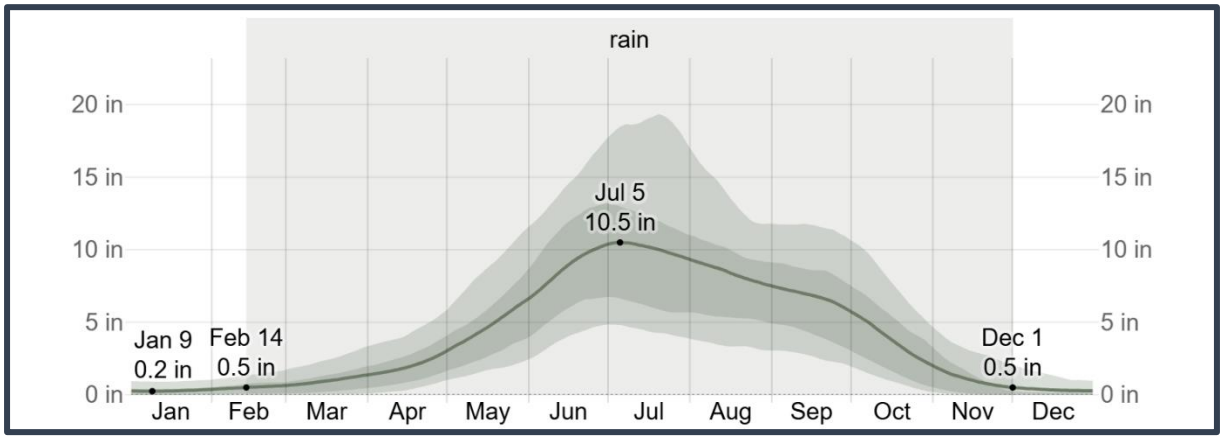


Figure 4.6: Average Monthly Rainfall in Dhaka

The length of the day in Dhaka varies over the course of the year. In 2025, the shortest day is December 21, with 10 hours, 44 minutes of daylight; the longest day is June 21, with 13 hours, 32 minutes of daylight.

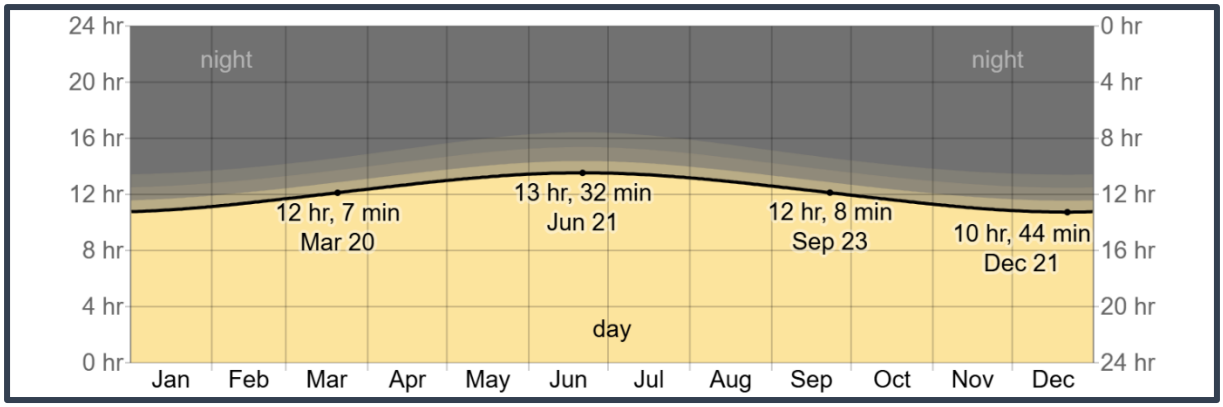


Figure 4.7: Hours of Daylight and Twilight in Dhaka

The earliest sunrise is at 5:15 AM on June 8, and the latest sunrise is 1 hour, 29 minutes later at 6:44 AM on January 14. The earliest sunset is at 5:15 PM on November 28, and the latest sunset is 1 hour, 35 minutes later at 6:51 PM on July 3. Daylight saving time (DST) is not observed in Dhaka during 2025.

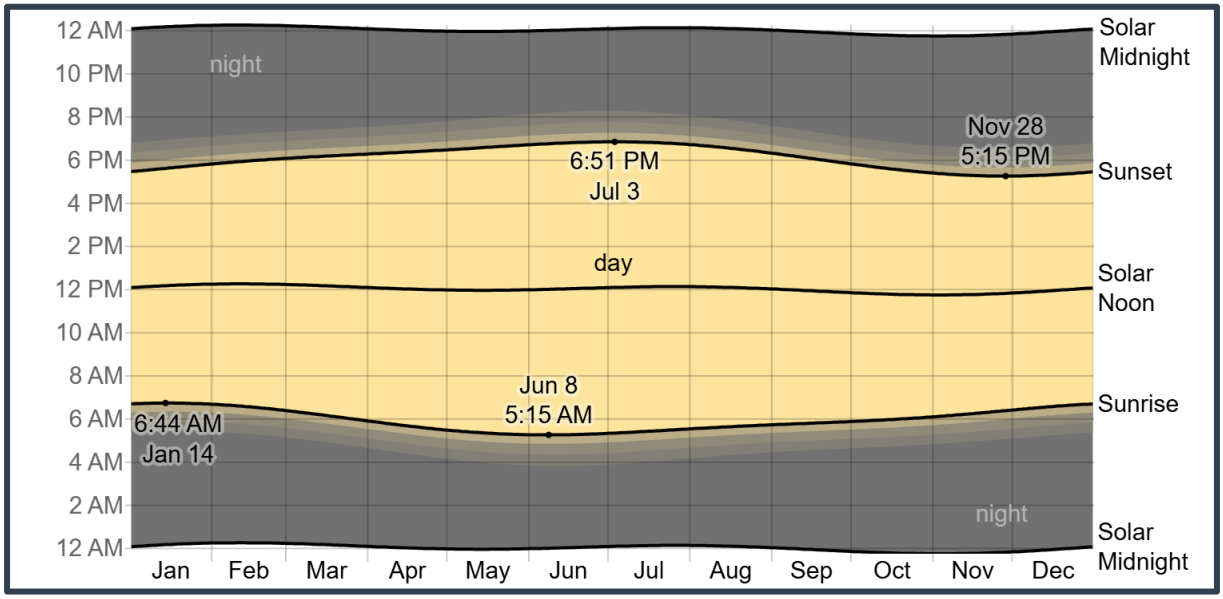


Figure 4.8: Sunrise and Sunset with Twilight in Dhaka

The figure below presents a compact representation of the sun's elevation (the angle of the sun above the horizon) and azimuth (its compass bearing) for every hour of every day in the reporting period. The horizontal axis is the day of the year and the vertical axis is the hour of the day. For a given day and hour of that day, the background color indicates the azimuth of the sun at that moment. The black isolines are contours of constant solar elevation.

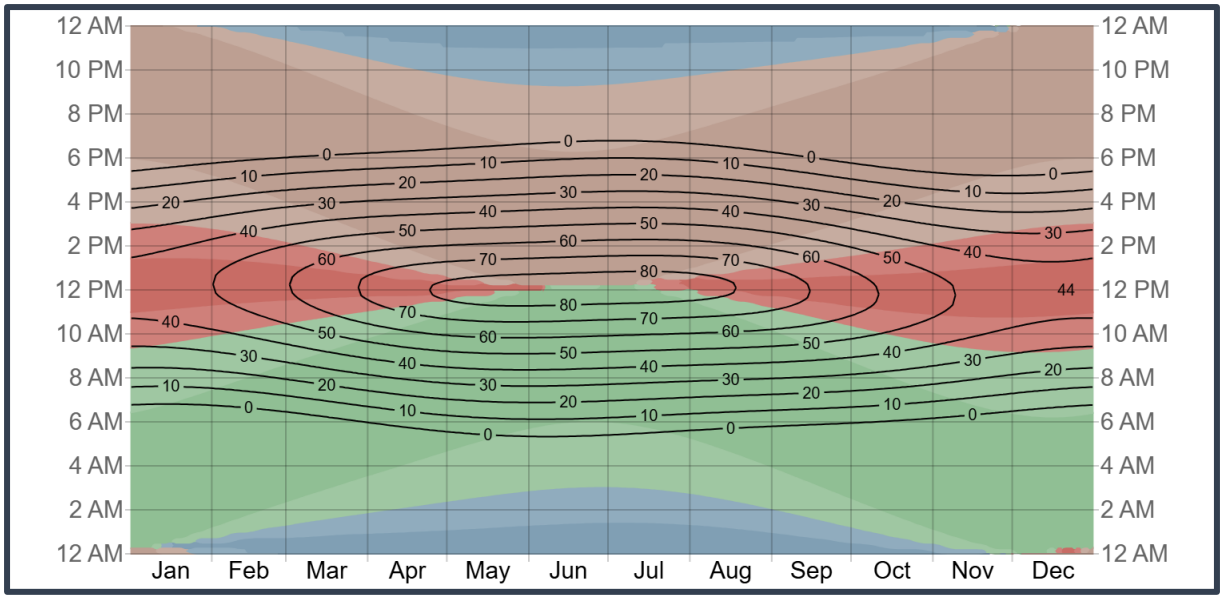


Figure 4.9: Solar Elevation and Azimuth in Dhaka

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night. Dhaka experiences extreme seasonal variation in the perceived humidity. The muggier period of the year lasts for 9.0 months, from February 27 to November 26, during which time the comfort level is muggy, oppressive, or miserable at least 26% of the time. The month with the fewest muggy days in Dhaka is January, with 0.9 days that are muggy or worse.

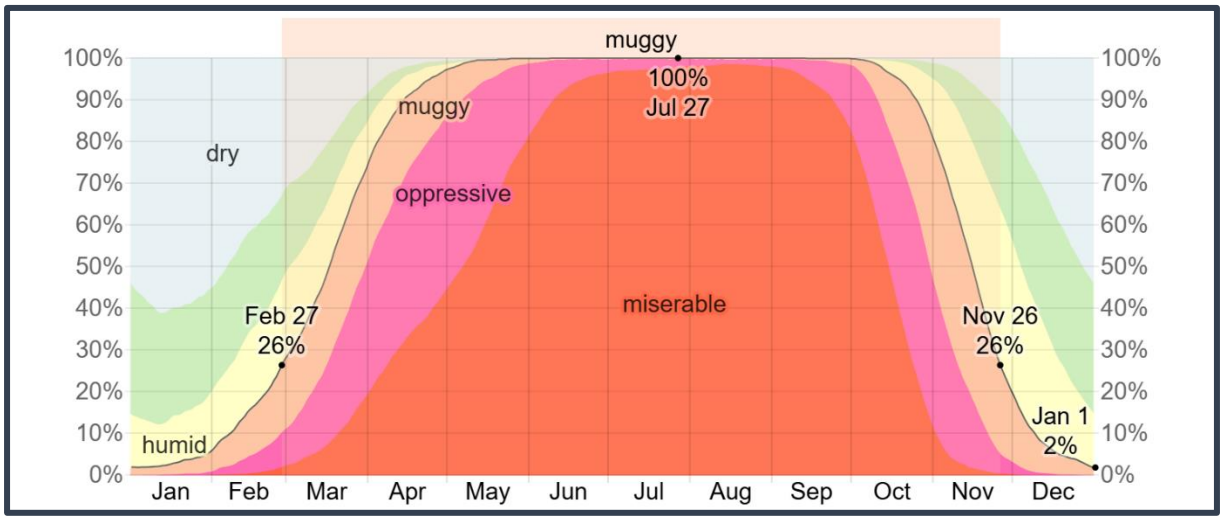


Figure 4.10: Humidity Comfort Levels in Dhaka

This section discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on

local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages. The average hourly wind speed in Dhaka experiences significant seasonal variation over the year. The windier part of the year lasts for 5.3 months, from March 25 to September 3, with average wind speeds of more than 6.9 miles per hour. The windiest month of the year in Dhaka is June, with an average hourly wind speed of 8.9 miles per hour. The calmer time of year lasts for 6.7 months, from September 3 to March 25. The calmest month of the year in Dhaka is October, with an average hourly wind speed of 4.7 miles per hour.

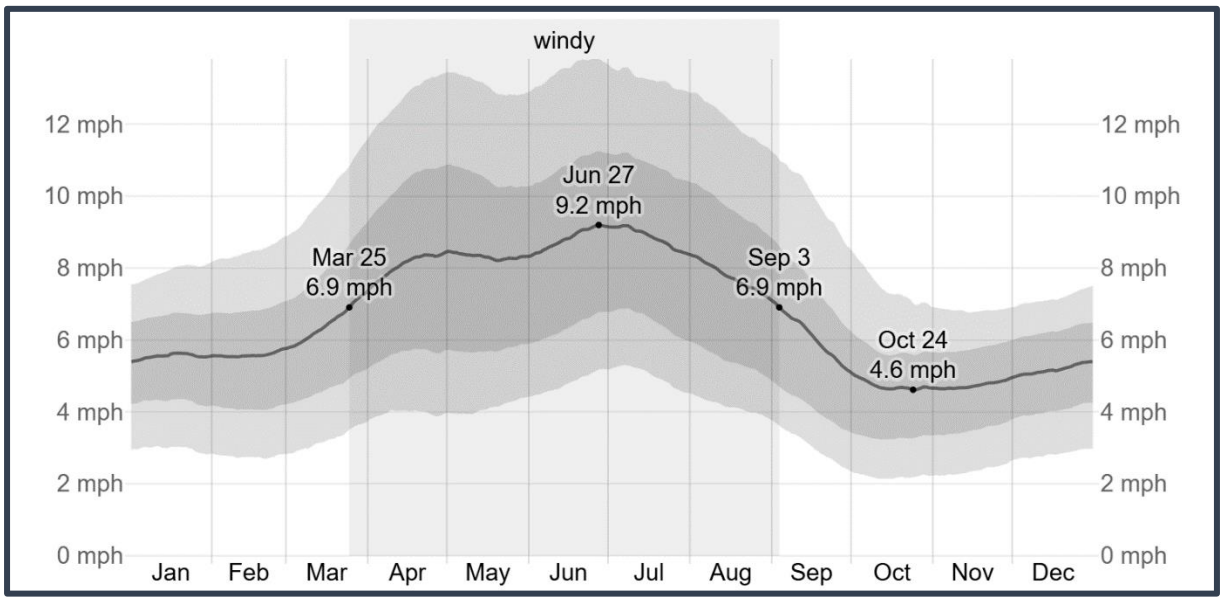


Figure 4.11: Average Wind Speed in Dhaka

The predominant average hourly wind direction in Dhaka varies throughout the year. The wind is most often from the west for 1.0 months, from February 19 to March 20, with a peak percentage of 48% on March 11. The wind is most often from the south for 6.7 months, from March 20 to October 11, with a peak percentage of 87% on May 25. The wind is most often from the north for 4.3 months, from October 11 to February 19, with a peak percentage of 75% on January 1.

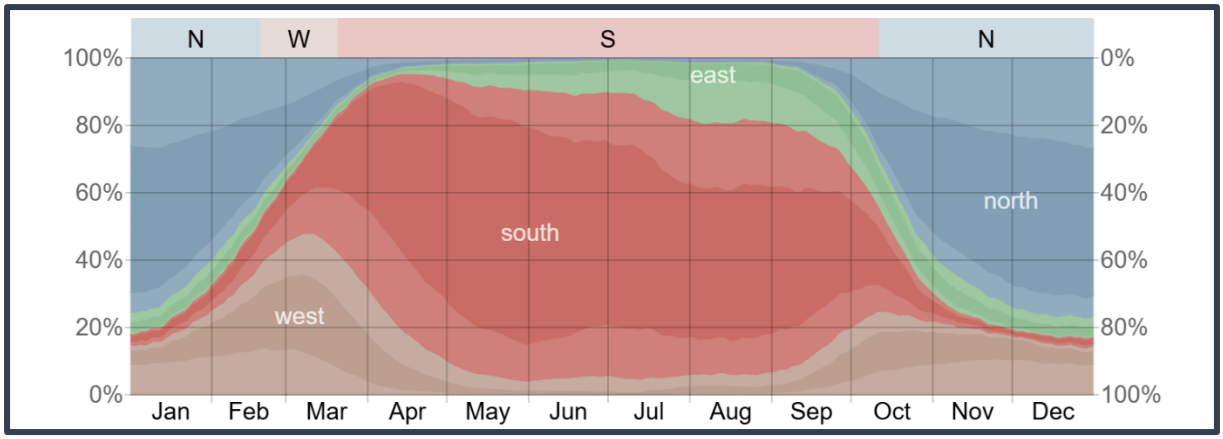


Figure 4.12: Wind Direction in Dhaka

Dhaka is located near a large body of water (e.g., ocean, sea, or large lake). This section reports on the wide-area average surface temperature of that water. The average water temperature experiences some seasonal variation over the course of the year. The time of year with warmer water lasts for 6.4 months, from April 22 to November 4, with an average temperature above 81°F. The month of the year in Dhaka with the warmest water is June, with an average temperature of 84°F. The time of year with cooler water lasts for 2.0 months, from December 20 to February 22, with an average temperature below 73°F. The month of the year in Dhaka with the coolest water is January, with an average temperature of 71°F.

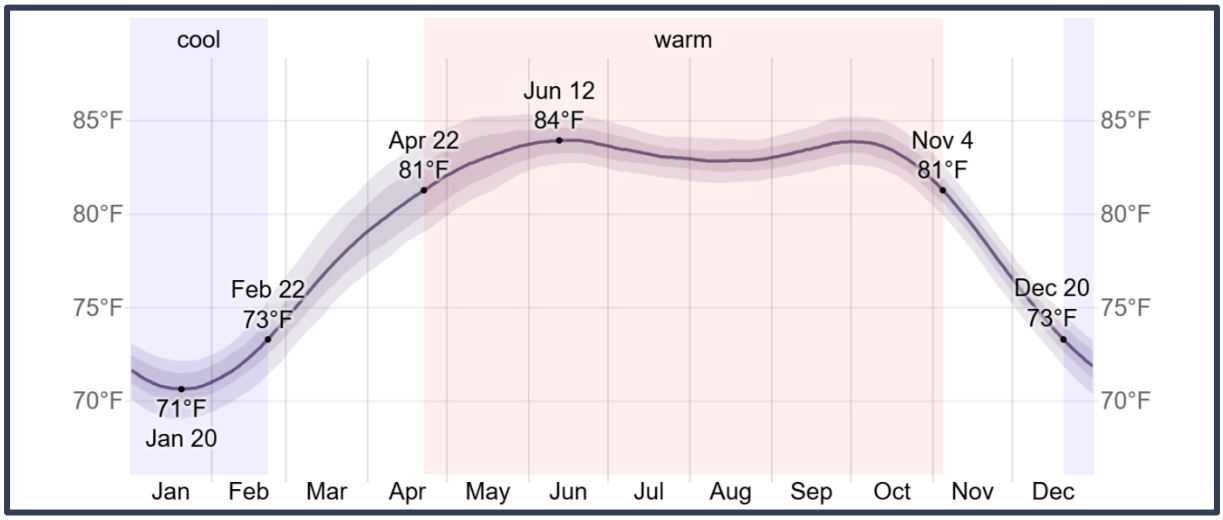


Figure 4.13: Average Water Temperature in Dhaka

For each hour between 8:00 AM and 9:00 PM of each day in the analysis period (1980 to 2016), independent scores are computed for perceived temperature, cloud cover, and total precipitation. Those scores are combined into a single hourly composite score, which is then aggregated into days, averaged over all the years in the analysis period, and smoothed. Our cloud cover score is 10 for fully clear skies, falling linearly to 9 for mostly clear skies, and to 1 for fully overcast skies. Our precipitation score, which is based on the three-hour precipitation centered on the hour in question, is 10 for no precipitation, falling linearly to 9 for trace

precipitation, and to 0 for 0.04 inches of precipitation or more. Our tourism temperature score is 0 for perceived temperatures below 50°F, rising linearly to 9 for 65°F, to 10 for 75°F, falling linearly to 9 for 80°F, and to 1 for 90°F or hotter. Our beach/pool temperature score is 0 for perceived temperatures below 65°F, rising linearly to 9 for 75°F, to 10 for 82°F, falling linearly to 9 for 90°F, and to 1 for 100°F or hotter.

Definitions of the growing season vary throughout the world, but for the purposes of this report, we define it as the longest continuous period of non-freezing temperatures (≥ 32°F) in the year (the calendar year in the Northern Hemisphere, or from July 1 until June 30 in the Southern Hemisphere). Temperatures in Dhaka are sufficiently warm year round that it is not entirely meaningful to discuss the growing season in these terms. We nevertheless include the chart below as an illustration of the distribution of temperatures experienced throughout the year.

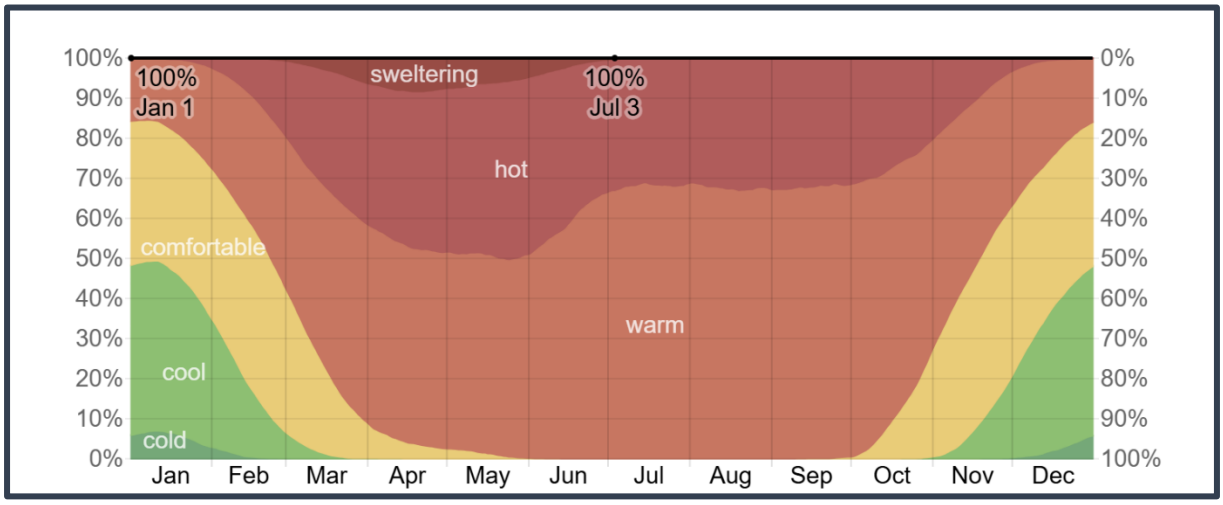


Figure 4.14: Time Spent in Various Temperature Bands and the Growing Season in Dhaka

Growing degree days are a measure of yearly heat accumulation used to predict plant and animal development, and defined as the integral of warmth above a base temperature, discarding any excess above a maximum temperature. In this report, we use a base of 50°F and a cap of 86°F.

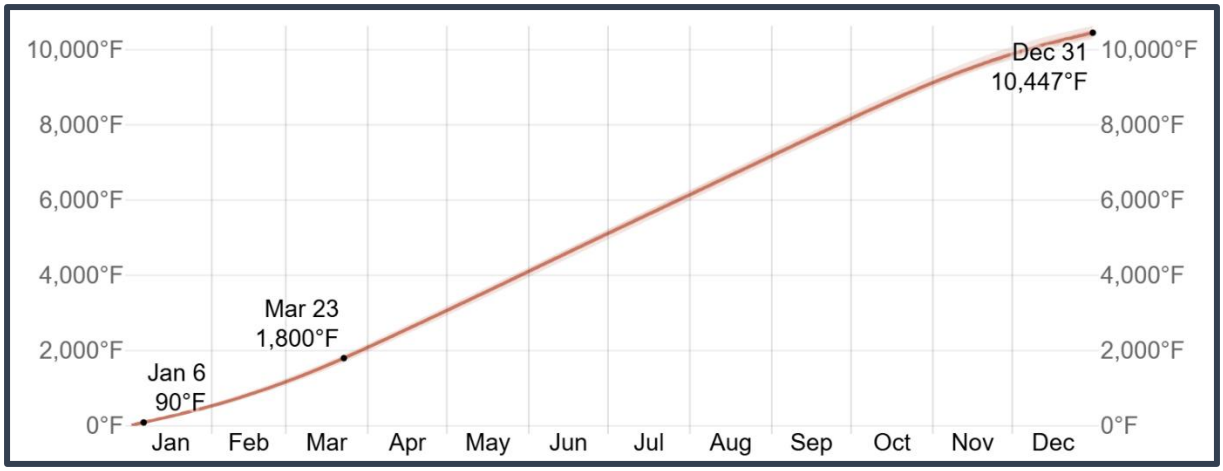


Figure 4.15: Growing Degree Days in Dhaka

The topography within 2 miles of Dhaka is essentially flat, with a maximum elevation change of 52 feet and an average elevation above sea level of 20 feet. Within 10 miles is essentially flat (108 feet). Within 50 miles also contains only modest variations in elevation (167 feet). The area within 2 miles of Dhaka is covered by grassland (34%), cropland (34%), water (21%), and artificial surfaces (11%), within 10 miles by grassland (44%) and cropland (42%), and within 50 miles by cropland (42%) and grassland (38%).

4.10. Archeological Heritage

There are no historical sites or structures of archaeological, paleontological, or architectural significance near the project or factory areas.

4.11. Life Pattern

The life pattern in the vicinity of the project site and factory area is generally positive, as the region is experiencing gradual development and increased job opportunities for the local population.

4.12. Settlement and Housing

Currently, there are limited settlements and housing in the project area. As the project progresses, the influx of workers from various sectors will necessitate additional housing, leading to the rapid development of settlements around the project site. This will also result in increased socio-economic activities due to the influx of capital and the economic contributions of the newly settled workforce. Consequently, the demand for infrastructure and services, such as water supply, garbage collection, sanitation, electricity, roads, and drainage, will rise. To meet these needs, the relevant local authorities, in collaboration with the project proponents,

will work to enhance and expand service facilities in the area. Therefore, the project does not require the evacuation of existing settlements or housing in the project vicinity.

4.13. Traffic and Transport

The project is strategically located adjacent to a well-maintained road network and is connected to the July 363 expressway Road. Existing traffic and transport facilities are adequate to support the project's operations. However, establishing this factory is expected to increase traffic and transport activities in the area, likely leading to a rise in socio-economic activities around the project site.

4.14. Terrestrial and Aquatic Flora and Fauna

Dhaka's climate and location favor the growth and development of various tree species. Despite being a bustling city, Dhaka district retains significant vegetation and diverse ecosystems, intersected by several rivers. The area boasts a rich array of flora and fauna, contributing to terrestrial and aquatic ecosystems. Key ecological features include the five major rivers (Buriganga River, the Turag River, and the Shitalakhya River), natural and social forestry initiatives, gardens, and institutions, all contributing to the ecological balance.

However, increasing industrialization and urban development pose significant threats to these ecosystems. Ecosystems provide essential goods and services crucial for human well-being and must be managed with care (Graham, 2004). In the past, many areas in Dhaka served as sanctuaries for avifauna, wildlife, and fisheries, contributing to rich faunal biodiversity and a well-functioning ecosystem. However, extensive land, including low-lying areas and wetlands, is being encroached upon for residential and industrial development. This trend is driven by Dhaka's attractive living conditions and excellent connectivity to the rest of the city (Hossain et al., 2008).

4.13.1 Flora

There are few patches natural forest near the project site as industrial and commercial establishments is dominating the area. These forestlands of this area are now well conserving; the composition of plant community is slow growing and herbaceous vegetation as well as other flora. Floral Species of the study area are given below in table 4.6.

Table 4.6: Some Floral Species in the study area

English Name	Scientific Name	Local Name	Use
Grass			
Grass	*Spontaneum*	Khar	Fuel/Covering
	Sccharum	Gash	Soil binder
	Cynodon Dactylon		
Trees			
Mango	*Mangefira Indica*	Alm	Fruit/Timber
Bate Plam	*Phoenix Sylvestris*	Khejur	Fruit/Timber
Black Berry	*SyzgiumCumini*	Jam	Fruit/Timber
Jack Fruit	*Heterophyllus*	Khatal	Fruit/Timber
Cocunut	*Cocos unifera*	Pape	Fruit/Timber
Guaba	*PasidiumSuajva*	Piara	Fruit/fuel
Banana	*Musa Sepaientum*	kala	Fruit/Timber
Wood Tree			
Timber/Fuel Wood	*ShoreaRubasta*	Shil koroi	Fuel/Timber
Mehagani	*SalmaliaMalabaricum*	Shik Cotton	

Source: Field Visit, 2026



Figure 4.7: Floral composition in the study area

4.13.2 Fauna

A study conducted on the faunal diversity of Dhaka District documented a wide range of species, including 35 species of birds, 20 species of migratory birds, 9 species of reptiles, 4 species of amphibians, 18 species of mammals, and 40 species of fish. The relative abundance of these species was assessed, revealing that the Common Myna (*Acridotheres tristis*) was the most abundant among the bird species, while the Black Baza (*Aviceda leuphotes*), Masked Finfoot (*Heliopais personata*), White-rumped Vulture (*Gyps bengalensis*), Pallas's Fish Eagle (*Haliaeetus leucoryphus*), and Indian Skimmer (*Rynchops albicollis*) were classified as rare. The relative abundance of migratory birds could not be determined due to their seasonal movement.

Among the reptiles, the Bengal Monitor (*Varanus bengalensis*) and Common Krait (*Bungarus caeruleus*) were observed to be common, whereas the Indian Flapshell Turtle (*Lissemys punctata*) and Yellow Monitor (*Varanus flavescens*) were recorded as endangered. For amphibians, the Indian Bullfrog (*Hoplobatrachus tigerinus*) was found to be abundant, while the Ganges Frog (*Euphlyctis cyanophlyctis*) was rare. In the mammalian category, the Indian Pipistrelle (*Pipistrellus coromandra*) and Small Indian Mongoose (*Herpestes auropunctatus*) were abundant, while the Fishing Cat (*Prionailurus viverrinus*), Smooth-coated Otter (*Lutrogale perspicillata*), and Ganges River Dolphin (*Platanista gangetica*) were noted as rare.

Regarding fish species, Rohu (*Labeo rohita*), Catla (*Catla catla*), and Hilsa (*Tenualosa ilisha*) were abundant. In contrast, species such as Gangetic Ailia (*Ailia coila*), Climbing Perch (*Anabas testudineus*), and Bagrid Catfish (*Bagridae spp.*) were rare. The study identified several major threats to the faunal diversity of the Dhaka District, including habitat destruction due to fish farming, salinity intrusion, deforestation, poaching, industrial pollution, and overfishing using harmful nets.

Terrestrial Fauna

A survey within a 1 km radius of the project site identified a total of 46 species of terrestrial animals, including 10 species of mammals, 31 species of birds, 2 species of reptiles, and 36 species of amphibians. Among these, the 2007 IUCN Red List classified two mammalian species and two bird species under the *Least Concern (LC)* category.

Mammals:

- **Fishing Cat** (*Felis viverrinus*)
- **Cat** (*Felis catus*)
- **Dog** (*Canis familiaris*)
- **Goat** (*Capra hircus*)
- **Sheep** (*Ovis aries*)
- **Cow** (*Bos taurus*)
- **Squirrel** (*Sciurus spp.*)
- **Rabbit** (*Leporidae cuniculas*)

Birds:

- **House Sparrow** (*Passer domesticus*)
- **House Crow** (*Corvus splendens*)
- **Indian Myna** (*Acridotheres tristis*)
- **Oriental Magpie Robin** (*Copsychus saularis*)
- **Rock Pigeon** (*Columba livia domestica*) – LC
- **Pariah Kite** (*Milvus migrans*) – LC
- **Black Drongo** (*Dicrurus macrocercus*)
- **Intermediate Egret** (*Mesophoyx intermedia*)
- **White-throated Kingfisher** (*Halcyon smyrnensis*)
- **Common Tailorbird** (*Orthotomus sutorius*)
- **Woodpecker** (*Picoides pubescens*)
- **Hoopoe** (*Upupa epops*)
- **Spotted Dove** (*Streptopelia chinensis*)
- **Pond Heron** (*Ardeola grayii*)
- **Green Bee-eater** (*Merops orientalis*)
- **Asian Openbill Stork** (*Anastomus oscitans*)
- **Red-whiskered Bulbul** (*Pycnonotus jocosus*)
- **Asian Koel** (*Eudynamys scolopacea*)
- **Goose** (*Anser spp.*)
- **Domestic Duck** (*Anatidae spp.*)
- **Owl** (*Strigiformes spp.*)

Reptiles:

- **Common Lizard** (*Lacertidae spp.*)
- **Bezi Snake** (*Unknown species*)

Amphibians:

- **Common Frog** (*Ranidae spp.*)

4.15. Socio-Economic Status

The area surrounding Bashundhara hosts diverse socio-economic activities, with residents engaged in trade, small-scale industries, transportation, and other commercial sectors. The population comprises individuals from various cultural and religious backgrounds, coexisting harmoniously. Establishing industries and infrastructure projects in the region is expected to stimulate economic activities, create business opportunities, and provide skilled and unskilled workers employment.

The primary sources of income in Bashundhara include business (55.23%), service (16.75%), non-agricultural labor (5.62%), transport and communication (4.18%), employment in government and private sectors (10.21%), remittances (3.79%), and other economic activities (4.22%) (Bangladesh Bureau of Statistics, 2022). Industrial projects in the area have contributed to economic growth, improving livelihoods and increasing access to essential services.

Employment opportunities generated by industrial and commercial establishments benefit local residents directly and indirectly. Local businesses, transportation services, and other support sectors experience growth as a result of industrial development. Additionally, improved infrastructure and economic activities reduce the need for long-distance commutes to major urban centers like Dhaka City for employment and essential services.

The region's socio-economic growth has been achieved while maintaining environmental integrity. The land in and around Bashundhara does not contain extensive wetlands, and no significant displacement of communities has occurred due to industrialization. Sustainable development efforts ensure that economic progress aligns with environmental conservation, contributing to the long-term well-being of the local population.

4.16. Rainfall

Information about rainfall data was collected from BBS, BMD, Bangladesh Agricultural Research Council's database and Annual rainfall averages 2004 mm in Dhaka. More than 70-85% of the total annual rainfall occurs in monsoon. The project area has been marked in the average rainfall map of Bangladesh in Figure 4.6. From the map it is evident that the mean rainfall varies from 2000 mm to 2500 mm.

Table 4.8: Monthly Average Rainfall in the project area (2009- 2019)

Year	Rainfall in mm											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	2.3	82	69	352	471	601	538	511	295	240	34	1.3
2018	4	1.6	35	85	147	271	123	100	101	60	19	20
2017	0.3	8	105	256	109	323	166	170	176	178	5	27
2016	2	12	36	190	113	225	183	130	141	92	59	0.67
2015	7	1	21	163	170	226	358	211	218	68	8	13
2014	0.4	9	23	88	267	336	251	354	211	39	2.47	0.1
2013	0.7	4	53	119	642	390	402	478	309	89	0	0.5
2012	5	8	35	318	160	403	382	491	468	205	37	2.7
2011	5	7	75	89	319	232	236	314	174	42	0.1	0.8
2010	0	1.8	5.6	105	229	230	145	353	303	151	8	11
2009	0	3.3	44	29	198	137	140	105	192	64	14	.04

Source: *BMD*

Table 4.9: Monthly Average Rainfall in the project area (1981 - 2010)

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Rainfall (mm)	8.0	22.0	64.0	141.0	288.0	347.0	388.0	303.0	340.0	180.0	31.0	13.0
Days of Rain (Per Month)	1	3	4	8	12	17	20	14	17	8	2	1
Days of Rain > 10mm (Per month)	0	1	2	4	8	9	9	8	7	4	1	0

Source: *ICWFM 2011 (International Conference on Water & Flood Management, 2011)*

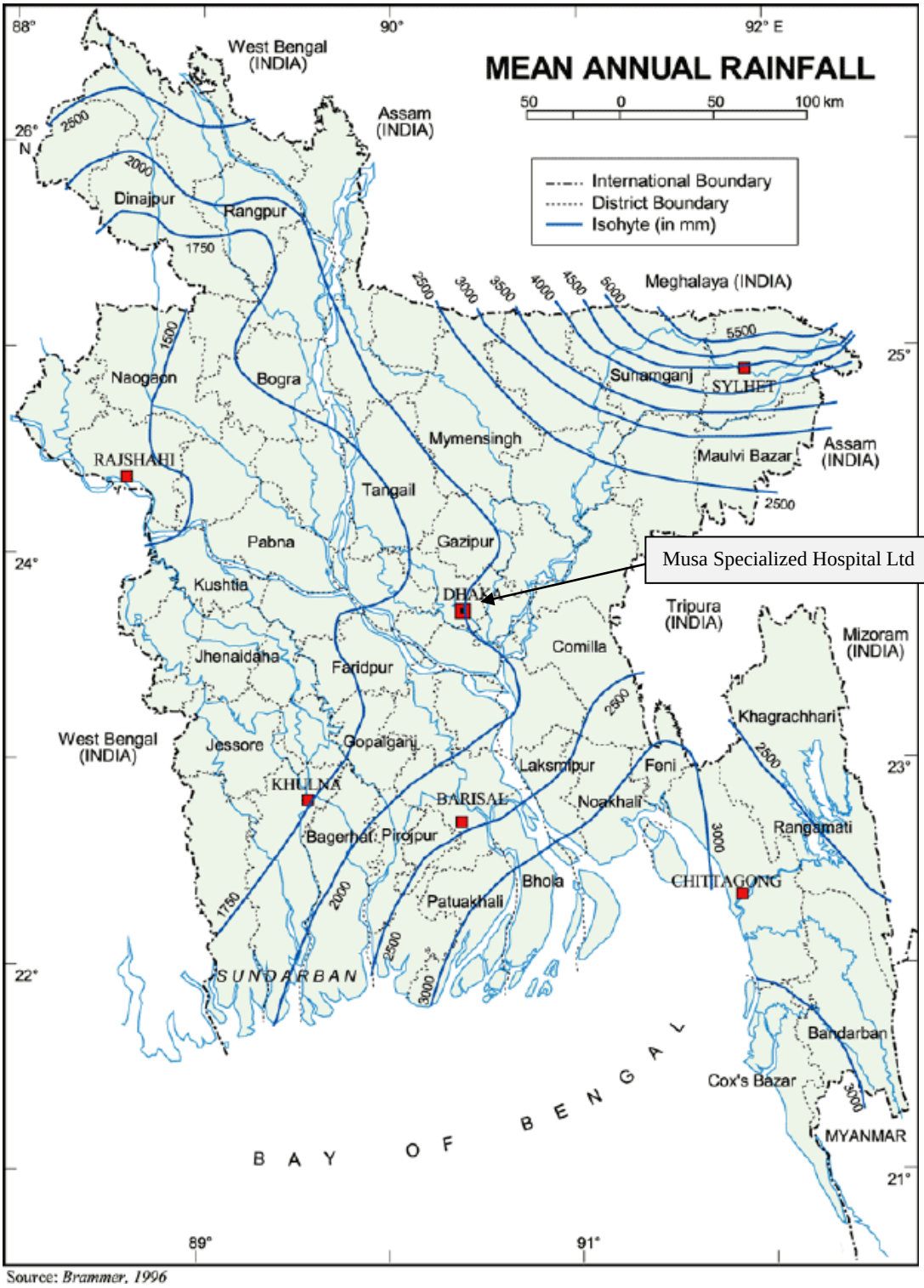


Figure 4.12: Average Rainfall Map of Bangladesh

Source: *The Prime Minister's Office eLibrary, (13 July, 2021)*

4.17. Seismicity

The Seismic Map of Bangladesh shows the epicenter location have been conformity with the presenting knowledge of faulting and other structural behaviors of the resign. Earthquake event in the shelf zone are random and follow the occurrence of the surface fault. Dhaka is too vulnerable of earthquake disaster due to some reasons. First of all, the population density is very high in Dhaka city. Secondly, it is predicted that the secondary hazard like fire break out from gas and electricity line will have more disastrous impact after earthquake.

Thirdly, not only building codes are not maintain during construction time of most of the high rise apartment buildings and most garment factory buildings but also they have been constructed without open spaces and most have encroached upon the streets and roadways. As a result, the collapse of these structures will block streets, further hindering rescue operations. But Musa Specialized Hospital Ltd has maintained all the rules and regulations for building/ Shed construction.

As per BNBC 2020, Musa Specialized Hospital Ltd falls under Zone 3 of seismicity map.

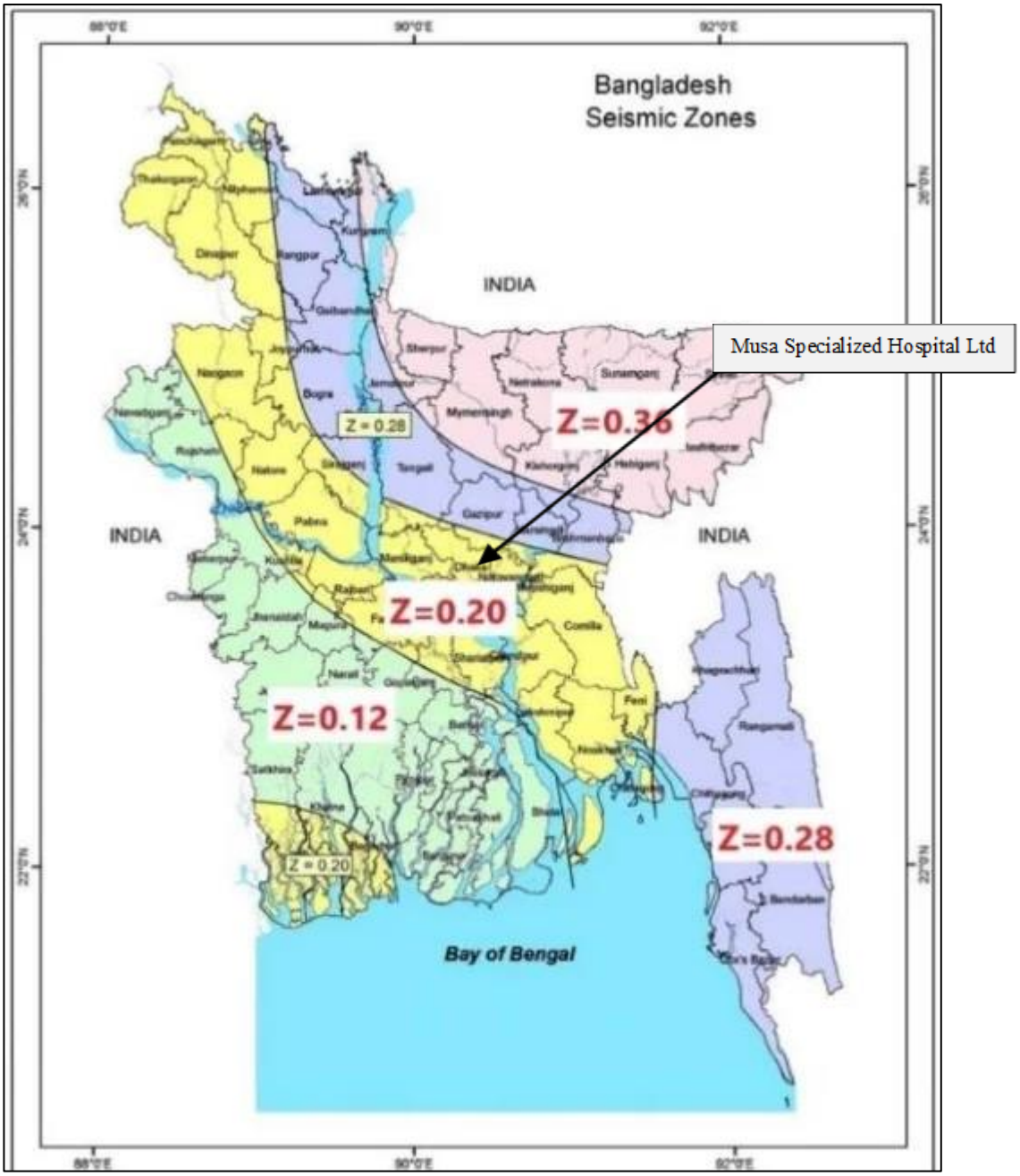


Figure: Seismic Zone map of Bangladesh

Chapter Five: Identification And Mitigation of Potential Impacts

5.1. General Consideration

In the case of most industrial or development projects, potential negative impacts are far more numerous than beneficial impacts. Several project activities during the operation of existing facilities of **Musa Specialized Hospital Ltd. or** construction at the project site have been identified in chapter three of this report. This chapter identifies potential positive and negative impacts that may be generated from those project activities, which is the first step of forming this EIA report. Though regional and national economic benefits associated with implementing any development project are considered to fall outside the scope of an EIA, they are also considered here. It is recognized that the long-term benefits will ultimately contribute to improving the quality of life in the project area.

5.2. Impacts Identification and Mitigation Measures

Identification of potential impacts due to the plant location and operation has been done using Checklist. Checklists are comprehensive lists of environmental effects and impact indicators designed to stimulate the analysis to think broadly about possible consequences of contemplated actions *(Munn, 1979)*. In order to prepare the checklist and further analyze the associated Environmental impacts due to the project, a multi-disciplinary team from the consultant's side visited the existing project site and closely identified activities of the project and significant environmental components that may be affected by the project. The project officials were interviewed during each visit to assess their understanding of the interrelation of the project activities and significant environmental impacts. The visitors in the project site were also interviewed randomly to assess their level of understanding about the general responsibilities to conserve the overall environment of this recreational spot. These were done mainly to identify the significant environmental components of the project and, at the same time, stimulate thinking about the environmental conservation of all the groups associated with the project. This process identifies the water quality of the project and its surroundings as the most significant environmental components. Overall project environment, erosion, sewage and stormwater management, solid waste management, sound and air quality management, maintenance practices, and overall environmental management systems are the major environmental issues identified from the consultant's side.

However, as the project is an existing project, the environmental management of the existing facilities' operation phases has been emphasized to develop the EIA. An outline of management issues in case of any future construction and development has also been included in the management plan so that Musa Specialized Hospital Ltd.'s authority can take proactive approaches to minimize environmental and socio-economic impacts to the lowest possible extent. Table -5.1 represents the checklists developed for Musa Specialized Hospital Ltd.. In this checklist, major activities that create the Significant Environmental Impacts (SEIs) are shown. The terms none, minor, moderate major, short-termed, and long-termed are used in checklists to classify the magnitude and duration of probable SEI.

5.2.1. Environmental Aspects Process Model

a. Identification of Environmental Aspects: Organizations identify and list the various activities, products, or services that interact with the environment. These are known as environmental aspects.

b. Evaluation of Environmental Impacts: Organizations assess the potential environmental impacts for each identified aspect. These impacts can affect air, water, soil, biodiversity, energy consumption, etc.

c. Significance Determination: The significance of each impact is determined based on criteria such as regulatory requirements, potential harm, frequency, and reversibility.

d. Legal and Other Requirements: Organizations identify applicable legal requirements and other obligations related to significant environmental aspects.

e. Objectives and Targets: Environmental objectives and targets are established to address the significant aspects and comply with legal requirements. These objectives are specific, measurable, achievable, relevant, and time-bound (SMART).

f. Operational Controls: Procedures and controls are implemented to ensure that operations are conducted in line with environmental objectives and legal requirements.

g. Monitoring and Measurement: Monitoring processes are established to track environmental performance and ensure compliance. This may involve regular inspections, sampling, and data analysis.

h. Review and Continuous Improvement: Periodic reviews are conducted to assess the effectiveness of the EMS. The findings are used to continually improve, update objectives, and enhance environmental performance.

Table 5.1 Checklist for identification of probable Environmental Impact of Musa Specialized Hospital Ltd. (Project Location).

Project Phase	Action Affecting Environmental Resources and Values		SEIs without Mitigation Measures				Impact Type				Duration	
			None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Hospital Location	a	Loss of and displacement from homestead land	√									
	b	Overland Drainage and Impact on Surface Water		√			√			√		√
	c	Change in Landscape		√			√			√		√
	d	Loss of and displacement from agricultural land and house	√									
	e	Disruption of Earth's Surface		√			√			√		√
	f	Inadequacy of Buffer Zone		√			√		√			√

Table 5.2 Checklist for identification of probable Environmental Impact of Musa Specialized Hospital Ltd. (Project Location).

Project Phase	Action Affecting Environmental Resources and Values		SEIs without Mitigation Measures				Impact Type				Duration	
			None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Construction	a	Air pollution		√			√			√	√	
	b	Noise Pollution and Vibration affect.		√			√			√	√	
	c	Spreading diseases		√			√			√		√
	d	Accidents		√			√			√		√

Table 5.3 Checklist for identification of probable Environmental Impact of Musa Specialized Hospital Ltd. (Operation of the Hospital).

Project Phase	Action Affecting Environmental Resources and Values		Effect on Environment and Economy	SEIs without Mitigation Measures				Impact Type				Duration	
				None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Hospital Operation	Operation of Musa Specialized Hospital Ltd.												
	a	Noise Pollution	Noise Generated from Electromechanical machinery and transports			√		√		√			√

Project Phase	Action Affecting Environmental Resources and Values		Effect on Environment and Economy	SEIs without Mitigation Measures				Impact Type				Duration	
				None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
	b	Water Pollution	Untreated liquid wastewater and sewage discharge can pollute the environment.				√	√			√		√
	c	Air pollution from the generators			√			√			√	√	
	d	Solid Wastes from daily activities as well as from routine maintenance work				√		√			√		√
	e	Accidental and Natural Hazard				√		√			√		√
	f	Employment- Recruitment of new staffs and operators					√		√				√

The checklist identifies the Impacts likely to occur in the different phases of the project. The following sections evaluate these impacts, mentioning their origin and characteristics, actual site condition implemented mitigation measures, and possible enhancement of mitigation/enhancing measures. At the end of each sub-section, the status of residual impact will also be mentioned.

5.3. Evaluation of Predicated Adverse Impacts and Mitigation

Unjustified and unplanned operations of any project can significantly impact the quality of life and the surrounding environment. Such operations may lead to increased air, noise, and water pollution, the generation of hazardous waste, and pollution from spillage or surface runoff. Additionally, they can disrupt local flora and fauna, resulting in the loss of trees due to increased access, and elevate land values, threatening agricultural activities. These environmental disturbances can have far-reaching consequences, affecting the natural ecosystem and the health and well-being of human populations.

5.4. Impact due to Operation of the Existing Project

Several environmental issues have been identified for evaluation during the operational phase of the Musa Specialized Hospital Ltd. project. These issues, which necessitate careful monitoring and management, include:

- **Topographical Impacts**: Moderate
- **Water Consumption and Wastewater Discharge**: Significant
- **Solid Waste Generation**: Significant
- **Noise Pollution**: Moderate
- **Natural and Accidental Hazard Risks**: Uncertain

Addressing these environmental considerations is crucial to maintaining compliance with regulatory standards and ensuring the long-term sustainability of the project

5.5. Impacts on Topography

5.5.1. Disruption of Earth Surface

5.5.1.1. Impact Origin

As mentioned earlier, a part of the landfilling and cutting would be required to develop the site to provide protection against floods and create an underground basement. This landfilling and cutting will not disrupt the earth's natural surface and obstruct the area's natural drainage system.

5.5.1.2. Mitigation Measure

According to the plan, Musa Specialized Hospital Ltd. will not create any water logging and drainage problems as the authority collects the soil to develop the area by carrying sand to and

from different places. Cross-drainage works should be constructed to bypass the surface water and other discharges.

5.5.1.3. Residual Impact

If the mitigation measures above are implemented, the residual impact will be very insignificant.

5.5.2. Change in Landscape

5.5.2.1. Impact Origin

A landscape is a subjective concept that cannot be precisely quantified. However, in general, any project that is not designed considering the local landscape creates visual intrusion to the people. The project may change the local landscape to some extent.

5.5.2.2. Mitigation Measure

Any part of the project should be designed to consider key landscape criteria like coherence, readability, hierarchy, and stability. It is understood that the project will have a modern architectural view, which does not provide any significant visual intrusion. A straightforward way the altered green area can be turned into its original visual quality is to plant trees around the project area.

5.5.2.3. Residual Impact

Provided the mitigation measures above are fully implemented, the residual impact will be very insignificant.

5.6. Impact on Climate

5.6.1. Impact Origin

The potential climate impact associated with the operations of Musa Specialized Hospital Ltd. can be attributed to several key sources:

- **Greenhouse Gas Emissions:** The hospital's operations generate greenhouse gas emissions, contributing to the overall carbon footprint.
- **Combustion of Fossil Fuels:** The use of natural gas and other fossil fuels for heating, electricity, and backup power supply systems contributes to carbon dioxide and other greenhouse gas emissions.
- **Energy Consumption:** Hospital operations, including medical equipment, lighting, HVAC systems, and IT infrastructure, require high energy consumption, which results

in substantial greenhouse gas emissions if the energy is sourced from non-renewable resources.

- **Intensive Water Use:** Water consumption for hospital activities, including sanitation, cleaning, and cooling systems, can indirectly impact climate change if water management is inefficient, leading to energy-intensive water supply and treatment processes.
- **Solid Waste Generation:** The generation of medical and general waste, if not appropriately managed, can lead to methane emissions from waste decomposition in landfills.
- **Transportation:** The transportation of medical supplies, staff, patients, and waste, which uses fuel-powered vehicles, contributes to carbon emissions.
- **Use of Chemicals:** Chemicals utilized in cleaning, disinfection, and medical treatments can have indirect environmental impacts, potentially contributing to climate change if not handled and disposed of properly

5.6.2. Mitigation Measure

- Transition to Renewable Energy Sources: Hospitals can utilize solar panels (in the future) or other renewable energy technologies to power operations, reducing their reliance on fossil fuels.
- Promote Sustainable Resource Use: Support responsible sourcing practices for all materials, including medical supplies, and engage in local afforestation projects to offset carbon emissions.
- Water Management and Conservation: Implement water recycling and rainwater harvesting systems (in the future) to reduce water usage and minimize the energy footprint associated with water supply and wastewater treatment.
- Invest in Energy Efficiency: Upgrade to energy-efficient equipment and appliances, conduct regular energy audits, and promote conservation practices among staff to reduce overall energy consumption.
- Waste Management Strategies: Develop comprehensive waste reduction, recycling, and disposal plans, focusing on minimizing medical and general waste and exploring options for the circular economy. Also, dispose of solid waste through the Prism Medical Waste Management Program.
- Optimize Transportation and Logistics: Use fuel-efficient and low-emission vehicles for hospital operations and consider regional sourcing to minimize transportation distances and associated emissions.
- Environmentally Friendly Chemical Use: Substitute harmful chemicals with eco-friendly alternatives, implement best practices in chemical handling, and adopt closed-loop systems to prevent chemical runoff and contamination.

5.6.3. Residual Impacts

- Minimal Residual Impacts: Implementing these measures will significantly reduce the hospital's carbon footprint, contributing to lower greenhouse gas emissions.
- Reduced Impact on Biodiversity and Ecosystems: Responsible sourcing and afforestation efforts will help protect local biodiversity and maintain healthy ecosystems.
- Reduced Water Stress and Pollution: Water recycling and conservation measures will decrease the hospital's water usage, lowering stress on local water resources and minimizing pollution.
- Lower Energy Consumption: Investing in energy-efficient technologies will decrease overall energy demand, reducing greenhouse gas emissions.
- Minimized Landfill Contribution: Effective waste management will reduce the amount of waste sent to landfills, promoting resource conservation.
- Reduced Carbon Footprint in the Supply Chain: Optimizing logistics and adopting eco-friendly transport modes will lower the hospital's supply chain emissions.
- Minimized Chemical-Related Environmental Harm: Using eco-friendly chemicals and closed-loop systems will reduce the environmental impact of hazardous substances.

5.7. Impact on Water Use & Wastewater Discharge on Environment

5.7.1. Impact Origin

Musa Specialized Hospital Ltd. will utilize approximately 2 m^3 of water daily. This water is distributed among various hospital operations, including utility services and other hospital-related purposes. The total volume of liquid wastewater generated by the hospital is around 60.12 m^3 per day, with the biochemical oxygen demand (BOD) and chemical oxygen demand (COD) levels expected to be relatively low. To manage this, Wastewater Treatment Plant (WWTP) with capacity of 5.0 m^3 per hour have been constructed to treat all the wastewater produced by hospitals and medical colleges.

Untreated hospital wastewater can have several adverse effects on agricultural land, including:

- Soil Contamination: The presence of hazardous chemicals, heavy metals, and pharmaceutical residues in untreated wastewater can contaminate the soil, making it toxic for plant growth and leading to the accumulation of harmful substances in the food chain.
- Water Pollution: When untreated wastewater enters agricultural water sources, it can pollute irrigation water, spreading contaminants across fields and negatively affecting crop health and yield.

- Nutrient Imbalance: Hospital wastewater often contains high levels of nitrogen and phosphorus, leading to nutrient imbalances in the soil. This may cause excessive algal growth in nearby water bodies, leading to eutrophication and oxygen depletion.
- Pathogen Spread: Untreated wastewater may carry pathogens, including bacteria, viruses, and parasites, which can contaminate crops and soil and pose health risks to humans and animals consuming these crops.
- Soil Salinity: Certain chemicals in untreated wastewater can increase soil salinity, adversely affecting plant health, reducing soil fertility, and leading to poor crop yields.
- Plant Toxicity: Exposure to certain chemicals and pharmaceuticals present in hospital wastewater can cause direct toxicity to plants, leading to stunted growth, poor development, or even plant death.
- Reduction in Soil Microbial Activity: Toxic substances in untreated wastewater can harm beneficial soil microorganisms, reducing soil fertility and its ability to support healthy plant growth.
- Impact on Groundwater Quality: Percolation of untreated wastewater into the soil can contaminate groundwater reserves, affecting agricultural activities and drinking water sources.

5.7.2. Mitigating Measure

Water quality issues are significant for hospitals and industries due to the generation of liquid and solid wastes, especially in hospitals dealing with patients and various pathogens. At Musa Specialized Hospital Ltd., wastewater will be treated using a Wastewater Treatment Plant (WWTP). Cooling water will be used in a closed-loop system, and treated water will be utilized for gardening, with any excess being safely discharged. Makeup water will be added to the system as needed.

The project includes a planned drainage system to manage surface runoff. The surface drainage network will be connected to an interceptor before discharge into natural water bodies. This interceptor will capture any oily substances present in the water. While liquid waste disposal poses a significant challenge, particularly in industrial contexts like paper production, the current measures ensure that wastewater from the hospital, estimated at around 83 m^3 per day, is effectively managed to minimize environmental impact.

5.7.3. Residual Impact

It is clear from the above study that hospital wastewater needs proper treatment before discharging into the environment, and accordingly, the project proponent has adopted necessary treatment options suitable to their needs, meeting the national standards and at the same time, which is cost-effective, easy to maintain, and operation. Adaptation of measures set out above may not provide total mitigation. So, in this case, to maintain national standards, Musa Specialized Hospital Ltd. will discharge some residual pollutants, which can affect the environment in the long run. So, this situation can be overcome by determining the exact level of treatment and proper monitoring, which is required to maintain the normal water quality of the receiving body.

5.8. Impact Due to Solid Waste Generation

5.8.1. Impact Origin

At Musa Specialized Hospital Ltd., solid waste generation arises from a variety of operational activities, which can be categorized as follows:

- **Medical Waste:** This includes infectious and biohazardous materials such as used bandages, gloves, syringes, disposable medical supplies, and pathological waste from surgeries or autopsies. If not handled and disposed of properly, these materials pose significant health risks.
- **Non-Medical Waste:** Comprising food waste from hospital kitchens, cafeterias, and patient areas, as well as general office waste such as paper, cardboard, packaging materials, and other non-hazardous items.
- **Sludge from WWTP:** WWTP process hospital wastewater, producing sludge that contains organic and inorganic substances and requires appropriate disposal methods to prevent environmental contamination.
- **Hazardous Waste:** Includes pharmaceutical waste, laboratory chemicals, and expired or unused medications. These substances must be managed carefully to prevent environmental pollution and potential health hazards.
- **Sharps Waste:** Encompasses needles, scalpels, and other sharp instruments. These pose risks of injury and contamination and thus require specialized handling and disposal protocols.
- **E-waste and Equipment:** This includes outdated or broken electronic devices and medical equipment, such as computers, monitors, and diagnostic machines. To prevent

environmental harm, these items must be disposed of in compliance with e-waste regulations.

- **Miscellaneous Waste:** Waste from maintenance activities, such as used air filters and cleaning rags, as well as minor amounts of domestic waste generated by staff and visitors

5.8.2. Mitigation Measures

Sludge To effectively manage the solid waste generated at Musa Specialized Hospital Ltd. and minimize its environmental impact, the following mitigation measures will be implemented:

- **Segregation of Waste:** Implement a comprehensive waste segregation system to separate medical, hazardous, and non-hazardous waste at the point of generation. Clearly labeled bins and color-coded bags will be provided to ensure proper disposal practices are followed.
- **Safe Disposal of Medical Waste:** Establish protocols for safely handling, storing, and disposing medical and biohazardous waste. This includes using autoclaves for sterilization and incineration or partnering with licensed medical waste disposal services to prevent contamination and infection risks.
- **WWTP Sludge Management:** Treat sludge generated from the WWTP to reduce its volume and toxicity. Utilize dewatering techniques and, if feasible, explore options for sludge recycling or safe landfilling by environmental regulations.
- **Hazardous Waste Management:** Establish secure storage areas for hazardous waste, such as pharmaceuticals and chemicals, and work with certified hazardous waste disposal contractors to ensure safe and compliant disposal.
- **Sharps Waste Protocols:** Use sharps containers to dispose of needles, scalpels, and other sharp objects. These containers will be puncture-resistant, clearly marked, and safely disposed of through specialized medical waste services.
- **E-Waste Recycling:** Partner with certified e-waste recycling facilities to responsibly dispose of outdated or broken electronic equipment and medical devices, ensuring compliance with e-waste regulations and minimizing environmental impact.
- **Training and Awareness:** Regularly training hospital staff on waste management practices, emphasizing the importance of proper waste segregation, handling, and disposal procedures to maintain a safe and sustainable environment.
- **Monitoring and Auditing:** Establish a waste management monitoring and auditing system to track waste generation, handling, and disposal processes. Regular audits will

ensure compliance with regulatory standards and identify opportunities for improvement.

- **Community Awareness Programs:** Engage with the surrounding community to raise awareness about hospital waste management practices and maintaining environmental health and safety standards.

5.8.3. Residual Impact

If the mitigation measure above is implemented, the residual impact will be very insignificant.

5.9. Impact on Air Quality

5.9.1. Impact Origin

The operation of Musa Specialized Hospital Ltd. may influence air quality through various sources and activities associated with hospital operations. The primary origins of air quality impact include:

- **Combustion Processes:** Backup generators and boilers powered by fossil fuels can release combustion by-products, such as nitrogen oxides (NOx), sulfur oxides (SOx), carbon monoxide (CO), particulate matter (PM), and volatile organic compounds (VOCs), into the atmosphere, contributing to air pollution.
- **Medical Waste Incineration:** If on-site medical waste incineration is practiced, it can release pollutants such as dioxins, furans, heavy metals, and particulate matter, which harm human health and the environment.
- **HVAC Systems:** Heating, ventilation, and air conditioning (HVAC) systems may contribute to the release of chlorofluorocarbons (CFCs) and other refrigerants, especially if equipment is not maintained properly. This could potentially deplete the ozone layer and contribute to greenhouse gas emissions.
- **Use of Anesthetic Gases:** The release of anesthetic gases, such as nitrous oxide and halogenated anesthetics, can contribute to greenhouse gas emissions and have a localized impact on air quality within and around the hospital.
- **Chemical Usage:** Disinfectants, cleaning agents, and sterilization chemicals can release VOCs into the air, potentially affecting indoor air quality and posing respiratory risks to hospital staff and patients.
- **Vehicle Emissions:** The operation of hospital transport vehicles, ambulances, and patient and staff vehicles contribute to air emissions, including CO_2, NO_x, PM, and VOCs, which can impact the air quality in and around the hospital premises.

- **Construction Activities:** During any construction or renovation activities, dust generation and emissions from construction equipment and machinery can contribute

5.9.2. Mitigation Measure

To address and mitigate the impact on air quality from Musa Specialized Hospital Ltd., the following measures will be implemented:

- **Adoption of Clean Energy Sources:** Transition to cleaner energy sources, such as natural gas or renewable energy (e.g., solar, wind), for backup generators to reduce NOx, SOx, CO, and PM emissions.
- **Improved Waste Management Practices:** If medical waste must be incinerated, use advanced and properly maintained incineration technologies designed to minimize the emission of harmful pollutants. Alternatively, explore options for waste segregation and off-site treatment to reduce on-site emissions.
- **HVAC System Maintenance:** Regularly maintain and service HVAC systems to ensure efficient operation and minimize the release of refrigerants. Consider upgrading to environmentally friendly refrigerants with low ozone depletion potential (ODP) and global warming potential (GWP).
- **Control of Anesthetic Gas Emissions:** Implement proper ventilation and capture systems in operating rooms to control the release of anesthetic gases. Use low-emission anesthetic agents when possible and ensure all equipment is calibrated correctly and maintained.
- **Use of Low-VOC Products:** Choose cleaning agents, disinfectants, and other chemicals with low volatile organic compound (VOC) content to minimize indoor air pollution. Ensure proper storage and handling of chemicals to prevent accidental releases.
- **Fleet Management:** Optimize the use of hospital transport vehicles by implementing regular maintenance schedules and adopting fuel-efficient or electric vehicles to reduce emissions. Implement carpooling and shuttle services to decrease the number of individual vehicles used by staff and patients.
- **Dust Control Measures:** During construction or renovation activities, employ dust control measures such as water spraying and dust suppressants to minimize particulate matter emissions. Ensure that construction equipment is properly maintained to reduce exhaust emissions.

5.9.3. Residual Impact

After the implementation of the proposed mitigation measures, the residual impacts on air quality at Musa Specialized Hospital Ltd. are expected to be:

- **Reduced Emission Levels:** The adoption of clean energy sources and advanced waste management practices will significantly lower emissions of nitrogen oxides (NOx), sulfur oxides (SOx), carbon monoxide (CO), particulate matter (PM), and volatile organic compounds (VOCs). This will lead to improved air quality both inside the hospital and in the surrounding community.
- **Minimized Air Pollutants:** Regular maintenance of HVAC systems, the use of low-VOC products, and proper handling of anesthetic gases will reduce indoor air pollutants, contributing to a healthier indoor environment for patients and staff.
- **Lower Environmental Impact:** Efficient fleet management and dust control measures will decrease emissions from hospital transport and construction activities, thereby reducing the hospital's overall environmental footprint.

5.10. Impacts on Acoustic Environment

5.10.1. Impacts and Origin

The operation of Musa Specialized Hospital Ltd. may impact the acoustic environment through the following sources:

- **Hospital Equipment:** Medical and diagnostic equipment such as MRI machines, ultrasound devices, and ventilation systems can generate continuous noise, which may affect nearby residents and hospital staff.
- **HVAC Systems:** Heating, ventilation, and air conditioning (HVAC) systems, including air handling units and chillers, contribute to ambient noise levels within and around the hospital premises.
- **Construction Activities:** During the construction phase, noise from machinery, excavation, and building activities can temporarily disrupt the surrounding area. This includes noise from construction equipment, drilling, and transportation of construction materials.
- **Emergency Vehicles:** Frequent use of sirens by emergency vehicles arriving or departing from the hospital can contribute to elevated noise levels in the vicinity.

- **Waste Management:** Noise generated from waste collection and disposal activities, including the operation of waste compactors and vehicles, can also affect the acoustic environment.
- **Staff and Patient Activity:** General noise from hospital staff, patient interactions, and public areas within the hospital can contribute to the overall acoustic environment.

5.10.2. Mitigation Measures

To address and minimize the impacts on the acoustic environment at Musa Specialized Hospital Ltd., the following mitigation measures will be implemented:

- **Soundproofing and Noise Insulation:** Install soundproofing materials and noise insulation in areas with high noise levels, such as medical equipment rooms, HVAC systems, and emergency vehicle bays. This will help reduce noise transmission within the hospital and surrounding areas.
- **Noise Control for Equipment:** Ensure that all medical and diagnostic equipment is maintained to operate within acceptable noise limits. Implement regular maintenance schedules to minimize noise from malfunctioning or outdated equipment.
- **Construction Noise Management:** Develop and enforce a construction noise management plan, including limiting construction activities to designated hours, using quieter machinery, and employing noise barriers or enclosures around high-noise equipment.
- **Emergency Vehicle Protocols:** Implement protocols to minimize the use of sirens within the vicinity of the hospital whenever possible. Ensure that emergency vehicle operations are conducted in a manner that reduces noise disturbance.
- **Waste Management Procedures:** Optimize waste collection and disposal schedules to avoid peak noise. Utilize quieter waste collection equipment and vehicles and implement noise reduction measures during waste handling.
- **Staff Training:** Train hospital staff on noise management practices and maintaining a quiet environment, particularly in sensitive patient rooms and recovery areas.

5.10.3. Residual Impact

Following the implementation of the proposed mitigation measures, the residual impacts on the acoustic environment at Musa Specialized Hospital Ltd. are expected to be:

- **Minimized Noise Pollution:** The measures will significantly reduce noise levels from hospital operations and construction activities, ensuring that any remaining noise is within acceptable limits and does not adversely affect the surrounding community.
- **Reduced Disruption:** The impact on nearby residential and commercial areas will be minimized, with noise levels managed to prevent significant disturbance. Regular monitoring and adjustment of noise control practices will help maintain a low level of acoustic disruption.
- **Improved Acoustic Comfort:** Enhanced soundproofing and noise management within the hospital will provide a more comfortable environment for patients and staff, promoting better overall health and well-being.

5.11. Impact on Health and Safety, Natural and Accidental Incidents

5.11.1. Health and Safety

5.11.1.1. Impact Origin

The operation of Musa Specialized Hospital Ltd. may present various health and safety impacts, originating from:

- **Medical Waste Management:** If not managed properly, the handling, storage, and disposal of medical waste pose risks of infection and contamination. This includes the potential for staff, patients, and the surrounding community to be exposed to hazardous materials.
- **Chemical Use:** Chemicals used in cleaning, disinfection, and laboratory processes can lead to potential health hazards if there are spills, leaks, or improper handling. Exposure to these chemicals may pose risks to the health of hospital staff and patients.
- **Infection Control:** Hospital environments are prone to the spread of infectious diseases. Ineffective infection control measures can result in cross-contamination and nosocomial infections, affecting patient and staff health.
- **Occupational Hazards:** Healthcare facilities involve various occupational health risks, such as repetitive strain injuries, ergonomic issues, and exposure to physical and biological hazards.
- **Emergency Response:** Effective emergency response protocols are critical. Potential fires, chemical spills, or natural disasters require preparedness to minimize health and safety impacts.
- **Construction and Maintenance Activities:** During the construction and maintenance phases, there are risks associated with heavy machinery, construction materials, and site activities that could pose safety hazards to workers and nearby residents

5.11.1.2. Mitigation Measures

To address health and safety impacts at Musa Specialized Hospital Ltd., the following mitigation measures will be implemented:

- **Medical Waste Management:**
    - **Segregation and Safe Disposal:** Implement strict protocols for segregating, storing, and disposing medical waste to minimize risks of infection and contamination. Use color-coded bins and ensure waste is handled according to regulatory standards.

  - **Training and PPE:** Provide comprehensive training for staff on medical waste management practices and ensure using personal protective equipment (PPE) to protect against exposure.

- **Chemical Use:**
  - **Proper Storage and Handling:** Store chemicals in designated, well-ventilated areas and properly label them. Implement safety data sheets (SDS) and follow handling guidelines to prevent spills and leaks.
  - **Spill Response Procedures:** Develop and train staff on spill response procedures, including using spill kits and emergency protocols.
- **Infection Control:**
  - **Enhanced Hygiene Practices:** Establish and enforce strict hygiene and sanitation protocols, including regular cleaning and disinfecting surfaces and equipment.
  - **Infection Control Training:** Provide ongoing training for healthcare staff on infection control practices and protocols to minimize the risk of nosocomial infections.
- **Occupational Health and Safety:**
  - **Ergonomic Assessments:** Conduct ergonomic assessments to minimize risks of repetitive strain injuries and provide appropriate ergonomic equipment and adjustments.
  - **Safety Training:** Offer regular occupational health and safety training, including topics on manual handling, safe work practices, and emergency procedures.
- **Emergency Response:**
  - **Emergency Preparedness Plans:** Develop and regularly update comprehensive emergency response plans for various scenarios, including fires, chemical spills, and natural disasters.
  - **Drills and Training:** Conduct regular emergency drills and training exercises for staff to ensure emergency preparedness and effective response.
- **Construction and Maintenance Activities:**
  - **Safety Protocols:** Implement strict safety protocols for construction and maintenance activities, including safety barriers, personal protective equipment (PPE), and adherence to construction safety regulations.

- **Regular Inspections:** Conduct regular inspections and audits of construction sites and maintenance activities to ensure compliance with safety standards and address potential hazards promptly

5.11.1.3. Residual Impact

After implementing the mitigation measures for health and safety at Musa Specialized Hospital Ltd., the residual impacts are expected to be:

- **Minimized Risk of Infection and Contamination:**
  - Effective medical waste management and infection control practices will significantly reduce the risk of healthcare-associated infections and contamination, ensuring a safer environment for both patients and staff.
- **Reduced Chemical Exposure:**
  - Proper storage, handling, and spill response protocols will minimize the risk of chemical exposure and associated health hazards, protecting employees and patients from potential harm.
- **Improved Occupational Health:**
  - Ergonomic improvements and comprehensive safety training will decrease the likelihood of occupational injuries and strain-related disorders, enhancing overall staff well-being.
- **Enhanced Emergency Preparedness:**
  - Well-developed emergency response plans and regular training will ensure that staff are prepared for emergencies, thereby reducing the impact of such incidents on health and safety.
- **Controlled Environmental Risks:**
  - Adherence to construction and maintenance safety protocols will mitigate risks associated with these activities, minimizing potential hazards and ensuring a safer working environment.

5.11.2. Natural and Accidental Incidents

5.11.2.1. Impact Origin

The potential impacts of natural and accidental incidents at Musa Specialized Hospital Ltd. can originate from the following sources:

- **Natural Disasters:**
  - **Flooding:** Heavy rains or natural flooding events could affect hospital operations, disrupt services, and damage infrastructure.
  - **Earthquakes:** Seismic activity could compromise the structural integrity of the hospital building, leading to safety risks and potential damage to equipment and facilities.
  - **Cyclones and Storms:** High winds and severe weather conditions could cause physical damage to the hospital structure and impact the availability of essential services.
- **Accidental Incidents:**
  - **Fire:** Potential sources include electrical faults, flammable materials, and chemical storage, which could lead to fire hazards affecting patient safety and hospital operations.
  - **Chemical Spills:** Accidental spills of hazardous substances used in medical or operational processes could threaten health, safety, and the environment.
  - **Equipment Failure:** Malfunctions or breakdowns in critical hospital equipment could disrupt medical services and impact patient care.
  - **Human Error:** Mistakes or lapses in following safety protocols by staff could lead to accidents, affecting personnel and patients.
- **Construction Phase Accidents:**
  - **Site Safety Hazards:** During the construction phase, risks such as falls from heights, accidents involving heavy machinery, and exposure to hazardous materials can pose serious safety threats to construction workers and nearby residents.
  - **Structural Failures:** Inadequate construction practices or failure to adhere to safety standards could result in structural collapses or accidents, impacting ongoing construction activities and future hospital operations.
  - **Traffic and Equipment Accidents:** Increased vehicle traffic and construction equipment operation could lead to accidents, posing risks to workers and the general public in and around the construction site.

- **Material Handling:** Improper handling and storage of construction materials could lead to accidents or injuries, affecting the safety of construction workers and nearby individuals.

5.11.2.2. Mitigation Measures

To manage impacts from natural and accidental incidents, including those during construction, the following measures will be implemented:

Natural Disasters

- Flooding: Utilize flood-resistant design and effective drainage systems and update flood management plans.
- Earthquakes: Follow seismic design standards and conduct regular structural inspections.
- Cyclones and Storms: Design for weather resilience and develop cyclone response plans.

Accidental Incidents

- Fire: Install fire safety systems, conduct regular drills, and ensure proper storage of flammable materials.
- Chemical Spills: Implement safe handling protocols and spill response plans and maintain containment equipment.
- Equipment Failure: Maintain and inspect critical equipment regularly and use backup systems.
- Human Error: Provide safety training and foster a strong safety culture.

Construction Phase Accidents

- Site Safety Hazards: Ensure safety training, PPE usage, and regular site inspections.
- Structural Failures: Enforce quality control and structural monitoring practices.
- Traffic and Equipment Accidents: Implement traffic management plans and ensure operator training.
- Material Handling: Establish safe handling procedures and conduct regular audits.

5.12. Socio-Economic Impacts

5.12.1. Positive Impacts

- Employment Opportunities: The hospital's operation will create many jobs, both skilled and unskilled, in various roles such as healthcare professionals, administrative staff, and support services.

- Economic Growth: Hospital operations will increase local spending and create business opportunities, benefiting local suppliers, contractors, and service providers.
- Healthcare Access: Enhanced medical services and diagnostic facilities will improve the community's overall health outcomes, reducing the need for travel to distant healthcare providers.
- Infrastructure Development: The project will improve local infrastructure, including roads, utilities, and public services, which will benefit residents.

5.12.2. Potential Negative Impacts

- Increased Cost of Living: The influx of hospital staff and related economic activity may lead to higher demand for housing and services, potentially increasing living costs in the area.
- Traffic Congestion: The hospital's operation may lead to increased traffic, which could impact local transportation and cause congestion.
- Cultural and Social Changes: Rapid development and increased population density might alter the area's social and cultural dynamics.

5.12.3. Mitigation Measures

- Community Engagement: Maintain open communication with residents to address concerns and incorporate their feedback into project planning.
- Traffic Management: Develop and implement plans to minimize congestion and ensure smooth transportation.
- Affordable Housing: Explore partnerships to provide affordable housing options and manage any potential increases in living costs.
- Cultural Sensitivity: Promote cultural awareness and inclusivity in hospital policies and community interactions to preserve local traditions and social harmony.

5.13. Overland Drainage and Impact on Surface Water

5.13.1. Impact Origin

- Altered Drainage Patterns: Construction and operation of the hospital can change natural drainage patterns, potentially leading to increased runoff and localized flooding.
- Surface Water Pollution: Increased runoff from the site, including pollutants such as oils, chemicals, and sediments, can contaminate nearby surface water bodies.
- Erosion: Construction activities and disturbed land can lead to soil erosion and sedimentation in local water sources.

- Reduced Natural Absorption: Impervious surfaces, such as pavements and building foundations, reduce natural water infiltration, increasing the volume and velocity of surface runoff.

5.13.2. Proposed Mitigation Measures

- Stormwater Management Plan: Implement a comprehensive stormwater management plan that includes the design of detention basins, retention ponds, and permeable surfaces to manage runoff and reduce peak flow rates.
- Erosion Control: Use erosion control measures, such as silt fences, sediment basins, and vegetation cover, to minimize soil erosion and sedimentation during and after construction.
- Pollutant Management: Implement best management practices (BMPs) to control and treat pollutants in runoff, including oil-water separators and regular maintenance of drainage systems.
- Regular Monitoring: Monitor surface water quality regularly to ensure that runoff and discharges comply with environmental regulations and do not adversely impact nearby water bodies.

5.13.3. Residual Impact

- Managed Runoff: Proper stormwater management and erosion control measures will minimize the residual impact on surface water quality and flooding.
- Reduced Pollution: Effective BMPs will reduce the potential for surface water contamination and maintain compliance with environmental standards.
- Minimal Erosion: Continued use of erosion control practices will limit soil erosion and sedimentation, preserving the health of local water bodies

5.14. Increase in Vehicular Traffic in The Area

5.14.1. Impact Origin

- Increased Traffic Volume: The establishment and operation of the hospital will likely result in a significant increase in vehicular traffic due to patient visits, staff commuting, and supply deliveries.
- Congestion: The influx of vehicles may lead to traffic congestion, particularly during peak hours, affecting local roadways and transportation efficiency.
- Increased Emissions: Higher traffic volumes can contribute to elevated levels of air pollutants, including particulate matter and greenhouse gases.

- Parking Demand: The increased number of vehicles will raise the demand for parking spaces, potentially leading to inadequate parking facilities and increased roadside parking.

5.14.2. Mitigation Measures

- Traffic Management Plan: Develop and implement a traffic management plan that includes strategies for managing peak traffic times, optimizing traffic flow, and reducing congestion around the hospital.
- Public Transport Options: Encourage the use of public transportation and provide information on available transit options to reduce the number of private vehicles.
- Parking Solutions: Design and provide sufficient on-site parking facilities to accommodate the needs of patients, staff, and visitors, minimizing the need for roadside parking.
- Emission Controls: Promote the use of low-emission vehicles and consider implementing vehicle emission control measures to reduce the impact on air quality.

5.14.3. Residual Impact

- Managed Traffic Flow: With effective traffic management and parking solutions, congestion and traffic-related issues can be minimized.
- Reduced Emissions: Emission controls and promotion of public transport will help mitigate the impact on air quality.
- Improved Accessibility: Adequate parking and efficient traffic management will enhance accessibility to the hospital while reducing potential negative effects on the local transportation network.

5.15. Impacts During Construction

5.15.1. Disruption of Earth Surface-Site Preparation and Clearing and Earthworks

5.15.1.1. Impact Origin

- **Land Disturbance:** Site preparation and clearing activities involve removing vegetation, topsoil, and altering the land surface, which can lead to soil erosion and sedimentation.
- **Soil Compaction:** Heavy machinery used for earthworks can compact the soil, affecting its permeability and potentially impacting groundwater recharge and soil fertility.

- **Erosion and Sedimentation:** Disturbance of the earth's surface increases the risk of erosion and sediment runoff into nearby water bodies, which can degrade water quality and harm aquatic habitats.
- **Habitat Destruction:** Clearing land for construction may destroy natural habitats and affect local flora and fauna, leading to potential biodiversity loss.

5.15.1.2. Mitigation Measures

- Erosion Control Measures: Implement erosion control practices such as silt fences, sediment basins, and vegetation cover to prevent soil erosion and manage sediment runoff.
- Minimize Land Disturbance: Limit the area of land disturbed at any one time and avoid unnecessary clearing of vegetation to reduce environmental impact.
- Soil Management: Use soil management techniques to reduce compaction, such as employing lighter machinery and maintaining soil quality through proper handling and storage practices.
- Habitat Preservation: Conduct pre-construction environmental assessments to identify and protect sensitive habitats and species. Implement measures to minimize habitat destruction and ensure the preservation of biodiversity.

5.15.1.3. Residual Impact

- Controlled Erosion: Erosion control measures will significantly reduce soil erosion and sedimentation, maintaining water quality and protecting aquatic ecosystems.
- Managed Soil Quality: Soil management practices will mitigate compaction effects, supporting groundwater recharge and maintaining soil health.
- Minimized Habitat Impact: By preserving critical habitats and minimizing land disturbance, the impacts on local flora and fauna will be reduced, supporting biodiversity conservation.

5.15.2. Impacts on Air Environment

5.15.2.1. Impact Origin

- Dust Generation: Construction activities such as excavation, grading, and demolition produce dust, which can lead to increased particulate matter in the air. This can impact air quality and cause respiratory issues for nearby residents.
- Vehicle Emissions: Construction vehicles and machinery, including trucks, bulldozers, and cranes, emit exhaust gases like nitrogen oxides (NOx), carbon monoxide (CO), and

particulate matter (PM). These emissions contribute to air pollution and can degrade air quality in the surrounding area.

- Machinery Emissions: The operation of construction equipment, such as generators and compressors, releases pollutants and particulate matter, further impacting air quality.
- Material Handling: The transportation and handling of construction materials, such as sand, gravel, and cement, generate dust and particulate matter, contributing to airborne pollution.
- Site Preparation: Activities such as land clearing and soil disturbance can release dust and particulate matter into the atmosphere, affecting local air quality.

5.15.2.2. Mitigation measures

To address the impacts on the air environment during construction, the following mitigation measures should be implemented:

- **Dust Suppression:** Regularly apply water or dust suppressants to construction sites and unpaved roads to minimize airborne dust. Use soil stabilizers where appropriate to reduce dust emissions.
- **Road Maintenance:** Maintain construction and access roads in good condition by filling potholes and smoothing surfaces to prevent dust and reduce vehicle emissions.
- **Vehicle Management:** Enforce speed limits on construction and access roads to reduce dust generation. Ensure that construction vehicles are well-maintained and equipped with proper emission control devices.
- **Erosion Control:** Implement erosion control measures, such as silt fences and sediment barriers, to prevent soil erosion and reduce dust and particulate matter release.
- **Air Quality Monitoring:** Conduct regular air quality monitoring to assess dust and kemission levels. Adjust mitigation strategies as necessary based on monitoring results.
- **Public Communication:** Keep local communities informed about construction activities, dust control measures, and any potential impacts on air quality to manage expectations and address concerns.

5.15.2.3. Residual Impact

Even with the implementation of mitigation measures, some residual impacts on the air environment may remain. These include:

- **Minor Dust Emissions:** Despite dust suppression efforts, there may still be occasional dust emissions from construction activities and unpaved surfaces.

- **Increased Vehicle Emissions:** Construction vehicles and machinery may continue to contribute to localized air pollution, though maintained and well-regulated vehicles will minimize this effect.
- **Temporary Air Quality Degradation:** Short-term increases in particulate matter and other pollutants may occur, particularly during peak construction periods or adverse weather conditions.

Overall, while mitigation measures will significantly reduce air quality impacts, occasional residual effects are expected. Regular monitoring and prompt adjustments to mitigation strategies will help manage and minimize these residual impacts

5.15.3. Gains to The Economy

5.15.3.1. During Operation Phase

i. Impact Origin

The operation phase of the Musa Specialized Hospital Ltd. hospital will bring several economic benefits, including:

- **Job Creation:** The hospital will provide employment opportunities for a range of professionals, including medical staff, administrative personnel, maintenance workers, and support staff. This will reduce local unemployment and contribute to household incomes.
- **Boost to Local Economy:** Increased employment and hospital operations will stimulate local businesses, including suppliers, vendors, and service providers. This can lead to the growth of ancillary businesses such as pharmacies, food outlets, and transport services, boosting the overall economic activity in the area.
- **Healthcare Services:** By providing accessible and high-quality healthcare services, the hospital will improve the productivity and well-being of the local population, contributing to the broader economic stability of the community.
- **Training and Development:** The hospital will offer opportunities for training and skill development for healthcare professionals and other staff, enhancing the local workforce's expertise and increasing their employability.
- **Increased Property Values:** The establishment of a major healthcare facility can lead to an increase in property values in the surrounding area, as improved healthcare services and job opportunities make the area more attractive to residents and businesses

ii. Benefit Enhancement Measure

To amplify economic gains during the operation phase of the Musa Specialized Hospital Ltd. hospital, the following benefit enhancement measures will be implemented:

- **Local Employment:** Prioritize hiring local residents to fill both skilled and unskilled positions. This will provide job opportunities for the community, reduce unemployment, and support local economic growth.
- **Local Procurement:** Source materials, supplies, and services locally whenever possible. This approach will support local businesses, stimulate the local economy, and reduce supply chain disruptions.
- **Staff Training and Development:** Invest in regular training and professional development for hospital staff. Enhanced skills will lead to better service quality, job satisfaction, and retention, while also contributing to the overall professionalism of the healthcare sector in the area.
- **Community Engagement Programs:** Establish initiatives that involve the community, such as health education programs, wellness workshops, and preventive health check-ups. These initiatives will improve public health awareness and create goodwill within the community.
- **Collaborative Partnerships:** Form partnerships with local educational institutions to provide internships, training, and research opportunities. This will not only enhance educational outcomes but also create a pipeline of qualified healthcare professionals for the hospital.
- **Infrastructure Support:** Contribute to the development of local infrastructure, such as roads, public transport access, and utility services, which will benefit both the hospital and the local community, improving accessibility and quality of life.

5.15.3.2. During Construction

i. Impact Origin

During the construction phase of the Musa Specialized Hospital Ltd. hospital, several economic benefits are anticipated, which include:

- **Job Creation:** The construction activities will generate direct employment opportunities for local workers, including engineers, architects, construction laborers, and support staff. This influx of employment will provide a boost to the local job market.

- **Local Business Opportunities:** The demand for construction materials, equipment, and services will benefit local suppliers and vendors, stimulating business for local hardware stores, equipment rental companies, and other service providers.
- **Increased Demand for Services:** Construction workers will require food, accommodation, and other amenities, leading to increased business for local restaurants, grocery stores, hotels, and transport services.
- **Skill Development:** The construction project will provide training and experience for local laborers and contractors, enhancing their skills and employability for future projects.
- **Boost to Local Economy:** The overall increase in economic activity due to the construction process will contribute to higher spending and circulation of money within the local economy, supporting overall economic growth and stability.

ii. Benefit Enhancement Measure

To maximize the economic gains during the construction phase of the Musa Specialized Hospital Ltd. hospital, the following benefit enhancement measures should be implemented:

- **Prioritize Local Hiring:** Establish policies that prioritize the hiring of local workers and contractors. This approach ensures that employment opportunities directly benefit the local community, boosting the local economy and fostering community support.
- **Support Local Businesses:** Encourage procurement of construction materials, equipment, and services from local suppliers and vendors. This not only stimulates the local market but also reduces transportation costs and the environmental footprint associated with sourcing materials from distant locations.
- **Provide Training Programs:** Implement training programs for local workers to improve their skills in construction and related fields. This initiative will enhance the employability of the workforce, ensuring they gain valuable skills and experience that can be applied to future projects.
- **Engage with Community Stakeholders:** Maintain open communication with community leaders and stakeholders to understand their needs and concerns. By involving the community in the planning process, the project can be better aligned with local economic development goals, and any issues can be promptly addressed.
- **Encourage Local Entrepreneurship:** Support initiatives that promote local entrepreneurship, such as small business grants or partnerships with local startups, to provide services and products needed during construction. This can help build a more diverse and resilient local economy.

- **Monitor Economic Impact:** Regularly monitor and assess the economic impacts of the construction project to ensure that the benefits are being realized and to make adjustments as needed. This may involve conducting surveys or working with local economic development agencies to track economic indicators.

5.15.4. Job Opportunities

5.15.4.1. Impact Origin

The construction and operation phases of the Musa Specialized Hospital Ltd. will create a significant number of job opportunities, contributing positively to local employment levels. During the construction phase, a wide range of positions will be available, including those for skilled labor, such as engineers, architects, and project managers, as well as unskilled labor for tasks such as site preparation, materials handling, and general construction work.

Once operational, the hospital will provide employment opportunities for medical professionals, including doctors, nurses, and technicians, as well as administrative, maintenance, and support staff. The increased demand for healthcare services will also likely spur the growth of related industries, such as pharmaceuticals, medical equipment, and local service providers, further enhancing job creation.

5.15.4.2. Benefit Enhancement Measures

To maximize the job opportunities created by the project, the following measures should be implemented:

- Local Employment Policies: Develop and enforce policies that prioritize the hiring of local residents for both construction and operational roles. This approach will help ensure that the economic benefits of job creation remain within the local community.
- Skills Training Programs: Offer training and apprenticeship programs to equip local residents with the necessary skills for employment during both the construction and operational phases. This will enhance the employability of the local workforce and ensure a steady supply of qualified personnel.
- Partnerships with Educational Institutions: Collaborate with local colleges, universities, and vocational training centers to develop programs tailored to the specific needs of the hospital. This can help prepare students and job seekers for roles in healthcare and construction.

- Career Development Opportunities: Provide ongoing career development and training opportunities for employees to advance within the organization. This can improve job satisfaction and retention rates while building a more skilled and capable workforce.
- Fair Wage and Labor Practices: Ensure that all employees, whether directly hired or contracted, receive fair wages and benefits. Adhering to ethical labor practices will foster a positive work environment and enhance the hospital's reputation as an employer of choice.
- Monitoring and Evaluation: Regularly monitor employment levels and the effectiveness of training and development programs. Adjust strategies as needed to address gaps and optimize job creation and employee development.

Chapter Six: Environmental Management Plan (EMP)

6.1. General

The Environmental Management Plan (EMP) for the Musa Specialized Hospital Ltd. project is a comprehensive framework designed to mitigate adverse environmental impacts and enhance beneficial outcomes throughout the project's implementation and operational phases. The EMP aims to ensure that all environmental measures comply with the Environmental Quality Standards (EQS) of Bangladesh, thereby safeguarding the project's long-term sustainability.

1. Mitigation Plan: This component focuses on identifying and implementing measures to minimize or offset the potential adverse environmental impacts associated with the project. By adhering to strict mitigation strategies, the project can reduce its environmental footprint to acceptable levels as per Bangladesh's regulatory standards.
2. Enhancement Plan: The enhancement plan aims to maximize the positive environmental and social benefits of the project. This includes promoting green practices, improving community health outcomes, and supporting local economic development through job creation and resource optimization.
3. Monitoring Plan: Continuous monitoring is essential to ensure that the environmental management measures are effective and that the project remains in compliance with environmental regulations. The monitoring plan outlines the procedures for regular assessment and reporting, enabling timely adjustments to the EMP as needed.

The project proponent has proactively implemented several policies and measures to prevent environmental degradation. The project authority is dedicated to environmental stewardship, ensuring that every sector of pollution—whether it be water, soil, air, or noise—is addressed through the EMP. The following specific management plans are integral to the overall EMP and are either already in place or will be activated during the project:

- Occupational Health & Safety Management Plan (OHSMP): Ensures the safety and well-being of all employees and stakeholders by adhering to best practices in occupational health and safety.
- Emergency Response and Fire Management Plan (EFMP): Prepares the hospital to effectively manage emergencies, including fires, by establishing clear protocols and training programs.

- Hospital Waste Management Plan (HWMP): Focuses on the proper disposal and treatment of medical and general waste generated by the hospital to prevent environmental contamination.
- Air Management Plan (AMP): Aims to control and reduce air emissions from the hospital, ensuring that air quality remains within acceptable limits.
- Noise Management Plan (NMP): Addresses noise pollution by implementing measures to minimize noise levels and their impact on the surrounding environment.

By implementing the EMP, the project will be able to reduce its environmental impact to levels that are acceptable under Bangladesh government regulations. Additionally, the EMP will enhance the project's positive effects, contributing to the overall well-being of the environment and the community. The proactive approach taken by Musa Specialized Hospital Ltd. in developing and executing the EMP reflects its commitment to environmental responsibility and sustainability.

6.2. Occupational Health and Safety Management Plan

Occupational health and safety are a worldwide concern. Every organization should give the highest importance to health safety. The worth of life cannot be measured by price. According to the World Health Organization (WHO), "Occupational health deals with all aspects of health and safety in the workplace and strongly focuses on primary prevention of hazards." It is the multi-disciplinary field of safety, health, and welfare. Sometimes, health service centers like hospitals or diagnostic centers face emergencies like fire, natural calamities, accidents, etc. A hazardous environment might be created on the hospital's premises. Fire can be another emergency hazard that will be horrible in a moment. All these situations are risks to health and safety. The project has already applied and will be applied the following measures to ensure health and safety in the hospital for all.

6.2.1. Present Scenario and Future Implementation

Musa Specialized Hospital Ltd. has implemented several health and safety measures to protect its employees. These measures include the availability of first aid kits, deployment of trained medical technologists, and regular health check-ups of the workers.

For future improvements, the hospital management plans to implement additional measures to enhance the safety and well-being of all stakeholders. These measures include:

- **Formation of a Health and Safety Committee**: A dedicated committee will be established in compliance with the *Bangladesh Labor Act (Amendment) 2013*. This committee will oversee, execute, and plan health and safety protocols for patients, doctors, nurses, and all staff members.
- **Pre-job Risk Assessment**: A risk assessment will be conducted before assigning new or hazardous tasks. This will be followed by issuing work permits that outline specific risks and management strategies and designate individuals responsible for taking corrective actions.
- **Provision of Personal Protective Equipment (PPE)**: Adequate PPE, such as gloves, safety goggles, masks, and helmets, will be supplied to all doctors, nurses, and staff engaged in potentially risky activities within the hospital.
- **Training Programs**: Employees will receive training to increase their awareness about the hazardous nature of chemicals and other risks associated with their roles. This will help minimize exposure and ensure safe handling practices.
- **Job Rotation**: To prevent prolonged exposure to high noise levels, workers will be rotated through different tasks, reducing the duration of exposure and mitigating potential health risks.
- **Regular Medical Examinations**: All staff members will receive periodic health check-ups. If any significant occupational health issues are identified, management will take the necessary corrective measures.
- **Implementation of Management Procedures**: Comprehensive management procedures will be implemented, including process safety protocols, ongoing training, management of change procedures, incident investigation processes, employee participation in safety initiatives, and contractor training and oversight.
- **Incident Reporting and Investigation**: All incidents will be promptly reported and investigated using root cause analysis. This will enable the development of action plans for continuous improvement, ongoing monitoring, and periodic review to ensure safety standards are upheld.

These proactive measures will help Musa Specialized Hospital Ltd. maintain a safe and healthy environment for its patients and staff, ensuring compliance with local regulations and international best practices.

6.3. Emergency Response and Fire Management Plan (ERFMP)

6.3.1. General

In the event of a fire at Musa Specialized Hospital Ltd., the following guidelines should be adhered to:

- If a small fire cannot be controlled using a portable extinguisher or fixed extinguishing system, or if the smoke poses a risk to the operator, the area should be evacuated immediately.
- The fire department must be notified without delay. Personnel should then move to a designated safe area and wait for the fire department to arrive.
- Attempting to extinguish a fire is a voluntary action. Only individuals who have received proper training and feel confident in using a portable extinguisher should consider attempting to extinguish the fire.
- It is crucial to recognize that improper use of portable extinguishers can result in severe injury or fatality. Safety should always be the priority, and untrained personnel should focus on evacuation and alerting emergency services.

These procedures aim to protect the safety of all personnel and ensure a coordinated response to fire incidents.

6.3.2. Types of Fire

There are five types of fire such as

Class A – Ordinary combustibles (wood, paper, plastics, etc.)
Class B – Combustible liquids (oils, gas, cooking oil, etc.)
Class C – Electrical (energized equipment – appliances, wiring, etc.)
Class D – Combustible metals (aluminum, magnesium, zinc, etc.)
Class E – Commercial cooking equipment (Cooking oils, Animal fats, Vegetable fats)

It is extremely important to choose the properly rated fire extinguisher for the class of fire that is burning.

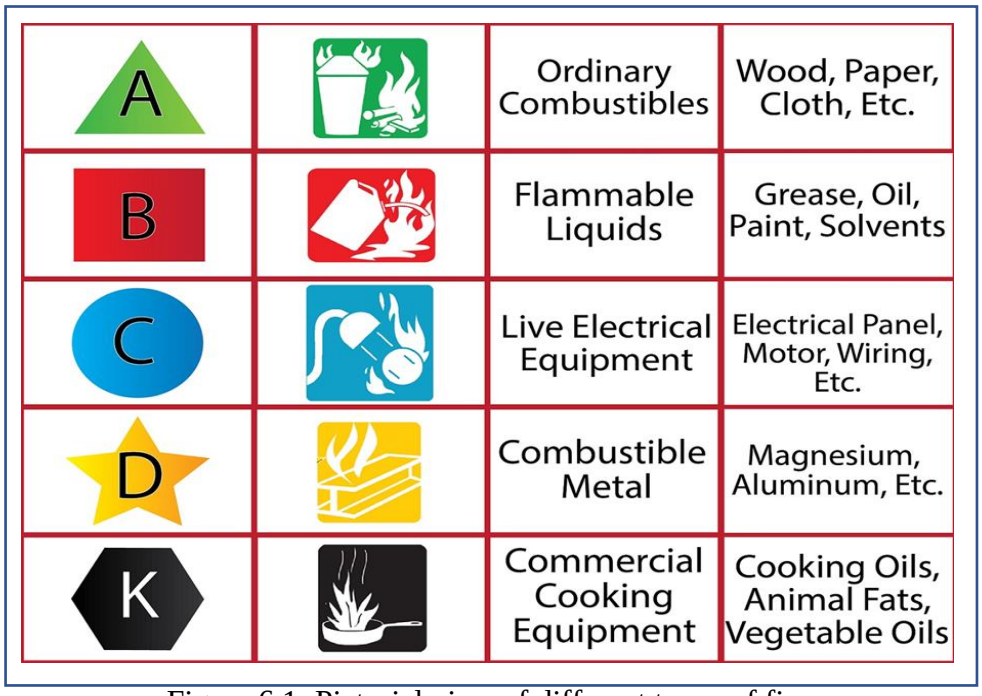


Figure 6.1: Pictorial view of different types of fire

6.3.3. Fire Safety Risk Assessment

A fire safety risk assessment is an organized and methodical look at the premises, the activities within the premises, the potential for a fire to occur, and the harm it could cause to the people in and around the premises. The prescribed process is available for inside or indoor fire risk assessment. The following fire risk assessment process can be followed and executed twice in a year.

Table 6.1: Fire Safety Risk Assessment

	FIRE RISK ASSESSMENT
1	Identify fire hazards Identify: Sources of Ignition Sources of Fuel Sources of Oxygen
2	Identify People at Risk Identify: People in and around the premises People especially at Risk
3	Evaluate, Remove, Reduce, and Protect from Risk Evaluate the risk to people from fire Remove or Reduce the Risks to people Detection and warning Fire-fighting

	Escape routes Lighting Signs and notices Maintenance
4	Record, Plan, Inform, Instruct and Train Record significant findings and action taken Prepare an emergency plan Inform and instruct relevant people co-operate and co-ordinate with others Provide training
5	Review Keep assessment under review Revise where necessary

Source: Project Paper, IDM, KUET

Beyond the above measures, the project also has full provision for firefighting equipment in each area and first aid medical services. Though there might not be a serious threat of fire in the hospital, the possibility still exists. Adequate precautionary measures should be taken to prevent that and also to combat a situation of fire need to be taken. The project is equipped with firefighting equipment such as a water sprayer, fire extinguisher, sand etc. Adequate first aid medical facilities should be provided in the project too.

6.3.4. Measures for Emergency Response and Fire Management

Musa Specialized Hospital Ltd. will implement several measures to ensure fire safety and effective emergency response at the hospital. Comprehensive firefighting systems will be installed, including fire lines and hose pipes. Regular health and safety training sessions will be conducted to educate staff on emergency procedures. Adequate first aid facilities will be made available throughout the premises. The use of personal protective equipment (PPE), such as masks, aprons, ear plugs, and ear muffs, will be mandated when necessary. Separate restrooms will be provided for men and women to enhance convenience and hygiene. The hospital will hold a valid fire license and will develop an emergency evacuation plan, as well as a waste management plan. The building will be equipped with a designated emergency staircase to facilitate safe evacuation during critical situations.

6.3.5. Proposed Future Measures

To further enhance fire safety and emergency preparedness at Musa Specialized Hospital Ltd., the following measures will be implemented:

- Common evacuation paths will be clearly marked and located near stairwells for easy access.

- All floors and staircases will have safety markings to guide occupants during an evacuation.
- The emergency evacuation paths will be kept free from any obstacles at all times to ensure unobstructed movement.
- Doors will be equipped to open from both the inside and outside to facilitate quick and easy exit during emergencies.
- Regular fire and evacuation drills will be conducted to ensure all staff and patients are familiar with the emergency procedures.
- Sufficient lighting will be installed along evacuation routes to ensure visibility during power outages or low-light situations.
- Drinking water quality will be tested at least twice a year to ensure it meets safety standards.
- Adequate numbers of toilets with necessary supplies such as soap and water will be provided, ensuring proper hygiene and accessibility.
- Electrical wires, cables, and connections will undergo monthly inspections to identify and rectify potential fire hazards.
- A more advanced fire detection system, including alarms or whistles, will be installed to provide early warning in the event of a fire.

6.4. Hospital Waste Management Plan

Musa Specialized Hospital Ltd. will generate different categories of healthcare and non-healthcare waste during its operation, including general solid waste, infectious waste, pathological waste, anatomical waste, sharps, pharmaceutical waste, cytotoxic waste, chemical waste, radioactive waste (where applicable), and liquid effluent. Improper handling, segregation, storage, transportation, treatment and disposal of these wastes may cause environmental pollution and pose risks to patients, healthcare workers, waste handlers and the surrounding community.

Considering the nature and scale of hospital operations, a comprehensive Hospital Waste Management Plan (HWMP) has been developed to ensure environmentally sound management of all waste streams generated within the facility. The plan is designed to minimize waste generation, promote segregation at source, ensure safe handling and transportation, facilitate appropriate treatment and disposal, and maintain compliance with applicable environmental and healthcare waste management requirements of Bangladesh.

The hospital has a reported capacity of 250 beds, supported by diagnostic facilities, 10 operation theatres, 28 dialysis units, laboratory services, intensive care facilities and other specialized medical services. Consequently, waste generation is expected from inpatient treatment, outpatient services, surgical procedures, laboratory investigations, diagnostic activities, pharmaceutical services, housekeeping, kitchen operations and administrative activities.

The hospital management has identified PRISM Bangladesh Foundation as the third-party organization responsible for managing medical waste. The arrangement will be supported by a formal agreement, verification of the service provider's applicable environmental authorization, and documentation of waste collection, transportation, treatment and final disposal.

The principal objectives of this Hospital Waste Management Plan are to:

- Minimize healthcare waste generation through efficient resource utilization and application of the Reduce, Reuse and Recycle (3R) principles.
- Ensure segregation of healthcare and general waste at the point of generation.
- Prevent mixing of hazardous and non-hazardous waste.
- Establish safe collection, internal transportation and temporary storage arrangements.
- Ensure appropriate treatment and final disposal of each waste category through authorized facilities.
- Protect healthcare workers, patients, visitors, waste handlers and the surrounding community from exposure to infectious, chemical, pharmaceutical and other hazardous waste.
- Establish specific management arrangements for anatomical, pathological, cytotoxic, sharps and radioactive waste.
- Maintain waste-generation records, collection registers, treatment records and disposal certificates.
- Establish monitoring, training and accountability mechanisms for effective implementation.

6.4.1. Healthcare Waste Generation and Characterization

6.4.1.1. Estimation of Healthcare Waste Generation

The hospital has an operational capacity of 250 beds. Healthcare waste will be generated from inpatient wards, operation theatres, emergency departments, intensive care units, laboratories, dialysis units, diagnostic departments, outpatient services and other supporting facilities.

The project indicates an estimated healthcare waste generation of approximately 40–50 kg/day, excluding general garbage. However, this figure does not represent the complete waste generation of the hospital and should be treated as a preliminary estimate rather than a verified total.

Based on the preliminary quantity, the indicative generation rate is for 40–50 kg/day. This preliminary figure excludes general garbage and should not be presented as the total healthcare waste generation rate.

A systematic waste audit shall therefore be conducted to establish the actual generation rate. The audit shall cover representative operating days and major waste-generating departments, considering patient occupancy, outpatient attendance, surgical activities and diagnostic services.

The following information shall be recorded during the waste audit:

- Daily quantity of waste generated by each department.
- Waste category and physical characteristics.
- Number of occupied beds and daily patient attendance.
- Quantity of general and hazardous healthcare waste.
- Quantity of infectious, pathological, anatomical, sharps, pharmaceutical, chemical and cytotoxic waste.
- Quantity of recyclable and reusable materials.
- Waste collection frequency and temporary storage requirements.

The total healthcare waste generation rate shall subsequently be calculated as:

Kg/bed/day = (Total daily healthcare waste (kg))/ 250 beds

The actual category-wise quantities shall be incorporated into the hospital's waste-generation register and periodically updated.

Table 6.2: Preliminary Healthcare Waste Generation Assessment

Particulars	Project information
Total hospital beds	250
Preliminary healthcare waste generation	40–50 kg/day
Preliminary waste generation rate	0.16–0.20 kg/bed/day
Total waste generation	To be established through waste audit
Category-wise waste generation	To be established through waste audit

6.4.1.2. Waste Characterization

Healthcare waste generated by the hospital shall be classified according to its nature, potential hazards and appropriate management requirements.

The principal categories of waste anticipated from hospital operations are presented below.

Table 6.3: Classification and Characterization of Hospital Waste

Sl. No.	Waste category	Typical sources and examples
1	General non-hazardous waste	Office waste, food waste, packaging materials, paper and uncontaminated housekeeping waste
2	Infectious waste	Blood-contaminated dressings, swabs, bandages, contaminated gloves and materials from infected patients
3	Anatomical waste	Human tissues, organs, body parts and placenta
4	Pathological waste	Biopsy specimens, tissue samples and other pathological materials
5	Sharps waste	Used needles, syringes with needles, blades, scalpels and broken contaminated glass
6	Pharmaceutical waste	Expired, unused or contaminated medicines and pharmaceutical products

7	Cytotoxic waste	Waste contaminated with cytotoxic or cytostatic medicines, including relevant drug containers and treatment materials
8	Chemical waste	Laboratory reagents, disinfectants, solvents, chemical residues and other hazardous chemicals
9	Radioactive waste	Radioactive materials and contaminated items generated from nuclear medicine or other licensed radioactive-material activities, where applicable
10	Recyclable waste	Uncontaminated paper, cardboard, plastic, glass and metal suitable for recycling
11	Liquid healthcare waste	Laboratory effluent, contaminated liquid from medical procedures and other healthcare-related wastewater
12	Pressurized containers	Empty or discarded gas cylinders, aerosol containers and other pressurized items

The actual waste composition and quantities shall be established through departmental waste audits. Waste shall not be classified as general waste solely on the basis of its physical appearance; its source and contamination status shall also be considered.

6.4.2. Waste Segregation and Collection System

Waste segregation shall be undertaken at the point of generation to prevent the mixing of hazardous healthcare waste with general waste.

The hospital shall introduce a department-wise colour-coded waste collection system using appropriately labelled and designated containers. The segregation system shall be implemented in all relevant areas, including:

- Inpatient wards and patient-care units.
- Operation theatres and recovery rooms.
- Intensive care units.
- Emergency departments.
- Pathology and diagnostic laboratories.
- Dialysis units.
- Pharmacy and medicine storage areas.

- Radiology and diagnostic imaging departments.
- Housekeeping and general service areas.



Figure: Color Coded Waste Segregation System

Each waste collection container shall be clearly identified by waste category and shall be appropriately designed for its intended use.

The following arrangements shall be maintained:

1. General waste shall be collected separately from hazardous healthcare waste.
2. Infectious waste shall be placed in designated, leak-resistant and properly labelled containers.
3. Sharps shall be collected in puncture-resistant, leak-proof and closable safety containers.
4. Anatomical and pathological waste shall be separately collected in secure, leak-proof containers.
5. Pharmaceutical and cytotoxic waste shall be separately segregated to prevent mixing with other waste categories.
6. Chemical waste shall be segregated according to chemical compatibility and hazard characteristics.

7. Recyclable materials shall only be collected separately where they are not contaminated with infectious or hazardous substances.
8. Liquid healthcare waste shall be managed through designated collection and treatment arrangements, as applicable.

Waste containers shall not be overfilled. Collection shall be undertaken at appropriate intervals to prevent overflow, leakage, odour generation and exposure to patients or staff.

6.4.2.1. Departmental Waste Segregation Responsibilities

Table 6.4: Department-wise Waste Segregation and Collection Arrangements

Department	Major waste generated	Management arrangement
Operation Theatre	Anatomical, pathological, infectious and sharps waste	Separate labelled containers and secure collection
ICU and CCU	Infectious waste, sharps and general waste	Source segregation and scheduled collection
Laboratory	Chemical, pathological, infectious and sharps waste	Separate containers based on waste characteristics
Dialysis Unit	Infectious materials, sharps and liquid effluent	Segregation and designated liquid-waste treatment
Pharmacy	Expired medicines and pharmaceutical waste	Separate pharmaceutical waste storage
Oncology/Chemotherapy, if applicable	Cytotoxic waste	Dedicated cytotoxic waste containers and supplier-return arrangements
Radiology/Nuclear Medicine, if applicable	Chemical and potentially radioactive waste	Separate handling according to actual waste characteristics and applicable authorization
General Wards	Infectious and general waste	Departmental segregation

Department	Major waste generated	Management arrangement
Kitchen and Canteen	Food waste and general waste	Separate collection and authorized disposal
Administrative Areas	Paper, packaging and general waste	Segregation and recycling where feasible

The hospital administration shall designate responsible personnel in each department to supervise segregation and collection activities.

6.4.3. Internal Waste Transportation and Temporary Storage

6.4.3.1. Internal Transportation

Waste generated from different departments shall be transported to the designated temporary storage area or **Secondary Transfer Station (STS)** through designated internal routes.

The hospital shall ensure that:

- Waste is transported in covered, labelled and dedicated trolleys.
- Separate trolleys are maintained for hazardous and general waste.
- Waste bags are properly sealed before transportation.
- Waste containers are not opened or manually sorted during transportation.
- Waste transportation routes avoid unnecessary contact with patients, visitors and food preparation areas.
- Trolleys are regularly cleaned and disinfected.
- Waste handlers are provided with appropriate personal protective equipment (PPE).
- Internal waste transportation is undertaken according to a predetermined collection schedule.

The transportation system shall minimize the possibility of leakage, accidental spillage, exposure and cross-contamination.

6.4.3.2. Temporary Waste Storage Facility

The project provides for a **Secondary Transfer Station (STS)** at the ground-floor level for temporary storage and transfer of collected waste.

The STS shall be managed as a designated waste storage facility with restricted access. The facility shall provide separate arrangements for hazardous healthcare waste and general waste.

The following provisions shall be maintained:

- Adequate storage space based on actual waste generation and collection frequency.
- Separate and clearly marked storage sections for different waste categories.
- Impermeable, washable and easily cleanable flooring.
- Proper ventilation and adequate lighting.
- Appropriate drainage and cleaning arrangements.
- Protection from rainwater, pests, insects and unauthorized access.
- Secure storage for hazardous and infectious waste.
- Clearly displayed warning signs and waste-category identification.
- Handwashing and hygiene facilities for waste handlers.
- Regular cleaning and disinfection of the storage area.

The final STS layout, dimensions, storage capacity and maximum holding periods shall be documented in the hospital's waste management records and supporting drawings.

Waste shall not be stored beyond the applicable permissible holding period. The collection schedule shall be coordinated with the authorized waste-management service provider to prevent accumulation.

6.4.4. Waste Treatment and Final Disposal Arrangements

The treatment and disposal of healthcare waste shall be undertaken according to the characteristics and hazards associated with each waste category. Hazardous healthcare waste shall not be disposed of together with ordinary municipal solid waste.

Musa Specialized Hospital Ltd. has identified **PRISM Bangladesh Foundation** as its third-party medical waste management service provider. The hospital shall maintain a valid contractual arrangement and verify the provider's applicable environmental authorization and treatment/disposal arrangements.

The proposed waste treatment and disposal arrangements are summarized below.

Table 6.5: Waste Treatment and Final Disposal Plan

Sl. No.	Waste category	Proposed treatment and disposal arrangement
1	General non-hazardous waste	Collection by authorized municipal or third-party service provider for appropriate disposal
2	Infectious waste	Collection in sealed and labelled containers followed by treatment at an authorized facility using an appropriate approved method
3	Anatomical waste, including placenta and body parts	Secure collection and transfer for deep burial at an appropriately authorized and suitable burial facility, in accordance with DoE requirements
4	Pathological waste	Secure collection and treatment/disposal through an appropriately authorized facility according to the nature of the waste
5	Sharps waste	Collection in puncture-resistant containers followed by appropriate treatment, such as authorized autoclaving or other approved treatment, and safe final disposal
6	Pharmaceutical waste	Separate collection and return to the supplier or transfer to an authorized facility for appropriate treatment and disposal
7	Cytotoxic waste	Separate collection, secure storage and return to the medicine supplier, as specifically required by the DoE condition
8	Chemical waste	Segregation according to chemical characteristics and transfer to an authorized hazardous-waste treatment/disposal facility or supplier-return arrangement, as applicable
9	Radioactive waste	Management through an appropriately authorized radiation-safety arrangement in compliance with BAERA requirements and applicable radiation-safety legislation
10	Recyclable waste	Transfer to authorized recycling facilities, provided that the materials are not contaminated with infectious or hazardous substances

Sl. No.	Waste category	Proposed treatment and disposal arrangement
11	Liquid healthcare waste	Treatment through the designated wastewater treatment system or other appropriate authorized treatment arrangement
12	Pressurized containers	Return to the supplier or management through an appropriate authorized recovery/disposal arrangement

The hospital shall maintain documentary evidence of waste collection, transportation, treatment and final disposal. Such evidence shall include waste-transfer records, collection receipts, treatment certificates and final disposal documentation.

6.4.4.1. Special Management of Anatomical and Pathological Waste

Anatomical waste, including placenta, human body parts and other relevant tissues, shall be collected separately in secure and leak-proof containers.

The hospital shall ensure that:

- Anatomical waste is not mixed with general or recyclable waste.
- Collection containers are properly labelled and securely closed.
- Waste is transferred through designated routes by trained handlers.
- Deep burial is arranged through an appropriate authorized facility in accordance with the specific DoE condition.
- Records of collection, transfer and final disposal are maintained.

Pathological waste, including biopsy specimens and laboratory tissue samples, shall be managed separately according to its characteristics and applicable treatment requirements.

6.4.4.2. Cytotoxic Waste Management

Cytotoxic waste is classified as highly hazardous due to its potential toxicity, mutagenicity, carcinogenicity and other adverse health effects.

The hospital shall establish a dedicated cytotoxic waste management system, particularly in the event of chemotherapy or other cytotoxic drug-related activities.

The following measures shall be implemented:

- Cytotoxic waste shall be segregated at the point of generation.
- Dedicated, properly labelled and leak-resistant containers shall be used.
- Cytotoxic waste shall not be mixed with general, infectious or ordinary pharmaceutical waste.
- Storage shall be secure and access shall be restricted to authorized personnel.
- Waste shall be returned to the medicine supplier in accordance with the specific DoE requirement.
- Records of waste quantities, supplier returns and disposal shall be maintained.

Personnel handling cytotoxic waste shall receive specialized training and use appropriate PPE.

6.4.4.3. Management of Used Linen and Reusable Textiles

Used bedsheets, pillow covers, patient clothing, staff clothing, surgical linen and other reusable textiles shall be collected separately from general and hazardous waste.

The hospital will establish a washing facility for the collection, transportation, washing, disinfection and return of reusable textiles.

The following arrangements shall be maintained:

- Separate collection of used and clean linen.
- Leak-resistant bags or containers for contaminated linen.
- Dedicated transportation arrangements.
- Appropriate washing and disinfection procedures.
- Prevention of cross-contamination between clean and contaminated textiles.
- Maintenance of collection and delivery records.

The applicable environmental authorization of the washing facility will be maintained as part of the hospital's environmental compliance documentation.

6.4.4.4. Radioactive Waste Management

The hospital has diagnostic imaging equipment, including X-ray, CT scan, mammography and other radiation-generating equipment. The use of such equipment shall be governed by applicable radiation protection and licensing requirements.

Radioactive waste management requirements shall apply where radioactive materials or radionuclides are actually used or generated, such as in nuclear medicine or other licensed activities. Ordinary X-ray imaging does not, by itself, establish the generation of radioactive waste.

Where radioactive materials are used, the hospital shall:

- Obtain and maintain applicable licences and approvals from the Bangladesh Atomic Energy Regulatory Authority (BAERA).
- Appoint appropriately qualified radiation-safety personnel.
- Establish controlled storage and handling arrangements.
- Maintain radioactive material inventory and waste records.
- Ensure radiation monitoring and personnel protection.
- Arrange return, decay storage or disposal through authorized arrangements, as applicable.
- Prevent unauthorized discharge or disposal of radioactive materials.

The hospital shall comply with the Bangladesh Nuclear Safety and Radiation Control Rules, 2012, and applicable BAERA requirements.

6.4.5. Wastewater and Liquid Waste Management

Hospital activities generate wastewater from sanitary facilities, patient wards, operation theatres, laboratories, dialysis facilities, kitchens, laundry and general cleaning operations.

The project information identifies a total hospital capacity of 250 beds and an estimated water consumption of 450 litres per bed per day, based on the design assumption referenced to BNBC 2021.

Accordingly, the estimated water requirement is:

250 * 450 = 112,500 litres/day

Assuming wastewater generation equivalent to 90% of the water consumed:

112,500 * 0.90 = 101,250 litres/day

Therefore:

Estimated wastewater generation = 101.25 m^3/ day

The corresponding wastewater generation rate is 450 litres/bed/day.

Table 6.6: Estimated Water Consumption and Wastewater Generation

Sl. No.	Particulars	Calculation	Estimated quantity
1	Total hospital beds	Project capacity	250 beds
2	Water consumption rate	Design basis	450 L/bed/day
3	Total water consumption	250 × 450	112,500 L/day
4	Wastewater generation factor	Assumed	90%
5	Total wastewater generation	112,500 × 0.90	101,250 L/day
6	Wastewater generation	Converted	101.25 m³/day
7	Wastewater generation per bed	101,250 ÷ 250	405 L/bed/day
8	Operating period	Design assumption	22 hours/day
9	Average hourly wastewater flow	101.25 ÷ 22	4.60 m³/hour
10	Proposed WWTP design capacity	Project design information	5.00 m³/hour
11	Nominal daily treatment capacity	5.00 × 22	110 m³/day

The proposed WWTP capacity of 5.0 m³/hour provides a nominal daily treatment capacity of 110 m³/day when operated for 22 hours. This is approximately 8.64% above the estimated wastewater generation of 101.25 m³/day.

The final treatment capacity and process design shall be verified against the installed/as-built WWTP drawings and engineering calculations before final approval.

6.4.5.1. Segregation of Wastewater Streams

To ensure appropriate treatment and minimize the risk of cross-contamination, wastewater shall be identified and managed according to its source and characteristics.

The principal wastewater streams are:

1. Domestic wastewater: Generated from toilets, washrooms, handwashing facilities and other sanitary installations.
2. Laboratory wastewater: Generated from laboratory cleaning, sample processing and diagnostic activities. Chemical and potentially hazardous laboratory residues shall be separately collected where necessary.
3. Operation theatre wastewater: Generated from surgical cleaning and related medical activities, requiring appropriate infection-control and pretreatment arrangements where applicable.
4. Dialysis wastewater: Generated from dialysis-related operations and cleaning activities, subject to assessment of its chemical and microbiological characteristics.
5. Kitchen and laundry wastewater: Generated from food preparation, washing and cleaning activities.
6. General utility wastewater: Generated from floor cleaning, equipment washing and other routine hospital activities.

The hospital shall maintain appropriate collection and pretreatment arrangements for wastewater streams that may contain hazardous chemicals, concentrated disinfectants, pharmaceuticals or other substances unsuitable for direct discharge into the biological treatment system.

6.4.5.2. Wastewater Treatment Plant Operation

The hospital shall operate a properly designed wastewater treatment plant capable of treating the estimated wastewater flow generated by its operations.

The WWTP shall incorporate suitable treatment processes based on the characteristics of hospital wastewater and the approved engineering design.

The final design and operation shall demonstrate compliance with the applicable provisions of Schedule 12 of the Environment Conservation Rules, 2023, and relevant DoE discharge standards.

The detailed treatment-unit configuration, hydraulic calculations, design parameters, process drawings and effluent-quality predictions shall be included in the STP/WWTP design annexure.

The treated effluent shall be tested before discharge or reuse. Discharge into the local drainage system and the downstream canal shall only take place in accordance with the applicable environmental standards and required permissions.

6.4.5.3. Sludge Management

Sludge generated from the wastewater treatment process shall be collected, handled and managed separately according to its characteristics.

The hospital shall ensure that:

- Sludge is periodically removed from treatment units.
- Appropriate dewatering arrangements are maintained.
- Sludge is temporarily stored in a designated secure area.
- Personnel handling sludge use appropriate PPE.
- Sludge is characterized where necessary to determine its hazardous properties.
- Transportation and final disposal are undertaken through an appropriately authorized facility.
- Sludge removal and disposal records are maintained.

Untreated sludge shall not be discharged into drains, nearby water bodies or surrounding open areas.

6.4.6. Emergency Management and Spill Response

The hospital shall establish emergency procedures for incidents associated with healthcare waste handling, storage, transportation and treatment.

Potential emergencies include:

- Accidental leakage or spillage of infectious waste.
- Blood and body-fluid spills.
- Chemical and pharmaceutical spills.

- Cytotoxic drug spills.
- Needle-stick injuries and accidental exposure to sharps.
- Damage to waste storage containers.
- Fire incidents in temporary waste storage areas.
- Failure of wastewater treatment equipment.

The following response arrangements shall be implemented:

1. Immediately isolate the affected area and restrict unauthorized access.
2. Inform the designated Medical Waste Management Officer.
3. Provide appropriate PPE to personnel responsible for cleaning and containment.
4. Use suitable spill kits and approved cleaning and disinfection procedures.
5. Collect contaminated materials separately and manage them as hazardous waste.
6. Provide immediate medical assessment and appropriate post-exposure management to affected personnel.
7. Record the incident, investigate its cause and implement corrective measures.

Dedicated spill-response kits shall be maintained in laboratories, operation theatres, waste storage areas and other locations where hazardous materials are handled.

6.4.7. Occupational Health and Safety of Waste Handlers

Healthcare waste handlers are potentially exposed to infectious agents, sharps injuries, hazardous chemicals and other occupational hazards.

The hospital shall establish occupational health and safety arrangements specifically addressing the risks associated with healthcare waste management.

The following measures shall be implemented:

- Provide suitable gloves, masks, protective clothing, footwear and other necessary PPE.
- Provide appropriate training on waste segregation, collection, transportation and disposal.
- Ensure safe handling of sharps and prohibit manual sorting of mixed waste.
- Maintain handwashing and personal hygiene facilities.
- Establish vaccination arrangements in accordance with occupational health recommendations.

- Conduct periodic medical examinations of waste-handling personnel.
- Establish procedures for reporting needle-stick injuries and other occupational exposures.
- Provide immediate medical evaluation and post-exposure management where required.
- Maintain records of accidents, occupational exposures, training and medical examinations.

The hospital management shall ensure that waste handlers and other personnel involved in hazardous waste management are adequately trained before undertaking their assigned responsibilities.

6.4.8. Institutional Responsibilities and Training

To ensure effective implementation of the Hospital Waste Management Plan, the hospital management shall establish a designated Medical Waste Management Committee or equivalent responsible unit.

The committee shall supervise the implementation of waste segregation, collection, storage, transportation, treatment and disposal procedures.

The proposed responsibilities are presented below.

Table 6.7: Institutional Responsibilities for Hospital Waste Management

Responsible personnel/unit	Principal responsibilities
Hospital Management	Overall supervision, resource allocation and regulatory compliance
Medical Waste Management Officer	Implementation and monitoring of the waste management plan
Department Heads	Ensuring segregation and collection within respective departments
Nursing Supervisors	Monitoring waste segregation in patient-care areas
Laboratory In-charge	Management of laboratory chemical, pathological and infectious waste
Operation Theatre In-charge	Management of anatomical, pathological, infectious and sharps waste

Housekeeping Supervisor	Internal waste collection, transportation and cleaning
Waste Handlers	Safe collection, handling and transfer of waste
PRISM Bangladesh Foundation	Contractual collection, transportation, treatment and disposal of designated medical waste
Environmental/OHS Personnel	Monitoring, documentation, reporting and corrective actions

The hospital shall arrange periodic training for doctors, nurses, laboratory personnel, housekeeping staff, waste handlers and other relevant employees.

Training shall cover:

- Waste classification and segregation.
- Colour-coded container identification.
- Safe handling and transportation.
- Management of anatomical and cytotoxic waste.
- Sharps injury prevention.
- PPE use and personal hygiene.
- Emergency spill response.
- Environmental and occupational health requirements.

Training records shall be maintained by the hospital administration.

6.4.9. Application of the Reduce, Reuse and Recycle (3R) Policy

Musa Specialized Hospital Ltd. shall implement the 3R principles to reduce waste generation and promote resource efficiency.

The proposed measures include:

Reduce

- Minimize unnecessary use of disposable materials where clinically appropriate.
- Optimize procurement of medicines, chemicals and other hospital supplies.
- Reduce excessive packaging and paper consumption.
- Prevent unnecessary food and material wastage.

Reuse

- Encourage the reuse of medical equipment and materials only where they are specifically designed and approved for reuse.
- Promote reusable linen and other appropriate non-disposable materials.
- Implement safe and approved sterilization procedures for reusable medical instruments.

Recycle

- Separate uncontaminated paper, cardboard, plastic, glass and metal for recycling.
- Arrange collection through authorized recycling service providers.
- Maintain records of recyclable waste quantities.

Infectious, cytotoxic, pathological and chemically contaminated materials shall not be recycled through ordinary recycling arrangements.

6.4.10. Waste Management Monitoring and Recordkeeping

The hospital shall establish a monitoring and recordkeeping system to assess the effectiveness of the Hospital Waste Management Plan.

The monitoring programme shall cover waste generation, segregation, collection, transportation, temporary storage, treatment and final disposal.

Table 6.8: Hospital Waste Management Monitoring Plan

Sl. No.	Monitoring parameter	Monitoring location/activity	Frequency	Responsible person
1	Waste generation quantity	Hospital departments	Daily	Department Heads
2	Waste segregation practices	Wards, OT, ICU, laboratories and other departments	Daily	Medical Waste Management Officer
3	Condition of colour-coded	All waste-generating departments	Daily	Housekeeping Supervisor

Sl. No.	Monitoring parameter	Monitoring location/activity	Frequency	Responsible person
	bins and containers			
4	Internal waste transportation	Designated waste routes	Daily	Housekeeping Supervisor
5	Temporary waste storage condition	Ground-floor STS	Daily	Waste Management Officer
6	Medical waste collection records	Waste collection point	At each collection	Hospital Administration
7	Treatment and disposal documentation	Third-party service provider	At each transfer/disposal	Medical Waste Management Officer
8	Cytotoxic waste return records	Pharmacy/chemotherapy area, if applicable	At each return	Pharmacy In-charge
9	Anatomical waste disposal records	Designated transfer and disposal arrangements	At each disposal	Medical Waste Management Officer
10	Waste-handler PPE and hygiene	Waste handling areas	Daily	OHS Officer
11	Waste management training	Hospital personnel	At induction and periodically	Hospital Administration
12	Occupational injuries and exposure incidents	Hospital departments	Immediately upon occurrence	OHS Officer
13	WWTP operation and performance	WWTP inlet and outlet	Daily operational checks; laboratory testing periodically	WWTP Operator

Sl. No.	Monitoring parameter	Monitoring location/activity	Frequency	Responsible person
14	Effluent quality	WWTP outlet	Quarterly and as required by DoE	Environmental Officer
15	Sludge collection and disposal	WWTP	At each removal	WWTP Operator
16	Effectiveness of the 3R policy	Hospital-wide	Quarterly	Environmental Officer

The monitoring results shall be documented in registers and reviewed periodically by the hospital management.

Corrective actions shall be undertaken whenever non-compliance, improper segregation, inadequate storage, treatment failure or unsafe disposal practices are identified.

6.4.11. Budgetary Provision and Implementation

The hospital management shall allocate adequate financial and human resources for implementation of the Hospital Waste Management Plan.

The budget shall cover the following activities:

- Procurement and replacement of colour-coded bins and waste containers.
- Procurement of covered transportation trolleys.
- Development and maintenance of the secondary waste storage facility.
- Contractual charges for medical waste collection, treatment and disposal.
- Return and management of cytotoxic and pharmaceutical waste.
- Arrangement with an approved laundry and washing facility.
- PPE and occupational health protection for waste handlers.
- Staff training and awareness programmes.
- Spill-response equipment and emergency supplies.
- Waste monitoring, recordkeeping and environmental compliance activities.

The annual budget shall be determined based on actual waste generation, contractual service costs, staffing requirements and operational needs.

The hospital shall maintain separate financial and operational records to demonstrate that adequate resources have been allocated for implementation of the waste management programme.

6.4.12. Expected Environmental Outcomes

Effective implementation of the Hospital Waste Management Plan is expected to:

1. Minimize environmental pollution arising from improper healthcare waste disposal.
2. Reduce the risk of infection and occupational exposure among healthcare workers and waste handlers.
3. Prevent contamination of soil, surface water and groundwater.
4. Ensure appropriate management of anatomical, pathological, cytotoxic and other hazardous waste.
5. Improve wastewater management and reduce the risk of untreated effluent discharge.
6. Promote resource conservation through implementation of the 3R principles.
7. Strengthen institutional accountability and compliance with applicable environmental requirements.

The hospital management shall periodically review the effectiveness of the plan and revise its implementation arrangements whenever necessary to address operational changes, regulatory requirements and environmental monitoring findings.

The total management plan of hospital waste is given in the following schematic diagram.

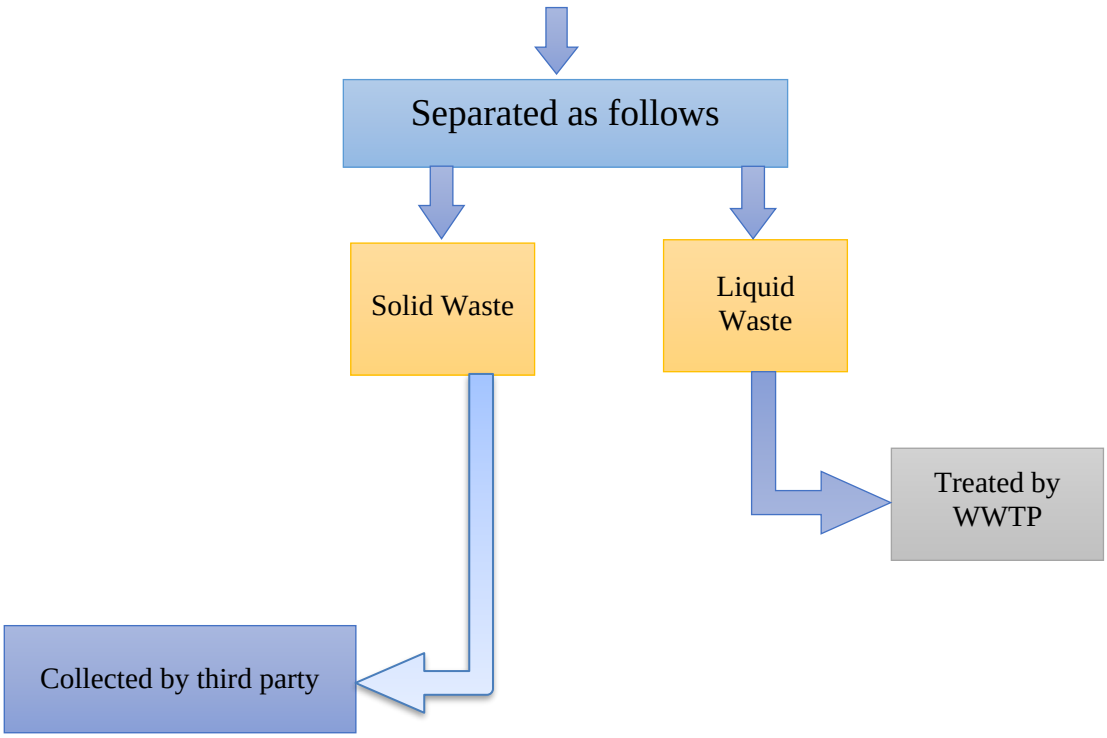


Figure 6.4: The proposed Medical Waste Management plan of the Hospital

The following table gives a summary of the total hospital waste management system.

Table 6.2: Medical Waste Management Plan of Musa Specialized Hospital Ltd.

SN	Types of Hospital Waste	Management Plan
1	Medical waste (solid in form)	Carried out by Prism Bangladesh Foundation.
2	Medical Liquid Waste	Treatment by WWTP
3	Gray Water	Treated by WWTP.
4	Black Water	Treated by Wastewater Treatment Plant (WWTP).
5	General Solid Waste	Carried out and managed by a third-party company.

6.3.6. Air Pollution Management Plan

Musa Specialized Hospital Ltd. will have minimal air pollution impact from its operations. The use of gas burners in the canteen and kitchen, as well as generators for power backup, will be the primary sources of emissions. However, these sources emit limited amounts of pollutants, which are not expected to have significant adverse effects on air quality. The center complies with the Environmental Conservation Rules (ECR), 2023, and will not show any negative impact on ambient air quality. To further ensure minimal air pollution, Musa Specialized Hospital Ltd. implements the following measures:

1. **Use of Low-Emission Gas Burners**: The canteen and kitchen will utilize gas burners, which are known for their low emissions compared to other types of fuel. Regular maintenance of these burners ensures efficient combustion and minimal emission of harmful gases.
2. **Generator Emission Control**: Generators used for power backup will be fitted with proper exhaust systems to minimize smoke emissions. Regular maintenance and timely servicing of generators help to ensure they operate efficiently, thereby reducing their impact on air quality.
3. **Regular Cleaning and Maintenance**:
    - Floors and common areas will regularly be washed and cleaned to reduce the spread of odors and minimize dust accumulation.
    - This practice will help to maintain a clean environment and reduce potential air quality issues caused by dust and debris.
4. **Vehicle Management**: Efficient management of transportation facilities will be in place to minimize emissions from vehicles. This will include the regular maintenance

of hospital vehicles to ensure they comply with emission standards, thereby reducing their impact on air quality.

5. **Greenery and Vegetation**: The hospital premises will feature greenery and vegetation that help absorb dust particles and reduce the amount of airborne dust. This natural barrier will play a significant role in maintaining clean air within the facility.
6. **Regular Water Sprinkling**: To further reduce dust levels, water sprinkling is conducted regularly around the premises. This practice helps to settle dust on surfaces and prevents it from becoming airborne, contributing to improved air quality.
7. **Odor Control Measures**: Proper waste management and ventilation systems will be in place to prevent the accumulation and spread of odors, particularly in areas like the canteen and kitchen.

By implementing these measures, Musa Specialized Hospital Ltd. ensures compliance with air quality standards and minimizes the potential for air pollution, thereby safeguarding the health and well-being of its patients, staff, and visitors

6.5. Noise Management Plan

At Musa Specialized Hospital Ltd., the noise levels will be monitored to ensure they comply with the Environmental Conservation Rules (ECR), 2023, and are currently around 60 dBA. The following Noise Management Plan outlines the strategies to manage and minimize noise pollution effectively.

Sources of Possible Noise Pollution:

1. **Generators**: Used for power backup and can emit significant noise.
2. **Kitchen and Canteen Areas**: Equipment such as exhaust fans, dishwashers, and cooking appliances generate noise.
3. **Transportation Facilities**: Vehicles and transportation equipment contribute to noise levels.
4. **General Hospital Operations**: Includes medical equipment, staff activities, and patient interactions.

Mitigation Measures:

1. **Generator Management**
    - **Enclosure**: The generator room will be fully enclosed to contain and reduce noise emissions.

- **Protective Gear**: Staff working in the generator room will be provided with earplugs as necessary.
- **Low-Noise Equipment**: Utilization of a modern generator designed to produce minimal noise.

2. **Kitchen and Canteen Areas**
   - **Regular Maintenance**: Ensure all kitchen equipment will be well-maintained to reduce noise.
   - **Noise Barriers**: Install noise-absorbing materials around high-noise equipment.
3. **Transportation Facilities**
   - **Vehicle Management**: Implement schedules and maintenance checks to ensure vehicles operate quietly.
   - **Parking Area**: Designate areas for vehicle idling and loading/unloading to minimize noise impact on sensitive areas.

4. **General Hospital Operations**
   - **Noise Protection**: Use noise protection materials in areas prone to high noise levels.
   - **Door and Window Management**: Keep doors and windows closed when not in use to prevent external noise from entering.
5. **Additional Measures**
   - **Regular Monitoring**: Conduct periodic noise level assessments to ensure compliance with ECR standards.
   - **Staff Training**: Educate staff about noise reduction practices and the importance of maintaining a quiet environment.

By implementing these measures, Musa Specialized Hospital Ltd. aims to effectively manage and reduce noise pollution, thereby enhancing the comfort and well-being of both staff and patients.

6.6. Other Environmental Management Plan

6.5.1. Disaster Management Plan

To ensure comprehensive emergency preparedness and response, Musa Specialized Hospital Ltd. has established a Disaster Management Program. This program encompasses training for

staff and volunteers, installation and maintenance of emergency equipment, and the establishment of a command center. The following sections outline the strategies and measures in place to mitigate disaster risks.

6.6.1.1. Objectives

- **Enhance Preparedness**: Equip staff and volunteers with the skills and knowledge needed for effective emergency response.
- **Reduce Risk**: Implement measures to minimize risks associated with potential disasters.
- **Ensure Continuity**: Maintain hospital operations and safety during and after emergencies.
- **Promote Awareness**: Foster a culture of safety and preparedness among staff and the community.

6.6.1.2. Current Measures to Reduce Disaster Risk

1. **Building Design and Infrastructure**
    - **Structural Integrity**: The hospital's well-designed building reduces the risk of collapse.
    - **Land Improvement**: Measures have been taken to reduce water logging and flooding in the hospital area.
    - **Electrical Safety**: Good electrical wiring practices have minimized the risk of electrical incidents.
    - **Engineering Expertise**: Recruitment of qualified engineers contributes to reducing disaster risks.
    - **Firefighting Measures**: Installed firefighting equipment supports the mitigation of fire risks.

6.6.1.3. Future Measures to Further Reduce Disaster Risk

1. **Fire Risk Assessment**
    - **Regular Assessments**: Conduct a comprehensive fire risk assessment annually, following the guidelines in Table 6.1.
2. **Fire Drills and Training**
    - **Drills**: Execute at least two fire drills annually involving firefighters, security personnel, the compliance team, and support from the district fire service and civil defense.
    - **Training**: Provide disaster risk reduction training for campus staff and students.

3. **Disaster Management Team**
    - **Formation**: Establish a dedicated disaster management team responsible for overseeing preparedness and response efforts.
4. **Seasonal Monitoring**
    - **Seasonal Vigilance**: Monitor weather conditions closely during the monsoon and cyclone seasons, and prepare for potential impacts.
5. **Awareness and Education**
    - **Community Awareness**: Implement awareness programs for students and staff to increase understanding of disaster risks and preparedness strategies.
    - **Training Programs**: Conduct disaster risk reduction training sessions for all campus members.

6.6.1.4. Implementation and Review

- **Training and Equipment**: Ensure ongoing training for all staff and volunteers, and regularly inspect and maintain emergency equipment.
- **Command Center**: Operate a command center to coordinate emergency response activities effectively.
- **Plan Review**: Regularly review and update the Disaster Management Plan based on new risks, lessons learned from drills, and feedback from staff.

Musa Specialized Hospital Ltd. is committed to maintaining a robust Disaster Management Plan to safeguard the well-being of patients, staff, and visitors while ensuring the continuity of hospital operations during emergencies.

6.7. Sequential Elements of Environmental Management Plan

The Environmental Management Plan (EMP) for Musa Specialized Hospital Ltd. follows a structured approach to ensure effective management of environmental impacts throughout the project lifecycle. The EMP process comprises three sequential elements:

1. **Identification of Impacts**
    - **Positive and Negative Impacts**: Identify all potential impacts, both positive and negative, on the natural and human environment resulting from the hospital's operations and infrastructure. This includes impacts on air quality, water resources, noise levels, solid waste, and community health.
2. **Evaluation and Assessment of Impacts**

- **Quantification and Analysis**: Evaluate and quantify the identified impacts to understand their significance. This includes assessing impacts relative to baseline conditions and understanding how they affect various aspects of the environment and community. The assessment helps in understanding the extent of impacts and the need for mitigation.

3. **Preparation and Implementation of Management Plans**
    - **Mitigation and Protection Measures**: Develop and implement management plans designed to reduce or offset the potentially significant negative impacts of the hospital operations to acceptable levels. These plans may include modifications to project design, implementation of specific environmental protection measures, and adoption of project alternatives that minimize adverse effects.

Monitoring and Review

- **Monitoring Plan**: Include a monitoring plan to track the effectiveness of the mitigation measures. Regular monitoring ensures that the environmental protection measures are functioning as intended and allows for adjustments as needed based on observed performance and environmental changes.
- **Review Process**: Periodically review the EMP to address any new environmental concerns or changes in project operations. This ongoing review helps in maintaining compliance with environmental standards and adapting to evolving environmental conditions.

Musa Specialized Hospital Ltd. is committed to integrating these sequential elements into its Environmental Management Plan to promote environmental sustainability, ensure regulatory compliance, and enhance the overall impact of the hospital's operations on the community and environment

Table 6.3: Environmental Management Action Plan for Operation Phases

Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
Air pollution	➢ Provide adequate ventilation and exhaust fan in the workplace; ➢ Maintain open air exhaust for generator and set catalytic converter and faulty engine would be repaired as soon as possible; ➢ Plant tree near the boundary line or in the green area; ➢ Monitoring Air every 06 Months;	Throughout Operation phase	Project site	Representative of project proponent
Water pollution	➢ Per day, 60 cubic meters of wastewater are generated during hospital operations, and Waste water is treated by Sewage Treatment Plant. After treatment, the water is reused, and excess treated water is discharged through the drainage system.	Throughout Operation phase	Project site	Representative of project proponent
Solid waste	➢ Apply the 3R method for waste management of the project (per day waste produces around 40-50 KG); ➢ Trained employees on waste control and disposal procedures; ➢ Segregates wastes at source and stores in demarcated places and disposes of them by Prism Bangladesh Foundation.	Throughout Operation phase	Project site	Representative of project proponent
Noise and Vibration	➢ Air plugs will be provided to workers while near to noise generating equipment or working in noise areas; ➢ Procure and use low noise generating machinery;	Throughout Operation phase	Project site	Representative of project proponent

Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
	➢ Conduct periodic maintenance of equipment, replace warn-out parts, lubricate rotating parts; ➢ Will procure noise monitoring device and monitor noise conditions in and outside the project premises; ➢ Monitoring noise condition every 06 months;			
Impact on soil or land	➢ Maintain Cleanliness of the Hospital and store Medical Waste in waste collection bin; ➢ Green belt development for enhancing the natural aesthetic of the site;	Throughout Operation phase	Project site	Representative of project proponent
Impact on traffic volume	➢ Control vehicle movement in an organized way and follow local traffic instructions;	Throughout Operation phase	Project site	Representative of project proponent
Fire/Explosion	➢ Explosion does not apply to the said project; ➢ Establish own firefighting system and maintain collaboration with government firefighting and civil defense departments locally; ➢ Organize fire drills and training for construction staff;	Throughout Operation phase	Project site	Representative of project proponent
Occupational health and safety risk	➢ Conduct job safety analysis; ➢ Use of personal protective equipment such as hard helmet, musk, boot, general glass, etc.; ➢ Aware and train employees on using safety devices;	Throughout Operation phase	Project site	Representative of project proponent

Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
Statutory requirements	➢ Meet all statutory requirements with DoE within the time frame;	Throughout Operation phase	Project site	Representative of project proponent

Table 6.4: Environmental Management Action Plan

Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Water Pollution	- Surface and groundwater pollution -Occupational illness	- Wastewater is treated by Sewage Treatment Plant. - Water recycling	-Monitoring of water quality	-Authority & workers - Health and safety officer	- monitoring half-yearly
Solid waste	- Air, water, and soil pollution -Poorly disposed waste may block drainage	- Proper solid waste management system - Medical Solid waste collection, storage, and transportation system - Awareness and training campaign	- Regular monitoring of the solid waste management facilities	-Authority & workers - Health and safety officer - Prism Bangladesh Foundation	-Must be kept daily register for solid waste - Quarterly reporting

Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Air Pollution	- Deterioration of indoor air quality -Occupational illness/health impact	- Proper stack height for the generator -Regular maintenance of Generators -Use of PPE	-Negligible amount of gaseous from generator (500 **kVA)** -Monitoring of Air Quality	-Authority & workers - Health and safety officer	- monitoring half-yearly
Noise Pollution	- Hearing loss -Reduced productivity and efficiency -Fatigue, headache, nervousness, irritability, and high pretension resulting in accidents at the workplace	- Implementation of an effective noise control and hearing conservation program -Noise measurement -Providing suitable hearing protection to all workers -Training of workers	-Determine Noise levels from time to time -Negligible sound produced by generator	-Authority & workers - Health and safety officer - Neighbors and - The General Public	- Half yearly Noise level monitoring

Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Occupational hazards	- Injury to employees on site -Injury to visitors - Reduced productivity - Plant and equipment damage -Negative corporate image	- Good and sound housekeeping practices -Provision of appropriate working tools and equipment -Use of PPE -Timely repair and maintenance of equipment -Employee training -Use appropriate elevators and other machinery	-Accident and incident records -Record of employee training	-Authority & workers - Health and safety officer	- The mitigation measures proposed should be put in alongside project implementation and daily operations, continuously improved on and sustained throughout the operation life of the hospital.

Chapter Seven: Environmental Management Policy & Monitoring Plan

7.1.Issues of Environmental Management Policy

7.1.1. Issues of Environmental Management Policy

Musa Specialized Hospital Ltd. is committed to implementing a robust environmental policy for its facilities. This policy will be periodically reviewed and enhanced to ensure that all operations adhere to high standards of environmental responsibility and sustainable resource utilization. The policy will address the following key areas:

- **Compliance with Legislation**: Ensure all activities comply with relevant national environmental regulations and standards.
- **Continuous Improvement**: Promote ongoing environmental enhancement and superior performance through rigorous monitoring and evaluation of hospital operations.
- **Resource Utilization**: Optimize the use of natural resources while implementing measures for conservation and preservation to ensure their availability for future generations.
- **Balanced Approach**: Achieve a harmonious balance between natural resource use, environmental conservation, and economic development.

To support these goals, the environmental stewardship program will entail both management responsibilities and individual employee obligations. To achieve the program's objectives, the following actions will be implemented:

- **EHSMS Maintenance**: Continuously maintain and improve the organization's Environment, Health, and Safety Management System (EHSMS).
- **Employee Training**: Provide appropriate training to all employees to fulfill their environmental responsibilities within the EHSMS framework.
- **Objectives and Targets**: Establish annual environmental objectives and targets and implement programs to meet them.
- **Legal Compliance**: Ensure compliance with relevant legal and other environmental requirements.
- **Resource Allocation**: Ensure Musa Specialized Hospital Ltd. has the necessary resources and skills to meet its environmental commitments.

- **Performance Appraisal**: Incorporate environmental performance into the annual appraisal of employees and contractors and provide recognition accordingly.
- **Monitoring and Reporting**: Conduct formal monitoring, auditing, and review of environmental performance and EHSMS requirements, and report annually on progress against defined objectives.

7.1.2. Occupational Health and Safety Policy

Musa Specialized Hospital Ltd. is dedicated to establishing a comprehensive Occupational Health and Safety (OHS) Policy as part of its broader environmental policy framework. This policy will be regularly reviewed and updated as necessary to ensure it addresses the health, safety, and welfare of all employees and meets the local community's health needs. The policy will encompass the following key areas:

- **Safety Measures**: Implement and maintain safety protocols for all machinery and equipment used within the facility.
- **Emergency Procedures**: Develop and enforce emergency procedures and actions to minimize risks and manage accidental damage to employees, the community, and the environment.
- **Training and Maintenance**: Ensure proper machinery maintenance and provide proficiency training for operators to address safety concerns effectively.
- **Personal Protective Equipment (PPE)**: Ensure appropriate PPE is available and used for all doctors, nurses, and staff members.

To promote best practices in health and safety management, the following actions will be undertaken:

- **EHSMS Improvement**: Continuously maintain and enhance the organization's Environment, Health, and Safety Management System (EHSMS).
- **Health and Safety Focus**: Balance efforts between managing health and well-being, personnel, and process safety.
- **Hazard Identification**: Actively identify hazards and manage risks as low as reasonably practicable.
- **Employee Engagement**: Encourage active participation and consultation with employees regarding their own and others' health, well-being, and safety.

- **Resource Allocation**: Provide the necessary resources to support a systematic approach to health, safety, and process management, ensuring continuous performance improvement.
- **Performance Measures**: Establish performance metrics, set improvement targets, and measure and report performance at all organizational levels.
- **Legal Compliance**: Ensure compliance with all relevant legal and regulatory requirements.
- **Safety Culture**: Foster a culture where employees remain vigilant about safety hazards and integrate health and safety performance into employee appraisals, recognizing and rewarding adherence to safety practices.

7.1.3. Local Community Policy

Musa Specialized Hospital Ltd. is committed to fostering strong relationships with both its employees and the local community based on mutual respect and active partnership. The Local Community Policy will focus on:

- **Collaboration:** Working closely with local communities, government departments, and relevant agencies to support sustainable community development.
- **Communication:** Enhancing the flow of information between management, employees, and the community to ensure transparency and effective engagement.
- **Capacity Building:** Actively involving the local community in hospital activities and decision-making processes to build community capacity and engagement.

7.1.4. Pollution Control Policy

Musa Specialized Hospital Ltd.'s Pollution Control Policy is derived from the comprehensive Environmental Management Plan (EMP) and is designed to prevent and manage pollution effectively. The policy includes:

- **Pollution Prevention:** Ensuring that hospital operations do not result in pollution of the premises or surrounding areas.
- **Waste Management:** Implementing proper measures for pollution control, including:
    - **Liquid Waste:** Treating liquid waste using a properly designed sewage treatment plant.
    - **Gaseous Effluents:** Managing incinerator emissions by passing them through water, with subsequent treatment of this water.

- **Solid Waste:** Preventing open dumping and ensuring safe disposal.
- **Sharp Waste:** Storing sharp waste in a reinforced concrete container (RCC tank).

- **Environmental Safety:** Taking all necessary steps to ensure a safe and clean environment in accordance with the policy.

7.2.Environmental Monitoring Plan

Monitoring is an essential part of EMP. Monitoring makes it easy to understand whether the recommended mitigation/enhancement measures are working well or not. Under this monitoring plan, different types of monitoring works, such as Water Pollution, Air Pollution, Noise pollution, etc., will be monitored periodically to measure the pollution level of specified locations within the project and the surrounding area.

7.2.1. Monitoring Parameters and Frequency

According to the monitoring data, improvements and further mitigation measures may be needed for more effective maintenance and control of pollution levels within the government-recommended level. The monitoring will be conducted as per the following table.

Table 7.1 Monitoring Parameters and Frequency

Issue	*Location of Monitoring*	*Parameters*	*Monitoring Frequency*	*Duty Unit /Persons*
Solid waste Generation	Every Floor/OT/Premises etc.	-	Daily	Based on discussion and the Management department
Medical wastewater discharge	METP inlet & outlet, OT, Drain.	pH, BOD, COD, Temp., TSS, etc.	Every Three Months	
Stack Emissions & Ambient air quality	Air pollutant emission points like generator room, Incinerator, and Around the Hospital site.	Not mandatory	Not mandatory	
Generation of Hazardous waste	Production area, chemical storeroom, X-Ray Room and OT	Chemicals sample, igneous, X-Ray Films, Sharp metal, etc.	Daily	

Issue	*Location of Monitoring*	*Parameters*	*Monitoring Frequency*	*Duty Unit /Persons*
Workplace Environment	Hospital Premises	Light, Air, Sound, Temperature, Moisture content, etc.	Once in every three months	
Noise Level	Hospital Premises	Noise at different locations day and night	Once in every three months	
Drinking water Quality	Drinking water outlet	pH, Total Alkalinity Total Hardness TDS, As, Fe, Chloride (Cl-), Fecal & Total Coliform	Once in six months	

7.2.2 Environmental Monitoring Budget

The monitoring budget has been developed considering the major environmental aspects associated with the operation phase of the facility, including stack emission monitoring, ambient air quality monitoring, wastewater analysis, noise monitoring, groundwater and surface water quality assessment, waste management monitoring, and occupational health monitoring. The budget includes laboratory testing costs, sample collection, monitoring equipment maintenance, environmental reporting, and professional consultancy support where required.

The proposed annual environmental monitoring budget will ensure that PFL maintains an effective environmental management system and remains compliant with regulatory requirements.

Table: Proposed Annual Environmental Monitoring Budget for Musa Specialized Hospital

Sl. No.	Monitoring Activity	Parameters / Scope	Frequency	Estimated Annual Cost (BDT)
1	Wastewater Quality Monitoring	pH, BOD_5, COD, TSS, TDS, DO, temperature and other relevant effluent parameters at WWTP inlet and outlet	Quarterly (4 times/year)	120,000
2	Ambient Air Quality Monitoring	$PM_{2.5}$, PM_{10}, SPM, SO_2, NO_2 and CO at representative project boundary locations	Half-yearly (2 times/year)	80,000
3	Ambient Noise Monitoring	Daytime and nighttime Leq, Lmax and Lmin at representative boundary locations	Quarterly (4 times/year)	60,000
4	Drinking Water Quality Monitoring	pH, TDS, total alkalinity, total hardness, arsenic, iron, chloride, faecal and total coliform	Half-yearly (2 times/year)	30,000
5	Surface Water Quality Monitoring	pH, TDS, TSS, DO, BOD_5, COD and lead at representative upstream, downstream and nearby water bodies	Half-yearly (2 times/year)	50,000
6	Groundwater Quality Monitoring	pH, TDS, iron, alkalinity, hardness, chloride, lead and arsenic	Annually (1 time/year)	18,000
7	Workplace Environmental Monitoring	Workplace lighting, air quality, sound level, temperature and moisture conditions	Quarterly (4 times/year)	40,000
8	Healthcare and General Waste Management Monitoring	Daily waste segregation, collection, storage, transportation, disposal records and verification of authorized waste management arrangements	Daily internal monitoring; annual compliance audit	25,000
9	Environmental Compliance Audit and Reporting	Review of EMP implementation, environmental monitoring results, waste management records, regulatory compliance and preparation of annual environmental monitoring report	Annually (1 time/year)	30,000
10	Total Estimated Annual Environmental Monitoring Budget			453,000

Chapter Eight: Analysis of Alternatives

This section examines various alternatives to the proposed hospital project by Musa Specialized Hospital Ltd., considering environmental, social, and economic factors. Each alternative is assessed to determine its implications on healthcare provision, community impact, and environmental sustainability.

8.1.Do Nothing

Description: This alternative involves not proceeding with the proposed hospital project and continuing to rely on the existing healthcare infrastructure in the area.

Implications:

- Healthcare Access: The existing facilities may continue to face challenges in meeting the healthcare needs of the growing population in Basila, Keraniganj and surrounding areas. This could exacerbate current deficiencies and limit access to quality medical care.
- Community Impact: The community might experience ongoing limitations in healthcare services, leading to potential health disparities and increased pressure on existing facilities.
- Environmental Impact: By not proceeding with the project, there would be no new construction-related environmental impacts. This alternative avoids any immediate environmental disturbances associated with building and operating a new facility.
- Costs and Benefits: While avoiding the costs associated with construction and operation, this alternative forgoes the potential benefits of improved healthcare access, regional development, and enhanced local infrastructure.

8.2.Alternative Land Use

Description: This alternative involves repurposing the designated site for a different use rather than constructing a healthcare facility. Potential alternative uses include community development projects, such as parks, educational institutions, or commercial establishments.

Implications:

- Community Development: Alternative land uses could provide significant benefits to the local community, such as enhanced public spaces, educational opportunities, or economic development through commercial ventures.
- Healthcare Needs: While this approach might benefit the community in various ways, it would not address the critical healthcare needs of the region. The absence of a new healthcare facility would mean that existing gaps in healthcare services would remain unaddressed.
- Environmental Impact: Depending on the alternative use, there could be varying environmental impacts. For example, developing a park might offer environmental benefits, while commercial establishments could introduce new pollution sources.
- Costs and Benefits: This alternative might offer immediate economic and community benefits but fails to provide the long-term health benefits associated with improved healthcare infrastructure.

8.3.Alternative Land Site

Description: This alternative involves relocating the proposed hospital to a different site within Dhaka or the surrounding area. The new site would be selected based on factors such as accessibility, environmental impact, and suitability for construction.

Implications:

- Accessibility: A new site might offer better accessibility for the target population, potentially improving the effectiveness of the healthcare facility in serving the community.
- Environmental Impact: Relocating the project could reduce environmental impacts if the new site is better suited for construction and minimizes disturbances to the surrounding environment. However, this would require a thorough environmental assessment of the alternative site.
- Costs and Benefits: Identifying and developing a new site could involve additional costs and delays. The benefits would include potentially addressing any concerns related to the original site, such as environmental or logistical issues. The new location would need to be carefully evaluated to ensure it meets the project's goals and effectively serves the target population.

- Community Impact: The success of this alternative depends on the suitability of the new site in addressing community healthcare needs and providing the intended benefits of improved healthcare access.

8.4.Conclusion

Each alternative presents distinct advantages and challenges:

- Do Nothing: Avoids construction and environmental impacts but fails to address existing healthcare deficiencies.
- Alternative Land Use: Offers community and economic benefits but does not address healthcare needs.
- Alternative Land Site: Provides potential for better site-specific benefits but involves additional costs and delays.

After evaluating the alternatives for the proposed hospital project, it is concluded that proceeding with the current site is the most suitable option for Musa Specialized Hospital Ltd.. This site offers several advantages that align with the project's objectives and the needs of the surrounding community.

a. Serving the Surrounding Area: The current location is strategically positioned to effectively serve the Keraniganj area and its surrounding neighborhoods. It provides a central and accessible site for residents, ensuring that the healthcare facility can address the medical needs of a significant population base. This proximity will enhance the facility's ability to deliver timely and efficient care, which is crucial for improving overall health outcomes in the region.
b. Economic Growth: Developing the hospital at this location will contribute to local economic growth by creating jobs, stimulating local business, and enhancing the infrastructure of the area. The presence of a healthcare facility can attract additional investments and foster economic development, benefiting both the immediate community and the broader region.
c. Cost Efficiency: Utilizing the existing land owned by Musa Specialized Hospital Ltd. significantly reduces costs associated with land acquisition, which can be substantial when seeking new sites. This advantage minimizes additional financial burdens and allows the organization to allocate resources more effectively toward the development and operation of the healthcare facility.

d. Environmental Considerations: Selecting a new land site would involve additional environmental assessments and potential disruptions associated with land acquisition and development. These activities could introduce new environmental challenges and delays, contrary to the current site, which has already been evaluated and is prepared for development. By proceeding with the existing site, Musa Specialized Hospital Ltd. avoids the environmental impacts and complexities associated with new site development.
e. Addressing Healthcare Needs: The proposed site is well-positioned to meet the growing healthcare demands of the local population. It ensures that the hospital can provide essential medical services without the added delays and complications of finding and developing a new location.

In summary, the current site is optimal for Musa Specialized Hospital Ltd.'s hospital project. It effectively meets the healthcare needs of the people, supports local economic growth, and provides a cost-effective solution by leveraging existing land. This approach avoids the additional environmental and financial impacts of acquiring a new site and aligns with the organization's goals of delivering high-quality healthcare services while promoting sustainable development.

Chapter Nine: Decommissioning Plan

The decommissioning plan for Musa Specialized Hospital Ltd. outlines a comprehensive strategy to safely dismantle the project site, minimize environmental impacts, and restore the area for future use. Each component of the plan is elaborated below:

9.1.Project Closure Notification

- Notification Process:
    - Regulatory Bodies: Notify relevant government agencies, including environmental authorities, about the decommissioning activities. This might include the Department of Environment and local municipal authorities.
    - Stakeholders: Inform key stakeholders such as employees, contractors, suppliers, and local community members about the project's closure and decommissioning plans. This helps to manage expectations and address any concerns.
    - Public Communication: Use local media and community meetings to keep the public informed about the decommissioning schedule and potential impacts. This transparency helps to build trust and facilitates smooth communication.
- Documentation:
    - Decommissioning Plan Documentation: Prepare comprehensive documentation outlining the decommissioning schedule, procedures, safety measures, and contact information for project managers.
    - Regulatory Compliance Records: Ensure that all regulatory compliance documents, including permits and approvals, are up-to-date and accessible.

9.2.Site Assessment

- Pre-Demolition Assessment:
    - Site Survey: Conduct a detailed survey of the site to assess current conditions, including structural integrity, environmental quality, and the presence of hazardous materials.
    - Review Historical Data: Analyze historical records and reports related to site operations, maintenance, and previous environmental assessments to identify potential issues.

- Hazard Identification:
    - Hazardous Materials: Identify and catalog hazardous materials such as asbestos, lead, or chemical residues. Use specialized services to assess the presence and concentration of these materials.
    - Risk Assessment: Evaluate the risks associated with these hazards, including potential health impacts on workers and environmental contamination.

9.3.Dismantling and Removal

- Dismantling Procedures:
    - Detailed Plan: Develop a detailed dismantling plan that outlines the steps for safely decommissioning the hospital's structures and systems. This plan should include methods for deconstructing buildings, removing equipment, and managing debris.
    - Safety Measures: Implement safety protocols to protect workers and the public, including barricades, signage, and emergency response plans.
- Equipment Removal:
    - Decommissioning Equipment: Safely decommission and remove medical and operational equipment, ensuring that any hazardous components are handled appropriately.
    - Special Handling: For equipment containing hazardous materials (e.g., batteries, electronic waste), follow specific disposal procedures.
- Structural Demolition:
    - Demolition Methods: Use appropriate demolition methods for different types of structures. This may include mechanical demolition, dismantling by hand, or using controlled explosives.
    - Debris Management: Manage demolition debris by sorting materials for recycling, disposal, or reuse. Ensure that debris is transported and disposed of according to regulations.

9.4.Waste Management

- Waste Categorization:
    - Types of Waste: Classify waste into categories such as hazardous, non-hazardous, recyclable, and general waste.

- Waste Tracking: Implement a waste tracking system to monitor the types and quantities of waste generated and their disposal methods.

- Disposal Procedures:
  - Licensed Contractors: Work with licensed waste disposal contractors to handle and dispose of hazardous and non-hazardous waste.
  - Compliance: Ensure that all waste disposal activities comply with local, national, and international regulations.
- Recycling and Reuse:
  - Recycling Programs: Establish recycling programs for materials such as metals, wood, and concrete. Partner with recycling facilities to process these materials.
  - Reuse Opportunities: Identify opportunities to repurpose or reuse materials in other projects or for charitable purposes.

9.5.Soil and Water Remediation

- Soil Testing:
  - Sampling and Analysis: Conduct soil sampling and laboratory analysis to detect contamination from hazardous materials or chemicals used during hospital operations.
  - Contamination Mapping: Map areas of contamination to target remediation efforts effectively.
- Remediation Measures:
  - Treatment Methods: Apply appropriate soil remediation techniques such as excavation, soil washing, or bioremediation to clean contaminated soil.
  - Regulatory Compliance: Follow guidelines and regulations for soil remediation to ensure effectiveness and safety.
- Water Quality Monitoring:
  - Testing: Regularly test surface and groundwater for contaminants, especially if there were storage tanks or waste disposal areas on-site.
  - Treatment: Implement water treatment solutions if contamination is detected, ensuring that treated water meets regulatory standards before discharge or reuse.

9.6.Site Restoration

- Restoration Plan:

- Land Regrading: Regrade and contour the land to restore it to its natural state or prepare it for new uses. This may involve filling in excavations or leveling uneven areas.
- Vegetation: Plant vegetation and grasses to stabilize the soil, prevent erosion, and enhance the aesthetic appeal of the site.

- Final Inspection:
  - Inspection Checklist: Conduct a final inspection to verify that all decommissioning and restoration activities have been completed according to the plan.
  - Regulatory Approval: Obtain any necessary approvals from regulatory authorities to confirm that the site meets all required standards for restoration.

9.7.Monitoring and Reporting

- Ongoing Monitoring:
  - Environmental Monitoring: Implement a monitoring program to track environmental conditions, such as soil quality and water quality, after decommissioning. This helps to detect any residual contamination or impacts.
  - Periodic Reviews: Conduct periodic reviews to assess the effectiveness of remediation and restoration efforts.
- Reporting:
  - Final Report: Prepare a comprehensive final report detailing the decommissioning activities, waste management practices, remediation efforts, and site restoration outcomes.
  - Stakeholder Communication: Share the final report with stakeholders, including regulatory bodies, local communities, and internal management.

9.8.Health and Safety

- Health and Safety Plan:
  - Risk Assessment: Conduct a risk assessment to identify potential health and safety hazards associated with decommissioning activities.
  - Safety Measures: Develop and enforce safety measures, including the use of personal protective equipment (PPE), training for workers, and emergency response procedures.
- Risk Management:

- Accident Prevention: Implement procedures to prevent accidents and injuries, including regular safety audits and inspections.
- Emergency Response: Establish an emergency response plan to address potential incidents, such as chemical spills or equipment failures, during decommissioning.

By addressing each of these components, Musa Specialized Hospital Ltd. ensures a thorough and responsible approach to decommissioning. This plan aims to protect the environment, safeguard public health, and prepare the site for future use in a sustainable manner.

Chapter Ten: Public Consultations

10.1. Introduction

The public consultation for the proposed healthcare facility project by Musa Specialized Hospital Ltd., located at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh, was conducted to gather input on the project's potential environmental and socio-economic impacts. This consultation aimed to facilitate open and transparent communication between the project developers and the local community. Through various engagement activities, including public meetings and interviews, community members and stakeholders were invited to share their concerns, suggestions, and expectations regarding the project's environmental footprint, socio-economic effects, and proposed mitigation strategies. The feedback gathered from these consultations was instrumental in shaping the Environmental Impact Assessment (EIA) report, ensuring that the project aligns with community interests and promotes sustainable development in the area.

10.2. Objectives of Public Consultation and Disclosure Meeting

The objectives of the public consultation for the proposed healthcare facility project by Musa Specialized Hospital Ltd. at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh, are outlined below:

- **Engagement and Inclusion:** To actively engage the local community, stakeholders, and relevant authorities in the decision-making process, ensuring their opinions, concerns, and feedback are collected and considered.
- **Information Sharing:** To provide clear and comprehensive information about the project’s objectives, scope, location, potential impacts, and proposed mitigation strategies, thereby fostering transparency and understanding among all participants.
- **Addressing Concerns:** To offer a platform for participants to express their concerns, ask questions, and share perspectives on potential environmental, socio-economic, and community impacts associated with the healthcare facility.
- **Gathering Feedback and Suggestions:** To solicit valuable feedback and suggestions from participants on how to minimize negative impacts, enhance positive outcomes, and incorporate sustainable development practices throughout the project's lifecycle.

- **Promoting Collaboration:** To promote collaboration and partnership between project developers, local community members, stakeholders, and relevant authorities, aiming to achieve a shared understanding and alignment on the project's vision and objectives.
- **Influencing Decision-Making:** To ensure that the input gathered during the public consultation process significantly influences the decision-making process, project design, and the development of the Environmental Impact Assessment (EIA) report.
- **Building Trust:** To build trust and credibility between Musa Specialized Hospital Ltd. and the local community by actively listening to concerns, responding to inquiries, and integrating meaningful feedback into the project's planning, implementation, and monitoring phases.

10.3. Approach and Methodology of Public Consultation and Disclosure Meeting

The approach and methodology for the public consultation and disclosure meeting for Musa Specialized Hospital Ltd.'s proposed healthcare facility project at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh, aim to ensure effective communication, meaningful engagement, and transparency. The following steps outline the suggested approach and methodology for the public consultation:

10.3.1. Preparing for the Consultation:

- Identify Key Stakeholders: Engage with relevant stakeholders, including local community members, government authorities, non-governmental organizations (NGOs), healthcare professionals, and environmental experts, who may have an interest in or be impacted by the project.
- Define Objectives and Scope: Clearly outline the objectives of the consultation, the key topics for discussion, and the scope of the process to provide clear guidance for the meeting.
- Develop an Engagement Plan: Prepare a comprehensive engagement plan that details the activities, timeline, and resources required to conduct the consultation process effectively.
- Information Preparation: Gather all relevant project information, such as project plans, Environmental Impact Assessment (EIA) findings, and proposed mitigation measures, to be shared with participants to facilitate informed discussions.

10.3.2. Communication and Outreach:

- Publicize the Meeting: Use a variety of communication channels, including local newspapers, radio stations, community notice boards, social media platforms, and direct invitations, to inform the community about the consultation meeting and invite their participation.
- Multilingual Support: Provide translation services or materials in local languages to ensure all participants, regardless of language barriers, can engage effectively in the consultation.
- Engage Local Leaders and Influencers: Collaborate with local community leaders, respected elders, and influencers to spread the word about the meeting and encourage widespread participation.

10.3.3. Consultation Meeting:

- Facilitate Open Discussion: Create a welcoming and inclusive environment that encourages open dialogue. Facilitators should ensure that all attendees have the opportunity to voice their opinions, ask questions, and share their concerns without fear of bias or intimidation.
- Present Project Information: Begin the meeting with a clear and concise presentation of the project's overview, its purpose, potential environmental and socio-economic impacts, and the proposed mitigation measures. Use visual aids and straightforward language to enhance understanding.
- Q&A and Interactive Sessions: Allocate ample time for participants to ask questions, seek clarifications, and provide feedback. Foster interactive discussions that allow for diverse perspectives and ideas to be shared.
- Workgroup Activities: Organize smaller workgroup activities or breakout sessions focused on specific issues or concerns. This approach ensures deeper engagement and allows participants to discuss topics more thoroughly.

10.3.4. Disclosure of Information:

- Transparent Information Sharing: Provide all participants with access to relevant project documents, reports, and studies, ensuring complete transparency in the disclosure of project-related information.
- Written Submissions: Encourage participants to submit written feedback or complete feedback forms to capture their concerns, suggestions, and recommendations in a structured and organized manner.

- Follow-Up Communication: Commit to sharing a comprehensive summary of the meeting, including key points discussed, concerns raised, and proposed actions, to keep all participants informed and maintain transparency.

10.3.5. Evaluation and Incorporation:

- Evaluate Feedback: Carefully analyze the feedback and input received during the consultation process to identify recurring themes, concerns, and valuable suggestions.
- Incorporate Feedback: Utilize the feedback to refine project plans, adjust mitigation measures, and address community concerns to the greatest extent possible, demonstrating a commitment to responsive and responsible project planning.
- Communication of Outcomes: Clearly communicate the outcomes of the consultation process, highlighting how the input received has influenced decision-making, and detailing any modifications made to the project based on the feedback provided by participants.

10.4. Public Consultation Meeting (PCMs)

Public consultation was initiated with the explicit objective of ensuring community participation from the planning stage of the project. The aim was to enhance the study by incorporating opinions and concerns from residents of the impacted area. During the household survey, conducted through a semi-structured questionnaire, knowledgeable individuals, community leaders, and local chairpersons and members were identified and approached for their input.

Musa Specialized Hospital Ltd. organized a public consultation meeting on 10 October2026 at Block M , Bashundhara, Dhaka. The meeting was attended by approximately 50 participants, including local residents, community leaders, and other interested individuals from various parts of the community.

The consultation provided a platform for open dialogue, allowing stakeholders to express their views, ask questions, and raise concerns about the proposed healthcare facility. This inclusive approach helped to gather valuable insights and foster a sense of collaboration and transparency between the project developers and the local community.

10.5. Public Disclosure Meetings (PDMs)

The local response to the proposed project by Musa Specialized Hospital Ltd. has been generally positive. Most residents living close to the project site have expressed no objections to establishing the healthcare facility at the chosen location. During interviews, many individuals were unaware of potential environmental hazards and did not perceive the project as threatening their well-being.

Historically, a top-down approach has been common in similar projects, where public involvement in the planning stages is minimal. This approach was also observed in the case of Musa Specialized Hospital Ltd.. It contrasts with a bottom-up approach, which would involve local community input throughout the project design and planning phases.

Despite this, the community appears optimistic about the project, primarily due to the anticipated employment opportunities and the potential for improved healthcare services. Public participation is limited to engaging residents in construction and related activities, with indirect benefits from associated economic activities.

Key outcomes from the Public Disclosure Meeting include:

- **Quality of Life Improvements**: Local residents believe that the project's implementation will enhance their quality of life. There are no significant concerns regarding disruptions to daily activities, and the community is positive about the job opportunities that the new facility will provide.
- **Environmental Concerns and Recommendations**: Stakeholders have voiced concerns about potential environmental impacts. They recommended that Musa Specialized Hospital Ltd. adopt sustainable waste reduction, reuse, and recycling practices.
- **Waste Management**: A comprehensive waste management plan is in place. The healthcare facility will have dedicated systems for managing medical and other waste, ensuring proper disposal and recycling where feasible.
- **Water Management**: The project includes measures for water management, with plans to maximize water reuse. Initially, a significant percentage of water will be recycled, with the remainder treated before discharge.
- **Consultancy Commitment**: The consultancy firm Environest Engineering (EE) has committed to incorporating recommendations such as waste reduction strategies into

the Environmental Impact Assessment (EIA) report. They will work closely with Musa Specialized Hospital Ltd. to ensure these measures are effectively implemented and monitored.

The Public Disclosure Meeting has been instrumental in addressing community concerns and ensuring transparency in the planning and implementation of the healthcare facility.

- Additional documents for Public Consultation are added in Annexure.

Chapter Eleven: Conclusion

The proposed site for Musa Specialized Hospital Ltd. is located at P-2341/A, R-26/A, 27/A, Block M, Bashundhara, Dhaka, Bangladesh. This location has been selected for its strategic advantages, including excellent road connectivity, reliable electricity supply, and access to essential services. Furthermore, the availability of adequate groundwater resources supports the operational needs of the healthcare facility.

The current Environmental Impact Assessment (EIA) report thoroughly evaluates the potential environmental and socio-economic impacts associated with the project. The study highlights the importance of implementing comprehensive mitigation measures to manage these impacts effectively. Key measures include proper handling of medical waste, ensuring water reuse and treatment, and adhering to stringent environmental controls to minimize pollution.

The project's success hinges on adhering to the Environmental Management Plan (EMP) outlined in this report. By following the recommended practices, Musa Specialized Hospital Ltd. will ensure a safe and healthy environment for both patients and staff. The facility is committed to maintaining high standards of environmental protection and sustainability.

The hospital's management has demonstrated a proactive approach to addressing environmental challenges. Initial measures have already been implemented, and the remaining actions outlined in the EMP will be executed promptly. This commitment will enable Musa Specialized Hospital Ltd. to not only meet but exceed regulatory requirements and environmental standards.

Overall, the project is set to become a leading healthcare facility in Dhaka, renowned for its advanced medical services and commitment to environmental stewardship. With the ongoing support and dedication of the management and staff, Musa Specialized Hospital Ltd. is poised to make a significant positive impact on the community and the healthcare sector in Bangladesh.

Chapter Twelve: Reference

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Annexure

Annexure A: Test Reports

Annexure B: Public Consultation

Annexure C: EIA TOR Approval Letter

Annexure D: Wastewater Treatment Plants (WWTP) Detail, Calculation, Design and Drawings

Musa Specialized Hospital Ltd.

2026

Environmental Impact Assessment

Prepared By - EnviroNest ENGINEERING