

Environmental Impact Assessment of Green Life Hospital Ltd. (Cancer Unit)

Plot: 39, Road: 108, Sector: 8, Purbachal Town, Narayanganj.



Submitted To,
Department of Environment (DoE)
Ministry of Environment, Forest and Climate Change
Government of the People's Republic of Bangladesh

Prepared by,
Environmental Study & Research Division (ESRD)
A Sister Concern of



Water Technology BD Limited

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Draft Environmental Impact Assessment (EIA) Report
(This draft report will be updated and finalized after completion of Public Consultation,
in accordance with the regulatory requirements of the Department of Environment (DoE))

June 2026

Acknowledgement

This Environmental Impact Assessment (EIA) Report has been prepared by Water Technology BD Ltd. (WTBL) in collaboration with the Environmental Study & Research Division, in accordance with the regulatory requirements set forth by the Department of Environment (DoE), Ministry of Environment, Forests and Climate Change (MoEFCC), Government of the People's Republic of Bangladesh. The Environmental Study & Research Division, a subsidiary of WTBL, has conducted a comprehensive environmental study and developed this report for Green Life Hospital Ltd. (Cancer Unit) located at Plot: 39, Road: 108, Sector: 8, Purbachal Town, Narayanganj.

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List of Abbreviation

AQM	: Air Quality Monitoring
BARC	: Bangladesh Agriculture Research Council
BREB	: Bangladesh Rural Electrification Board
BDT	: Bangladeshi Taka
BBS	: Bangladesh Bureau of Statistics
BERC	: Bangladesh Energy Regulatory Commission
BECA	: Bangladesh Environmental Conservation Act
BFD	: Bangladesh Forest Department
BIWTA	: Bangladesh Inland Water Transport Authority
BMD	: Bangladesh Meteorological Department
BNBC	: Bangladesh National Building Code
BWA	: Bangladesh Water Act
BOI	: Board of Investment
BOD	: Biochemical Oxygen Demand
BPDB	: Bangladesh Power Development Board
BRTA	: Bangladesh Road Transport Authority
BRRI	: Bangladesh Rice Research Institute
CESR	: Corporation Environmental and Social Responsibilities
CIA	: Cumulative Impact Assessment
CO	: Carbon Monoxide
COD	: Chemical Oxygen Demand
CEL	: Control Engineering Laboratory
DAE	: Department of Agriculture Extension
DC	: Deputy Commissioner
DG	: Director General
DDM	: Department of Disaster Management
DoE	: Department of Environment
DoF	: Department of Fisheries
DPHE	: Department of Public Health and Engineering
DPA	: Domestic Processing Area
DIFE	: Department of Inspection for Factory and Establishments
BFD	: Bangladesh Forest Department

ECR	: Environment Conservation Rules
ECA	: Environment Conservation Act
ECC	: Environmental Clearance Certificate
EMP	: Environmental Management Plan
EIA	: Environmental Impact Assessment
EPA	: Export Processing Area
EHS	: Environmental, Health, and Safety
ESRD	: Environmental Study & Research Division
ERP	: Emergency Response Plan
EMoP	: Environmental Monitoring Plan
EN	: Endangered
FGD	: Focus Group Discussions
FS	: Feasibility Study
GoB	: Government of Bangladesh
GIS	: Geographic Information System
GPS	: Global Positioning System
GDP	: Gross Domestic Product
GRM	: Grievance Redress Mechanism
HIES	: Household Income and Expenditure Survey
HCR	: Household Consumption Report
IEE	: Initial Environment Examination
IFC	: International Finance Corporation
IUCN	: International Union for Conservation of Nature
KII	: Key Informant Interviews
LC	: Least Concern
LULC	: Land Use and Land Cover
LT	: Long Term
MoEFCC	: Ministry of Environment, Forests & Climate Change
MoFL	: Ministry of Fisheries and Livestock
MoL	: Ministry of Land
MMCFD	: Million Cubic Feet per Day
MW	: Megawatt
mg/L	: Milligrams per Liter

MoLE	: Ministry of Labor and Employment
MoLPA	: Ministry of Law and Parliamentary Affairs
MOHFW	: Ministry of Health and Family Welfare
MoS	: Ministry of Shipping
NGO	: Non-Governmental Organization
NOC	: No Objection Certificate
NO_x	: Nitrogen Oxides
NAAQS	: National Ambient Air Quality Standards
NEQS	: National Environmental Quality Standards
NEP	: National Environmental Policy
NWP	: National Water Policy
NT	: Near Threatened
NWMP	: National Water Management Plan
NEMAP	: National Environmental Management Action Plan
NWRC	: National Water Resources Council
OSH	: Occupational Safety and Health
PGCB	: Power Grid Company of Bangladesh
PMO	: Prime Minister's Office
PCM	: Public Consultation Meetings
PM	: Particulate Matter
PPE	: Personal Protective Equipment
RR	: Rare Resident
SRDI	: Soil Resource Development Institute
STP	: Sewage Treatment Plant
ST	: Short Term
SO₂	: Sulfur Dioxide
SW	: Surface Water
TSS	: Total Suspended Solids
ToR	: Terms of Reference
UNEP	: United Nations Environment Programme
UP	: Union Parishad
VU	: Vulnerable
WARPO	: Water Resources and Planning Organization

WB	: World Bank
WTP	: Water Treatment Plant
WTB	: Water Technology Bangladesh

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Chapter-01

Executive Summery

1 Executive Summary

a. Introduction

The Environmental Impact Assessment (EIA) has been prepared for the proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town, located at Plot-039, Road-108, Sector-08, Purbachal New Town under Narayanganj District, Bangladesh. The project site is situated within a well-planned and structured urban township, designed with modern infrastructure, utilities, and supporting civic amenities.

The proposed facility is a specialized oncology hospital aimed at providing advanced cancer diagnosis, treatment, and patient care services in accordance with national healthcare standards and international best practices. The development of this hospital reflects the growing need for specialized healthcare infrastructure in Bangladesh, particularly in the field of cancer treatment and associated medical services.

The hospital will be developed with modern healthcare infrastructure, including diagnostic units, treatment facilities, operation theatres, inpatient and outpatient services, laboratory services, and supporting utility systems. Essential infrastructure such as electricity supply, water supply, wastewater management systems, and backup power generation will be incorporated to ensure uninterrupted hospital operation.

Environmental protection measures will be integrated into the project design, including a Combined Effluent Treatment System (ETP-STP), proper solid waste management system, fire safety arrangements, stormwater drainage system, and energy-efficient and renewable energy solutions. These measures will ensure that hospital operations remain environmentally compliant and sustainable throughout its lifecycle.

To ensure environmental compliance with national regulations, the project proponent has appointed a competent consultancy firm (WTB) to carry out the EIA study in accordance with the requirements of the Department of Environment (DoE), Bangladesh. The study evaluates potential environmental and social impacts and proposes appropriate mitigation measures to minimize adverse effects while enhancing positive outcomes.

The EIA report includes an Environmental Management Plan (EMP) outlining mitigation measures, monitoring mechanisms, and institutional responsibilities to ensure proper environmental management during construction and operational phases. The hospital authority will ensure strict compliance with all relevant environmental rules and standards,

and will maintain continuous monitoring to support safe, sustainable, and environmentally responsible healthcare services.

b. Project Description

Green Life Hospital Limited (GLHL) proposes to establish a specialized Cancer Hospital in Purbachal New Town, Dhaka, with provisions for future expansion into a Specialized General Hospital. The project has been initiated in response to the increasing burden of cancer in Bangladesh, where cancer accounts for approximately 10–12% of annual deaths nationwide.

Although Bangladesh's healthcare sector is expanding, the availability of advanced cancer treatment facilities remains limited. At present, only a small number of hospitals provide comprehensive oncology services, while there is a significant shortage of radiotherapy machines and modern cancer care infrastructure. This situation highlights the urgent need for additional specialized facilities to meet growing patient demand.

The proposed hospital will be located in Purbachal New Town, a planned urban area with ongoing infrastructure development and improved connectivity with Dhaka and surrounding regions. The strategic location, combined with GLHL's ownership of the project land, ensures timely implementation and supports phased development of the facility. The hospital will initially have a capacity of 100 beds with advanced cancer treatment technologies, with future expansion up to 200 beds.

Although application will be made to the Department of Environment (DoE) for a 100-bed hospital license, the initial phase of operation will be limited to outpatient (OPD) services only. In this phase, the facility will provide diagnostic consultation, outpatient oncology services, and related support services without inpatient admission. Inpatient (bed) services will be introduced in the future based on patient demand and operational feasibility.

Overall, the project aligns with national healthcare priorities and addresses a critical gap in specialized oncology services. The establishment of Green Life Cancer Hospital is expected to strengthen the healthcare system of Bangladesh by providing modern, high-quality, and internationally compliant cancer treatment services.

Table 1.1 At a glance of the GLHLCU.

Name of Project		Green Life Hospital Ltd. (Cancer Unit)
Project Location	:	Plot: 39, Road: 108, Sector: 8, Purbachal Town, Narayanganj.

Head Office	:	Green Life Hospital Ltd. 32, Green Road (Bir Uttam KM Shafiullah Sarak), Dhanmondi, Dhaka-1205.
Project Proponent	:	Dr. Md. Mainul Ahasan (Managing Director)
GPS Location	:	Latitude: 23°50'45.18" N, Longitude: 90°31'14.08" E
Project area	:	46,475 sqft
Total Investment	:	99,77,02,500 BDT
Types of Project	:	100 Bed Cancer Hospital
Services	:	Radiotherapy, fiberoptic laryngoscopy, ECHO/ECG, ultrasonography, digital X-ray, MRI, CT/brachytherapy, minor OT, pharmacy, OPD (oncology + hematology), consultation, etc.
Water Requirements	:	80-90 m ³ /day.
Source of Water	:	WTP
Waste Water Treatment	:	Combined Effluent Treatment Plant
Power Requirement	:	2000 kwh
Sources of Power	:	Solar Plant and Generator.

c. Location and Connectivity

The proposed Green Life Hospital Ltd. (Cancer Unit) is located at Plot-039, Road-108, Sector-08, Purbachal New Town, under Narayanganj District, Bangladesh, within the master-planned township of Purbachal New Town. This modern urban development features a structured road network, integrated utility corridors, and clearly designated institutional and residential zones. The project site is situated at 23°50'45.18" North latitude and 90°31'14.08" East longitude.

Table 1.2: Surroundings of the GLHLCU.

Direction	Object
North	Road 313 (9.144 m wide)
South	Road no 108 (30.48 m wide)
East	Pedestrian Walkway (4.114 m wide)
West	Green Space

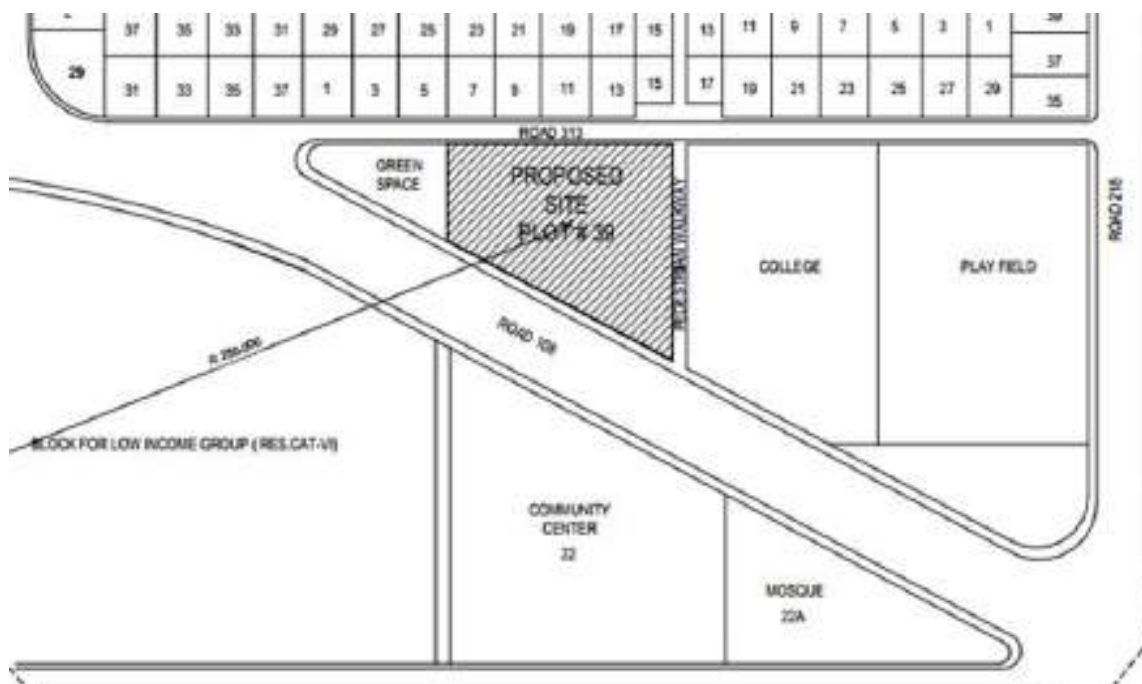


Figure 1-1: Connectivity & Surroundings of GLHLCU.

The project site is well connected through an organized hierarchy of internal roads within Purbachal New Town. Direct access is available from Road-108 of Sector-08, ensuring smooth movement of ambulances, staff, visitors, and service vehicles.

The site is located approximately 1.0–1.1 km from the Purbachal Link Road, which provides direct connectivity to major transport corridors such as the 300-Foot Road (Progoti Sarani Extension) and the Dhaka City Bypass. Through these linkages, the site has efficient access to key urban centers including Kuril, Badda, Gulshan, Baridhara, and Uttara, as well as regional highways such as the Dhaka–Sylhet Highway (N-2) and the Dhaka Elevated Expressway. Connectivity to Hazrat Shahjalal International Airport is also convenient via the Purbachal Link Road–300 Feet corridor.

Overall, the proposed hospital benefits from a strategically located, well-planned urban setting with strong regional connectivity. The surrounding road network is suitable for the safe and efficient movement of patients, healthcare staff, emergency vehicles, and service logistics during both construction and operational phases of the project.

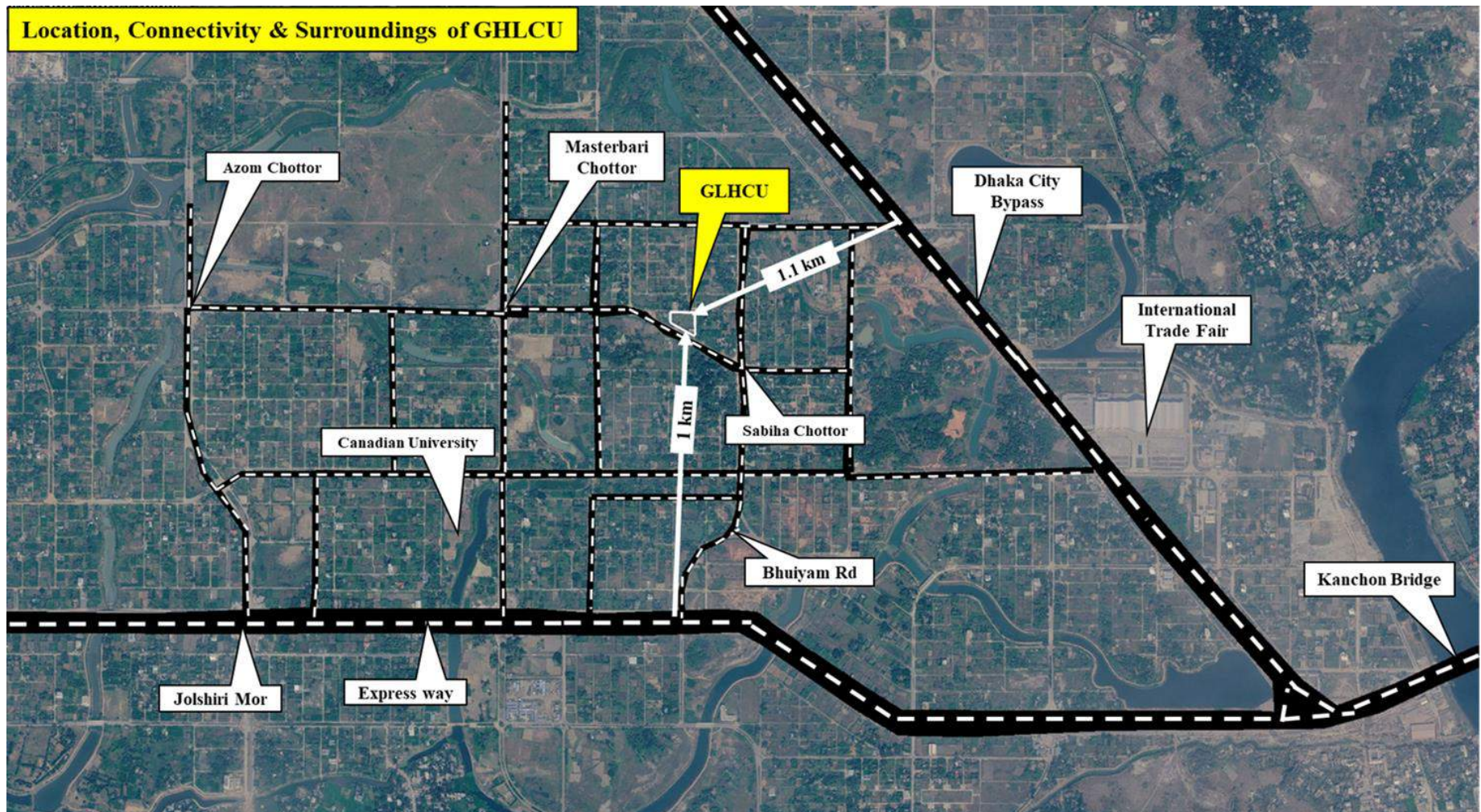


Figure 1-2: Location, Connectivity & Surroundings of GLHCU.

d. Project Activities

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town is a specialized tertiary healthcare facility located at Plot-039, Road-108, Sector-08, within Narayanganj District, Bangladesh. The project site lies within the well-planned and structured township of Purbachal New Town, which is characterized by organized land use, modern infrastructure, and integrated utility networks, making it highly suitable for advanced healthcare development.

The project aims to establish a comprehensive cancer care hospital equipped with modern diagnostic facilities, radiotherapy, chemotherapy, inpatient care, laboratory services, oncology treatment units, and supporting healthcare infrastructure. The facility will be developed with advanced medical technologies integrated with environmental management systems to ensure safe, efficient, and sustainable healthcare delivery.

The development will be implemented in a phased and structured manner, ensuring systematic integration of civil works, medical infrastructure, utility systems, and environmental safeguards. Each phase will comply with relevant healthcare standards, radiation safety requirements, and environmental regulations.

Upon completion, the hospital will significantly enhance access to specialized oncology services in the region, reduce patient travel burden, strengthen national healthcare capacity, and generate skilled employment opportunities in the health sector.

Boundary and Site Security:

A secure boundary system will be provided to ensure controlled access and safety of patients, staff, and hospital infrastructure. The boundary will consist of a permanent perimeter wall with controlled entry and exit points, supported by security personnel and access control systems to regulate movement of visitors, patients, staff, and service vehicles.

Internal Road Network and Street Lighting:

An organized internal circulation system will be developed to ensure safe and efficient movement of ambulances, patients, visitors, hospital staff, and service vehicles.

The circulation system will ensure:

- Uninterrupted emergency ambulance access to critical care areas
- Separation of pedestrian, patient, and service traffic flows
- Barrier-free access for patients, including emergency cases

- Clear emergency evacuation and fire access routes.

Proper signage, road markings, and traffic management measures will be implemented to ensure safety and operational efficiency.

Energy-efficient LED lighting will be provided across all internal roads, walkways, parking areas, and emergency zones to ensure safe nighttime operation, improved visibility, and reduced energy consumption.

Traffic Plan & Parking:

A structured traffic and parking management system will be implemented to ensure smooth vehicle movement and avoid congestion within the hospital premises.

Dedicated zones will be provided for:

- Ambulance drop-off and emergency circulation
- Patient and visitor parking
- Staff parking
- Service and utility vehicles

Traffic movement will be controlled through signage, security supervision, and speed regulation measures. Emergency routes will remain unobstructed at all times to ensure rapid response during critical situations.

Greenery Area:

The hospital will include well-planned landscaped green areas within the premises to enhance environmental quality, aesthetic value of the facility, and provide a calm healing environment. These green spaces will be developed using native and low-maintenance plant species to support ecological balance, improve air quality, and enhance patient and staff well-being. The landscaping will also help reduce dust, moderate temperature, and improve the local microclimate.

Regular maintenance will be ensured to preserve both the ecological function and aesthetic value of the green zones throughout the operational phase.

Demand for Utilities:

The proposed hospital will require reliable utility services to support continuous healthcare operations, including patient care, diagnostics, laboratory services, and facility management.

(i) Water Demand and Supply Network

The estimated water requirement of the hospital is approximately 150–200 m³/day, covering domestic use, patient care, laboratory activities, laundry, housekeeping, and landscaping. However, in the initial Phase-1, the hospital will require approximately 80–90 m³/day.

Water will be supplied through a dedicated Water Treatment Plant (WTP), ensuring safe and adequate water supply throughout the facility. Internal storage and distribution systems will be installed to ensure uninterrupted supply.

Wastewater generated from hospital activities will be treated through the proposed Effluent Treatment Plant (ETP) prior to reuse or safe disposal in compliance with DoE standards.

(ii) Power Requirement

The hospital will require an estimated **2,000 kWh/day** to support critical healthcare systems, including radiotherapy, diagnostic equipment, HVAC systems, lighting, elevators, and laboratory operations.

Power will be supplied through a combination of:

- Rooftop solar photovoltaic (PV) system
- National grid supply
- Standby generator system for emergency backup.

This hybrid energy system will ensure uninterrupted and reliable power supply, especially for life-support and critical care units.

Wastewater Management System:

The hospital will generate wastewater from domestic sources (patients, attendants, staff sanitation facilities) and operational sources (laboratories, oncology units, laundry, kitchen, cleaning activities). A centralized wastewater treatment system will be implemented within the premises.

(i) Combined Treatment Plant (STP–ETP) and Reuse Plan

A Combined Treatment Plant integrating STP and ETP will be installed to treat all wastewater in a unified system. Wastewater will be collected through an internal sewer network and treated in compliance with DoE standards.

A Zero Liquid Discharge (ZLD) approach will be adopted, ensuring that no untreated or inadequately treated effluent is discharged into the external environment. Treated water will be fully reused within the hospital for non-potable purposes such as:

- Gardening and irrigation
- Toilet flushing
- Floor and pavement washing
- Other utility applications

This closed-loop system will enhance water efficiency, reduce freshwater demand, and minimize environmental impact.

(ii) Sludge Management System

Sludge generated from the treatment plant will be dewatered using a **screw belt press system**, producing a dry cake form for easy handling and storage.

The dewatered sludge will be stored in a designated covered facility and subsequently handed over to DoE-authorized contractors for safe treatment or disposal in accordance with environmental regulations.

Regular monitoring will be carried out to ensure safe, efficient, and compliant sludge management practices.

Fire Hydrant Network Plan:

The hospital will be equipped with a comprehensive fire protection system designed in accordance with BNBC and Fire Service and Civil Defence (FSCD) requirements.

The system will include:

- Fire hydrants and hose reels
- Fire pumps and water storage tanks
- Sprinkler system (where applicable)
- Fire detection and alarm systems
- Portable fire extinguishers
- Emergency exits and evacuation signage

Regular inspection, maintenance, and fire drills will be conducted to ensure preparedness. Coordination with local fire services will be maintained to ensure rapid emergency response.

Surface Drainage and Stormwater Management:

The hospital will be integrated with the planned drainage infrastructure of Purbachal New Town. An internal drainage system will be developed to collect stormwater from rooftops, roads, parking areas, and landscaped zones.

A rainwater harvesting system will also be incorporated to collect rooftop runoff for reuse in non-potable applications such as gardening and cleaning, reducing dependence on external water sources.

Catch pits, silt traps, and inspection chambers will be provided to ensure efficient drainage and prevent clogging. Regular maintenance will ensure long-term functionality.

Integrated Energy Efficiency and Renewable Energy:

The hospital will adopt energy-efficient technologies including LED lighting, energy-efficient HVAC systems, and optimized medical and electrical equipment.

A rooftop solar PV system will be installed to promote renewable energy use, supplemented by standby generators to ensure uninterrupted power supply for critical medical services.

This integrated approach will reduce energy consumption, enhance reliability, and minimize environmental impact.

e. Environmental Quality

The existing environmental conditions of the GLHLCU site and of its close vicinity have been analyzed through primary and secondary data.

Air Quality:

Air quality was monitored at four (04) locations, where measurements were taken to assess the air quality. The primary objective of these measurements was to gather current air quality data and to monitor potential future increases in pollution levels due to project activities. This data will help in formulating appropriate mitigation measures if air pollution levels rise as a result of construction activities. The instrument used for these measurements was the OCEANUS AQM-09, which recorded and documented the presence of key pollutants. It specifically measured carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and particulate matter (PM).

According to NAAQS there are five (5) air parameter (SO₂, NO_x, PM_{2.5}, PM₁₀, and CO) that was considered during measuring air quality of the study area. PM_{2.5} within the study areas varies from 49.56-60.32 µg/m³, PM₁₀ levels were found ranging from 73.98-98.56 µg/m³, SO₂ levels were found ranging from 13.87-27.23 µg/m³, NO_x levels were found ranging from 10.98-16.34 µg/m³, and CO levels were found ranging from 0.67-1.54 mg/m³.

Noise Level:

During the site visit, the ambient noise levels at various locations within the project area were measured. Noise levels were recorded at eight (08) specific locations around the project area during the sampling process. The monitoring sites were strategically selected to provide a comprehensive understanding of the noise levels across the entire area.

The average noise levels recorded at the eight monitoring locations show a range of measurements during both day and night. During the day, the maximum recorded noise level was 72.5 dB(A), the minimum was 37.4 dB(A), and the average was 52.36 dB(A). At night, the maximum noise level recorded was 51.8 dB(A), the minimum was 33.6 dB(A), and the average was 44.81 dB(A).

Surface Water Quality:

The surface water quality monitoring results indicate generally stable conditions across the study area. COD concentrations range from 5–33 mg/L, with the highest value recorded at SW4, suggesting localized organic contamination. TDS levels vary between 110–130 mg/L, showing little variation among sampling points. The pH ranges from 6.2–6.5, indicating slightly acidic to near-neutral conditions. TSS concentrations range from 6–15 mg/L, with the highest value observed at SW2. Overall, the water quality is relatively consistent across the monitoring locations, with no major anomalies except for the elevated COD level at SW4.

f. Environmental and Social Impacts

The Environmental Impact Assessment (EIA) for the proposed Green Life Hospital Ltd. (Cancer Unit) (GLHLCU) indicates that the project will generate limited and manageable environmental impacts, primarily during the construction phase. During operation, impacts are expected to be low in magnitude due to the non-industrial nature of the facility and the incorporation of modern environmental control systems.

(i) Air Quality:

During construction, temporary air quality impacts may arise from dust generation, earthworks, material handling, and vehicle movement. These impacts will be localized and short-term in nature.

During the operational phase, air emissions will be minimal and mainly associated with standby generators, internal vehicular movement, and HVAC systems. With proper dust suppression, equipment maintenance, green landscaping, and emission control measures, air quality impacts will remain within acceptable limits.

(ii) Water Resources:

Construction activities may cause minor impacts on surface water quality due to runoff and sediment transport. During operation, the hospital will generate wastewater from domestic and clinical activities. However, all wastewater will be treated through an integrated Effluent Treatment Plant (ETP) and Sewage Treatment Plant (STP) system. A Zero Liquid Discharge (ZLD) approach will be adopted, ensuring full treatment and reuse of water for non-potable purposes such as flushing, cleaning, and landscaping. This will prevent any untreated discharge into the environment and support water conservation.

(iii) Noise and Vibration:

Construction phase activities will generate temporary noise from machinery and transport vehicles. During operation, noise will mainly originate from hospital services, generators, HVAC systems, ambulances, and internal traffic. As the surrounding area is not densely developed with sensitive receptors, impacts are expected to remain localized. With acoustic enclosures, traffic management, scheduling of activities, and routine monitoring, noise levels will be effectively controlled.

(iv) Impact on Land Resources:

Since the project is located on a well-planned and developed site within Purbachal New Town, no major land alteration is required. Construction impacts will be limited to localized excavation and foundation works. During operation, potential risks related to soil contamination will be effectively controlled through proper waste handling, chemical storage, drainage management, and spill prevention measures.

(v) Impact on Ecosystem:

The project site does not contain significant natural habitats; therefore, impacts on flora and fauna are expected to be negligible. Any potential indirect impacts during construction and operation will be controlled through proper waste management, wastewater treatment, and green landscaping within the hospital premises, which will further improve the local microclimate.

(vi) Odor Management

No significant odor impacts are expected during construction. During operation, minor odor may be generated from waste handling areas, kitchen facilities, and wastewater treatment systems. These will be effectively managed through proper waste segregation,

timely disposal, ventilation systems, sludge management, and good housekeeping practices.

(vii) Waste Management

Both construction and operational phases will generate solid and hazardous waste, including biomedical waste from healthcare services. A structured waste management system will be implemented, including segregation at source, recycling of reusable materials, safe handling of hazardous and biomedical waste, and disposal through authorized facilities in compliance with Department of Environment (DoE) guidelines.

(viii) Socio-Economic Impact

Negative Impacts (Both Phases)

During the construction phase, temporary disturbances may occur due to movement of construction vehicles, material transport, and workforce activity. This may lead to minor traffic congestion, noise, and short-term inconvenience in surrounding areas. However, as the project is located within a planned RAJUK institutional zone with well-developed infrastructure, these impacts will be limited and manageable through a proper construction traffic management plan.

During operation, additional traffic from patients, visitors, ambulances, and staff may increase local movement; however, this will be routine in nature and effectively managed through internal traffic circulation and parking systems.

Since no displacement of local communities is involved, conflicts related to land acquisition or resettlement are not anticipated. Minor social issues related to workforce movement and site access during construction will be addressed through stakeholder coordination and local employment prioritization where feasible.

Health and safety risks include occupational hazards during construction and infection risks in healthcare settings during operation. These will be controlled through strict Occupational Health and Safety (OHS) measures and Infection Prevention and Control (IPC) systems, including PPE use, safety training, and hospital hygiene protocols.

Gender-related risks will be minimized through safe workplace design, anti-harassment policies, separate facilities where required, and gender-sensitive management practices.

Positive Impacts (Both Phases):

The project will generate substantial direct and indirect employment opportunities during both the construction and operational phases. Direct employment will include healthcare professionals, technical experts, administrative personnel, support staff, and facility management teams, while indirect opportunities will emerge in transportation services, supply chains, food services, pharmaceuticals, and other local business activities.

In addition to employment generation, the project will significantly contribute to skill development and capacity building by providing exposure to modern healthcare systems, advanced oncology technologies, and internationally standardized hospital management practices. This will enhance the long-term employability and technical competence of the local workforce.

One of the most important benefits of the project will be the improvement in access to specialized cancer treatment services. The establishment of the GLHLCU Cancer Hospital will strengthen the regional healthcare system, reduce patient referral burdens, and minimize the need for long-distance travel for advanced medical care.

Further positive impacts include stimulated local economic activity, improved healthcare infrastructure, enhanced availability of medical services, and an overall improvement in the quality of life for the surrounding communities.

Vulnerable Groups and Gender Inclusion

No physically or economically displaced vulnerable groups have been identified, as the project is located on RAJUK-leased institutional land within a planned urban development area, without any resettlement requirement.

However, the hospital will provide significant benefits to health-vulnerable populations, particularly cancer patients, elderly individuals, and critically ill patients, by ensuring improved access to timely, specialized, and quality healthcare services.

The project will also promote gender equality and social inclusion by ensuring safe working environments, equal employment opportunities, and gender-responsive infrastructure. These measures will help create a secure, respectful, and inclusive environment for both employees and patients.

Overall Assessment:

Overall, the socio-economic impacts of the proposed GLHLCU Cancer Hospital are expected to be predominantly positive, particularly in terms of healthcare service

enhancement, employment generation, and local economic development. Any potential negative impacts are expected to be temporary, localized, and fully manageable through proper planning, safety measures, and effective institutional management practices.

g. Environmental Management and Monitoring Plan

Environmental Management:

This Environmental Management Plan (EMP) has been prepared as an integral part of the Environmental Impact Assessment (EIA) for the proposed Green Life Hospital Ltd. (Cancer Unit), located at Plot-039, Road-108, Sector-08, Purbachal New Town, Narayanganj, Bangladesh. The EMP provides a structured framework for managing, monitoring, and mitigating potential environmental and social impacts arising from both the construction and operation of the proposed specialized cancer hospital.

The primary objective of this EMP is to ensure that all project activities are carried out in an environmentally sound, socially responsible, and regulatory-compliant manner in accordance with the Environmental Conservation Act (ECA), 1995, Environmental Conservation Rules (ECR), 2023, Medical Waste (Management and Processing) Rules, 2008, and other applicable guidelines issued by the Department of Environment (DoE), Bangladesh.

As a healthcare facility, the project will generate environmental aspects such as medical and hazardous waste, wastewater, air emissions from standby generators, noise, chemical usage, and occupational health and safety risks. Accordingly, the EMP outlines mitigation measures, monitoring requirements, institutional responsibilities, and emergency response procedures to ensure effective environmental performance throughout the project lifecycle.

The EMP also acts as a sustainability tool to promote environmentally responsible healthcare delivery, ensuring protection of environmental quality, public health, and occupational safety, while supporting continuous improvement in environmental performance during construction, operation, and eventual decommissioning phases.

Environmental Management Framework:

The EMP addresses all key environmental and social components associated with the project, including:

- ❖ Medical and hazardous waste management
- ❖ Wastewater treatment and management

- ❖ Air quality and emission control
- ❖ Noise and vibration control
- ❖ Chemical and pharmaceutical handling
- ❖ Occupational health and safety
- ❖ Infection prevention and control
- ❖ Community health and safety
- ❖ Resource efficiency and energy conservation
- ❖ Emergency preparedness and response
- ❖ Environmental monitoring and reporting

Effective implementation of this framework will ensure that the GLHLCU Cancer Hospital operates in compliance with national regulations and good international healthcare practices while maintaining a safe, efficient, and environmentally sustainable healthcare environment.

Mitigation Plan:

The proposed Green Life Hospital Ltd. (Cancer Unit) will significantly enhance access to specialized cancer care services in the Purbachal New Town area. However, construction and operational activities may generate environmental and occupational health risks if not properly managed.

Potential impacts include generation of medical and hazardous waste, wastewater discharge, air emissions from standby generators, noise from equipment and hospital operations, chemical handling risks, infection hazards, and occupational safety concerns.

To address these issues, a comprehensive EMP has been developed to avoid, minimize, and control environmental impacts throughout the project lifecycle. The Project Proponent will be fully responsible for ensuring implementation of all mitigation measures in compliance with applicable environmental and healthcare regulations.

EMP Implementation Phases

Construction Phase:

During construction, the EMP will focus on:

- Dust suppression and air quality control
- Construction waste management and housekeeping
- Noise and vibration control

- Soil protection and stormwater management
- Occupational health and safety of workers
- Traffic management and community safety
- Prevention of pollution from fuels, oils, and construction materials.

Operational Phase:

During operation, the EMP will focus on:

- Implementation of Medical Waste Management Plan (MWMP)
- Safe handling of hazardous medical waste
- Wastewater treatment through integrated STP–ETP system
- Air emission control from standby generators
- Infection prevention and control (IPC) measures
- Chemical and pharmaceutical waste management
- Occupational health and safety management system
- Emergency preparedness and response planning
- Environmental monitoring, auditing, and reporting
- Community health and safety protection.

h. Monitoring Plan

An environmental monitoring plan will be implemented for the proposed Green Life Hospital Ltd. (Cancer Unit) to ensure the effective implementation of mitigation measures and compliance with applicable environmental regulations during both construction and operational phases. The monitoring system is designed to verify environmental performance, assess the effectiveness of control measures, and identify any unforeseen impacts at an early stage so that appropriate corrective actions can be taken in a timely manner.

The monitoring framework will focus on the key environmental aspects relevant to a tertiary healthcare facility, including wastewater quality, noise levels, solid and biomedical waste management, soil and land conditions, and occupational health and safety performance. Special attention will also be given to infection prevention and control practices, chemical handling, and overall environmental management within the hospital premises to ensure a safe and hygienic healthcare environment.

Key monitoring indicators will include wastewater quality parameters such as pH, BOD, COD, TSS, and coliform; noise levels within and around the hospital area; effectiveness

of waste segregation, storage, treatment, and disposal systems; and conditions related to soil and land protection. Occupational health indicators such as PPE compliance, incident records, and emergency preparedness will also be regularly monitored to ensure safety of workers, patients, and visitors.

Monitoring activities will be conducted through routine inspections, periodic sampling, and scheduled audits on a monthly, quarterly, and annual basis depending on the parameter. The Environmental, Health and Safety (EHS) team of the hospital, in coordination with relevant experts and regulatory authorities, will be responsible for implementing, supervising, and documenting all monitoring activities.

Overall, this monitoring plan will ensure that the GLHLCU Cancer Hospital operates in an environmentally responsible, safe, and compliant manner while maintaining high standards of healthcare service delivery and minimizing potential environmental impacts.

Conclusion:

The Environmental Impact Assessment (EIA) for the proposed GLHL Cancer Unit at Purbachal New Town concludes that the project is environmentally feasible and sustainable, subject to proper implementation of mitigation and management measures.

During the construction phase, potential impacts such as dust generation, noise, vibration, and temporary site disturbances are expected to be short-term, localized, and manageable. During the operational phase, environmental concerns are mainly associated with biomedical waste, wastewater generation, chemical handling (including chemotherapy and laboratory activities), radiation safety in treatment units, and energy use.

These impacts are considered site-specific and controllable through the effective implementation of the Environmental Management Plan (EMP), Occupational Health and Safety (OHS) system, Infection Prevention and Control (IPC) measures, and regular environmental monitoring.

Overall, no significant long-term adverse environmental impacts are anticipated. On the contrary, the project will provide substantial socio-economic benefits, including improved access to specialized cancer treatment, employment generation, and strengthened healthcare services in the region.

Chapter-02

General Information

2 General Information

(a) Project Related Information

- **Project Name:** Green Life Hospital Ltd. (Cancer Unit).
- **Name of Entrepreneur and Address:** Dr. Md. Mainul Ahasan (Managing Director), Green Life Hospital Ltd., 32, Green Road (Bir Uttam KM Shafiullah Sarak), Dhanmondi, Dhaka-1205.
- **Head of the Project:**

Name	Designation	Contact No.	email
Dr. Md. Mainul Ahasan	Managing Director	01738239877	glhcancer@gmail.com

- **Name of the person responsible for investigating any matter related to environmental impact assessment:**

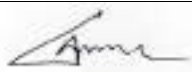
Name	Designation	Contact No.	email
Dr. Nusrat Hoque	Assistant Professor Dept. of Oncology Green Life Medical College	01738239877	nusrathoque1046@gmail.com

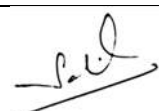
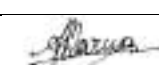
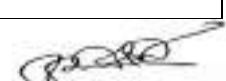
(b) Consultancy Firm

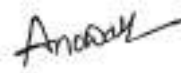
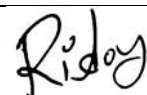
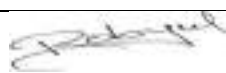
- **Name of environmental consultancy firm:** Water Technology BD Ltd.
- **Contact Information:** House: 1248 (L-4) & 1244 (L-2), Road-9, Mirpur DOHS, Dhaka.
- **Email:** eia@wtbl.com.bd, hkfservice.inn@gmail.com
- **List of Consultant.**

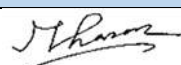
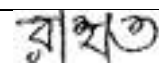
A multidisciplinary team of professionals having experience of conducting Environment & Social Impact Assessment Studies for Industrial Parks, Industrial Areas, Special Economic Zones, DTA, Economic Zones, Area development, Industrial Corridors etc. were involved in carrying out EIA study for this project. Details of the professionals are given in the following table.

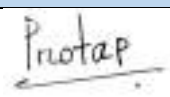
SN	Name of Staff	Position Assigned	Area of Study	Signature
1	Niger Sultana Assistant Professor Dept of ESDM, NSTU. M.Sc. & B.Sc. in Environmental Science and Disaster Management, NSTU Experience: 08 years	Risk Assessment and Hazard Management Specialist	Responsible for identifying and evaluating potential environmental and safety risks, conducting hazard assessments (e.g., natural disasters, industrial risks), and developing management and mitigation strategies to minimize risk exposure and enhance project resilience.	<i>Niger Sultana</i>
2	Md. Nahmudul Hasan M.Sc. & B.Sc. RUET Former Officer, Dhaka Transport Corporation Authority Experience: 30 years	Senior Urban Planner	- Designing and implementing plans for urban areas to accommodate population growth and economic activities. - Designing green spaces and promoting eco-friendly infrastructure like sustainable buildings, parks, and walkways. - Addressing traffic congestion and ensuring smooth mobility across urban areas.	<i>Hasan</i>
3	Abdullah al Mahmud Lead Auditor & M.Sc. & BSc. in Environmental Science and Disaster Management, NSTU Experience: 10 years	Senior Environmental Specialist, GIS & Remote Sensing Expert	- Responsible for providing expert oversight and guidance on environmental impact assessments, ensuring compliance with environmental regulations, and developing comprehensive mitigation and management plans for all environmental aspects of the project. - Responsible for conducting spatial analysis and mapping using GIS and remote sensing tools, supporting environmental and land use assessments, analyzing spatial data to	<i>Abdullah</i>

SN	Name of Staff	Position Assigned	Area of Study	Signature
			identify areas of impact, and creating maps for effective visualization and decision-making.	
4	Md. Nazrul Islam M.Sc. & BSc. in Environmental Science and Disaster Management, NSTU Experience: 08 years	Environmental Management Specialist	Responsible for developing and implementing environmental management plans, ensuring compliance with environmental standards, monitoring project impacts on natural resources, and recommending strategies for sustainable resource use and pollution control throughout the project lifecycle.	
5	Iffat Iram Amena Bachelor of Urban & Regional Planning, KUET Experience: 05 years	Land Use Planning Specialist	Responsible for analyzing current land use patterns, assessing the project's impact on land resources, and developing plans to optimize land use, minimize environmental disruption, and ensure sustainable development that aligns with regulatory guidelines and community needs.	
6	Engr. Mr. Enamul Habib BSc in Chemical Engineering, SUST Experience: 15 years	Wastewater and Solid Waste Management Specialist	Responsible for assessing the project's wastewater and solid waste generation, designing management and treatment strategies to minimize environmental impacts, ensuring compliance with waste disposal regulations, and proposing recycling, reuse, and safe disposal methods	

SN	Name of Staff	Position Assigned	Area of Study	Signature
			to promote sustainability throughout the project lifecycle.	
7	Engr. Md. Shahiduzzaman BSc. in Engg (Mechanical), BUET, FIEB Experience: 35 years	Water Management Specialist	Responsible for assessing water resource availability and quality, developing sustainable water use and conservation plans, managing storm water and wastewater impacts, and ensuring compliance with water-related environmental regulations to protect local ecosystems and communities.	
8	Engr. Arnab Barua M.Phil University of Malaya, Malaysia B.Sc. in Chemical Engineering & Polymer Science Experience: 10 years	Air & Noise Quality Modeler	Responsible for conducting baseline assessments of air and noise levels, using modeling tools to predict pollutant dispersion and noise impacts from project activities, evaluating potential effects on public health and nearby environments, and recommending mitigation strategies to ensure compliance with air and noise quality standards.	
9	Sovel Ahsan Chowdhury Lead Auditor QMS M.Sc. & B.Sc. in Environmental Science and Disaster Management, NSTU Experience: 10 years	Groundwater and Hydrology Specialist	Responsible for assessing groundwater resources and hydrological conditions, analyzing potential impacts on water levels, quality, and flow patterns, and developing strategies for sustainable water use, flood management, and aquifer protection to mitigate environmental impacts.	

SN	Name of Staff	Position Assigned	Area of Study	Signature
10	MD. Anowar Sadat M.Sc. in Environmental Science, JU B.Sc. in Chemical Engineering, SUST Experience: 03 years	Junior Climate Change Specialist	Responsible for supporting climate risk assessments, analyzing climate data, assisting in the development of climate adaptation and mitigation strategies, and helping ensure project resilience to climate-related impacts.	
11	Md Tofail Hyder BSS in Social Science MSS in Social Science LLB, NU Experience: 15 years	Sociologist	Responsible for assessing the social impacts of the project on local communities, conducting socio-economic surveys, understanding community concerns, and developing strategies to enhance social benefits and mitigate negative impacts.	
12	Naimul Islam Ridoy MSS in International Relation, BUP BSS in International Relation, BUP Experience: 03 years	Junior Sociologist	Responsible for supporting the Sociologist in conducting field surveys, data collection, and community engagement activities, assisting with data analysis, and documenting social impacts to aid in social impact assessments.	
13	Md. Robyul Islam BS in Agriculture, BSMSTU MS in Biotechnology, BSMSTU Experience: 10 years	Ecologist	Responsible for assessing the project's impact on local ecosystems, conducting surveys of flora and fauna, identifying sensitive habitats, and developing biodiversity conservation and habitat restoration strategies to mitigate ecological impacts.	

SN	Name of Staff	Position Assigned	Area of Study	Signature
14	Engr. Mahmudul Hasan B.Sc in Chemical Engineering, SUST Experience: 15 years	Health and Safety Expert	Responsible for identifying potential health and safety risks to workers and nearby communities, developing safety protocols, implementing risk mitigation measures, and ensuring compliance with occupational health and safety standards throughout the project lifecycle.	
15	Engr. Faysal Ahmed B.Sc. in Civil & Environment Experience: 10 years	Geology and Soils Specialist	Responsible for assessing geological and soil conditions, analyzing soil stability, erosion potential, and land suitability, and providing recommendations to minimize environmental impacts and support safe project design and construction.	
16	Farhan Tanvir Rahat B.Sc. in Environmental Management Experience: 04 years	Environmental Surveyor	Responsible for conducting field surveys to collect environmental data on air, water, soil, and noise quality, documenting baseline conditions, and ensuring accurate data collection to inform the environmental impact assessment.	
17	Md. Sagor Hossain Diploma in Environmental Technology Experience: 04 years	Junior Environmental Surveyor	Responsible for assisting the Environmental Surveyor in field data collection for air, water, soil, and noise quality, ensuring accurate documentation, and supporting data analysis for baseline environmental assessments.	

SN	Name of Staff	Position Assigned	Area of Study	Signature
18	Protap Bisswas Diploma in Environmental Technology Experience: 02 years	Junior Environmental Surveyor	Responsible for assisting the Environmental Surveyor in field data collection for air, water, soil, and noise quality, ensuring accurate documentation, and supporting data analysis for baseline environmental assessments.	

Chapter-03

Introduction

3 Introduction

3.1 Overview

The proposed Green Life Hospital Ltd. (GLHL) Cancer Unit at Purbachal New Town is a specialized healthcare development designed to strengthen advanced cancer diagnosis and treatment facilities in the region. The project aims to provide modern, patient-centered oncology services within a well-planned institutional area, contributing to improved healthcare accessibility and quality in Bangladesh.

The development of the project is aligned with national priorities for expanding specialized healthcare infrastructure and improving public health services. The facility has been planned as a state-of-the-art cancer treatment center incorporating advanced medical technologies, including radiotherapy, chemotherapy, diagnostic imaging, laboratory services, and supportive care units.

The Environmental Impact Assessment (EIA) has been prepared to identify and evaluate potential environmental, occupational health, and social impacts associated with both the construction and operation phases of the proposed hospital. The study also outlines appropriate mitigation measures and an Environmental Management Plan (EMP) to ensure that all impacts are effectively managed and kept within acceptable limits.

The EIA further ensures that the project complies with the relevant environmental laws and regulations of Bangladesh, including requirements set by the Department of Environment (DoE). In addition, it emphasizes safe hospital operation through proper management of biomedical waste, wastewater, chemical handling, radiation safety, and occupational health and safety.

Overall, the EIA provides a structured framework to support environmentally sound and sustainable implementation of the GLHL Cancer Unit while maximizing its positive contributions to public health and socio-economic development.

3.2 Background of the Study

Environmental Impact Assessment (EIA) is a systematic process used to evaluate the potential environmental and socio-economic impacts of proposed development projects prior to their implementation. It helps in identifying, predicting, and assessing possible impacts and in formulating appropriate mitigation and management measures to ensure environmentally sound development.

The EIA process is not limited to identifying adverse impacts only; it also considers potential positive impacts and explores ways to enhance them through improved design, planning, and operational measures. In this way, EIA supports the optimization of project benefits while minimizing environmental and social risks.

A comprehensive EIA examines impacts across the physical environment (land, air, and water), biological environment (flora and fauna), and socio-economic environment (community health, livelihoods, safety, and welfare). Based on this holistic assessment, an Environmental Management Plan (EMP) is developed to ensure effective mitigation, monitoring, and enhancement measures throughout the project lifecycle.

The proposed Green Life Hospital Ltd. (Cancer Unit) (GLHLCU) falls under the Red Category as per the Environmental Conservation Rules (ECR), 2023. Accordingly, a detailed Environmental Impact Assessment (EIA) study has been undertaken in line with the approved **Terms of Reference (ToR)** issued by the Department of Environment (DoE) to ensure compliance with national regulatory requirements prior to the commencement of construction and operation activities.

EIA approval is a mandatory prerequisite for project implementation, ensuring that all potential environmental and occupational health risks are properly addressed and that the project is aligned with national environmental standards and sustainable development goals.

To fulfill these requirements, the project proponent has engaged an experienced environmental consultancy firm to prepare this EIA report in accordance with DoE guidelines and internationally accepted best practices for healthcare infrastructure development.

3.3 Scope of the Study

The Environmental Impact Assessment (EIA) for the proposed Green Life Hospital Ltd. (Cancer Unit) (GLHLCU) is designed to evaluate the potential environmental and socio-economic impacts of the project and ensure environmentally sustainable development. The study provides a comprehensive assessment of baseline environmental conditions and identifies key environmental components, including physical, biological, and socio-economic aspects.

The EIA will also assess proposed project activities and their potential environmental interactions during both construction and operation phases. Based on this assessment, both positive and negative impacts are identified, and appropriate mitigation measures are recommended to minimize adverse effects and enhance beneficial outcomes. An Environmental Management Plan (EMP) has been developed to guide the implementation of these measures throughout the project lifecycle.

The scope of the EIA includes the following:

- Assessment of existing environmental conditions of the project area, covering physical, biological, and socio-economic environment.
- Review of project components and activities with respect to their potential environmental impacts.
- Identification of potential negative impacts during construction and operation phases.
- Development of mitigation measures to minimize or eliminate adverse environmental effects.
- Review of applicable national environmental laws, regulations, and DoE requirements to ensure compliance.
- Identification of key environmental aspects such as waste generation, wastewater, resource use, and occupational health and safety.
- Assessment of stakeholder concerns and social acceptance of the project.
- Proposals for enhancing positive environmental and socio-economic impacts.
- Preparation of an Environmental Management Plan (EMP) covering mitigation, monitoring, and management measures.
- Development of an environmental monitoring framework to ensure compliance and continuous improvement.

3.4 Objectives of the Study

The primary objective of this Environmental Impact Assessment (EIA) is to identify and evaluate the significant environmental and socio-economic impacts of the proposed Green Life Hospital Ltd. (Cancer Unit) (GLHLCU) and to recommend appropriate mitigation measures to minimize adverse effects while enhancing positive environmental outcomes.

The specific objectives of the EIA are as follows:

- ✓ To provide a clear description of the proposed project and the existing environmental conditions of the project site and its surrounding area.
- ✓ To establish baseline environmental conditions for physical, biological, and socio-economic components for impact comparison.
- ✓ To identify, predict, and evaluate potential environmental impacts during both construction and operational phases of the project.
- ✓ To develop a comprehensive Environmental Management Plan (EMP) outlining mitigation measures, enhancement measures, and monitoring requirements for effective environmental management.
- ✓ To ensure that the project is planned and implemented in an environmentally sustainable manner, minimizing its ecological footprint and protecting surrounding environmental resources.

3.5 Approach & Methodology

The Environmental Impact Assessment (EIA) study for the proposed Green Life Hospital Ltd. (Cancer Unit) (GLHLCU) has been carried out to develop a comprehensive understanding of the existing environmental conditions of the project area and to assess the potential environmental and socio-economic impacts associated with the project. The study covers baseline conditions of the physical, biological, and socio-economic environment and identifies suitable mitigation and management measures to ensure environmentally sustainable development.

The EIA was conducted using both primary and secondary data sources. The study area considered baseline environmental conditions within the project influence zone, based on site-specific observations, field investigations, stakeholder consultations, and available literature. The methodology also included evaluation of applicable environmental regulations and standards, including the Environmental Conservation Rules (ECR), 2023, and relevant guidelines of the Department of Environment (DoE), Bangladesh.

The main objectives of the EIA method:

- ✓ To identify and evaluate potential environmental and socio-economic impacts during pre-construction, construction, and operational phases of the project.
- ✓ To ensure integration of appropriate mitigation measures into project planning, design, construction, and operation.

- ✓ To assess potential impacts on surrounding environmental components and propose suitable management actions.
- ✓ To analyze project-related environmental risks and recommend feasible alternatives where applicable.
- ✓ To develop an effective Environmental Management Plan (EMP) ensuring sustainable implementation, monitoring, and compliance.

The EIA methodology followed a structured approach consisting of the following key components:

3.5.1 Scoping

The scoping process was undertaken to define the boundaries of the study, identify key environmental issues, and determine the level of assessment required:

3.5.1.1 Project Data Compilation:

A detailed description of the proposed activities was compiled with the help of primary and secondary data. This data was gathered through literature reviews, Environmental, Health, and Safety (EHS) guidelines, national and international standards, field studies, and environmental testing. A comprehensive list of potential environmental and social concerns was developed, along with an analysis of relevant stakeholders for subsequent consultations.

3.5.1.2 Published Literature Review:

Secondary data, including information on weather, soil, water resources, wildlife, and vegetation, was collected from credible sources such as published journals, government reports, books, and online resources. This data was carefully reviewed and compiled for inclusion in the environmental analysis.

3.5.1.3 Legislative Review:

A thorough review of relevant legislation, regulations, environmental guidelines, and standards, including those stipulated by the Department of Environment (DoE), Bangladesh, was conducted. This ensured compliance with the legal and regulatory framework governing environmental protection and sustainability in Bangladesh.

3.5.1.4 Identification of Potential Impacts:

The data collected through the previous steps was reviewed to identify potential environmental and social impacts associated with the proposed project. The potential impacts were categorized based on their nature and significance.

3.5.1.5 Baseline Data Collection:

Primary data: Field visits were carried out to collect firsthand information about the site alternatives and to verify existing conditions. A questionnaire was developed to engage local residents and obtain their views on the project. The data collection process also included social surveys, biological assessments, and laboratory tests conducted by accredited laboratories such as Control Engineering Laboratory (CEL) and Envirocare International Ltd. to analyze environmental parameters and assess compliance with the National Environmental Quality Standards (NEQS).

Secondary data: Additional secondary data was obtained from existing literature, online sources, and field surveys conducted by relevant departments, ensuring a comprehensive understanding of the project area and its environmental context.

3.5.2 Impact Assessment

The data gathered from environmental, socioeconomic, and project-related sources was used to assess the potential environmental and social impacts of the proposed project. The impact assessment covered the following key areas:

- ✓ Geomorphology
- ✓ Groundwater and surface water quality
- ✓ Ambient air quality and noise levels
- ✓ Flora and fauna (ecology)
- ✓ Socioeconomic conditions and local communities.

For each identified impact, the following aspects were evaluated:

- **Baseline conditions:** Current state of the environment before project implementation.
- **Potential changes:** Changes in environmental parameters likely to be caused by project activities.
- **Identification of impacts:** Identifying and categorizing the potential impacts on environmental and social factors.
- **Evaluation of significance:** Evaluating the likelihood, magnitude, and significance of each potential impact.
- **Mitigation measures:** Defining practical and effective mitigation measures to reduce impacts to acceptable levels.

- **Residual impacts:** Assessing any residual impacts that may remain even after mitigation, both in the short and long term, direct and indirect, positive and negative.
- **Monitoring of impacts:** Proposing mechanisms for the ongoing monitoring of residual impacts to ensure compliance with the NEQS and the effectiveness of mitigation measures.
- **Environmental Management Plan (EMP):** A comprehensive EMP was developed to guide the implementation of mitigation measures, ensure regulatory compliance, and promote the sustainable operation of the project.

3.5.3 Documentation

This Environmental Impact Assessment (EIA) report has been prepared in accordance with the approved Terms of Reference (ToR) and the requirements outlined in Schedule-11 and Rules 15 and 16 of the Environmental Conservation Rules (ECR), 2023. The report provides a comprehensive presentation of the project description, baseline environmental conditions, impact assessment findings, and proposed mitigation measures. It also incorporates a detailed Environmental Management and Monitoring Plan to ensure effective implementation of environmental safeguards throughout the project lifecycle. The report is systematically organized into the following chapters:

Chapter 01: Executive Summary

This chapter provides a concise overview of the Environmental Impact Assessment (EIA) report, summarizing the project background, key environmental and social baseline conditions, anticipated impacts, proposed mitigation measures, environmental management strategies, and major conclusions and recommendations.

Chapter 02: General Information

This chapter presents general information regarding the project proponent, project location, environmental focal person, and the consultancy firm responsible for conducting the EIA study and preparing the report.

Chapter 03: Introduction

This chapter provides background information on the proposed Green Life Hospital Ltd. Cancer Unit (GLHLCU), including the rationale for the project, objectives of the EIA study, applicable environmental clearance requirements, project location, study methodology, scope of assessment, and organization of the report.

Chapter 04: Legislative, Regulation and Policy Considerations

This chapter describes the relevant national laws, regulations, policies, guidelines, standards, and international best practices applicable to the proposed hospital project. It also outlines the environmental compliance requirements to be followed during project implementation and operation.

Chapter 05: Project Description

This chapter provides a detailed description of the proposed hospital project, including site location, accessibility, land use, hospital facilities, building layout, oncology services, radiotherapy and diagnostic facilities, utility requirements, wastewater treatment systems, waste management facilities, infrastructure components, project cost, and implementation schedule.

Chapter 06: Environmental and Social Baseline

This chapter presents the existing environmental and social conditions of the study area within a 10 km radius of the project site. The assessment covers physical environment (air quality, noise, water resources, soil, climate, and land use), biological environment (flora and fauna), and socio-economic environment (population, infrastructure, educational institutions, healthcare facilities, and economic activities).

Chapter 07: Impact Identification, Prediction and Evaluation

This chapter describes the methodology used to identify, predict, and evaluate the potential environmental and social impacts associated with the construction and operation of the proposed cancer hospital. It assesses the significance, magnitude, duration, and extent of anticipated impacts.

Chapter 08: Environmental and Social Impact Assessment

This chapter presents the detailed assessment of potential environmental and social impacts arising from project activities. It evaluates impacts related to air quality, noise, wastewater, healthcare waste, radiation safety, occupational health and safety, community health, traffic, resource consumption, and other relevant environmental and social aspects, together with proposed mitigation measures.

Chapter 09: Traffic Impact Assessment

This chapter evaluates the existing traffic conditions surrounding the project area and assesses the potential traffic impacts associated with hospital operation, including patient

movement, visitor access, ambulance services, staff transportation, parking requirements, and traffic management measures.

Chapter 10: Cumulative Impact Assessment

This chapter assesses the cumulative environmental and social impacts that may arise from the proposed hospital in combination with existing and planned developments in the surrounding area.

Chapter 11: Public Consultation and Disclosure

This chapter presents the stakeholder engagement process undertaken during the EIA study, including consultation meetings, stakeholder feedback, concerns raised by affected communities and institutions, and the proposed measures to address identified issues.

Chapter 12: Environmental Management and Monitoring Plan

This chapter presents the Environmental Management Plan (EMP) and Environmental Monitoring Plan developed for the proposed hospital. It includes mitigation measures, institutional arrangements, environmental monitoring requirements, medical waste management, wastewater management, occupational health and safety measures, environmental monitoring schedules, and budgetary provisions for implementation.

Chapter-13: Emergency Response Plan

This chapter presents the Emergency Response Plan (ERP) for the proposed hospital. It identifies potential emergency scenarios such as fire, radiation incidents, medical gas leakage, infectious disease outbreaks, utility failures, and natural disasters, and outlines preparedness, response, evacuation, communication, and recovery procedures.

Chapter 14: Conclusions and Recommendations

This chapter summarizes the overall findings of the Environmental Impact Assessment and presents conclusions regarding the environmental feasibility of the project. It also provides recommendations for effective environmental management, regulatory compliance, continuous monitoring, and sustainable operation of the proposed Green Life Hospital Ltd. Cancer Unit.

3.6 Limitation of the Study

The Environmental Impact Assessment (EIA) study for the proposed Green Life Hospital Ltd. Cancer Unit (GLHLCU) was conducted based on both primary and secondary data sources. Primary information was obtained through field visits, environmental monitoring,

site observations, stakeholder consultations, and discussions with project representatives. Secondary information was collected from relevant government agencies, including the Department of Environment (DoE), Bangladesh Meteorological Department (BMD), Bangladesh Bureau of Statistics (BBS), Department of Public Health Engineering (DPHE), published literature, technical reports, and other reliable sources.

The environmental and social assessment presented in this report is based on the information available during the study period, together with professional judgment and interpretation of collected data. Environmental monitoring was conducted within the specified study area and reflects the prevailing conditions at the time of sampling.

As the project is currently in the planning and design stage, certain engineering and operational details may be refined during detailed design and implementation. Consequently, some assessments have been undertaken based on preliminary design information, proposed operational arrangements, and available project documentation provided by the project proponent.

Furthermore, future environmental conditions may vary due to changes in surrounding land use, urban development activities, traffic patterns, population growth, and other external factors beyond the control of the project. Nevertheless, all reasonable efforts have been made to ensure that the findings, impact predictions, and recommended mitigation measures presented in this EIA report are technically sound, representative, and sufficient for environmental decision-making and regulatory review.

3.7 References

List of secondary data used for carrying out EIA study and preparation of EIA report is given at the following table.

Table 3.1: Reference Used for EIA Study

S.N.	Reference
Government Departments	
1.	Department of Environment (DoE)
2.	Bangladesh Agriculture Research Council (BARC)
3.	Bangladesh Water Development Board (BWDB)
4.	Bangladesh Meteorological Department (BMD)
5.	Bangladesh Forest Department (DoF)
6.	Bangladesh Bureau of Statistics (BBS)
7.	Bangladesh Food & Agriculture Department (FAO, Bangladesh)
8.	Geological Survey of Bangladesh (GSB)
9.	Disaster Management Bureau (DMB)
10.	Department of Disaster Management (DDM)

S.N.	Reference
11.	Department of Agriculture Extension (DAE)
12.	Bangladesh Rice Research Institute (BRRI)
13.	Department of Fisheries (DoF)
14.	Power Grid Company of Bangladesh (PGCB)
15.	Land & Revenue Department, Narayanganj.
Journals, Books & Existing Studies	
16.	Geological Settings Of The Areas Of Arsenic Safe Aquifers, Md. Munir Hussain And SKM Abdullah, Ground Water Task Force, October, 2001
17.	Hasan MA, Bhattacharya P, Sracek O, Ahmed KM, Bromssen M and Jacks G (2009). Geological controls on groundwater chemistry and arsenic mobilization: Hydrogeochemical study along an E–W transect in the Meghna basin. Bangladesh Journal of Hydrology 318(1-2): 105-118.
18.	Nishat A, Huq SMI, Barua SP, Khan AHM and Moniruzzaman AS (2002). Bio ecological zones of Bangladesh. IUCN, Bangladesh Country Office, Bangladesh, Dhaka, p.141.
19.	HIES (The Household income and expenditure survey) (2010). Bangladesh Bureau of Statistics, Ministry of Planning, Dhaka, Bangladesh.
20.	SRDI (Soil research development institute) (1999). Thana Instruction Guide, p. 54.
21.	SRDI (Soil research development institute) (1997). Agricultural land use of Bangladesh. Soil resources development institute, Dhaka
22.	Statistical Yearbook (2012-2013). Fisheries resources survey system (FRSS), Department of Fisheries, Bangladesh. Volume 29: p. 44.
23.	BBS (Bangladesh Bureau of Statistics) (2011). District statistics. Statistics and informatics division (SID) Ministry of planning, Government of the people's republic of Bangladesh, pp. 1-149.
24.	Banglapedia (2017). Agro-ecological zones of Bangladesh. Available online at: http://en.banglapedia.org/index.php?title=Agroecological_Zone
25.	Banglapedia (2017). Flood plain of Bangladesh. Available online at: http://en.banglapedia.org/index.php?title=Floodplain
Website	
26.	Wikipedia
27.	Google maps
28.	http://www.bangladeshtourismdirectory.com/bangladesh-archaeological-sites-list.html
29.	Google earth imageries
30.	http://www.saarc-sadkn.org/countries/bangladesh/disaster_mgt.aspx (Bangladesh Disaster Knowledge Network)
Others	
31.	Site visits
32.	Feasibility Report of the GLHLCU.

Chapter-04

Legislative, Regulation and Policy Considerations

4 Legislative, Regulation and Policy consideration

4.1 Introduction

This chapter provides a description of the regulatory framework applicable to the GLHLCU. It highlights environmental, health & safety and social regulations with applicable permits and standards in association with the project. It broadly focuses on the:

- Legal Enforcement Agencies at National Level;
- Applicable national and local Environmental and Social Laws, Regulations and Policies;
- International & National Environment Standards/ Guidelines.

4.2 Legal Enforcement Agencies

In Bangladesh, the responsibility for formulating, implementing, and modifying national environmental laws lies primarily with the Ministry of Environment, Forests and Climate Change (MoEFCC). The Department of Environment (DoE), which operates under the MoEFCC, is tasked with enforcing the Environment Conservation Act, 1995 (ECA), as amended. The DoE ensures compliance with environmental regulations and provides critical oversight for environmental management across the country. Below is a comprehensive overview of key legal enforcement agencies involved in environmental governance and their respective functions.

Table 4.1: Relevant legal enforcement agencies and their functions

SN	Agency	Functions
1.	Ministry of Environment, Forests & Climate Change (MoEFCC)	The MoEFCC serves as the central authority for environmental planning, coordination, and implementation of national environmental and forestry programs. It is pivotal in overseeing the country's environmental management and plays a significant role in international environmental forums like the United Nations Environment Programme (UNEP). Its primary functions include: ✓ Conservation of flora, fauna, forests, and wildlife. ✓ Prevention and control of pollution. ✓ Afforestation and regeneration of degraded areas. ✓ Implementation of policies to protect the environment within the legislative framework.
2.	Department of Environment (DoE)	An Environment Pollution Control Board was setup under the Environment Pollution Control Ordinance, 1977. It underwent a series of subsequent restructuring and was finally renamed as Department of Environment in 1989. It is headed by a Director General appointed by the Government.

SN	Agency	Functions
		The DoE through its head, divisional and district level offices conducts the following principal activities : ✓ Advising the Government to avoid such manufacturing processes, commodities and substances which are likely to cause environmental pollution; ✓ Advisory and issuing directions to the concerned person regarding the environmentally sound use, storage, transportation, import and export of a hazardous substance or its components; ✓ Conducting inquiries and research activities on conservation, improvement and pollution of the environment and rendering assistance to any other authority/organization regarding the same; ✓ Collection and publication of information about environmental pollution; ✓ Conducting programs for observation of drinking water quality and issuing directives if necessary for adherence to drinking water quality standards; ✓ Formulation of environmental guidelines; ✓ Prescribing and modifying environmental quality standards pertaining to air, water, noise, vehicular emissions etc.; ✓ Issuing Location Clearance and Environmental Clearance Certificates to Projects; and ✓ Implementation of provisions of ECA and rules made there under.
3.	Water Resources and Planning Organization (WARPO)	Established by the Water Resources Planning Act, 1992, WARPO plays a critical role in water resource management. It supports sustainable water use, conservation, and distribution by: ✓ Overseeing the implementation of the National Water Management Plan (NWMP). ✓ Maintaining the National Water Resources Database (NWRD) and providing technical support for water resources planning. ✓ Laying down effluent discharge standards in consultation with the DoE. ✓ Coordinating national water policies and strategies.
4.	Ministry of Fisheries and Livestock (MOFL)	The MOFL focuses on managing and preserving fisheries resources, which are vital for food security and the economy. Its primary responsibilities include: ✓ Promoting sustainable fisheries management. ✓ Enforcing the Protection and Conservation of Fish Act, 1950.

SN	Agency	Functions
		✓ Enhancing the socio-economic conditions of fishermen. ✓ Regulating the fisheries sector to ensure sustainable practices and conservation.
5.	Bangladesh Power Development Board (BPDB)	The BPDB, established in 1972, is responsible for the generation, transmission, and distribution of electricity in Bangladesh. It ensures that the power sector complies with environmental standards and implements sustainable energy practices. Key functions include: ✓ Managing power generation and ensuring compliance with environmental regulations. ✓ Expanding the power generation capacity to meet growing demand. ✓ Promoting energy efficiency and renewable energy sources.
6.	Bangladesh Energy Regulatory Commission (BERC)	It was established under the Bangladesh Energy Regulatory Commission Act, 2003. Some of its key functions include: ✓ Issue, cancel, amend and determine conditions of licenses, exemption of licenses and determine the conditions to be followed by such exempted persons; ✓ Regulation of generation, storage, supply, and transmission of energy; ✓ Determine tariff for electricity distribution etc.; ✓ Ensure control of environmental standard of energy under existing laws; ✓ Extend co-operation and advice to the Government, if necessary, regarding electricity generation, transmission, marketing, supply, distribution and storage of energy.
7.	Ministry of Labour and Employment (MOLE)	It was established with following objectives: ✓ Creation of employment opportunity; ✓ Creation of semi-skilled and skilled manpower; ✓ Enhancement of productivity of factories by creating friendly working environment between workers & employers; ✓ Ensuring welfare of workers in different industrial areas; ✓ Implementation of labour laws; ✓ Fixing up minimum wages of labour; and ✓ Ensuring justice through Labour Court.
8.	Ministry of Law and Parliamentary Affairs	This ministry is responsible for providing legal advice and drafting laws related to environmental protection. It oversees the formulation, review, and approval of new environmental legislation and amendments to existing laws.
9.	Ministry of Land	The Ministry of Land is tasked with managing government-owned land, overseeing land acquisition, and supporting land development projects that comply with environmental

SN	Agency	Functions
		standards. Key functions include: ✓ Managing land surveys and records. ✓ Overseeing land acquisition for development projects, ensuring proper environmental considerations.
10.	Board of Investment (BOI), Bangladesh	The Board of Investment was established in 1989 by the Investment Board Act. The specific functions of board are: ✓ Implementation of all provisions as lay down under The Investment Board Act, 1989. ✓ To promote domestic and foreign investment as well to enhance international competitiveness of Bangladesh; ✓ To identify the hindrance of investment and provide necessary facilities and assistance in the establishment of industries.
11.	Union Parishad	The Union Parishad is the local government body responsible for rural governance. It plays a key role in the implementation of environmental policies at the grassroots level. Its responsibilities include: ✓ Implementing local development programs in agriculture, forestry, and waste management. ✓ Protecting public properties and infrastructure. ✓ Overseeing land and water conservation efforts within local communities.

4.3 Environmental Policies and Legislation

Effective project planning requires not only good technical expertise but also proper understanding of government policies relevant to environmental protection and management. An understanding of these policies is useful to ensure that development projects are undertaken in a manner that does not conflict with stated policies but ideally to complement them. Additionally, the legal and administrative requirements and procedures that affect a project are important considerations, especially during the stage of planning approval.

Various national policies and legislations that are prescribed in the country are of relevance to environmental protection and management. While there are those that are of direct relevance to environmental pollution control, many of the other policies and legislations relate to resource protection and conservation, and these include forest, fisheries, land, mineral resources, community and occupational safety & health, and others. Although these environment and social related legislations fall within the responsibilities of other

agencies and authorities, they nevertheless need to be understood as EIA requires a holistic approach be adopted in order that a comprehensive assessment is achieved.

It is good EIA practice to make it a point to review statutory and non-statutory requirements for a project, as this will provide a clear understanding of how best an EIA can proceed. Clearing the legal and administrative requirements of authorities is as important in project planning as does clearing the technical and financial concerns. A summary of the legal and administrative requirements for the project within an EIA report will assist the project proponent and the authorities keep into focus environmental objectives during the EIA review process.

This Sections highlights some of the more important statutory and non-statutory requirements that may directly or indirectly affect the planning and development of a project in the industrial sector. It is, however, incumbent on the project proponent, and the Consultant/ assessor engaged to undertake an EIA, to review these and other legislation and authority requirements each time a project is undertaken, as changes in the form of new legislation or amendments to older ones may be made from time to time.

4.3.1 National Environment Policy and Legislation

The National Environment Policy of 1992 and the associated legislation on environmental protection and conservation represent the most important documents that relate to environmental protection and management in Bangladesh. The requirement of EIA for projects is described in these documents.

4.3.1.1 National Environment Policy

In 1992 the Bangladesh Government developed the National Environmental Policy (NEP) which defines the overall environmental framework and assigns responsibility for regulatory development, administration and enforcement. This responsibility has been given to the Department of Environment (DoE) which is under the Ministry of Environment, Forest and Climate Change. The National Environment Council, with the head of the government as chairperson, provides the overall policy direction.

In 26 years since adoption of Environment Policy, 1992, the nature and level of environment and ecological degradation have been changed. In order to address all those changes and with a view to protect and conserve environment and ecosystem in a rigorous, pragmatic and sustainable manner as well as to bring the climate change to the mainstream of the environment and development, the government has revised the National Environment Policy, 1992 and adopted the revised National Environment Policy, 2018.

Following are the key subject matters covered under the National Environment Policy, 2018:

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

- Strengthening institutional and legal capacity of institution (Government, local, private and technical) relevant to the enforcing and implementation of rules and regulation relating to environment policy and environment conservation;
- Ensuring considerations of climate change and challenges of calamities in all kind of infrastructure projects;
- Reducing of all SLCP (Short-Lived climate pollutants) which are harmful to health and environment;
- Taking development programs considering sustainable production and consumption as integral part of environmental conservation to meet the need of present and future generation;
- Allocating necessary funds to all areas of environmental conservation, preservation and control;
- Taking up programs in favor of flourishing environment friendly economy;
- Including environmental and ecological conservation particularly to introduce the environment and ecological concept in the environmental academic curriculum and textbooks of schools and colleges.

The policy has provided sector wise policy coverage for 24 different sectors along with their plan of implementation, identification of respective implementing agencies, legal and institutional framework and directives on compliances.

4.3.1.2 List of other National Plans, Policies Guidelines that confirm, compliment and support the National Environmental Policy:

- National Bio-safety Strategy & Action Plan 1995
- National Biodiversity Strategy & Action Plan of Bangladesh 2016-2021
- A Roadmap for Clean Fuels and Vehicles in Bangladesh, 2011
- National Action Programme on Desertification, Land Degradation and Drought (DLDD) 2016-2024
- Ecologically Critical Area Management Rules, 2016.
- Medical Waste (Management and Processing) Rules, 2008
- Hazardous Waste and Ship Breaking Waste Management Rules, 2011
- Bangladesh Biosafety Rules, 2012
- Bangladesh Biological Diversity Act 2017
- Natural Water Reservoir Conservation Act, 2000

- National Forestry Policy 2016
- National Conservation Strategy 1998 and Draft Update 2013
- National 3R (Reduce, Reuse & Recycle) Strategy 2010
- Bangladesh Climate Change Strategy & Action Plan (BCCSAP) 2009
- Bangladesh Delta Plan 2100
- National Disaster Management Plan 2010.
- Nationally Determined Contributions (NDCs)
- Five Year Plan
- Sustainable Development Goals (SDGs)
- National Adaptation Program of Action (NAPA) 2005 and Update 2009
- Other Sectoral Policies/Strategies like Industry, Agriculture, Energy, Water, Health, etc.
- National Bio-safety Framework and Guidelines
- Guidelines on Environmental Management, Waste Treatment and Workers' Occupational Health and Safety for Ship Breaking Yard in Bangladesh
- Establishing National Land use and Land Degradation Profile 2018.

4.3.1.3 The Bangladesh Environment Conservation Act, 1995 (as amended in 2000, 2002 & 2010)

The Bangladesh Environmental Conservation Act (BECA), 1995 is the main legislation for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. The enabling powers of the BECA are wide ranging. Wide-ranging powers (Section 4) are given to the DG to take various actions or measures to enforce the BECA (Table 4.2).

Table 4.2: Provisions of the BECA, 1995

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

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

Section 12, requiring an Environmental Clearance Certificate, is effectively enforced by way of The Environmental Conservation Rules, 1997, which is made pursuant to the powers provided under Section 20 of the BECA.

4.3.1.4 The Environment Conservation Rules, 2023.

The Environment Conservation Rules (ECR), 2023 is the main subsidiary legislation of the BECA which outlines various procedures or measures that need to be taken for compliance with the related provisions of the BECA (4.3).

The ECR provides specific rules and procedures for various categories of projects in relation to their approval prior to construction and operation. For projects and activities listed within the Red category, the ECR requires that a terms of reference (ToR) be first

submitted for approval. The EIA is to be based on a ToR that has the prior approval of the DoE.

Table 4.3: Principal Provisions of the ECR, 2023.

Rules/Schedules/ Forms	Main Theme
Rule 5 (1)	Classification of industrial units and projects for purpose of issuance of into four categories:- (a) Green; (b) Yellow; (c) Orange; and (d) Red.
Rule 9	Procedure for granting environmental clearance to green category industrial establishments and projects.
Rules 10 and 11	Site and Environmental clearance procedures for yellow category industrial establishments and projects.
Rules 12 and 13	Site and environmental clearance procedures for orange category industrial establishments and projects.
Rules 14 and 19	Site and environmental clearance procedures for red class industrial establishments and projects.
Rule 15	Environmental impact assessment studies are prepared by listed environmental consultants for red category industrial establishments or projects.
Rule 20	The green category industrial establishment or project environmental clearance period is 5 years, yellow category clearance period is 2 years and orange and red category class clearance period is 1 year.
Rules 21 and 22	Procedure for renewal of Site and Environmental clearances certificates.
Rules 27, 28, 29 and 30	Appeal, Appellate Authority, Procedure to be followed by Appellate Authority and procedure for hearing appeal.
Rules 37 and 38	Enrollment of environmental consultant or expert and cancellation, renewal, etc. of enrolment.
Form-3	Application form for site or environmental clearance Certificate.
Form-4	Application Form for Renewal of Site Clearance Certificate
Form-4	Application form for renewal of Environmental Clearance Certificate.
Schedule-1	List of different categories of industrial establishments or projects.

Rules/Schedules/ Forms	Main Theme
Schedule-2	Water quality.
Schedule-3	Effluent standards.
Schedule-4	Liquid waste emission standards of industrial establishments or projects.
Schedule-5	Liquid waste emission standards based on industrial class.
Schedule-6	Application processing fees for site or environmental clearances certificates.
Schedule-7	Fees for obtaining and renewing site or environmental clearances certificates.
Schedule-8	Fees relating to analysis of water, liquid waste, air and noise samples and provision of various data or data analyzed by the Department of Environment.
Schedule-9	Guidelines for locating industrial establishments or projects.
Schedule-10	Guidelines for Formulation of Scope of Environmental Impact Assessment.
Schedule-11	Guidelines for Preparation of Environmental Impact Assessment Report of Industrial Establishments or Projects.
Schedule-12	Liquid waste treatment of industrial establishments or projects (construction of treatment plant, approval, operation, discharge method, discharge standard, discharge point etc.).
Schedule-13	Enrollment of environmental consultant or expert.
Schedule-14	Determinant of classification of industrial establishments or projects.

Also specified in the ECR are ambient environmental standards as well as standards for control of emissions or discharges that are required to be met. While these standards are intended to assist project planners in determining measures to be taken to comply with these requirements, it is the ultimate responsibility of the project proponent to ensure that the environmental impacts arising from their projects are minimal or within acceptable levels that will protect the environment. An EIA provides the means to determine if this will be so and it is recommended for adoption by project proponents for all major projects irrespective of whether or not it is a requirement of the DoE. Environmental stewardship

demands that corporate governance includes taking responsibility for protection of the environment.

The pathway for compliance with rules and procedures for EIA are outlined within the ECR. More detailed discussions of the procedures for undertaking an EIA are presented in later sections of this chapter.

4.3.1.5 Noise Pollution (control) Rules, 2006

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

4.3.1.6 Solid Waste Management Regulations 2021

The Regulations define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to **Extended Producer Responsibility (EPR)** on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery.

The main provisions of the Regulations are as follows.

- ❖ When recovering resources from waste, the principles of management that consider the waste hierarchy, such as the 3Rs, segregation, and reduction, must be followed at all stages from waste generation to final disposal.
- ❖ Responsibilities of waste generators, consumers, and users: Dispose of waste in accordance with the regulations of authorities including local government. Dispose of waste separately.
- ❖ Do not dump, store, or burn waste outdoors.
- ❖ Responsibilities of manufacturers (*not defined) and importers of products Collect non-biodegradable products such as glass, plastic, polyethylene, multi-layered packaging, bottles, and cans from consumers and recycle or dispose of them if appropriate.

Determine work plans and implementation procedures for recycling and disposal.
Ensure that EPR is properly implemented.

- ❖ Submit an annual report to the Department of Environment (DOE) on the amount of plastic recycled.
- ❖ Raise public awareness of proper waste management.

Any violation of the above provisions shall be subject to imprisonment for not more than two years or a fine not exceeding 200,000 taka (approximately 270,000 yen), or both. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery.

4.3.1.7 Medical Waste (Management and Processing) Rules, 2008

Key Provisions:

The Rules provide a regulatory framework for safe management of healthcare waste. The **main provisions include:**

- Segregation of waste at source using color-coded systems
- Safe storage and handling of infectious, pathological, sharps, and chemical waste
- Treatment through approved methods such as autoclaving, incineration, or disinfection
- Safe transportation and final disposal through authorized facilities
- Licensing requirement for waste handlers and treatment operators

Project Compliance Approach:

The hospital will develop and implement a Hospital Waste Management Plan (HWMP). Waste will be segregated at source, stored in designated secured areas, and treated using approved technologies. Licensed service providers will be engaged for waste transportation and final disposal in compliance with DoE requirements.

4.3.1.8 Bangladesh Atomic Energy Regulatory Framework (BAEC Act & Rules)

Key Provisions:

The Bangladesh Atomic Energy Commission (BAEC) is the national regulatory authority responsible for controlling the use of ionizing radiation and nuclear technology in Bangladesh. The regulatory framework is primarily governed by the Bangladesh Atomic Energy Commission-related laws and associated rules, as well as internationally accepted radiation safety standards such as those of the International Atomic Energy Agency (IAEA).

The main provisions of the BAEC regulatory framework include:

- Mandatory licensing for the import, installation, and operation of radiation-generating equipment such as Linear Accelerators (LINAC), CT scanners, X-ray machines, and other diagnostic or therapeutic devices
- Regulation and control of radioactive materials used in medical, industrial, and research applications
- Enforcement of radiation protection principles, including justification of use, optimization of exposure, and dose limitation (ALARA principle)
- Requirement for proper shielding design for radiation facilities (e.g., bunker rooms, lead shielding walls, controlled access areas)
- Establishment of controlled and supervised radiation zones within healthcare facilities
- Mandatory personal radiation monitoring (dosimetry) for occupationally exposed workers
- Regular inspection, calibration, and safety auditing of radiation equipment
- Requirement for trained and certified Radiation Safety Officers (RSO) in radiation facilities
- Emergency preparedness and response planning for radiation incidents or accidental exposure.

Project Compliance Approach:

The proposed Green Life Cancer Hospital (GLHLCU) will fully comply with the BAEC regulatory requirements for all radiation-based diagnostic and therapeutic services.

In this regard, the project will ensure the following:

- All necessary licenses and approvals will be obtained from BAEC prior to installation and operation of radiation-emitting equipment
- Radiation bunker design and shielding calculations will be incorporated during the architectural and engineering design stage in compliance with BAEC and IAEA standards
- Controlled access systems will be implemented in radiation zones to restrict unauthorized entry
- Personal dosimetry monitoring will be ensured for all radiation workers, and exposure records will be maintained
- A qualified Radiation Safety Officer (RSO) will be appointed to oversee radiation protection practices and regulatory compliance

- Regular maintenance, calibration, and quality assurance of radiation equipment will be carried out as per BAEC requirements
- Emergency response procedures will be established to address any potential radiation accidents or abnormal exposure events.

4.3.1.9 Infectious Disease Control Regulations

Key Provisions

The Infectious Diseases (Prevention, Control and Elimination) Act, 2018 emphasizes:

- Infection prevention and control measures
- Isolation and containment of infectious patients
- Hospital-acquired infection (HAI) prevention
- Safe handling of biological materials.

Project Compliance Approach:

The hospital will establish infection control protocols, isolation facilities, sterilization systems, and hygiene management practices to prevent disease transmission.

4.3.1.10 Drug Control and Pharmaceutical Regulations

Key Provisions

Drug regulations govern:

- Storage and dispensing of pharmaceuticals
- Licensing of pharmacy operations
- Safe disposal of expired medicines

Project Compliance Approach:

The hospital will ensure licensed pharmacy operations, proper storage of controlled drugs, and safe handling protocols for chemotherapy and hazardous pharmaceuticals.

4.3.1.11 International Guidelines and Best Practices

Key Provisions

Relevant international frameworks include:

- WHO Healthcare Waste Management Guidelines
- IAEA Radiation Protection Standards
- IFC / World Bank EHS Guidelines for Healthcare Facilities
- Good International Industry Practice (GIIP)

Project Compliance Approach:

The project will adopt international best practices in healthcare waste management, radiation safety, infection control, and environmental protection to ensure global-standard healthcare service delivery.

4.3.2 Resources Protection and Conservation Policies and Legislation

Besides the main environmental protection laws mentioned above, various other national policies and legislations need to be considered because of their relevance to environmental protection and conservation. These are mostly those that relate to natural resources protection and conservation, and include matters such as forest, fisheries, wild flora and fauna, water, and coastal zone protection and management.

4.3.2.1 Fisheries Protection and Conservation

The coastal wetlands and estuarine rivers of the Bay of Bengal southwest of Bangladesh are rich in biodiversity and highly productive ecosystems for many marine species, especially fish and shrimps. These resources have been identified as the principal source of animal protein for the people of Bangladesh and future dependency on this protein source requires strong action to protect these resources.

The National Fisheries Policy provides the framework for the conservation and management of fisheries resources to ensure supply and enhance production. All the water bodies suitable for fisheries production and their fisheries resources conservation, development and management are addressed under this policy. These include rivers and canals, haor and baor, floodplains, open and coastal water systems.

Matters related to marine fisheries are governed by the Marine Fisheries Ordinance (MFO), 1983, which was amended in 1992. The legislation provides for the Director responsible to take measures for the management, conservation, supervision and development of marine fisheries resources, and for implementation of actions to achieve the objectives of the legislation. Various powers for enforcement, mainly through licensing, are provided in the legislation.

4.3.2.2 Water Resources Protection and Conservation

The National Water Policy (NWP) provides the framework for the management of water resources of the country in a comprehensive, integrated and equitable manner. The NWP recognizes that water is essential for human survival, socio-economic development of the country and preservation of its natural environment. It is vital that the continued

development and management of the nation's water resources should include the protection, restoration, and preservation of the environment and its bio-diversity.

The Bangladesh Water Act (BWA), 2008, gives effect to the National Water Policy. The overall purpose of the BWA is to consolidate and supplement existing laws for water resources in the country to regulate water resources in order to ensure integrated, equitable and sustainable management, development, and utilization of water resources and their conservation.

4.3.2.3 Open Space Protection

The Urban Open-fields, Garden and Natural Water Bodies Protection Act (Jaladhar Ayne) 2000 is intended to preserve areas of open space from encroachment or conversion to other uses. With proper implementation of the law, the respective authorities can protect the open spaces natural water bodies including the flood plains of the urban areas from filing up for the sake of urbanization and development.

4.3.3 Community and Occupational Safety & Health Legislation

4.3.3.1 The Occupational Safety and Health (OSH) Legislation

Within Bangladesh OSH policy and regulatory frameworks, there are three broad areas of occupational safety and health related issue: (i) occupational accidents, hazards and diseases;

(ii) safety equipment, tools and facilities, and (iii) workplace environment. The key provisions of each area include:

- Occupational Accidents, Hazards and Diseases
 - ❖ Accident prevention regulations
 - ❖ Prevention from workplace hazards
 - ❖ Disease prevention and safeguards
 - ❖ Record keeping and planning
 - ❖ Rehabilitation and awareness building
- Safety Equipment, Tools and Facilities
 - ❖ Fire-fighting apparatus and emergency fire exit
 - ❖ Personal Protective Equipment
 - ❖ Safety of buildings and machineries
- Workplace Environment
 - ❖ Health services and medical care
 - ❖ Workplace safety

Through the legal provisions on OSH related issues, Bangladesh established tripartite National Industrial Health and Safety Council in 2009. The Council has formulated a National Occupational Safety and Health Policy in 2013 and working towards implementation of the policy in every industrial sector.

The Labour Act 2006 (as amended in 2013)

The Labour Act is the most comprehensive labour and workplace related legislation of the country, consolidating the provisions of 25 separate acts into single labour code in 2006. Among others, it sets occupational safety and health standards, compensation for injury and accidents in the workplace, maternity benefits, factory inspectorate and restrictions in child labour. The responsibility of enforcing workplace safety such as fire safety, and welfare of workers has been given to the Department of Inspection for Factory and Establishments (DIFE), which is under the Ministry of Labour and Employment.

The law applies to all “establishments” which are defined widely to include, shops, hotels, restaurants, factories (though these must employ more than five laborers), plantations, docks, transport services, construction sites, and “any premises in which laborers are employed for the purposes of carrying on any industry.” It does not apply to the agricultural sector – though it does apply to tea plantations, and certain obligations apply to tea gardens. The agencies mandated to implement the law include the Department of Labor/Labor Directorate (DOL) and the Department of Inspection for Factories and Establishments (DIFE) of the Ministry of Labor and Employment (MOLE) and the Labor Appeal Tribunal/Labor Court. The DoL is mainly responsible for facilitation of effective labour management relations, collective bargaining and negotiations and ensures prompt and efficient settlement of labour disputes in the industrial sectors of Bangladesh while the DIFE is responsible for ensuring workplace safety including fire safety, structural integrity of workplace buildings and welfare of workers. It conducts inspections of factories, shops, industries and commercial establishments, tea gardens, railway, internal water transport and road transport. The labor courts deal with both industrial disputes and individual grievances.

National Occupational Health and Safety Policy, 2013

The National Occupational Health and Safety Policy, 2013 addresses national commitment as per Constitution for continual improvement of occupational health and safety management system of the establishment to prevent or reduce workplace fatalities and work-related diseases. The policy specified the obligations of all relevant stakeholders and

organizations. With the objectives, the various roles and responsibilities of relevant stakeholders including government, factory/business owners, trade union, employers and workers are clearly identified and established. The ministry of labor and employment (MoLE) is mainly responsible implementation and development of national action plan under the policy coordinating with all stakeholders. The key provisions include occupational accidents, hazards and diseases relate to accident prevention regulations, prevention from workplace hazards, disease prevention and safeguards, record keeping and planning, rehabilitation and awareness building. The National OSH Policy also ensures safety in transportation, maintenance and use of chemicals used in the production process.

Public Procurement Rule (PPR) 2008

This rule applies to the Procurement of Goods, Works or Services by any government, semi government or any statutory body established under any law. The Public Procurement Rule 2008 requires contractors to take all reasonable steps to: (i) safeguard the health and safety of all workers working on site and other persons authorized to be in it; (ii) to keep the site in an orderly state; and (iii) to protect the environment on and off the site; to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.

Table 4.4: Legislations and policy issuances related to safety in the workplace

Legislations and Issuances	Key Provisions
National Occupational Health and Safety Policy, 2013	Specifies the obligations of all relevant stakeholders and organizations in promoting and enforcing occupational health and safety
Labour Act 2006 as amended, 2013 Labour Rules (2015)	Imposes obligations on the part of the employer on the conditions of service and employment including wages and payment, employment of young people, maternity benefits, working hours and leave; trade unions and industrial relations; and, occupational health, safety, hygiene, and welfare of workers, and compensation for injury.
National Building Code 2006	Provides for standards for structural integrity; adequate, accessible and discernible means of exit/escape in Buildings; fire extinguishing system.
Public Procurement Rule (PPR) 2008	Requires contractors to provide for adequate measures regarding the “Safety, Security and Protection of the Environment’ in the construction works.

Legislations and Issuances	Key Provisions
National Child Labour Elimination Policy 2010	Sets a policy to eliminate child labour exploitation through enactment of pragmatic laws, implementation of plans and programs, etc.
Fire Prevention and Extinction Act 2003 Fire Prevention And Extinction Rules 2014	Requires the owner of a building to apply for Occupancy Certificate to ensure compliance with the relevant provisions of the Building Code

4.3.3.2 Community Safety and Health (CSH) Legislations

There is no specific legislative framework for community health and safety aspect of industry or projects but under the government of Bangladesh there are specific laws and acts enacted by various ministries. The project proponent conducting the EIA may consult ongoing community based programs and policies of the Ministry of Health to help improve assessment and mitigation planning on community health and safety impacts and risks. Table 4.5. Below provides some of the relevant legislations and policy issuances that have relevant provisions on community health and safety of industry projects.

National Health Policy, 2011

The National Health Policy aims to ensure accessibility of primary health care and emergency care for all by, among others, providing quality and easily accessible care, irrespective of an urban and rural community, mainly focusing on the poor and disadvantaged population; and, ensuring coordination between different healthcare-related departments, ministry of GoB, and MOHFW, in addition to coordination between the Government of Bangladesh and NGOs. It also aims to ensure adequate epidemiological tracking of disease patterns and impacts of climate change on health.

Table 4.5: Legislations and policy issuances related to community health and safety

Policy Issuances/Legislations	Relevant Provisions
National Health Policy, 2011	Promotes coordination of various agencies in pursuing a more accessible and equitable quality health care for the communities. Focuses programs on the poor and disadvantaged sector of the population. It also aims to ensure adequate epidemiological tracking of disease patterns and impacts of climate change on health.
National Policy for Safe Water Supply and Sanitation, 1998	Aims to improve the standard of public health and to ensure improved environment, particularly by

Policy Issuances/Legislations	Relevant Provisions
	facilitating access of all citizens to basic level of services in water supply and sanitation
Disaster Management Act, 2012	Provides the legal basis for coordinating activities for disaster management. Establishes the Department of Disaster Management under the Ministry Disaster Management and Relief

National Policy for Safe Water Supply & Sanitation (NPSWSS) 1998

This policy was promulgated to improve the standard of public health and to ensure improved environment, particularly by facilitating access of all citizens to basic level of services in water supply and sanitation, bringing about behavioral changes regarding use of water and sanitation; reducing incidence of water borne diseases; building capacity in local governments and communities to be effectively with problems relating to water supply and sanitation; promoting sustainable water and sanitation services; ensuring proper storage, management and use of surface water and preventing its contamination, among others. The Department of Public Health Engineering is the national lead agency responsible exclusively for water supply and sanitation facilities along with advisory service to GoB in framing policy and action plans. The Department has a Water Quality Monitoring and Surveillance Circle.

Disaster Management Act, 2012

This Act is the legal basis for coordinating activities about disaster management, setting policies and formulation of rules and to build up infrastructure of effective disaster management to fight all types of disaster. It also described the national disaster management principles and planning by reducing the overall vulnerability from different impacts of disaster through risk reduction activities; conduct of humanitarian assistance programs efficiently to enhance the capacity of poor and disadvantaged as well as strengthening and coordinating programs undertaken by various government and NGOs related to disaster risk reduction and emergency response. The Department of Disaster Management (DDM) is responsible for the Disaster Management Act and to mandate the implement of the objectives.

Road Transport Act, 2018

The Road Transport Act 2018 set-forth requirements for road/traffic safety and prevention of motor vehicle accidents. The Bangladesh Road Transport Authority (BRTA) is a regulatory body to control, manage and ensure discipline in the road transport sector, as well as to maintain road safety. It works under the Ministry of Communication to carry out the purposes set out for it under the Motor Vehicle Ordinance.

The relevant Acts and Rules pertaining to the Project have been summarized in the following table.

Table 4.6: Applicable Environmental, Social Laws, Regulations & Policies.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
The Environment Conservation Act, 1995 (amended up to 5 October 2010) & Environment Conservation Rules, 2023 (ECR) The Act and Rules constitute the principal legal framework for environmental protection in Bangladesh. Key provisions include: • Establishment of the Department of Environment (DoE) under MoEFCC for enforcement of environmental regulations • Declaration and management of Ecologically Critical Areas (ECA) with restrictions on harmful activities • Mandatory requirement of Environmental Clearance Certificate (ECC) prior to establishment or operation of any project • Environmental guideline formulation for pollution control, mitigation, and sustainable environmental management • Classification of industrial and development projects into Green, Yellow, Orange, and Red categories under Schedule-I of ECR 2023 • Requirement of Location Clearance Certificate (LCC) for applicable categories prior to ECC issuance	Ministry of Environment and Forests, Bangladesh Department of Environment, Bangladesh	GLHLCU shall obtain Environmental Clearance Certificate (ECC) from DoE as the project falls under Red Category. The project shall ensure compliance with all applicable provisions of ECA and ECR, maintain emission and discharge within prescribed limits, implement effective biomedical waste and wastewater management systems, and comply with all environmental quality standards. Continuous environmental monitoring and implementation of mitigation measures shall be ensured during both construction and operation phases.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
- Submission of ECC application in prescribed Form-3 along with supporting documents and fees - Validity of ECC for Red Category projects is one year, subject to timely renewal - Specification of environmental quality standards for air, water, noise, odor, and other parameters under relevant schedules - Emission and effluent discharge standards defined under Schedules 3–5 of ECR 2023.		
National Industry Policy, 2016 - Promotion of green productivity and environmentally friendly industrial development through the use of green technology - Encouragement of installation of Effluent Treatment Plants (ETP) and Central Effluent Treatment Plants (CETP) for pollution control - Promotion of Clean Development Mechanism (CDM) initiatives to reduce greenhouse gas emissions and enhance sustainability - Adoption of the 3R principle (Reduce, Reuse, Recycle) in all industrial activities for sustainable resource management - Discouragement of industrial development on agricultural land to protect arable land and food security.	Ministries of Industries	GLHLCU shall comply with the policy by adopting environmentally sustainable practices throughout project design, construction, and operation. The project will promote energy-efficient technologies, ensure appropriate treatment of wastewater and biomedical waste, implement waste minimization and recycling practices, and follow the 3R principles. The project shall also ensure sustainable land use and avoid adverse impacts on surrounding land and environment.
National Environment Policy, 2018 Encourage collection and promotion of low carbon emission technology in the country.	Ministry of Environment, Forest and Climate Change	GLHLCU shall comply with the policy by ensuring low-emission and environmentally friendly technologies, effective pollution

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
- Identifying and controlling all types of environmental pollution and degradation activities. - Ensure sustainable, long-term, and environmentally friendly use of all natural resources. - To take PPP for the development of the environment. - Maintain and streamline the environmental policies and strategies among other policy strategies in the interest of sustainable development. - Ensure the EIA and SEA are in all necessary sectors. - Take action to reduce poverty through environmental protection. - Strengthen observations on proper compliance with environmental laws and regulations.		prevention and control measures, and sustainable resource management. The project will implement EIA recommendations, ensure regulatory compliance, and maintain continuous monitoring for environmental protection throughout construction and operation phases.
Bangladesh Water Act, 2013 The key features of the Act are: - A National Water Resources Council (NWRC) to be established for implementing the provisions of the Act - A National Water Policy shall be adopted by the Council addressing the following issues: - Purpose and sectors of water use - Affordability of water users - Actual cost of water abstraction and distribution - Financial ability and backwardness of water users of any group thereof - Water demand and supply - Any other issues considered relevant by GoB	Water Resource Planning Organization (WARPO)	GLHLCU shall ensure compliance with the provisions of the Bangladesh Water Act, 2013, as applicable. The project will adopt sustainable water use practices, avoid over-extraction of groundwater, and comply with any future directives related to water stress areas, zoning, and abstraction limits issued by the competent authority.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
• An Executive Committee of the Council shall be established or ensuring efficient performance of the Council. • The GoB can declare certain areas as Water Stress Areas for the protection of water sources or aquifers. • Water zone demarcation (industrial, agricultural, brackish water aquaculture and hatchery water zones) through gazette notification and issuance of protection order for efficient water management in such zones • Declaration of flood control zone and its management. • Restriction on abstraction of total water from any water source.		
National Water Policy, 1999 • Protection and prevention of the natural environment for ensuring sustainable development. • Minimize disruption to the natural aquatic environment in streams and water channels. • Water development plans will not interrupt fish movement and will make adequate provisions in control structures for allowing fish migration and breeding. • Water development projects should cause minimal disruption to navigation and, where necessary, adequate mitigation measures should be taken. • Full consideration of environmental protection, restoration, and enhancement measures consistent with NEMAP and the NWMP.	Ministry of Water Resources	GLHLCU shall ensure compliance with the National Water Policy, 1999 by adopting sustainable water management practices. The project will ensure protection of nearby water bodies, maintain natural drainage patterns, avoid disruption to aquatic ecology, and implement appropriate mitigation measures to prevent water pollution and ecological imbalance during construction and operation phases.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
Ensure adequate upland flow in water channels to preserve the coastal estuary ecosystem threatened by the intrusion of salinity from the sea.		
Ground Water Management Ordinance, 1985 As per the provisions as per schedule 5 of this act, no tube well shall be installed in any place without a license granted by the Union Parishad. Also, no application shall be entertained by the Union Parishad unless it is accompanied by such fee as may be prescribed under the requirements of this ordinance.	Ministry of Environment, Forests & Climate Change, Bangladesh	GLHLCU shall ensure that no tube-well is installed without obtaining prior license from the Union Parishad. The project will provide all required technical information including aquifer condition, distance from existing tube-wells, expected water demand, potential impacts on surrounding water users, and site suitability. Compliance with all licensing conditions and regulatory requirements shall be strictly maintained.
The National Fisheries Policy, 1999 The objectives of the fisheries policy are: - Enhancement of the fisheries production; - Poverty alleviation through creation of self-employment and improvement of socio-economic conditions of the fishermen; - Fulfilling the demand for animal protein; - Achieve economic growth through earning foreign currency by exporting fish and fisheries products; and - Maintain ecological balance, conserve biodiversity, ensure public health and provide recreational facilities. The policy broadly aims at fisheries development, regulation of aquaculture, biodiversity conservation and formulation of	Ministry of Fisheries and Livestock (MoFL) Department of Fisheries (DoF)	GLHLCU shall ensure that no untreated effluent is discharged into any surface water body during project operation. All wastewater shall be properly treated and comply with the discharge standards prescribed under the Environment Conservation Rules (ECR), 2023. Continuous monitoring and compliance with applicable environmental standards shall be maintained.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
laws to ban the disposal of any untreated industrial effluents into the water bodies.		
Air Pollution (Control) Rules, 2022 - Stipulate ambient air quality standards, emission standards for vehicles, emission standards for water vessels, gaseous emission standards applicable to industries or projects, odor standards, and standards for construction dust control. - Local government organizations, construction management authorities, and other relevant organizations shall comply with the standards and control methods specified in the rules. - Rules also provide for the prevention of air pollution from hazardous waste, excessive emissions of air pollutants, air quality monitoring and warning, data management, the establishment of a national executive committee for air pollution control, measures to prevent damage to ecosystems caused by air pollution, awards for contributions to air pollution control, and penalties for violations.	Ministry of Environment and Forests & Climate Change, Bangladesh Department of Environment, Bangladesh	GLHLCU shall comply with all applicable air quality standards and emission limits during both construction and operation phases. The project will implement adequate dust suppression measures, control emissions from vehicles and equipment, ensure proper handling of materials to minimize air pollution, and conduct regular air quality monitoring to ensure compliance with DoE requirements.
Noise Pollution (Control) Rules, 2006 - The Rules have been established to manage noise generating activities, which have the potential to impact the health & wellbeing of workers and the surrounding communities. - An area up to a radius of 100 meters around hospitals, educational institutions, offices, or similar types of institutions is designated as a silent area. The acceptable	Ministry of Environment and Forests & Climate Change, Bangladesh Department of Environment,	GLHLCU shall ensure that noise levels generated during construction and operation remain within the permissible limits prescribed by the Noise Pollution (Control) Rules, 2006. The project will implement appropriate noise control measures such as scheduling of high-noise activities during daytime hours, use of low-noise

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
sound limit in the silent areas is 50 dB(A) for daytime and 40 dB(A) for nighttime. - The residential areas are primarily occupied by dwellings. The acceptable sound limit in residential areas is 55 dB(A) for daytime and 45 dB(A) for nighttime. - Mixed areas with a mix of residential, commercial & industrial land use. The acceptable sound limit in the mixed areas is 60 dB(A) for daytime and 50 dB(A) for nighttime. - Commercial areas are primarily occupied by businesses and officers. The acceptable sound limit in commercial areas is 70 dB(A) for daytime and 60 dB(A) for nighttime. - Industrial areas are used for industry or manufacturing. The acceptable sound limit in the industrial areas is 75 dB(A) for daytime and 70 dB(A) for nighttime. - An area between 500 meters from the last limit of a residential area for construction-related activity use of brick and stone crusher machine is prohibited and operation of mixture machine and construction-related machinery and equipment are prohibited from 7 PM to 7 AM. - The guidelines say exceeding the maximum noise level in certain areas is a punishable offense	Bangladesh	equipment, installation of noise barriers where necessary, and regular monitoring to ensure compliance with DoE standards.
National 3R Strategy for Waste Management, 2010 The concept of this strategy is minimizing waste impacts in terms of quantity or ill-effects, by reducing the quantity of waste products with simple treatments and recycling the waste by using it as resources to	Department of Environment	GLHLCU shall adopt the 3R principles in all phases of the project to minimize waste generation and maximize resource efficiency. The project will implement proper waste segregation, reuse and recycling practices for

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
produce the same or modified products. The principle of “3R” is stated as reducing waste, reusing, and recycling resources and products. • Reducing means choosing to use items with care to reduce the amount of waste generated. • Reusing involves the repeated use of items or parts of items that still have usable aspects. • Recycling means the use of waste itself, as resources. • It suggests ISO 14001 or any other EMS structure which is significant for the development of strategies relevant to the industry and its social and environmental setting. ISO 14001 is increasingly important in international trade.		general and operational wastes, and ensure environmentally sound disposal of residual waste in compliance with DoE requirements and applicable standards.
Bangladesh Atomic Energy Regulatory Framework (BAERA Act & Radiation Safety Rules) • Regulates the use of ionizing radiation in medical facilities • Requires licensing for installation and operation of radiotherapy equipment (e.g., LINAC, brachytherapy units) • Ensures radiation protection of patients, workers, and the public • Sets exposure limits and monitoring requirements for radiation safety • Mandates safe handling, storage, and disposal of radioactive materials and sources	Bangladesh Atomic Energy Regulatory Authority (BAERA)	GLHLCU shall obtain necessary radiation use and operation licenses from BAERA prior to installation and commissioning of radiotherapy equipment. The project will ensure radiation shielding design approval, regular dose monitoring, and compliance with all radiation protection standards for staff, patients, and surrounding environment.
Medical Waste (Management and Handling) Rules, 2008 / DoE Guidelines	Department of Environment (DoE)	GLHLCU shall implement a comprehensive Biomedical Waste Management System including

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
- Governs segregation, collection, treatment, and disposal of biomedical waste - Classifies waste into infectious, sharp, pathological, chemical, and general waste categories - Requires use of color-coded waste segregation system in healthcare facilities - Mandates treatment through autoclave, incineration, or approved disposal facilities - Requires authorized waste management contractors for hazardous waste handling.	/ Ministry of Environment, Forest and Climate Change	color-coded segregation, on-site treatment (autoclave/incineration where applicable), and disposal through approved contractors. Strict compliance will be maintained for safe handling of infectious and hazardous hospital waste generated from cancer treatment and diagnostic activities.
Drug Control Ordinance / Pharmaceutical Management Regulations - Regulates storage, handling, and distribution of controlled drugs and pharmaceuticals - Governs chemotherapy drugs and other controlled medical substances - Ensures licensing of hospital pharmacy operations - Requires secure storage and proper inventory management systems.	Directorate General of Drug Administration (DGDA)	GLHLCU shall ensure proper licensing and compliance for hospital pharmacy operations, including secure storage, controlled handling, and recordkeeping of chemotherapy drugs and restricted pharmaceuticals used in cancer treatment.
The Building and Construction Act, 1952 As per Section 3A of this act, No owner or occupier of a building shall, without obtaining previous permission from the Authorized Officer or the Committee use the building for the purpose other than that mentioned in the sanction.	Authorized Officer or Committee	GLHLCU shall ensure that no construction, reconstruction, or structural modification is undertaken without prior approval from the competent authority. All development activities will be carried out strictly in accordance with

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
All the construction, re-construction works to be undertaken as per terms or conditions prescribed.		approved designs, permits, and applicable building regulations.
The Vehicle Act, 1927 - As per section 4 of this act, no owner or person in charge of a vehicle shall allow any person under the age of eighteen years to drive the same in any public place. - As per section 7, no person shall drive a vehicle in a public place unless he is licensed in the prescribed manner. - Every vehicle must possess a valid registration certificate as per section 11 of this act.	Bangladesh Road Transport Authority	GLHLCU shall ensure that all project-related vehicles are properly registered and operated only by licensed drivers. The project will strictly comply with BRTA requirements to ensure road safety and lawful transportation of materials and personnel during construction and operation phases.
The Motor Vehicle Ordinance Act, 1983 (as modified on November, 1990) - As per section 3 of the ordinance, no person shall drive a motor vehicle in any public place unless he holds an effective driving license. - No person under the age of eighteen years shall drive a motor vehicle in any public place.	Bangladesh Road Transport Authority	GLHLCU shall ensure that all drivers engaged for project-related activities possess valid and appropriate driving licenses issued by the competent authority. The project will strictly prohibit underage driving and ensure full compliance with BRTA regulations to maintain road safety during construction and operational phases.
Fatal Accidents Act, 1855 This Act was promulgated to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong. The company will be liable to pay compensation in case of death of any worker/employee or damages in case death has not ensued but such circumstances could have resulted in death.	Ministry of Labour and Employment	GLHLCU shall ensure compliance with the provisions of the Act by establishing proper occupational health and safety (OHS) measures. The project will implement accident prevention protocols, emergency response procedures, and worker safety training. In case of any incident, statutory compensation and legal obligations will

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
		be fulfilled in accordance with applicable labor and safety regulations.
Penal Code, 1860 - Valid provisions related to pollution management, environment protection, and protection of health and safety. Chapter XIV of the Penal Code provides offenses effective public health, safety, convenience, decency, and morals: - Section 277: Falling Water or Public Spring or Reservoir. - Section 278: Making Atmosphere Noxious to Health. - Section 284: Negligent Conduct with respect to Poisonous Substance. - Section 285: Negligent Conduct with respect to Fire or Combustible Matter. - Section 286: Negligent Conduct with respect to Explosive Substance.	Ministry of Law, Justice, and Parliamentary Affairs	GLHLCU shall ensure strict compliance with all applicable provisions of the Penal Code by implementing adequate environmental protection, pollution prevention, and occupational health and safety measures. The project will ensure safe handling of chemicals, fire prevention systems, controlled storage of hazardous materials, and effective mitigation measures to avoid any environmental or public health risks during construction and operation phases.
Fire Prevention & Extinguish Act, 2003 and Rules, 2014 - Regulatory enactments in regard to the prevention, the successful extinguishing of fire, and also reduction of damages and consequences of fire. - States to obtain a license from the Director General of Fire Service and Civil Defense in case of any warehouse.	Ministry of Home Affairs	GLHLCU shall obtain necessary No Objection Certificate (NOC) and fire safety approval from the Department of Fire Service and Civil Defense prior to construction and operation. The project will implement adequate fire prevention systems, emergency exits, fire-fighting equipment, and regular safety drills to ensure full compliance and minimize fire-related risks.
Bangladesh Labour Act, 2006 (as amended through July 22, 2013)	Ministry of Labour and	GLHLCU shall ensure full compliance with all applicable provisions of the Bangladesh Labour

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
The provisions prescribed under chapters pertaining to occupational health and safety, and compensations due to accidents are entailed below. Chapter V: Health and Hygiene The chapter deals with provisions regarding cleanliness of the any facility, drinking water supply, ventilation, lighting, dust bean and spittoons, etc. Chapter VI: Safety This chapter addresses the issues regarding safety of building and machinery, precautions in case of fire, fencing of machinery, works on or near machinery in motion, hoists and lifts protection of eyes, explosive or inflammable dust/gas, etc. Chapter VII: Special Provisions related to Health, Hygiene and Safety This chapter deals with provisions to be taken in case of hazardous operations, notice to be given in accidents, notice of certain dangerous occurrences and diseases etc. Chapter VIII: Welfare This chapter prescribes the provisions to be facilitated in the facility regarding first-aid appliances, safety record books, washing facilities, canteens, shelters, rooms for children, etc. This Act consolidates and amends the laws relating to employment of labour, relations between workers and employers, determination of minimum wages, payment of wages and compensation for injuries to workers, formation of	Employment	Act, 2006 during both construction and operation phases. The project will implement formal employment policies, provide statutory worker benefits, ensure safe and hygienic working conditions, maintain occupational health and safety systems, and strictly comply with wage, working hour, and compensation requirements. The project will also ensure adequate welfare facilities, training, emergency preparedness, and strict prohibition of unsafe or child labour practices.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
trade unions, raising and settlement of industrial disputes, health, safety, welfare and working conditions of workers, apprenticeship and matters connected therewith. The provisions prescribed under chapters pertaining to labour benefits and entitlements are as follows: • Conditions of Service and Employment • Employment of Adolescent • Maternity Benefit • Working Hours and Leave • Wages and Payment • Workmen's Compensation for Injury by Accidents • Trade Unions and Industrial Relations • Regulation of Employment and Safety of Dock Workers		
National Child Labor Elimination Policy, 2010 The National Child Labor Elimination Policy 2010 has been adopted to provide a framework towards eradicating all forms of child labor by 2015. The policy defines and lays guidelines for underage workers, regulation of their working hours, wages, nutrition needs, mental health, education and overall work environment. As per the policy, a child is a person under the age of 14. A person between the ages of 14 and 18 is an adolescent, and should be granted special amendments, if compelled to work due to poor economic status. The policy also entails that a child may not be employed as a regular employee, not be made to work in hazardous settings, provided breaks more frequent	Ministry of Labor and Employment Ministry of Women and Child Welfare	GLHLCU shall strictly prohibit the engagement of any child labour (below 14 years) in all project activities. Any employment of adolescents (14–18 years), if applicable, will comply with legal safeguards ensuring non-hazardous duties, restricted working hours, and protection of health, safety, education, and welfare. The project will maintain strict monitoring to ensure ethical labour practices across construction and operation phases.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
than those for regular employees and have enough time left for study.		
Children's Act, 2013 (Act No. 24 of 2013). The Act implements the Nation's ratification to the UN Convention on the Rights of the Child (CRC), and replaces The Children's Act of 1974. The main components of the act are as follows: • The Act changes the legal definition of a child from being a person under the age of 14 to one under the age of 18. • It enforces the national authorities to establish Child Welfare Boards in each district, besides one at the national level. • It criminalizes any kind of cruelty inflicted on children while they are working in both the formal and informal sectors. • The Act further prescribes stricter punishments for using or exploiting children in begging, in brothels, and in carrying drugs, arms, or other illegal commodities.	Ministry of Law, Justice and Parliamentary Affairs. District commissioner's Office.	GLHLCU shall ensure strict compliance with the Children's Act, 2013 by prohibiting employment of any person under 18 years of age in all project activities during construction and operation phases. The project will implement a zero-tolerance policy on child labour and ensure full adherence to child protection and safeguarding principles across all contractor and subcontractor operations.
The Acquisition and Requisition of Immovable Property Ordinance, 1982 The ordinance consolidates and amends the laws relating to acquisition and requisition of immovable property by the government. It lays down the procedures and conditions for acquisition of land and other immovable properties such as common property resources (wells, places of worship, burial grounds, etc.).	Ministry of Land, Bangladesh	The project land for Green Life Hospital Ltd. (Cancer Unit) is located within the planned Purbachal New Town project and has been allocated through a formal allotment and lease agreement by RAJUK. Therefore, no direct land acquisition or resettlement under this Ordinance is applicable to the project. However, GLHLCU shall ensure

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
As per Section 8 of this ordinance, the amount of compensation to be determined taking into consideration market value and decision of Deputy Commissioner.		compliance with relevant land use, lease conditions, and regulatory requirements associated with government-allocated institutional land.
Investment Board Act (1989) Board of Investment, established under this act, is the principal private investment promotion and facilitation agency of Bangladesh which is responsible for implementation of provisions of above said policy. Under the provision of this act as per Schedule 11, All industries established in non-governmental sectors licensed by the Board shall be registered in the prescribed manner. As per Schedule 15 of this act, any industrial undertaking licensed transgresses any provision of this Act or of any rule made there under or breaks any condition relating to the license, the Board may, in such manner as may be prescribed, cancel the license of the industrial undertaking.	Board of Investment (BOI), Bangladesh	GLHLCU shall ensure that the proposed healthcare investment project is duly registered and approved by the relevant investment promotion authority (as applicable). The project will comply with all conditions set by the Board of Investment (or successor investment authority) including licensing, reporting, and regulatory requirements to ensure lawful establishment and operation of the facility.
National Land Use Policy, 2001 - To prevent arbitrary use of land. - To formulate guidelines for the maximum use of land according to the natural differences in different parts of the country. - In the case of land acquisition for urbanization and development projects or any other purpose, to ensure its best use by acquiring the least amount of land and to avoid the acquisition of excess land as required.	Ministry of Land	GLHLCU shall ensure that the project is implemented in accordance with the National Land Use Policy, 2001 by utilizing the allocated RAJUK-leased land strictly for approved institutional (hospital) purposes. The project will ensure optimal land use efficiency, avoid encroachment or unauthorized land conversion, and maintain full compliance with approved zoning and land use regulations under the Purbachal New Town development plan.

Summary of Applicable legislation/ Policy	Agency Responsible	Applicable Permit and Requirements
• Arranging for the preservation of such lands, especially government Khas lands, which may be required in the future for various development activities. • To ensure that the use of land is compatible with the natural environment. • Making the best use of land to alleviate poverty and increase employment. • To play a helpful role in preventing the increase in the number of landless.		

4.5 International and National Environment Standards/ Guidelines

The environmental standards and guidelines applicable to the construction and operation of the Green Life Hospital Ltd. (Cancer Unit) – GLHLCU are derived from both the national regulatory framework of Bangladesh and internationally recognized standards, including those of the World Bank Group. These standards are intended to ensure protection of environmental quality, public health, and sustainable development of healthcare infrastructure.

The key environmental aspects covered under these standards and guidelines include:

- Control of atmospheric emissions and maintenance of ambient air quality standards;
- Protection and management of surface water and groundwater quality;
- Regulation of liquid effluent discharge into surface water bodies and drainage systems;
- Control of noise emissions and maintenance of acceptable ambient noise levels in hospital and surrounding areas.

Compliance with these standards will be ensured throughout the construction and operational phases of the project through the implementation of appropriate mitigation measures, environmental monitoring programs, and good environmental management practices specific to healthcare facilities.

4.5.1 Ambient Air Quality Standards

As per the ECR 2023, the MoEFCC is responsible for laying down environmental quality standards (pertaining to air, water, sound, odor and other components) and standards for discharge and emission of waste. According to Air Pollution Control Rules 2022, the ambient air quality standards have been mentioned in the following table 4.7:

Table 4.7: Air Quality Standards of Bangladesh.

Pollutant	Averaging Time	Concentration
Carbon Monoxide (CO)	8 hours	05 mg/m ³ .
	1 hour	20 mg/m ³ .
Lead (Pb)	Annual	0.25 µg/m ³ .
	24 hours	0.50 µg/m ³ .
Oxides of Nitrogen (NO _x)	Annual	40 µg/m ³ .
	24 hours	80 µg/m ³ .
Sulphur dioxide (SO ₂)	1 hour	250 µg/m ³ .
	24 hours	80 µg/m ³ .

Pollutant	Averaging Time	Concentration
PM ₁₀	Annual	50 µg/m ³ .
	24 hours	150 µg/m ³ .
PM _{2.5}	Annual	35 µg/m ³ .
	24 hours	65 µg/m ³ .
Ozone (O ₃)	8 hours	100 µg/m ³ .
	1 hour	180 µg/m ³ .
Ammonia (NH ₃)	Annual	100 µg/m ³ .
	24 hours	400 µg/m ³ .

Source: Air Pollution Control Rules, 2022.

4.5.2 Water Quality Standards

As per Schedule 2 (ka) (1) of the ECR 2023, the standard for inland surface water as given in table below.

Table 4.8: Standards for inland surface water

S N	Usage	Parameter											
		pH	BO D mg/l	DO 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 number/1 00	TDS mg/l	CO D mg/l
a.	Source of drinking water for supply only after disinfecting	6.5 - 8.5	2 or less	6 or above	7.0	0.1	0.1	0.02	0.03	0.001	100 or less	1000	10
b.	Water usable for recreational activity	6.5 - 8.5	3 or less	5 or more	7.0	0.3	0.5	0.2	0.05	0.001	50 or less	1000	10
c.	Source of drinking water for supply after conventional treatment	6-9	3 or less	5 or more	7.0	0.3	0.5	0.02	0.03	0.001	5000 or less	1000	25
d.	Water usable by fisheries	6-9	6 or less	5 or more	7.0	0.3	0.5	0.05	0.1	0.004	5000 or less	1000	50
e.	Water usable by various process and cooling industries	6.5 - 8.5	12	1 or more	-	2.7	-	0.1	0.1	0.05	-	1000	100
f.	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

Notes:

1. Electrical conductivity for irrigation water – 2250 µ mhos/cm (at a temperature of 25 ° C); Sodium less than 26%; boron less than 0.2%.

Standards for drinking water have been presented in following table as per Schedule 2 (kha) of ECR-2023.

Table 4.9: Standards for Drinking Water

S.N.	Parameters	Unit	Standard
1.	pH	-	6.5 – 8.5
2.	Temperature	° C	20-30
3.	Turbidity	(in NTU)	5
4.	Color	Hazen	15
5.	TDS	mg/l	1000
6.	SS	mg/l	10
7.	Oil and Grease	mg/l	0.01
8.	Chlorides	mg/l	250*
9.	2,4,6 Trichlorophenol	mg/l	0.2
10.	Calcium	mg/l	75
11.	Magnesium	mg/l	30-35
12.	Sulphate	mg/l	250
13.	Fluorides	mg/l	1.0
14.	Iron	mg/l	0.3-1.0
15.	Trychloroethylene	mg/l	0.02
16.	1.2 Dichloroethylene	mg/l	0.03
17.	Ammonia	mg/l	1.5
18.	1.1 Dichloroethylene	mg/l	0.03
19.	Copper	mg/l	1.5
20.	Mercury	mg/l	0.001
21.	Barium	mg/l	0.7
22.	Cadmium	mg/l	0.003
23.	Arsenic	mg/l	0.05
24.	Lead	mg/l	0.01
25.	Zinc	mg/l	5
26.	Total Chromium	mg/l	0.05
27.	Manganese	mg/l	0.4
28.	Total Coliform	(CFU/100 ml)	0
29.	Faecal Coliform	(CFU/100 ml)	0
30.	Carbontetrachloride	mg/l	0.005
31.	Aluminium	mg/l	0.2
32.	Benzene	mg/l	0.01
33.	Boron	mg/l	1.0
34.	Tetrachloroethylene	mg/l	0.04
35.	Pentachlorophenol	mg/l	0.009
36.	Free Residual Chlorine	mg/l	0.2
37.	Chloroform	mg/l	0.09
38.	Cyanide	mg/l	0.05
39.	Hardness as CaCO ₃	mg/l	500
40.	Kjeldahl Nitrogen (total)	mg/l	1
41.	Nickel	mg/l	0.05
42.	Nitrite	mg/l	1.0
43.	Nitrate	mg/l	45
44.	Odor	-	Odorless

S.N.	Parameters	Unit	Standard
45.	Phenolic Compounds	mg/l	0.002
46.	Silver	mg/l	0.02
47.	Sodium	mg/l	200
48.	Aldrin/Dieldrin	Micro Gram/L	0.03
49.	Sulfide as H ₂ S	mg/l	0.05
50.	Anionic Detergents	mg/l	0.2
51.	Selenium	mg/l	0.01
52.	Potassium	mg/l	12
53.	Radioactive materials (gross alpha activity)	Bq/l	0.1
54.	Radioactive materials (gross beta activity)	Bq/l	1.0
55.	Tin (Sn)	Mg/l	2.0

4.5.3 Liquid Effluent Discharges Standard for Hospital

As per Schedule 4 of ECR 2023, standards for Waste from Industrial Units or Project Waste have been described. The same has been detailed in table below:

Table 4.10: Standards for Liquid Effluent Discharge for Hospital

S.N.	Parameters	Unit	Standard
1.	pH	-	6-9
2.	BOD ₅ at 20° C	mg/l	30
3.	COD	mg/l	125
4.	SS	mg/l	100
5.	E-Coli	CFU/100 mg/l	1000

4.5.4 Sewage Standards

Table 4.11: Sewage Standards

S.N.	Parameters	Unit	Standard
1.	Temp	° C	30
2.	pH	-	6-9
3.	BOD ₅ at 20° C	mg/l	30
4.	COD	mg/l	125
5.	SS	mg/l	100
6.	Oil & Grease	mg/l	10
7.	NO ₃	mg/l	50
8.	PO ₄	mg/l	15
9.	Total Coliform	CFU/100 mg/l	1000

Note:

(1) This standard applies to discharges to surface water streams.

(2) Sewage shall be treated with chlorine before final discharge. Residual Chlorine (chlorine) 0.2 mg/l. Can't be more.

4.5.5 Ambient Noise Standards

The MoEFCC under the provisions of ECR, 2023 is responsible for laying down ambient noise standards. Noise Pollution (Control) Rules, 2006 were laid down by the Ministry through a Gazette notification dated September 7, 2006:

Table 4.11: Ambient Noise Standards.

S.N.	Type of Area	Limits in dB(A) L_{eq}	
		Day	Night
1.	Silent Zone	50	40
2.	Residential area	55	45
3.	Mixed area	60	50
4.	Commercial area	70	60
5.	Industrial area	75	70

Note:

1. dB(A) L_{eq} represents time-weighted average noise level on the Decibel-A scale
2. Day time is from 6 am to 9 pm, Night time is from 9 pm to 6 am
3. Mixed area is mainly residential area, and also simultaneously used for commercial and industrial purposes.

Chapter-05

Project Description

5 Project Description

5.1 Overview

Green Life Hospital Limited (GLHL) proposes to establish a Cancer Hospital, with provisions for future expansion into a Specialized General Hospital, in Purbachal New Town, Dhaka. The project has been initiated in response to the rapidly increasing burden of cancer in Bangladesh, where cancer is responsible for approximately 10–12% of annual deaths nationwide.

Bangladesh's healthcare sector is experiencing rapid growth, driven largely by the private sector. However, despite the rising incidence of cancer, the availability of specialized cancer treatment facilities remains limited. At present, only around 19 hospitals across the country provide cancer care services, accompanied by a critical shortage of radiotherapy machines and advanced oncology infrastructure. This gap highlights the urgent need for additional, modern cancer treatment facilities.

Strategically, Purbachal presents a promising location due to its urban expansion and infrastructure development, ensuring accessibility and future growth. With GLHL's existing land ownership in the area, the hospital can establish an early presence in East Dhaka, capturing a growing patient base. The proposed hospital will initially have 100 beds, advanced cancer treatment technologies, later expanding to a 200-bed facility.

The proposed project site at Purbachal New Town offers a strategically advantageous location due to its planned urban development, expanding infrastructure, and improved connectivity with Dhaka and surrounding regions. Moreover, GLHL's existing ownership of land in the project area enables timely implementation and allows the hospital to establish an early presence in East Dhaka, thereby serving a rapidly growing and underserved population. The proposed hospital will be developed in phases. The proposed hospital will initially have 100 beds, advanced cancer treatment technologies, later expanding to a 200-bed facility.

Although application will be made to the Department of Environment (DoE) for a 100-bed hospital license, the initial phase of operation will be limited to outpatient (OPD) services only. In this phase, the facility will provide diagnostic consultation, outpatient oncology services, and related support services without inpatient admission. Inpatient (bed) services will be introduced in the future based on patient demand and operational feasibility.

Overall, the project is well aligned with national healthcare priorities and market demand. It aims to address the critical need for specialized cancer treatment, research, and capacity building in Bangladesh. The establishment of the Green Life Cancer Hospital is expected to significantly strengthen the country's healthcare system by providing high-quality, internationally compliant cancer care services.

Table 5.1: At a glance of the GLHLCU.

Name of Project		Green Life Hospital Ltd. (Cancer Unit)
Project Location	:	Plot: 39, Road: 108, Sector: 8, Purbachal Town, Narayanganj.
Head Office	:	Green Life Hospital Ltd. 32, Green Road (Bir Uttam KM Shafiullah Sarak), Dhanmondi, Dhaka-1205.
Project Proponent	:	Dr. Md. Mainul Ahasan (Managing Director)
GPS Location	:	Latitude: 23°50'45.18" N, Longitude: 90°31'14.08" E
Project area	:	46,475 sqft
Total Investment	:	99,77,02,500 BDT
Types of Project	:	100 Bed Cancer Hospital
Services	:	Radiotherapy, fiberoptic laryngoscopy, ECHO/ECG, ultrasonography, digital X-ray, MRI, CT/brachytherapy, minor OT, pharmacy, OPD (oncology + hematology), consultation, etc.
Water Requirements	:	80-90 m ³ /day. (Phase-1)
Source of Water	:	WTP
Waste Water Treatment	:	Through combined ETP-STP
Power Requirement	:	2000 kwh
Sources of Power	:	Solar Plant and Generator.

5.1.1 Project Layout and Floor Details

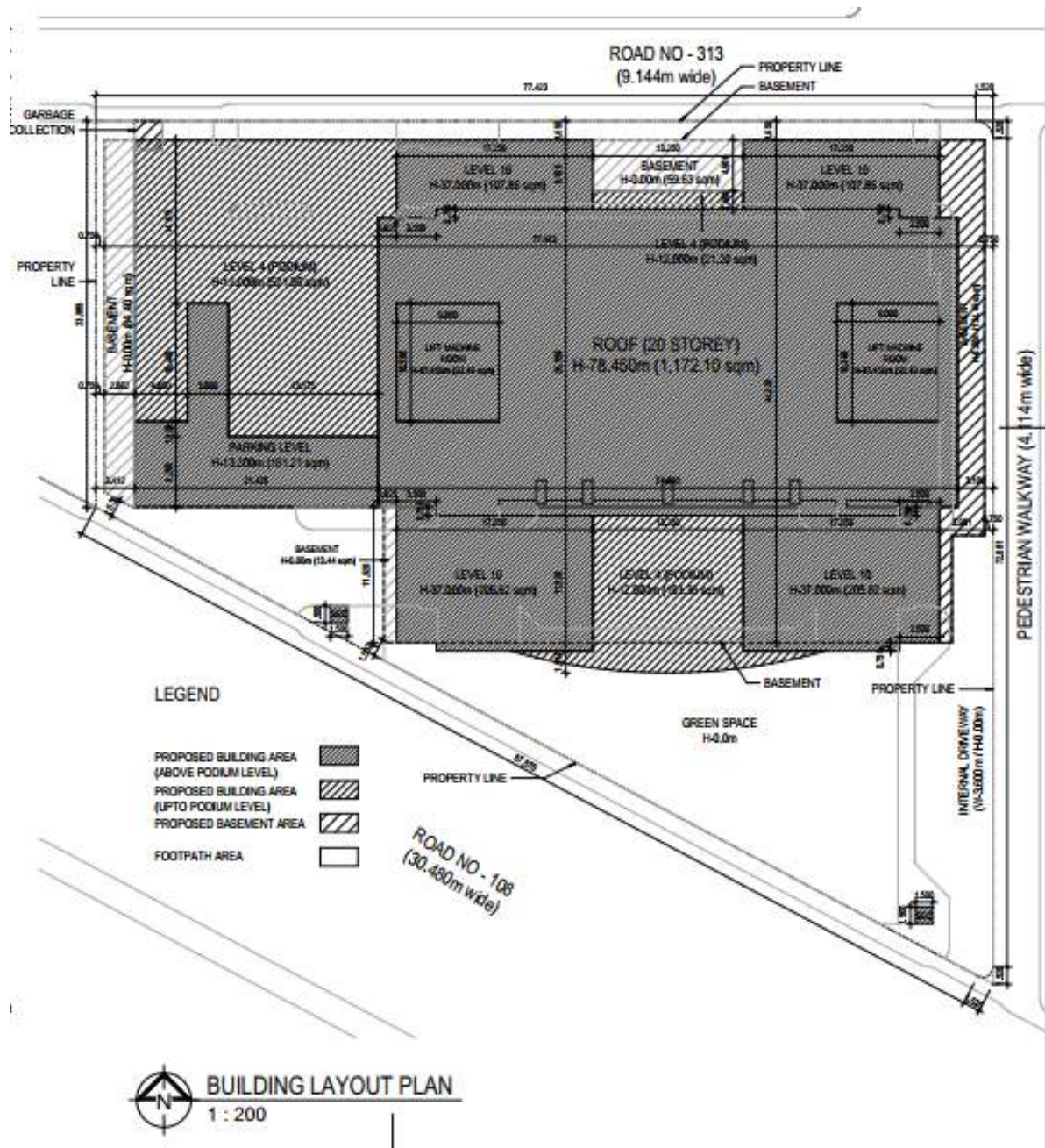


Figure 5-1: Layout of Green Life Hospital Ltd. (Cancer Unit) Project.

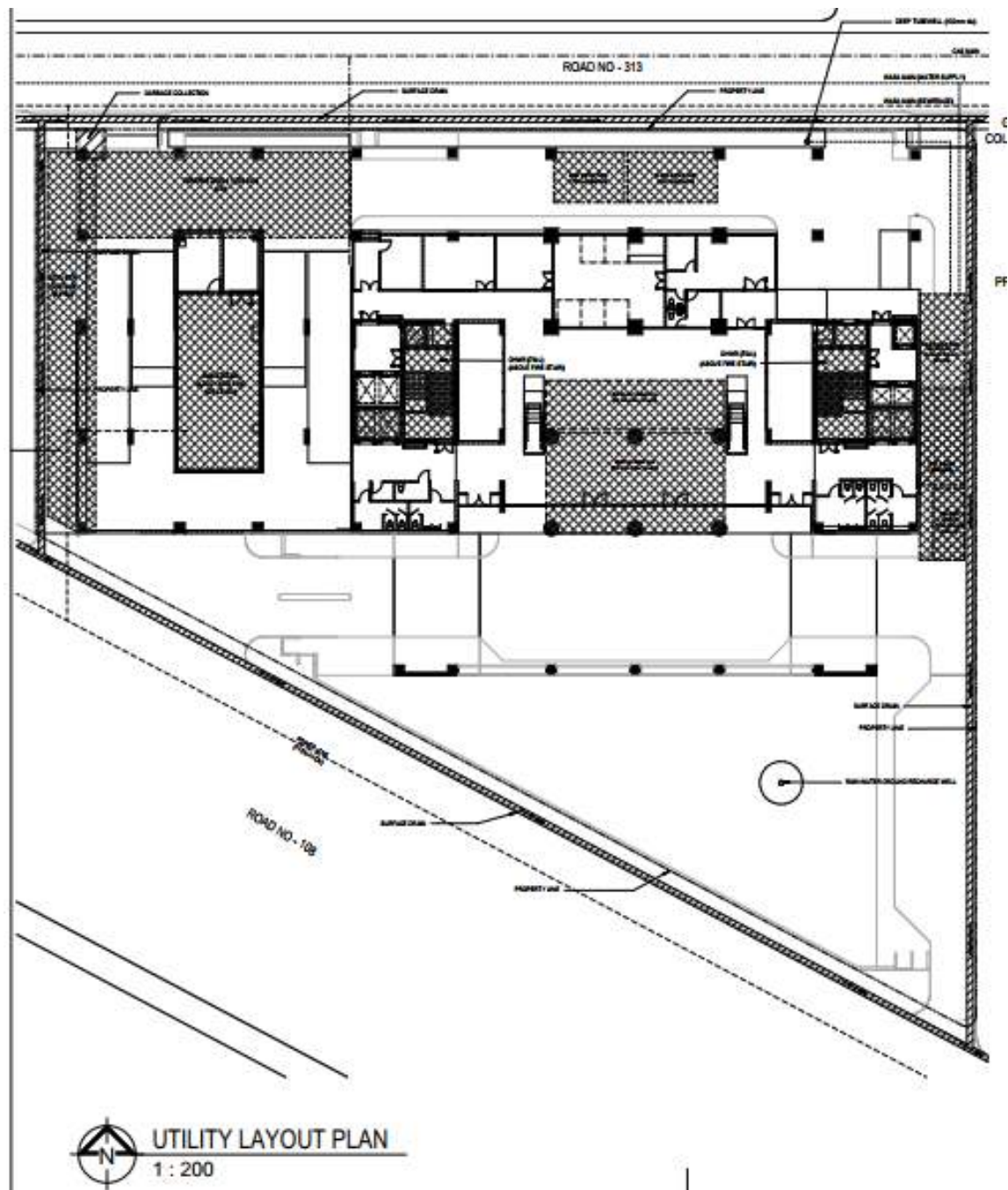


Figure 5-2: Layout Plan Showing Utility Facilities.

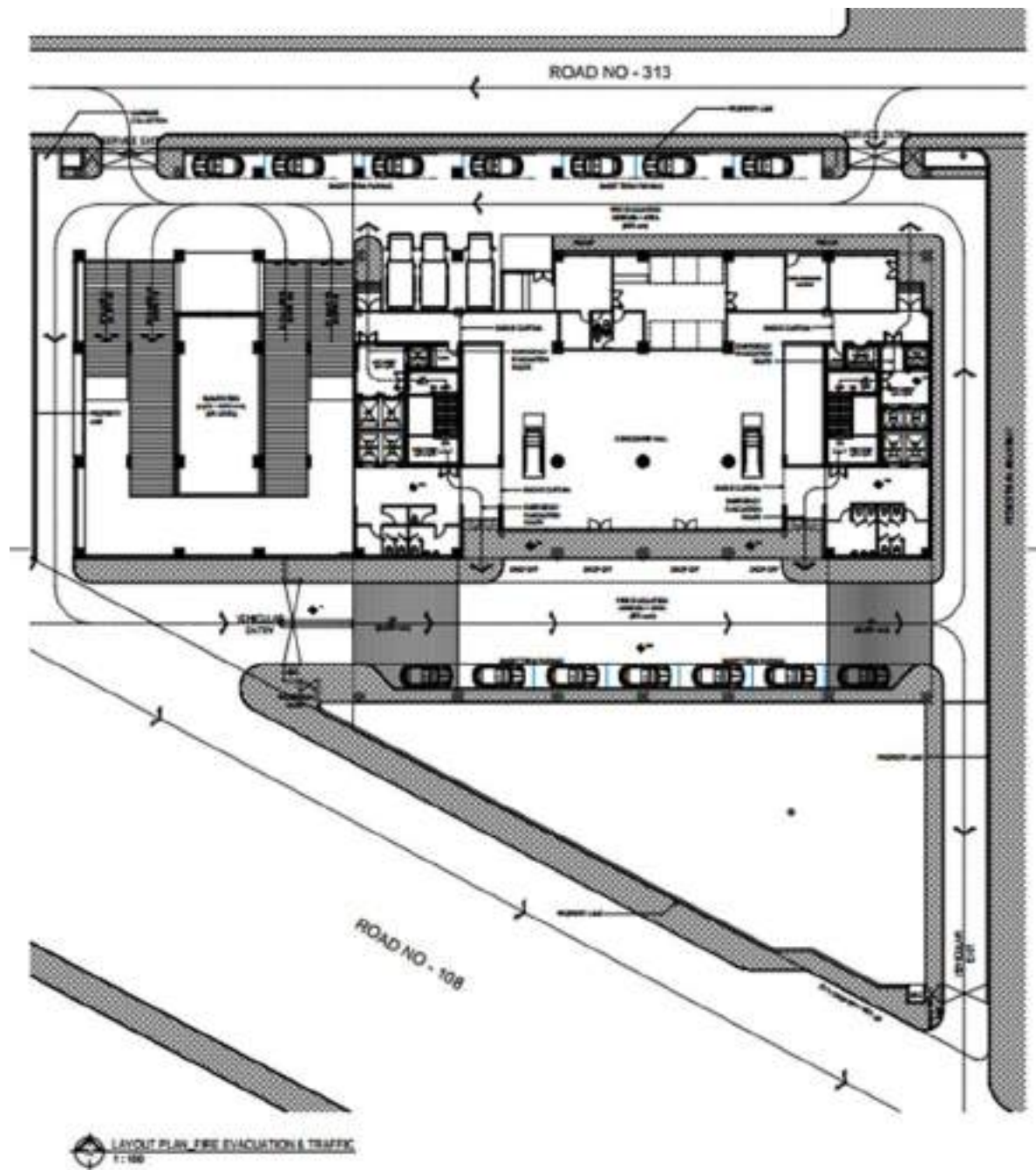


Figure 5-3: Layout (Fire Evacuation and Traffic Management).

5.2 Location and Surroundings

The proposed Green Life Hospital Ltd. (Cancer Unit) is located at Plot-039, Road-108, Sector-08, Purbachal New Town, under Narayanganj District, Bangladesh, within the master-planned township of Purbachal New Town. This modern urban development features a structured road network, integrated utility corridors, and clearly designated institutional and residential zones. The project site is situated at 23°50'45.18" North latitude and 90°31'14.08" East longitude.

Table 5.2: Surroundings of the GLHLCU.

Direction	Object
North	Road 313 (9.144 m wide)
South	Road no 108 (30.48 m wide)
East	Pedestrian Walkway (4.114 m wide)
West	Green Space

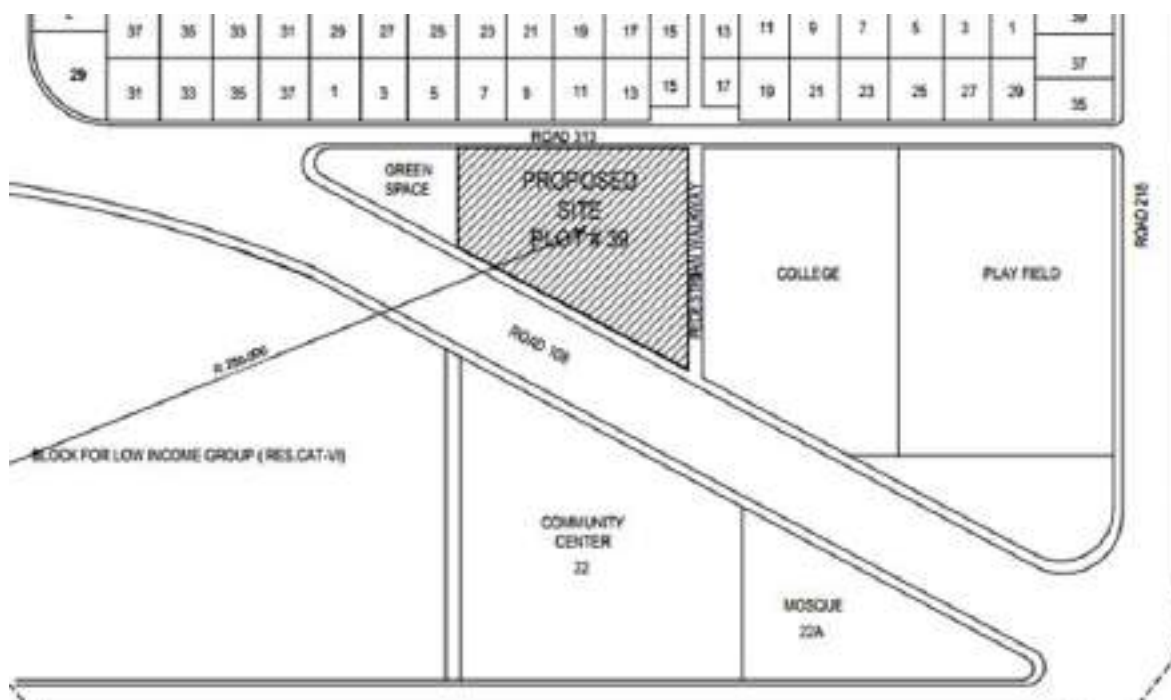


Figure 5-4: Connectivity & Surroundings of GLHLCU.

The site enjoys excellent connectivity through a hierarchy of internal and regional roads. Direct access is provided via Road-108 of Sector-08, which connects seamlessly with the township's internal road system. These roads are designed to safely accommodate light

and heavy vehicles, ensuring smooth movement for ambulances, service vehicles, and general traffic.

The project is located approximately 1.0–1.1 km from Purbachal Link Road, a major arterial corridor linking the site to the Dhaka City Bypass and the 300-Feet Road (Progoti Sarani Extension), providing convenient access to key areas of Dhaka, including Kuril, Badda, Gulshan, Baridhara, and Uttara. Through this network, the site is also well-connected to regional highways, such as the Dhaka–Sylhet Highway (N-2) and the Dhaka Elevated Expressway, facilitating access to Narayanganj, Gazipur, and surrounding districts. Secondary roads, including Bhuivam Road, further support smooth local circulation.

Additionally, the project site is conveniently accessible to Hazrat Shahjalal International Airport via the Purbachal Link Road–300-Feet Road corridor, supporting easy movement for patients, staff, emergency services, and logistics.

Overall, the proposed Green Life Hospital Ltd. (Cancer Unit) benefits from a strategically planned location, well-developed transportation infrastructure, and proximity to major urban and regional transport corridors. The surrounding road network is well suited to support the safe and efficient movement of patients, hospital staff, visitors, medical supplies, and waste transportation vehicles during both the construction and operational phases of the project.

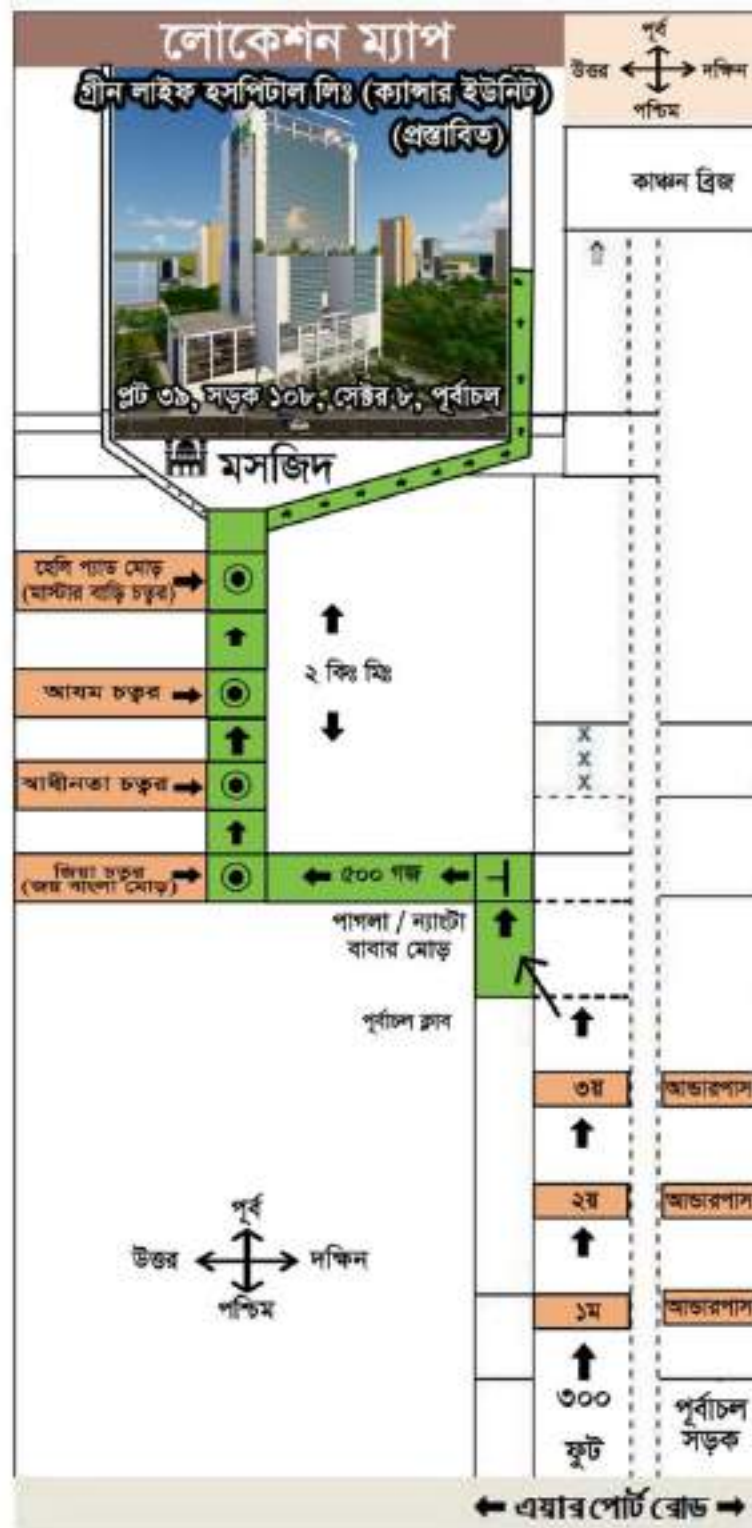


Figure 5-5: Location of the Proposed Project Area.

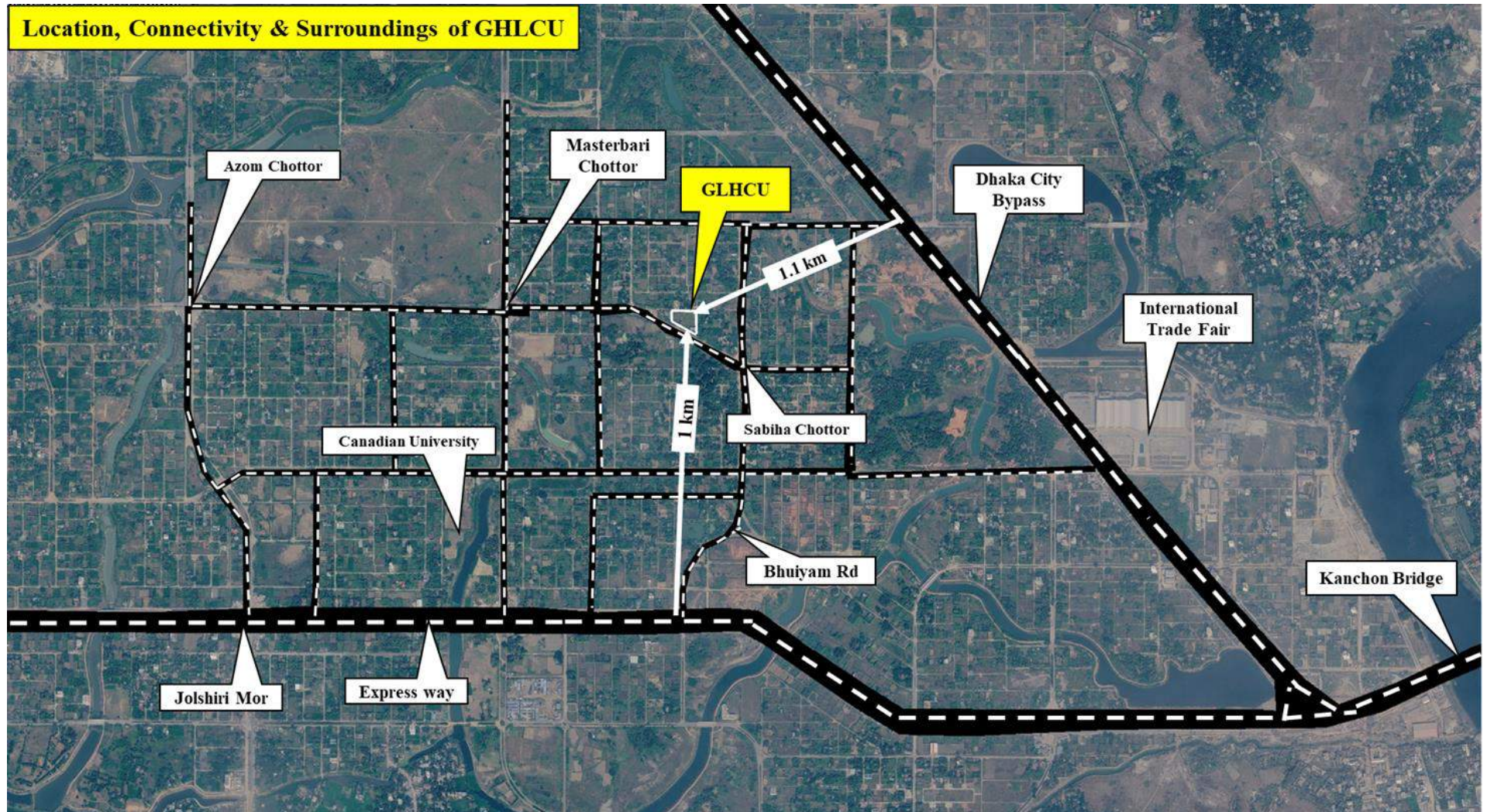


Figure 5-6: Road Connectivity of GLHLCU.

5.3 Settlement, Industries and Others within a 5 km Radius:

Planned Urban Development:

The area within a 5 km radius of the proposed Green Life Hospital Ltd. (Cancer Unit) is part of Purbachal New Town, a master-planned township with designated zones for residential, institutional, commercial, and recreational uses. The landscape is in a phase of rapid development, with several plots under construction and ongoing urbanization activities.

Educational and Institutional Facilities:

Several prominent educational institutions are located within this radius, including Canadian University of Bangladesh, Green University of Bangladesh, State University of Bangladesh, and Adamjee Cantonment School & College. In addition, government facilities and training establishments, such as police training centers, further strengthen the institutional character of the area.

Residential Areas:

The surrounding region is dominated by planned residential sectors, including high-end developments such as Jolshiri Abason. Residential plots are interspersed with open spaces and developing areas, reflecting moderate population density and steadily increasing urbanization.

Commercial, Recreational, and Public Facilities:

Notable public and recreational facilities include the International Trade Fair Ground, Purbachal Cricket Stadium, and other commercial and event-based developments. These generate periodic public activity and traffic, which are effectively accommodated through the township's planned road network and zoning controls.

Transportation and Connectivity:

The area is well connected via Purbachal Link Road, 300-Foot Road, Dhaka City Bypass, and the Metro Rail Depot, ensuring smooth access to Dhaka city and surrounding regions for patients, staff, and visitors.

Utility Infrastructure:

Essential utility facilities such as Power Grid Purbachal and the RAJUK Central Mechanical Yard support the provision of electricity, mechanical services, and other urban infrastructure needs in the area.

Industrial and Other Facilities:

Only limited light industrial and engineering-related facilities are present within the 5 km radius. These are spatially separated from residential and institutional zones through planned zoning and buffer roads, minimizing any potential land-use conflicts.

Environmental Sensitivity:

There are no ecologically sensitive areas, protected forests, or critical habitats within the influence zone. The existing land use is compatible with institutional and healthcare development.

Overall Assessment:

The 5 km influence zone surrounding the proposed GLHLCU site represents a well-planned, mixed-use urban environment, dominated by residential, institutional, educational, and infrastructure developments. The surrounding land-use pattern and supporting facilities confirm the suitability of the site for a specialized healthcare facility, ensuring accessibility while maintaining harmony with adjacent developments.



Figure 5-7: Existing Road Condition, Connectivity, and Surrounding Road Network of the Project Area.

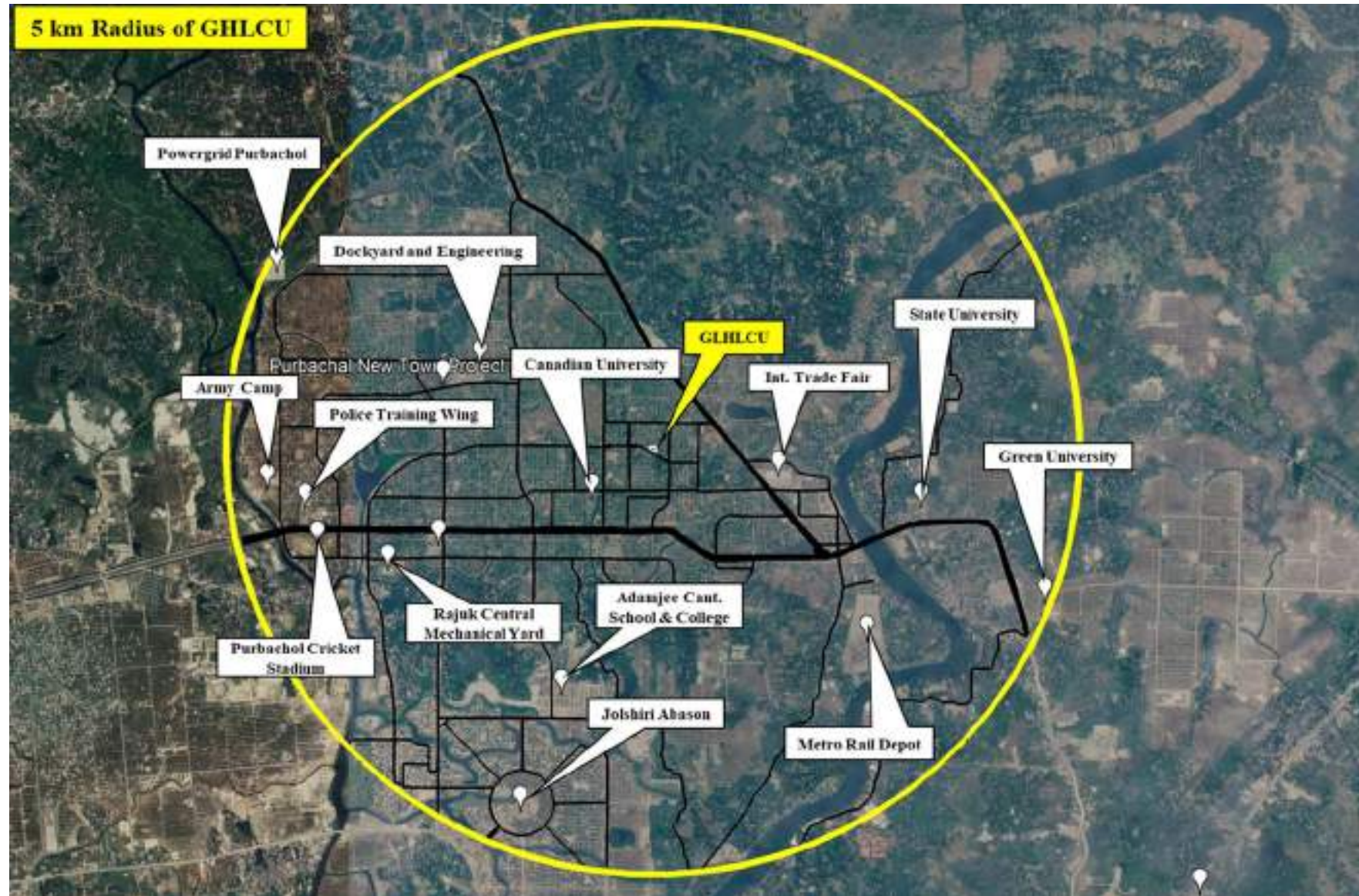


Figure 5-8: 5 km radius area of the Project.

5.4 Project Need and Justification

The proposed Green Life Hospital Limited (Cancer Unit) at Purbachal, Dhaka is being developed to address the rapidly growing demand for specialized cancer care in Bangladesh. Cancer is a major public health concern, accounting for approximately 10–12% of all annual deaths, with an age-standardized incidence rate of around 106 cases per 100,000 population. Despite increasing prevalence, access to high-quality cancer treatment remains limited, placing significant pressure on existing hospitals and often requiring patients to travel abroad for care.

The establishment of a dedicated cancer hospital aims to bridge this critical healthcare gap, providing advanced diagnostic and treatment services in a modern, patient-centered facility. This will improve access to care, reduce treatment delays, and contribute to better health outcomes for patients in Dhaka and surrounding regions.

5.4.1 Objectives of the Project

The primary objectives of the proposed Cancer Unit are:

- **Provide Specialized Cancer Care:** Deliver comprehensive diagnostic and treatment services—including chemotherapy, radiotherapy, surgery, and follow-up care—within a single integrated facility.
- **Enhance Quality of Healthcare Services:** Ensure patient-centered care using modern medical technology, internationally recognized protocols, and skilled healthcare professionals.
- **Reduce Healthcare Burden:** Support existing hospitals and reduce the need for patients to seek treatment abroad.
- **Promote Early Detection and Awareness:** Facilitate cancer prevention, early diagnosis, and public awareness initiatives to improve patient survival rates and quality of life.
- **Strategic Placement and Future Expansion:** Utilize Purbachal’s planned urban development, excellent connectivity, and existing land availability to enable phased growth and long-term service expansion.

5.4.2 Justification and Benefits

The project is justified based on **public health, urban development, and social impact**:

- **Healthcare Gap and Demand:** Bangladesh currently has only 19 hospitals providing cancer treatment, with roughly 465 chemotherapy beds and 40 radiotherapy units nationwide, compared to an estimated need of 300. Private hospitals manage 67% of cancer patients, highlighting the urgent need for additional specialized facilities.
- **Strategic Location Advantage:** Purbachal is Bangladesh's largest planned township, with excellent road connectivity, access to utilities, and proximity to future urban expansion. The site's location supports both immediate service delivery and long-term growth.
- **Population Growth:** The World Bank projects that Greater Dhaka's population will reach 25 million by 2035, with significant eastward migration. Purbachal is expected to accommodate a large portion of new residents, ensuring demand for healthcare services.
- **Social and Public Health Impact:** The hospital will strengthen national cancer care capacity, contribute to reducing cancer mortality, and support early detection, training, and research initiatives, in line with UN Sustainable Development Goals (SDGs).
- **Employment and Capacity Building:** The project will create direct and indirect employment for medical, technical, and support staff, fostering skills development and socio-economic benefits.
- **Environmentally Responsible Facility:** Operations will comply with national environmental regulations, incorporating medical waste management, energy-efficient systems, and sustainable infrastructure.

5.4.3 Project Vision and Phasing

The proposed hospital will be developed in phases:

- **Phase 1:** A 100-bed cancer hospital equipped with two Linear Accelerator (LINAC) machines and one brachytherapy unit, providing chemotherapy, immunotherapy, and radiotherapy.
- **Phase 2:** Expansion to a 200-bed multi-specialty cancer hospital, offering a one-stop, internationally-standardized facility for comprehensive cancer care.

The establishment of Green Life Cancer Hospital at Purbachal is a timely, socially essential initiative. Its strategic location, patient-focused services, and phased development ensure long-term accessibility, capacity, and sustainability. The project is expected to provide significant health, social, and environmental benefits, strengthen Bangladesh's healthcare system, and improve outcomes for patients, families, and the broader community.

5.5 Project's Option

The proposed site for Green Life Hospital Ltd. (Cancer Unit) is located at Plot-039, Road-108, Sector-08, Purbachal Town, Narayanganj. This site has been carefully selected based on its strategic location, surrounding environment, accessibility, and suitability for a healthcare facility. The area is part of a planned township, offering a safe, well-connected, and supportive environment for the establishment of a modern cancer hospital.

5.5.1 Key Factors Based on Surrounding Conditions:

- **Planned and Peaceful Environment:** The site is situated within Purbachal Town, a well-organized township characterized by open spaces, low population density, and minimal traffic congestion. This ensures a calm and patient-friendly environment, suitable for a healthcare facility.
- **Excellent Road Connectivity:** The hospital site is directly accessible via Road-108, which links seamlessly to the main arteries of Purbachal Town and connects to Dhaka and Narayanganj. This provides convenient access for patients, staff, and emergency vehicles.
- **Proximity to Public Transport:** The surrounding area is served by public buses, shuttle services, and local transport options, facilitating easy access for visitors and hospital staff.
- **Availability of Utilities and Services:** The site is fully supported by essential services, including reliable electricity, water supply, drainage, and telecommunication facilities, ensuring uninterrupted hospital operations.
- **Safety and Low Risk Exposure:** The location is free from industrial hazards, flood-prone zones, and other natural or man-made risks, making it a safe and secure site for critical healthcare infrastructure.
- **Minimal Social and Environmental Disruption:** Sensitive receptors such as schools, religious institutions, and residential clusters are located at a safe distance.

The surrounding environment allows hospital operations without disturbing the community.

- **Supportive Workforce and Amenities:** The township's proximity to urban and semi-urban settlements ensures access to a skilled and semi-skilled workforce, while nearby amenities such as markets, pharmacies, and services support hospital operations and patient needs.

Considering these factors, the site at Plot-039, Road-108, Sector-08, Purbachal Town, Narayanganj (23°50'45.18" N, 90°31'14.08" E) has been identified as the most suitable location for establishing **Green Life Hospital Ltd. (Cancer Unit)**. Its strategic location, calm surroundings, accessibility, safety, and expansion potential make it ideal for providing high-quality, patient-focused cancer care.

5.6 Site selection criteria

The selection of the proposed site for Green Life Hospital Ltd. (Cancer Unit) at Purbachal was undertaken through a detailed assessment of planning, environmental, and operational suitability. The following criteria were considered to ensure that the site is appropriate for establishing a specialized healthcare facility:

- I. **Accessibility and Connectivity:** The site is well connected to major road networks, including the Purbachal Link Road and 300-Foot Road, ensuring convenient access for patients, emergency services, staff, and visitors. This is particularly important for emergency medical services, patient access, and uninterrupted supply of medical logistics.
- II. **Land Availability and Suitability:** The selected plot is designated for institutional use within the Purbachal New Town Master Plan. The land is vacant, development-ready, and free from agricultural use. The relatively flat terrain is suitable for hospital construction, minimizing the need for extensive land development and site preparation.
- III. **Environmental Acceptability:** The site is located outside any protected forest, Ecologically Critical Area (ECA), or environmentally sensitive zone. There are no significant natural habitats or critical ecological features within the immediate project area. The selection of this site avoids adverse impacts on environmentally sensitive resources and supports environmentally sound development.
- IV. **Social Considerations:** The land has been officially allotted through the government authority, and no involuntary land acquisition, displacement, or

resettlement is involved. The project is therefore free from social conflicts and is expected to contribute positively to community healthcare services.

V. Availability of Utilities and Services: The site is supported by existing and planned infrastructure, including electricity, water supply, drainage, and telecommunication facilities. These utilities are essential for the continuous and reliable operation of a healthcare facility.

VI. Compatibility with Surrounding Land Use: The surrounding area consists of planned residential, institutional, and mixed-use developments under the Purbachal township framework. The absence of heavy industries, hazardous installations, or polluting sources ensures a suitable and safe environment for hospital operation.

Regulatory Compliance: The site complies with all applicable land-use and planning regulations. The land has been allotted by Rajdhani Unnayan Kartripakkha (RAJUK) for institutional development. The project has been prepared in accordance with relevant environmental regulations and has been submitted to the Department of Environment (DoE) for obtaining environmental clearance.

Overall Justification:

Considering accessibility, environmental suitability, availability of utilities, and compatibility with surrounding land use, the selected site is appropriate for the development of a specialized cancer hospital. The location supports safe operation, patient accessibility, and compliance with environmental and planning requirements.

5.7 Land Acquisition

The land for Green Life Hospital Ltd. (Cancer Unit) is located within the planned Purbachal New Town project, has been acquired through a formal allotment process by the Rajdhani Unnayan Kartripakkha (RAJUK). As per the final allotment letter (Memo No: RAJUK/Estate-3/Purbachal/2674-Estate), a total land area of **1.07 acres (equivalent to 64.735 katha)** has been allocated under **Plot No. 39, Road No. 108, Sector 08** for the development of the proposed hospital facility.

The acquisition followed a structured legal framework between the Lessor (RAJUK) and the Lessee (Green Life Hospital Ltd.), culminating in a Standard Lease Agreement executed on October 30, 2014. The total land value was determined at BDT 9,71,02,500/- , calculated at a rate of BDT 15,00,000/- per Katha.

Since the plot is located within a planned government township (Purbachal New Town), the land was handed over for institutional use as a developed site, ensuring it is free from homestead or habitation issues. The project authority is committed to utilizing this land for healthcare infrastructure development. The establishment of the proposed hospital will enhance access to specialized medical services in Purbachal and the surrounding areas, thereby contributing to improved healthcare delivery and socio-economic development in the region.

5.8 Project Activities

The proposed Green Life Hospital Ltd. (Cancer Unit) is a specialized tertiary healthcare facility located at Plot-039, Road-108, Sector-08, Purbachal New Town, under Narayanganj District, Bangladesh. The project is situated within a master-planned and highly structured township, characterized by organized land use, planned road networks, and provision of modern urban utilities. The site is designated for institutional development and is well-suited for advanced healthcare infrastructure.

The project aims to establish a comprehensive cancer care facility providing diagnostic services, radiotherapy, chemotherapy, inpatient treatment, laboratory services, and associated clinical support functions. The hospital will integrate modern medical technologies with robust engineering and environmental management systems to ensure safe, efficient, and sustainable healthcare delivery.

The development will be implemented in a phased and coordinated manner, ensuring systematic integration of medical services, building infrastructure, utility systems, and environmental safeguards. Each phase will be executed in compliance with applicable healthcare standards, radiation protection requirements, and environmental regulations.

Upon completion, the facility is expected to significantly improve access to specialized oncology services in the region, reduce patient travel burden, strengthen national healthcare capacity, and generate skilled employment opportunities in the healthcare sector.

5.8.1 Boundary and Site Security

A secure perimeter will be established around the hospital premises to ensure patient safety, controlled access, and protection of critical healthcare infrastructure. The boundary will consist of a permanent boundary wall with controlled entry and exit points, supported by security monitoring systems and access control arrangements to regulate movement of

patients, visitors, staff, and service vehicles.

5.8.2 Internal Road Network and Street Lighting

An organized internal circulation system will be developed to ensure smooth and safe movement of ambulances, patients, visitors, hospital staff, and service vehicles.

The circulation system will be designed to:

- Ensure uninterrupted emergency ambulance access to emergency and critical care units
- Separate pedestrian, patient, and service traffic flows
- Provide safe and barrier-free access for patients, including emergency cases
- Maintain clear access routes for fire safety and emergency evacuation.

Proper signage, road markings, and traffic control measures will be incorporated to enhance safety and operational efficiency.

Adequate lighting will be provided across all internal roads, pedestrian walkways, parking areas, emergency routes, and building surroundings to ensure safety, security, and operational continuity during night-time.

Energy-efficient lighting systems such as LED fixtures will be prioritized to reduce energy consumption, enhance visibility, and improve overall safety within the hospital premises.

5.8.3 Traffic Plan & Parking

A structured traffic and parking management system will be implemented within the hospital premises to ensure smooth vehicular movement and prevent congestion.

Dedicated zones will be allocated for:

- Ambulance drop-off and emergency circulation
- Patient and visitor parking
- Staff parking
- Service, supply, and utility vehicles

Traffic movement will be regulated through proper signage, security supervision, and speed control measures. Emergency access routes will remain free from obstruction at all times to ensure rapid response during critical situations.

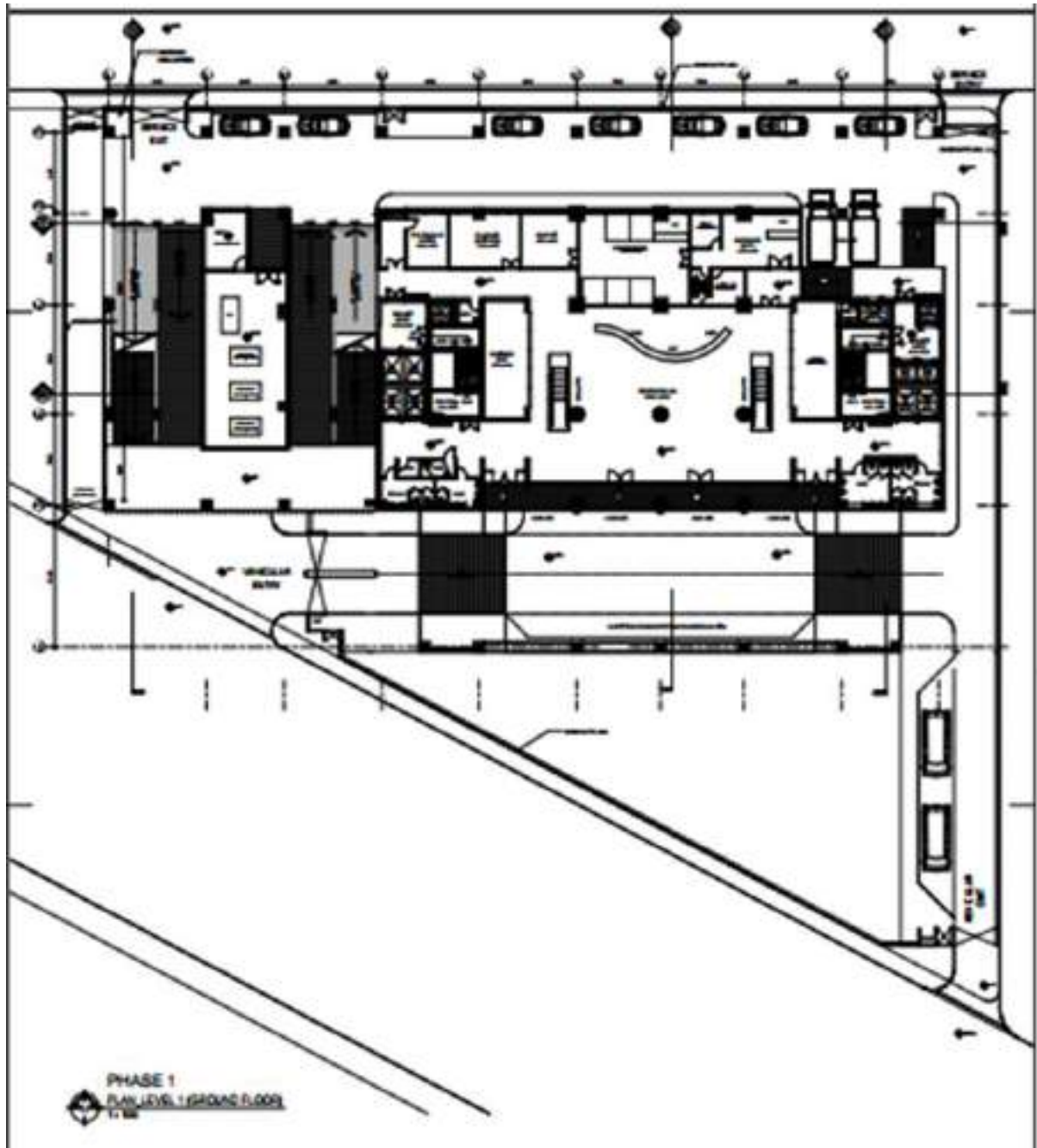


Figure 5-9: Parking Facilities (Level-1: Ground Floor).

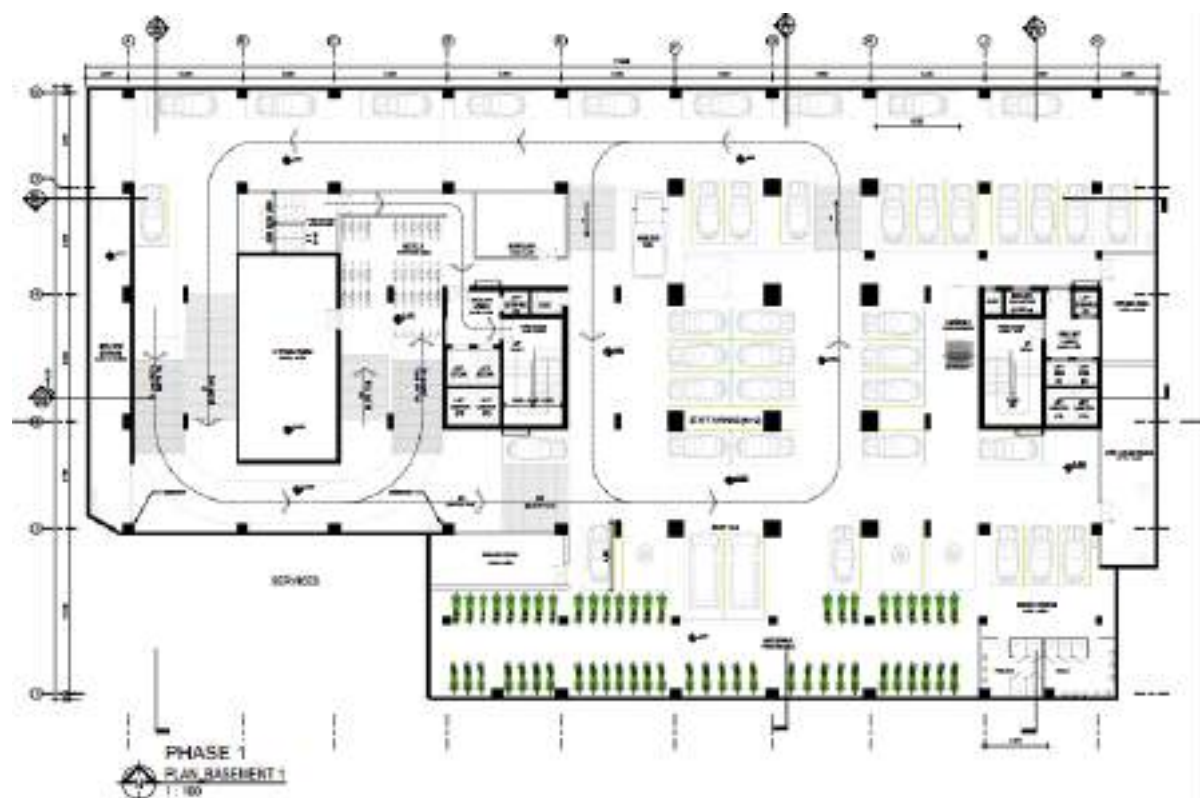


Figure 5-10: Parking Facilities (Basement-1).

5.8.4 Greenary Area

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will include landscaped green areas within the premises to enhance environmental quality, aesthetic value of the facility, and create a calm healing environment.

These green spaces will be developed using native, low-maintenance plant species to support ecological balance, improve air quality, and promote patient and staff well-being. The landscaping will also help reduce dust, moderate temperature, and improve the local microclimate within the hospital campus.

Regular maintenance will be ensured to sustain both the ecological function and aesthetic value of the green areas throughout the operational phase.

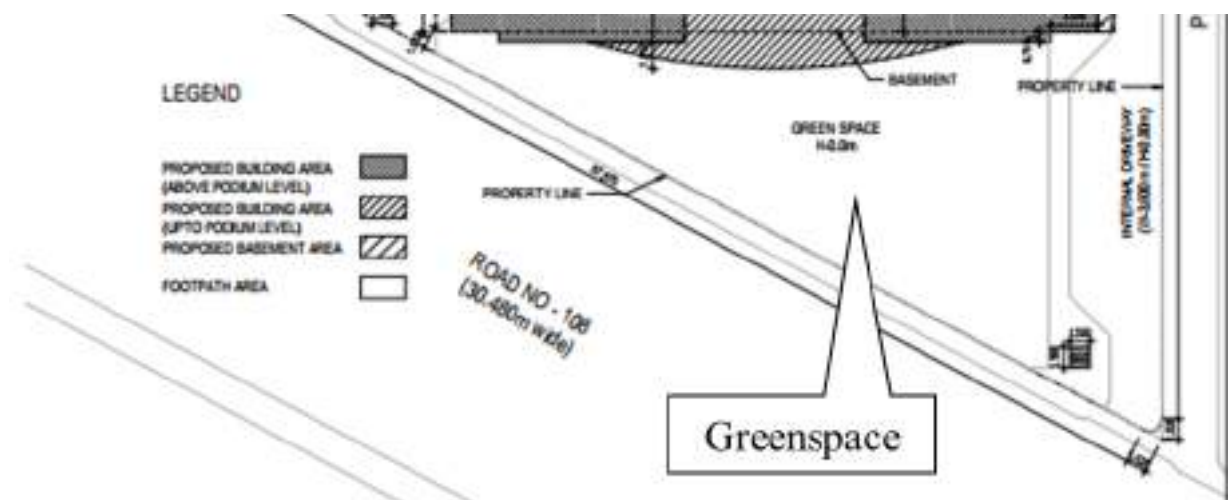


Figure 5-11: Greenery Spaces within the Project Premises.



Figure 5-12: Existing Greenery Scenario within the Green Zone and Along the Project Boundary.

5.8.5 Demand for Utilities

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will require adequate utility services to ensure uninterrupted healthcare operations, patient care, diagnostic services, radiation therapy, laboratory activities, and facility management. The major utility requirements of the proposed hospital are presented below.

5.8.5.1 Water Demand and Supply Network

Water is required for patient care services, sanitation, housekeeping, laboratory operations, laundry facilities, landscaping, and other ancillary activities within the hospital. The estimated water requirement of the hospital is approximately 150–200 m³/day, covering domestic use, patient care, laboratory activities, laundry, housekeeping, and landscaping. However, in the initial Phase-1, the hospital will require approximately 80–90 m³/day.

The required water will be supplied through the project's dedicated Water Treatment Plant (WTP), which will ensure the availability of safe and adequate water for hospital operations. Water storage and internal distribution facilities will also be provided to maintain a continuous supply throughout the premises.

Wastewater generated from hospital activities will be collected and treated through the proposed Effluent Treatment Plant (ETP) prior to reuse and/or disposal in accordance with applicable environmental standards.

5.8.5.2 Power Requirement

A reliable power supply is essential for the continuous operation of critical hospital facilities, including radiation therapy units, diagnostic equipment, laboratories, HVAC systems, lighting, elevators, and other healthcare services.

The estimated power requirement of the proposed hospital is approximately 2,000 kWh/day. The facility will utilize a combination of solar power generation systems and standby generators to ensure an uninterrupted power supply and enhance energy reliability. Emergency backup power arrangements will be maintained for critical medical equipment and life-safety systems to ensure uninterrupted patient care during power outages.

5.8.6 Wastewater Management System

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will generate wastewater from both domestic activities—including patients, attendants, and staff sanitation facilities—and operational activities such as laboratory services, diagnostic

units, oncology treatment areas, laundry, kitchen operations, and routine cleaning activities. To ensure safe, hygienic, and environmentally sound management of all wastewater, a combined wastewater treatment system will be developed within the hospital premises.

Combined Treatment Plant (STP–ETP) and Reuse Plan:

A Combined Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP) will be installed to treat all domestic sewage and hospital effluents in a single integrated system. This approach will ensure efficient treatment, reduced footprint, and improved operational control.

The proposed **design capacity of the treatment system is 200 m³/day**, considering present demand and future expansion requirements.

The detailed drawing-design calculation are attached in Annexure-4.

Water Demand and Wastewater Generation (Phase-1 Basis):

- Per capita water consumption: 40 litres/person/day
- Per bed water consumption: 450 litres/bed/day (According to BNBC for healthcare facilities).
- Total beds: **100 nos.**
- Total manpower: **725 persons**
- Total estimated water demand: approximately 74 m³/day (Phase-1 operational requirement).

All wastewater will be collected through a dedicated internal sewerage and drainage network and conveyed to the combined treatment plant for treatment in compliance with the applicable environmental standards of the Department of Environment (DoE), Bangladesh.

The implementation of a combined treatment system will optimize space utilization, improve operational efficiency, and enhance overall environmental protection, while supporting sustainable water management within the hospital campus.

The project will follow a Zero Liquid Discharge (ZLD) approach, ensuring that no untreated or inadequately treated effluent is released into the external environment. The treated water will be fully recycled and reused within the hospital for various non-potable applications such as gardening, toilet flushing, floor and pavement washing, and other

utility purposes. This integrated closed-loop system will promote efficient water utilization, reduce dependence on external freshwater sources, minimize environmental impact, and ensure compliance with national regulations and internationally accepted best practices.

5.8.6.1 Sludge Management System

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will generate sludge as a by-product from the Combined Effluent and Sewage Treatment Plant (ETP–STP) during wastewater treatment processes. To ensure safe, efficient, and environmentally sound management of sludge, a structured sludge handling system will be implemented within the hospital premises.

Sludge generated from the treatment process will be dewatered using a screw belt press system to reduce moisture content and convert it into a semi-solid dry cake form. This dewatered sludge cake will be significantly easier to handle, store, and transport, while minimizing odor, volume, and environmental risks.

The dewatered sludge will be stored in a designated, covered storage area designed to prevent leakage, odor, and environmental contamination. Subsequently, it will be handed over to DoE-authorized waste contractors for safe treatment, recycling, or disposal in accordance with applicable environmental regulations.

The sludge management system will be regularly monitored and maintained to ensure operational efficiency, environmental compliance, and sustainable waste handling practices throughout the operational phase of the hospital.

5.8.7 Waste Management & Radiation Safety

5.8.7.1 Waste Management (Construction & Operation Phase)

During construction, GLHLCU will generate typical construction wastes such as metal scraps, wood, concrete debris, bricks, glass, and packaging materials. These will be segregated on-site, with recyclable materials sent to authorized recyclers and inert wastes disposed of at approved locations under DoE supervision.

During operation, the hospital will generate multiple waste streams including general waste, infectious and hazardous healthcare waste, sharps, biomedical waste, biodegradable and non-biodegradable waste, e-waste, and liquid waste from clinical and support services. The hospital will implement a structured waste management system based on:

- Source segregation using color-coded bins
- Dedicated internal transport and safe handling system
- Central secured waste storage facility
- Recycling and composting for suitable waste streams
- Strict hazardous waste management via DoE-approved contractors (no open dumping or burning)
- ETP-based treatment of all wastewater before discharge as per ECR 2023
- Regular monitoring, audits, training, and record keeping.

Overall, the system ensures safe, hygienic, and compliant waste handling across all hospital departments.

5.8.7.2 Environmental Safety and Radiation Waste Management

The GLHLCU will operate a fully controlled radiation safety system in compliance with **IAEA standards, BAERA regulations, and WHO guidelines**, ensuring **zero environmental release of radioactive materials**.

Key systems include:

- **LINAC radiotherapy:** No radioactive waste generation; only non-radioactive consumables managed as general medical waste
- **HDR brachytherapy:** Uses sealed radioactive sources managed under strict control and returned to suppliers after use

The radiation safety system is based on:

- **ALARA principle and continuous monitoring**
- Safe storage, tracking, and controlled handling of sources
- No discharge of radioactive materials into air, water, or soil

Emergency and safety measures include:

- Supervision by a Radiation Safety Officer (RSO)
- Emergency response procedures (source control, evacuation, monitoring, reporting to BAERA)
- Shielded treatment rooms and controlled access areas
- Personnel monitoring using TLDs and dosimeters with lifetime dose records.

The integrated system ensures **safe waste management and radiation control**, protecting patients, staff, and the environment while maintaining full regulatory compliance and operational safety.

5.8.8 Radiation Protection and Safety Measures for LINAC Facility

The LINAC facility shall be housed within a radiation-shielded bunker designed in accordance with **BAERA regulatory requirements and IAEA shielding standards**. The bunker walls, roof, and floor shall be constructed using high-density reinforced concrete with adequate thickness determined through radiation shielding calculations to ensure that dose levels outside the treatment room remain within permissible limits.

Access to the treatment room shall be controlled through electronic interlock systems, warning lights, audible alarms, and restricted entry protocols, ensuring that irradiation cannot occur when the door is open or personnel are present inside the room.

All radiation workers shall be provided with **personal dosimeters** and shall receive regular radiation safety training. Continuous radiation monitoring, periodic quality assurance testing, and equipment calibration shall be conducted in line with BAERA licensing conditions and IAEA safety standards.

These engineering and administrative controls collectively ensure that the facility maintains effective structural shielding (including wall thickness design), operational safety, and regulatory compliance, thereby protecting patients, staff, and the public from unnecessary radiation exposure.

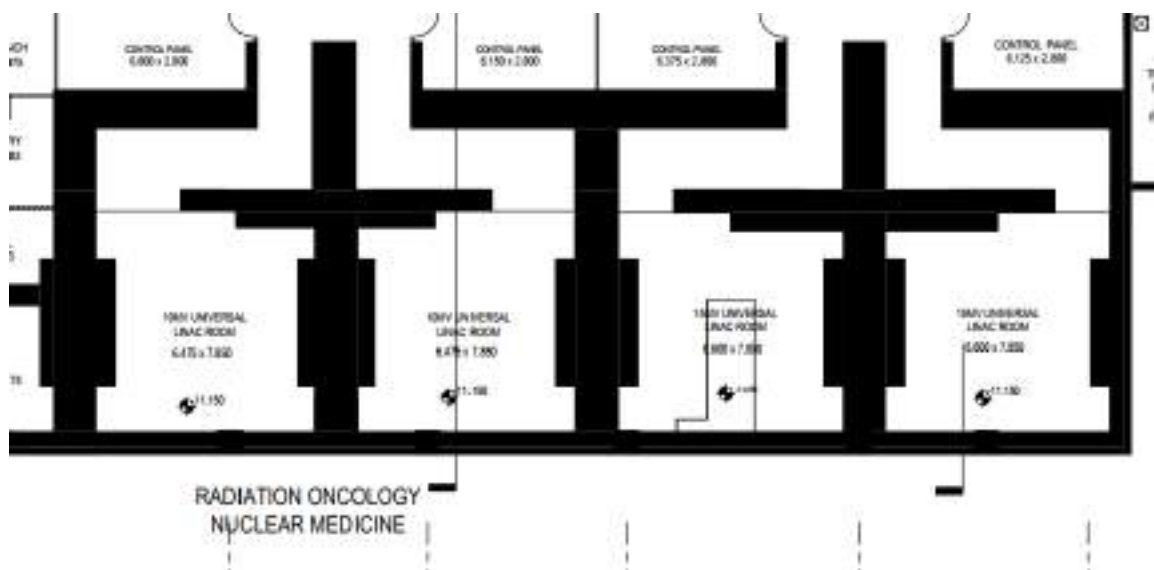


Figure 5-13: Radiotherapy Unit.

5.8.9 Fire Hydrant Network Plan

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will be equipped with a comprehensive fire protection system designed in accordance with the Bangladesh National Building Code (BNBC) and Fire Service and Civil Defence (FSCD) requirements. The system will include fire hydrants, hose reels, fire pumps, water storage facilities, portable fire extinguishers, fire detection and alarm systems, emergency exits, evacuation routes, and emergency signage strategically located throughout the facility.

Regular inspection, testing, and maintenance of firefighting equipment will be conducted to ensure operational readiness. Periodic fire drills and emergency response training programs will also be organized to strengthen preparedness among hospital personnel. The proposed fire protection system will minimize fire risks, facilitate rapid emergency response, and ensure the safety of patients, visitors, staff, and hospital assets throughout the operational life of the facility.

5.8.10 Surface Drainage

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will be located within the planned urban drainage infrastructure of Purbachal New Town, which is designed to ensure efficient stormwater management and minimize waterlogging risks in the area.

Within the hospital premises, a properly designed internal surface drainage system will be provided to collect stormwater from rooftops, paved areas, internal roads, parking zones, and landscaped spaces. The collected runoff will be safely conveyed and discharged into the existing municipal stormwater drainage network of Purbachal New Town in a controlled and systematic manner.

To promote sustainable water management, a rainwater harvesting system will also be incorporated within the hospital design. Rooftop rainwater will be collected through dedicated downpipes and directed to a storage system after preliminary filtration. The stored rainwater will be utilized for non-potable purposes such as landscaping, gardening, and cleaning activities within the hospital premises, thereby reducing dependency on external water sources.

Adequate provisions such as catch pits, silt traps, and inspection chambers will be integrated into the drainage system to prevent clogging and sediment accumulation.

Regular inspection and maintenance will be ensured to maintain system efficiency and long-term functionality.

This combined approach of efficient surface drainage and rainwater harvesting will ensure effective stormwater management, enhance water resource efficiency, and support environmentally sustainable operation of the hospital facility.

5.8.11 Integrated Energy Efficiency and Renewable Energy Solutions

The proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will adopt energy-efficient systems and reliable power solutions to ensure uninterrupted hospital operations while minimizing environmental impact.

The facility will utilize energy-efficient equipment such as LED lighting, energy-saving HVAC systems, and optimized electrical and medical equipment to reduce overall electricity consumption. Smart control systems and automation may be incorporated where feasible to improve energy management and operational efficiency.

For primary and supplementary energy supply, the hospital will install a rooftop solar photovoltaic (PV) system to utilize renewable energy and reduce dependence on conventional grid electricity. In addition, a dedicated standby generator system will be provided to ensure uninterrupted power supply during grid failures, which is critical for life-support systems, operating theaters, diagnostic units, and emergency services.

This combined approach of solar energy utilization, efficient energy management, and reliable backup generation will ensure continuous, safe, and sustainable hospital operation while reducing the overall environmental footprint.

5.9 Project Schedule

The construction of the proposed Green Life Hospital Ltd. (Cancer Unit), Purbachal New Town will commence after obtaining Environmental Clearance Certificate (ECC) from the Department of Environment (DoE) and other necessary regulatory approvals.

As the project is located within a well-planned and developed urban area of Purbachal New Town, construction activities will be confined within the allocated plot, supported by existing infrastructure, ensuring smooth execution with minimal site preparation requirements.

The project is expected to be completed within approximately 2 to 3 years, depending on procurement schedules, regulatory processes, and any unforeseen technical or logistical factors.

Development will be carried out in a phased manner, including civil works, structural construction, installation of MEP systems, and commissioning of specialized hospital and oncology facilities. Each stage will be monitored through regular supervision, quality control, and compliance checks in line with applicable standards.

A detailed implementation schedule will be prepared to track progress against key milestones and ensure timely completion. Overall, the schedule aims to ensure efficient, safe, and compliant delivery of the hospital project.

Chapter-06

Environmental and Social Baseline

6 Environmental and Social Baseline

6.1 Overview

Baseline data on environment is important to understand physical, biological, cultural, economic and social environmental characteristics of the project study area. This information forms the basis to analyze the probable impacts of the project activities. Mainly the following are the objectives or outcome of examining and defining the existing environment:

- To identify environmental and socioeconomic components that may be affected due to project activities;
- To recognize potential environmental impacts on them
- To provide a base line against which environmental conditions in the future project may be measured.

For this EIA study the emphasis is given on the environmental features like water, air and noise quality of study area. Considerations are given to both the environment and ancillary area that seems to be affected.

6.2 Objective and Methodology

6.2.1 Objective

The primary objective of the Environmental Impact Assessment (EIA) is to establish a comprehensive understanding of the current environmental and social conditions in the project area for the proposed Green Life Hospital Ltd. (Cancer Unit). This baseline will be used to identify potential impacts from the development and guide the formulation of mitigation measures. Specifically, the objectives are:

Environmental Assessment: To assess the existing physical environmental conditions, including air quality, water resources, soil quality, and noise levels, within the project's vicinity.

Ecological Evaluation: To document the local biodiversity, flora and fauna, and ecological health, ensuring that sensitive habitats are identified and preserved.

Social Impact Assessment: To analyze the demographic, economic, and social conditions of communities within the study area, focusing on livelihoods, land use, and access to essential services.

Stakeholder Engagement: To gather community feedback, address concerns, and ensure that the project aligns with local needs and priorities through public consultations and grievance mechanisms.

6.2.2 Methodology

The methodology for the study involves the systematic collection of data through both primary field surveys and secondary sources. It covers three key aspects: physical environmental data, ecological data, and social data.

6.2.2.1 Physical Environmental Data Collection

- ✓ **Air Quality:** Air quality monitoring stations are set up at 4 different locations of the project site to measure pollutants like PM_{2.5}, PM₁₀, SO₂, and NO_x and the data is compared with national Air Pollution Control Rule 2022.
- ✓ **Water Quality:** Surface water and groundwater samples are collected from nearby rivers and wells. Parameters like pH, BOD, COD, TSS, and TDS are analyzed. Sampling is done in both dry and wet seasons to account for seasonal variations.
- ✓ **Noise Levels:** Noise monitoring is conducted at sensitive receptor points (schools, hospitals, and residential areas) using sound level meters, focusing on day and night to capture variations.

6.2.2.2 Ecological Data Collection

- ✓ **Flora and Fauna Surveys:** Transect sampling and direct observations are conducted within a 10 km radius to document plant and animal species. Special attention is given to endangered species and critical habitats. Camera traps and other field techniques are employed to assess mammal and bird populations.
- ✓ **Habitat Mapping:** GIS and satellite imagery are used to map critical habitats and biodiversity zones. Habitat quality and ecosystem services are assessed to ensure sustainable management.
- ✓ **Aquatic Biodiversity:** Sampling is done in nearby water bodies to document fish and aquatic invertebrates, focusing on species diversity and habitat conditions.

6.2.2.3 Social Data Collection

- ✓ **Household Surveys:** Structured questionnaires are administered to households within a 5 km radius, collecting data on demographics, income, land use, health, and education.
- ✓ **Key Informant Interviews (KII):** Local leaders, government officials, and vulnerable groups are interviewed to gather insights on the potential social impacts of the project.

- ✓ **Focus Group Discussions (FGD):** Discussions with various community groups, such as women, youth, and farmers, are conducted to understand their concerns and expectations.
- ✓ **Secondary Data Review:** Government census data, land use plans, and historical data are reviewed to complement the primary data collection.
- ✓ **Public Consultations:** Community meetings are held to share project details and gather feedback. A grievance redress system is set up, ensuring transparency and accountability.

The methodology and boundary ranges for data collection in this study follow internationally recognized guidelines from the World Business Council for Sustainable Development (WBCSD) and the United Nations Environment Programme (UNEP). The following table shows the detailed summary of Environment, Social and Ecological baselines for the study area.

Table 6.1: Existing Environmental Settings of GLHL (Cancer Unit) Area.

Particulars	Details
Location	Purbachal Town, Rupganj, Narayanganj
Nearest Airport	Hazrat Shahjalal International Airport (~20 km, North-West)
Nearest Railway Station	Kamalapur Railway Station (~22 km, West)
Climatic conditions	Temperature: Annual max 41°C (April 2024), min 15°C (January); Avg. annual rainfall ~1900 mm; Avg. relative humidity ~70%
Seismic Zone	Zone II
Forests / National Parks	None within 10 km
Archaeological Site	None within the project site
Water Bodies	Tongi Khal ((~350 m North-east) Balu River (~3.8 km South-west); Shitalakkhya River (~2 km east)
Ecologically Critical Area	No ecologically critical areas were found in the study area.
Reserve/Protected Forests	No reserve or protected forests area were found in the study area.
Major crops	Paddy, Vegetables like Tomato, Begun, Lau, Jingha, Corola, Sim, etc.
Environment and Social	River, School, College, Madrasha, Mosjid, playground,

Particulars	Details
Hotspots	nearby water bodies, etc.
Major Settlement	Residential area, Commercial area, Industrial Area, Institutional structures, etc.

Source: Google Earth, Site Visits

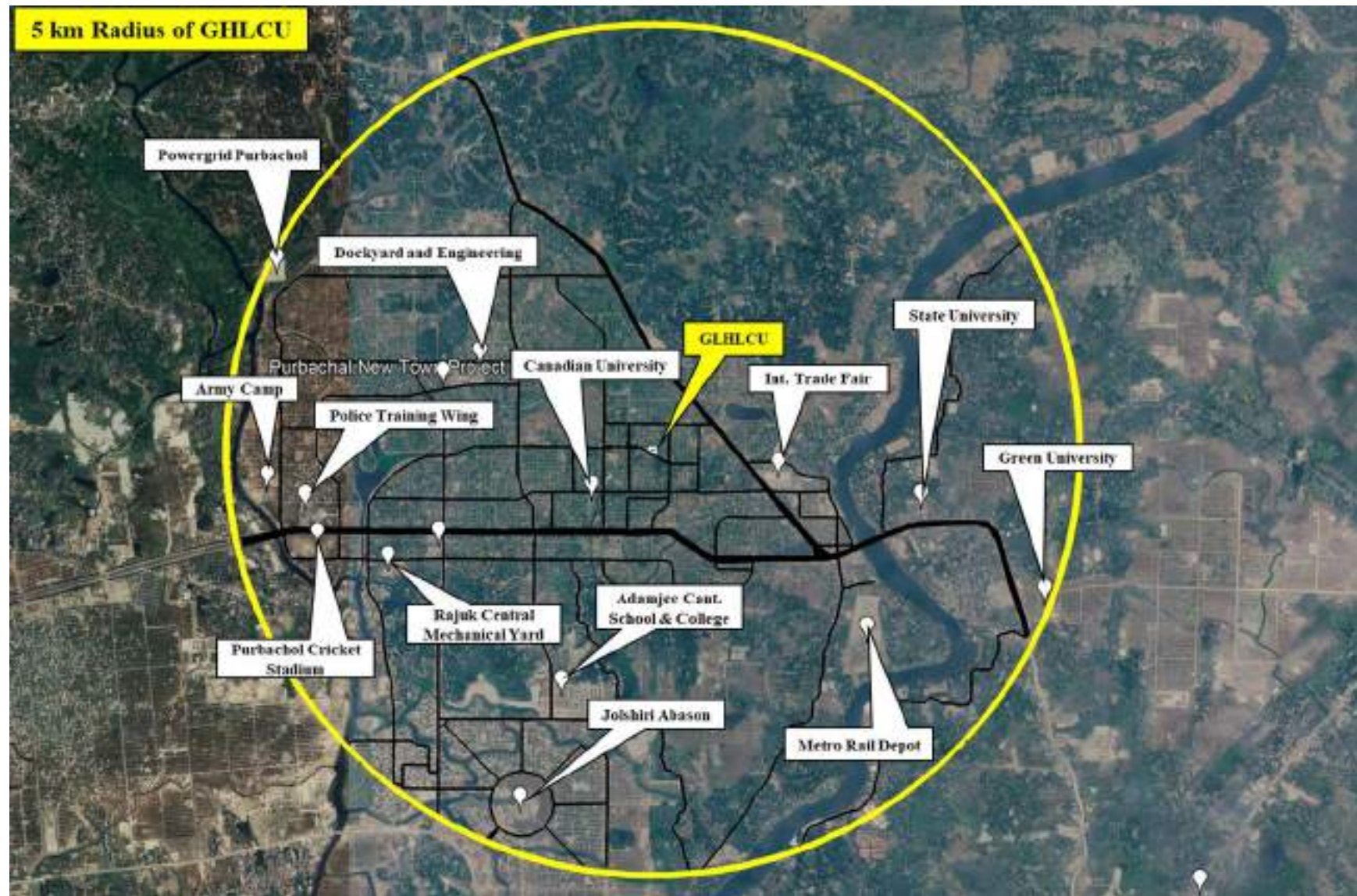


Figure 6-1: Map showing major Settlement, Industries and Others within 5 km radius of project site.

6.3 Physical Environment

6.3.1 Meteoroidal Data

6.3.1.1 Temperature

The temperature pattern of the project area, based on meteorological data from 2015–2025, indicates a warm and humid tropical climate with noticeable seasonal variations throughout the year. The average monthly temperature generally ranges between 20°C and 33°C, while the recorded minimum and maximum temperatures vary from approximately 15°C to 41°C.

The coolest period occurs during December to February, when average temperatures remain between 20°C and 25°C and minimum temperatures occasionally fall to around 15°C–19°C. From March onwards, temperatures gradually increase, marking the onset of the pre-monsoon summer season.

The highest temperatures are typically recorded during April to June, when maximum temperatures frequently exceed 35°C. The highest temperature recorded during the study period was 41°C in April 2024, reflecting occasional extreme heat conditions. During the monsoon season (June to September), temperatures remain relatively stable, with average values generally ranging from 28°C to 31°C despite increased rainfall and cloud cover.

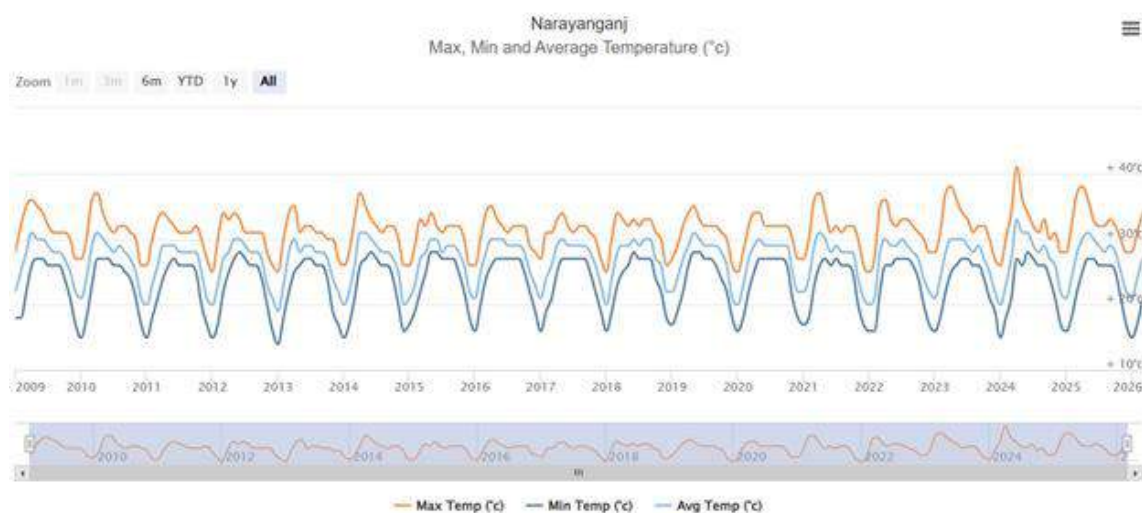
Following the monsoon, temperatures gradually decline during October and November, with average temperatures ranging between 25°C and 29°C, before transitioning into the cooler winter months. Overall, the long-term climatic data indicate that the area experiences predominantly warm to hot conditions throughout the year, with peak temperatures occurring during the pre-monsoon period.

Table 6.2: 15 Years Monthly Temperature of the Study Area.

Year	Temperature °C											
	January	February	March	April	May	June	July	August	September	October	November	December
2015	Max:26	Max:29	Max:33	Max:32	Max:34	Max:32	Max:31	Max:32	Max:32	Max:32	Max:30	Max:26
	Avg:21	Avg:23	Avg:27	Avg:28	Avg:30	Avg:30	Avg:28	Avg:29	Avg:29	Avg:28	Avg:26	Avg:22
	Min:17	Min:19	Min:22	Min:25	Min:28	Min:28	Min:27	Min:27	Min:27	Min:25	Min:22	Min:18
2016	Max:26	Max:30	Max:34	Max:35	Max:33	Max:32	Max:31	Max:32	Max:32	Max:32	Max:29	Max:28
	Avg:21	Avg:25	Avg:28	Avg:30	Avg:30	Avg:30	Avg:29	Avg:29	Avg:29	Avg:28	Avg:25	Avg:23
	Min:15	Min:20	Min:24	Min:26	Min:27	Min:27	Min:27	Min:27	Min:27	Min:25	Min:22	Min:19
2017	Max:27	Max:31	Max:31	Max:33	Max:34	Max:32	Max:31	Max:32	Max:32	Max:31	Max:30	Max:27
	Avg:21	Avg:24	Avg:26	Avg:29	Avg:30	Avg:29	Avg:29	Avg:29	Avg:29	Avg:28	Avg:26	Avg:23
	Min:16	Min:19	Min:21	Min:25	Min:27	Min:27	Min:27	Min:27	Min:27	Min:25	Min:22	Min:19
2018	Max:25	Max:30	Max:34	Max:33	Max:32	Max:33	Max:32	Max:33	Max:33	Max:31	Max:30	Max:26
	Avg:20	Avg:24	Avg:28	Avg:29	Avg:29	Avg:30	Avg:29	Avg:30	Avg:30	Avg:27	Avg:26	Avg:22
	Min:16	Min:19	Min:23	Min:25	Min:26	Min:28	Min:27	Min:27	Min:27	Min:24	Min:22	Min:16
2019	Max:27	Max:29	Max:32	Max:34	Max:35	Max:33	Max:32	Max:32	Max:32	Max:31	Max:30	Max:26
	Avg:22	Avg:24	Avg:27	Avg:29	Avg:31	Avg:30	Avg:29	Avg:29	Avg:29	Avg:28	Avg:26	Avg:21
	Min:17	Min:19	Min:22	Min:26	Min:28	Min:28	Min:27	Min:27	Min:26	Min:24	Min:22	Min:18
2020	Max:25	Max:28	Max:32	Max:34	Max:34	Max:32	Max:32	Max:32	Max:32	Max:32	Max:30	Max:27
	Avg:20	Avg:23	Avg:27	Avg:29	Avg:30	Avg:29	Avg:29	Avg:29	Avg:29	Avg:29	Avg:25	Avg:22
	Min:16	Min:18	Min:22	Min:25	Min:27	Min:27	Min:27	Min:27	Min:27	Min:26	Min:21	Min:18
2021	Max:27	Max:30	Max:36	Max:37	Max:34	Max:31	Max:32	Max:31	Max:32	Max:32	Max:30	Max:26
	Avg:22	Avg:24	Avg:29	Avg:31	Avg:30	Avg:28	Avg:29	Avg:28	Avg:28	Avg:28	Avg:24	Avg:21

Year	Temperature °C											
	January	February	March	April	May	June	July	August	September	October	November	December
	Min:17	Min:18	Min:23	Min:26	Min:27	Min:26	Min:27	Min:26	Min:26	Min:25	Min:20	Min:17
2022	Max:25	Max:27	Max:35	Max:36	Max:33	Max:32	Max:33	Max:33	Max:32	Max:31	Max:30	Max:28
	Avg:20	Avg:21	Avg:28	Avg:30	Avg:29	Avg:29	Avg:30	Avg:29	Avg:28	Avg:27	Avg:24	Avg:22
	Min:16	Min:16	Min:22	Min:26	Min:26	Min:27	Min:27	Min:27	Min:26	Min:24	Min:20	Min:17
2023	Max:28	Max:31	Max:37	Max:38	Max:36	Max:34	Max:33	Max:31	Max:32	Max:32	Max:30	Max:27
	Avg:21	Avg:24	Avg:28	Avg:30	Avg:30	Avg:30	Avg:29	Avg:28	Avg:29	Avg:27	Avg:25	Avg:22
	Min:16	Min:18	Min:22	Min:25	Min:26	Min:27	Min:27	Min:26	Min:26	Min:24	Min:21	Min:19
2024	Max:26	Max:30	Max:34	Max:41	Max:36	Max:34	Max:32	Max:31	Max:33	Max:30	Max:31	Max:28
	Avg:20	Avg:23	Avg:27	Avg:33	Avg:31	Avg:31	Avg:29	Avg:28	Avg:29	Avg:27	Avg:26	Avg:22
	Min:15	Min:18	Min:21	Min:27	Min:26	Min:28	Min:27	Min:26	Min:26	Min:24	Min:21	Min:17
2025	Max:28	Max:32	Max:37	Max:38	Max:36	Max:33	Max:32	Max:32	Max:33	Max:32	Max:30	Max:28
	Avg:21	Avg:24	Avg:28	Avg:30	Avg:31	Avg:30	Avg:29	Avg:28	Avg:29	Avg:28	Avg:25	Avg:22
	Min:16	Min:18	Min:22	Min:25	Min:27	Min:27	Min:26	Min:26	Min:26	Min:25	Min:21	Min:17

Source: worldweatheronline.com



Source: worldweatheronline.com

Figure 6-2: Average, Min and Max Tem over the 17 years (2009-2025) at project area.

6.3.1.2 Wind Speed and Direction

The wind regime of the project area was assessed using meteorological data for the period 2015–2025. The analysis indicates that wind speed varies seasonally, with stronger winds generally occurring during the pre-monsoon and monsoon periods and relatively calmer conditions prevailing during the winter months.

Average wind speeds in the study area generally range between 7 km/h and 18 km/h throughout the year. The lowest wind speeds are typically recorded during November to February, when average wind speeds remain between 6 km/h and 9 km/h. Wind speeds begin to increase from March, reaching their peak during the pre-monsoon and monsoon seasons (April to July). During this period, average wind speeds commonly range between 13 km/h and 18 km/h, while maximum wind speeds frequently exceed 20 km/h.

The highest recorded maximum wind speed during the study period was approximately 28.5 km/h, observed in April 2024 and April 2025, reflecting the influence of seasonal thunderstorms and pre-monsoon weather systems. Average gust speeds are generally higher than average wind speeds and may reach 20–27 km/h during the monsoon season.

The prevailing wind direction in the region is generally influenced by the seasonal monsoon pattern. During the southwest monsoon period, winds predominantly flow from the south and southwest, while during the dry winter months, winds are generally influenced by north and northeasterly air masses. These seasonal wind patterns play an important role in local air circulation, dispersion of pollutants, thermal comfort, and overall microclimatic conditions.

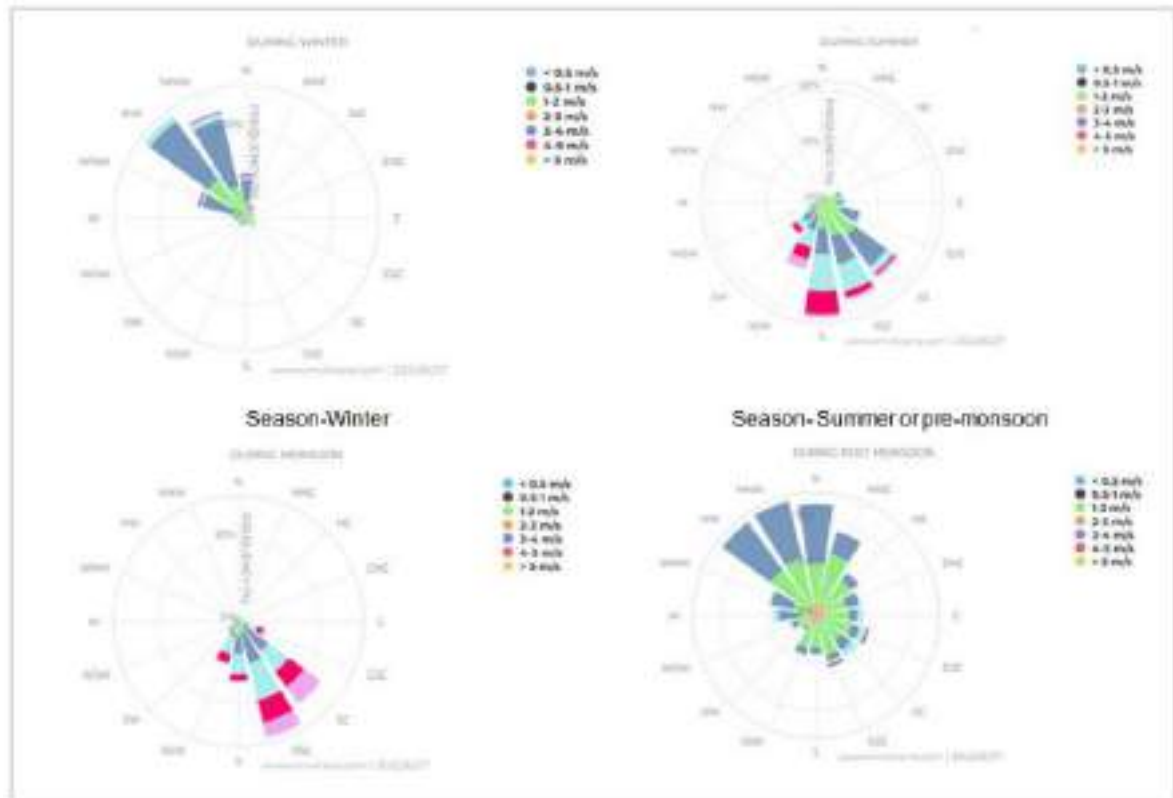
Table 6.3: Wind Speed of the study area.

Year		Wind Speed (Kmh)											
		Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2015	Max Wind	12.1	13.2	13.4	17	18	22.2	20.1	20.1	14.6	10.7	9.2	11
	Avg Wind	8.4	8.4	9.4	12.5	13.2	16.5	14.7	14.8	10.6	7	6	7.1
	Avg Gust	13.5	13.8	16	19.5	19.9	25.9	23.3	23.6	17.4	11.4	9.9	11.4
2016	Max Wind	12	12.2	14.9	22.9	15.7	16.5	19.1	19.8	13	11.2	9.9	10
	Avg Wind	7.8	7.9	9.7	16.8	11.6	12.2	14.5	14.1	9.5	7.5	7	7.3
	Avg Gust	12.5	13.4	16.2	26	18.6	19.3	23	23	16.2	12.5	10.8	11.4
2017	Max Wind	12.4	12.4	15	19.3	15.1	19.1	18.4	16.2	13.1	12.9	11.3	9.7
	Avg Wind	9.4	8.3	10.1	14.3	10.4	14.4	13.2	11.7	9.2	9.3	7.4	6.6
	Avg Gust	15.4	14.5	16.6	22.5	16	23.2	22	18.7	14.9	14.8	10.4	9.6
2018	Max Wind	12	11.6	12.3	13.8	16.6	17	20.9	18.7	14.1	10.7	9.5	11.6
	Avg Wind	8.1	7.2	8.1	9.2	11.2	12	15.3	13.4	10.3	7.3	6.5	8.6
	Avg Gust	11.1	11.2	13.4	14.5	18.2	18.8	23.7	20.9	16.2	11.2	9.2	12.4
2019	Max Wind	10.3	13.6	14.8	16.7	22.5	19.4	22.6	19.5	16	12	11.5	12.2
	Avg Wind	7.7	8.9	9.5	11.9	22.5	14.9	17	14.6	12	8.6	8	8.1
	Avg Gust	11.4	13.4	14.5	18.1	26.4	22.9	27	22.8	19	12.9	11.1	11.5
2020	Max Wind	12.3	12.7	14.7	17.9	20.2	20.6	20.3	21.3	16.8	12.3	11.5	11.4
	Avg Wind	8.1	8.2	8.9	12.5	14.3	16.2	16	16.5	12.7	8.5	8.1	7.3
	Avg Gust	11.7	12.4	13.9	19.5	22.4	25	25.4	26.3	20.1	13.2	11.3	10.2
2021	Max Wind	12	13.3	15.8	18.4	18.6	20.9	19.2	17.5	15.3	12.2	10.7	11.7
	Avg Wind	7.5	8.8	10.9	14.1	13	16.4	14.6	13.3	10.5	8.9	8.1	9
	Avg Gust	11.2	13	16.9	21.6	20.6	25.9	23	21.3	17	14.3	13	14.6
2022	Max Wind	12.8	13.8	16.4	23	18.2	22.3	17.9	18.7	14.5	13.7	11	12.2
	Avg Wind	9.1	9.2	11	17.9	13.3	18.1	13.5	14.4	10.9	9.5	8.3	8.2
	Avg Gust	14.7	15.1	17.6	26	20.6	27.5	20.6	22.2	17.5	14.9	13.3	13
	Max Wind	12.9	14.4	22.3	18.9	20	22.9	21.2	18	17.3	14.4	12.2	10.8

Year		Wind Speed (Kmh)											
		Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2023	Avg Wind	8.7	9.1	11.4	12.6	12.8	17.2	16	12.7	12.7	9.9	8.4	7.4
	Avg Gust	14.6	15.1	17.3	18.9	19.5	26.1	24.2	20	18.7	15.5	13.2	12.1
2024	Max Wind	12.3	16.8	22.2	28.5	23.9	22.9	22.4	19.8	15.2	11.5	12.5	11.6
	Avg Wind	8.1	8.4	13.1	16	14.9	17	17	14.3	10.8	8.2	9.6	8.3
	Avg Gust	13.8	13.8	20.2	22	21.1	24.1	24.3	20.5	16	13.1	15.1	14.2
2025	Max Wind	13.5	16.8	22.2	28.5	23.9	22.9	22.4	19.8	15.2	11.5	12.5	11.6
	Avg Wind	8.3	8.4	13.1	16	14.9	17	17	14.3	10.8	8.2	9.6	8.3
	Avg Gust	14.2	13.8	20.2	22	21.1	24.1	24.3	20.5	16	13.1	15.1	14.2

Source: worldweatheronline.com

The annual wind rose shows that the predominant wind directions are from South South East and North North-west. During pre-monsoon (March-May) the predominant wind direction is from South and South-South-East, and during monsoon season (June September) it is from South-South-East and South-East whereas during the post monsoon (October-November) predominant wind direction is also from North-West and North North-West. During the winter season (December-February) it is from North-North-west & North-west. The Annual and seasonal Wind rose is presented in Figure 6.4.



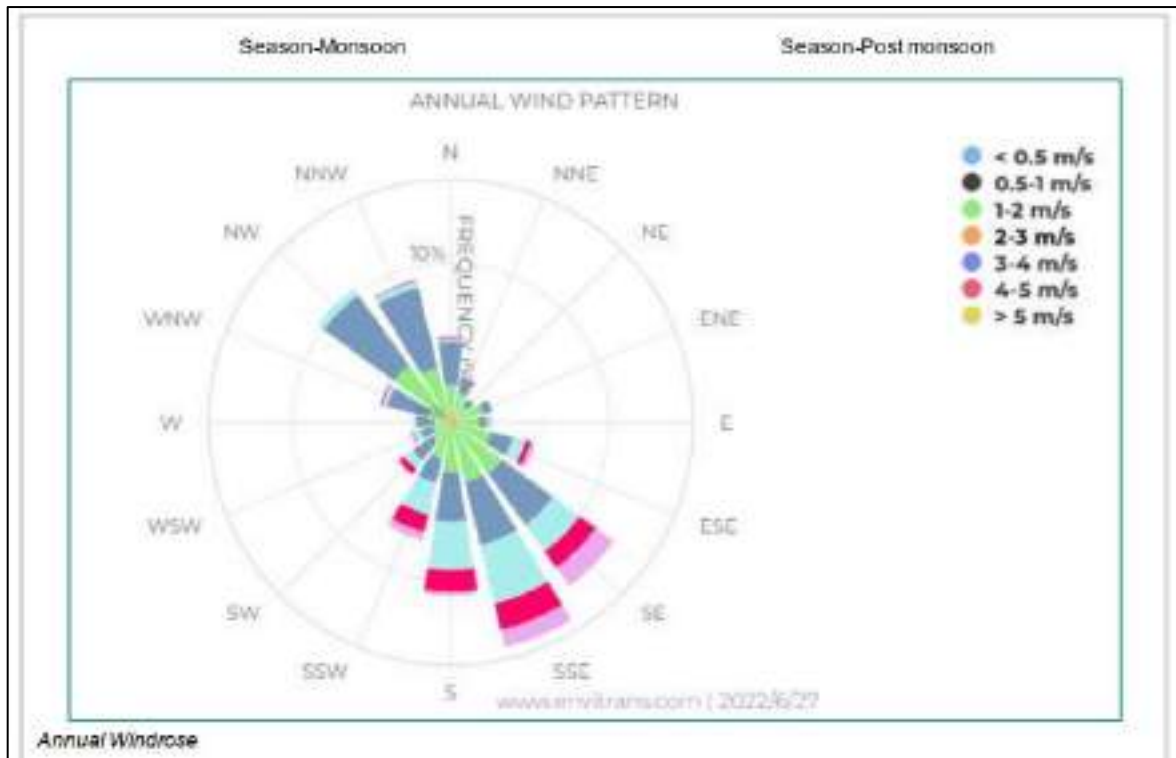


Figure 6-3: Annual and Seasonal Wind Rose Diagram.

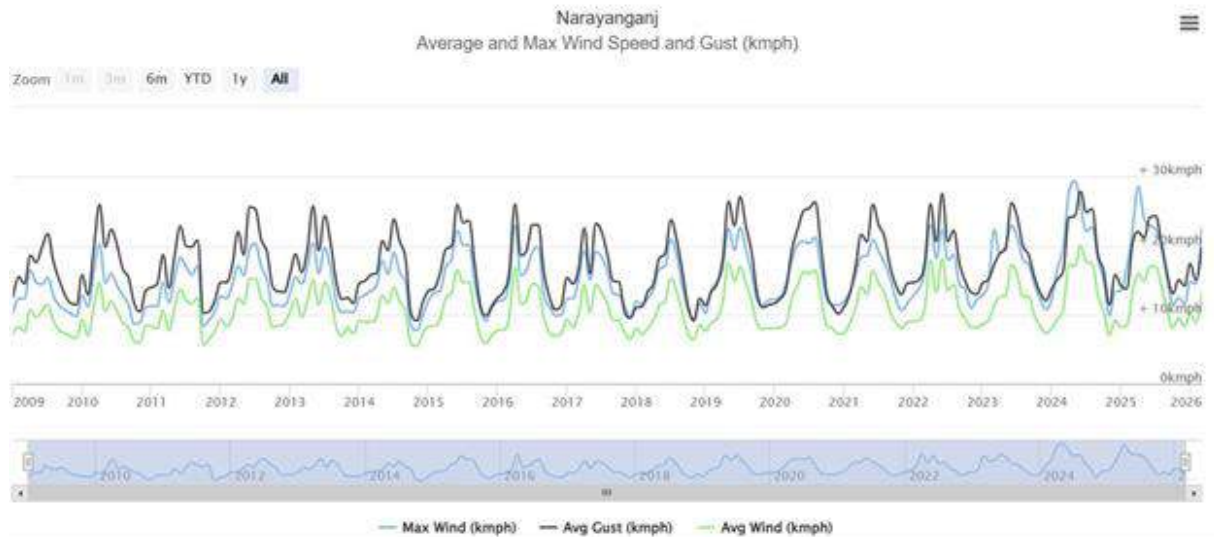


Figure 6-4: Average, Max wind speed and Gust (kmph) over the 17 years (2009-2025) at project area.

6.3.1.3 Rainfall

The project area experiences a typical tropical monsoon rainfall pattern characterized by distinct wet and dry seasons. Analysis of rainfall data from 2015 to 2025 indicates that precipitation is highly seasonal, with the majority of annual rainfall occurring during the monsoon period from May to October.

The average annual rainfall in the study area varies considerably from year to year, ranging from approximately 1,500 mm to 2,450 mm. The highest annual rainfall of about 2,453 mm was recorded in 2017, while the lowest annual rainfall of approximately 1,504 mm was recorded in 2025. The monsoon months, particularly June, July, August, and September, receive the highest rainfall, with monthly precipitation frequently exceeding 200–500 mm. The highest monthly rainfall recorded during the study period was approximately 724 mm in July 2015.

In contrast, the dry season extending from November to February receives very limited rainfall, with some months recording negligible or no precipitation. Rainfall gradually increases from March and April, marking the transition to the monsoon season.

The number of rainy days also exhibits significant variation, ranging from approximately 50 to 158 days per year during the study period. Higher rainfall frequencies are generally associated with the monsoon season, contributing to groundwater recharge, surface water availability, and maintenance of local ecological functions.

Table 6.4: Rainfall and Rainy days at the Study Area.

Year	Rainfall per Month (mm)												Total Rainfall	Total Rainy Days
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec		
2015	5.5	9.5	41.1	348.12	165.78	416.69	723.58	356.92	245.49	106.38	17.1	9.6	2445.76	158
2016	3.5	36.6	192.89	115.5	373.69	219.38	380.99	267.5	194.29	133.52	92.77	0	2010.63	150
2017	0	2.3	87.44	274.63	202.25	454.57	422.74	353.98	325.04	213.59	10.5	106.3	2453.34	149
2018	0	1.2	28.8	191.82	438.95	365.19	286.62	168.19	160.18	129.38	0.9	26.4	1797.63	139
2019	0.4	35.8	50.8	213.71	222.4	315.97	272.68	233.17	196.16	156.77	131.4	11.2	1840.46	129
2020	12.2	15.6	19	350.94	191.31	375.58	392.4	280.81	252.21	275.98	10.7	0	2176.73	155
2021	6.7	0.4	6.3	29.13	214.21	454.32	387.24	314.43	241.08	230.17	9.9	113.2	2007.08	133
2022	16.3	31.6	11.2	97.01	308.55	323.29	141.2	146.43	310.4	206.1	0.3	0.5	1592.88	124
2023	0.2	1	68.2	46.1	228.5	263.1	208.05	527.9	233.31	128.5	29.17	9.31	1743.34	101
2024	0	13.43	20.56	0.2	509.59	125.36	291.23	420.89	352.92	60.77	8.94	0	1803.89	57
2025	0.52	1.48	1.91	97.5	321.33	183.48	326.76	218.3	170	178.2	4.8	0	1504.28	50

Source: worldweatheronline.com

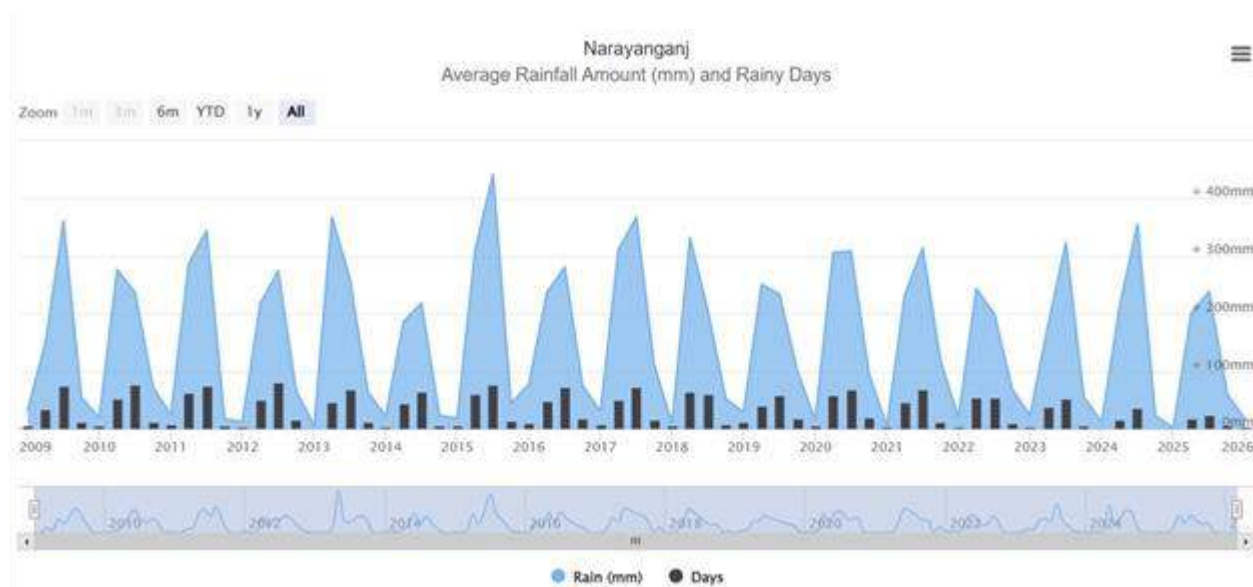


Figure 6-5: Average Rainfall amount and Rainy Day.

6.3.1.4 Cloud and Humidity

The climatic conditions of the project area are characterized by relatively high humidity and seasonal variations in cloud cover, reflecting the influence of the tropical monsoon climate. Analysis of meteorological data from 2015 to 2025 indicates that both humidity and cloud cover increase significantly during the monsoon season and decrease during the dry winter months.

Relative humidity in the study area generally ranges between 35% and 83% throughout the year. The lowest humidity levels are typically observed during the winter season (December to February) and parts of the post-monsoon period, while the highest humidity levels occur during the pre-monsoon and monsoon months (April to September). During this period, average humidity frequently exceeds 70%, creating warm and moist atmospheric conditions.

Cloud cover also exhibits a distinct seasonal pattern. Lower cloud cover is generally experienced during the dry season, particularly between November and February, when clear skies are more common. Cloudiness gradually increases from March, reaching its highest levels during the monsoon months of June to September, when frequent rainfall and overcast conditions prevail. The highest cloud cover values are typically recorded during the peak monsoon season, reflecting increased atmospheric moisture and rainfall activity.

The combined effects of high humidity and seasonal cloud cover influence local temperature conditions, rainfall distribution, solar radiation, and overall microclimatic characteristics of the area.

Overall, the study area experiences a humid tropical climate with elevated humidity and cloud cover during the monsoon season and comparatively drier and clearer conditions during the winter months.

Table 6.5: Cloud & Humidity (2015-25) at the Project Area.

Year	Humidity And Cloud Monthly																							
	Jan		Feb		Mar		April		May		June		July		Aug		Sep		Oct		Nov		Dec	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
2015	54	9	49	9	43	20	63	45	69	43	73	56	82	67	79	60	76	47	72	32	64	11	59	17
2016	52	7	49	14	49	16	65	42	68	44	75	49	78	63	76	53	78	53	75	33	69	16	60	4
2017	47	2	45	7	58	24	69	42	67	38	78	57	78	61	75	57	73	54	73	34	58	11	59	12
2018	48	1	45	9	48	13	57	32	70	50	74	55	77	61	76	54	71	47	65	27	57	8	54	12
2019	61	48	73	68	78	73	77	71	77	59	73	54	54	15	45	4	39	6	35	4	45	10	51	17
2020	65	51	79	72	79	69	80	69	78	61	70	46	52	12	54	17	47	19	47	15	39	12	61	35
2021	72	61	77	67	73	62	74	65	78	68	73	41	54	4	44	5	35	2	39	5	44	19	52	20
2022	60	40	72	55	76	70	80	72	78	62	68	35	57	13	54	12	39	4	43	17	46	16	49	13
2023	65	42	74	53	80	73	83	75	78	59	76	58	53	7	41	4	41	4	37	7	43	7	56	26
2024	63	40	76	57	81	74	79	69	76	59	68	32	56	10	46	3	76	59	68	32	56	10	46	3
2025	41	4	37	7	43	7	56	26	63	40	76	57	81	74	79	69	76	59	68	32	56	10	46	3

Source: worldweatheronline.com

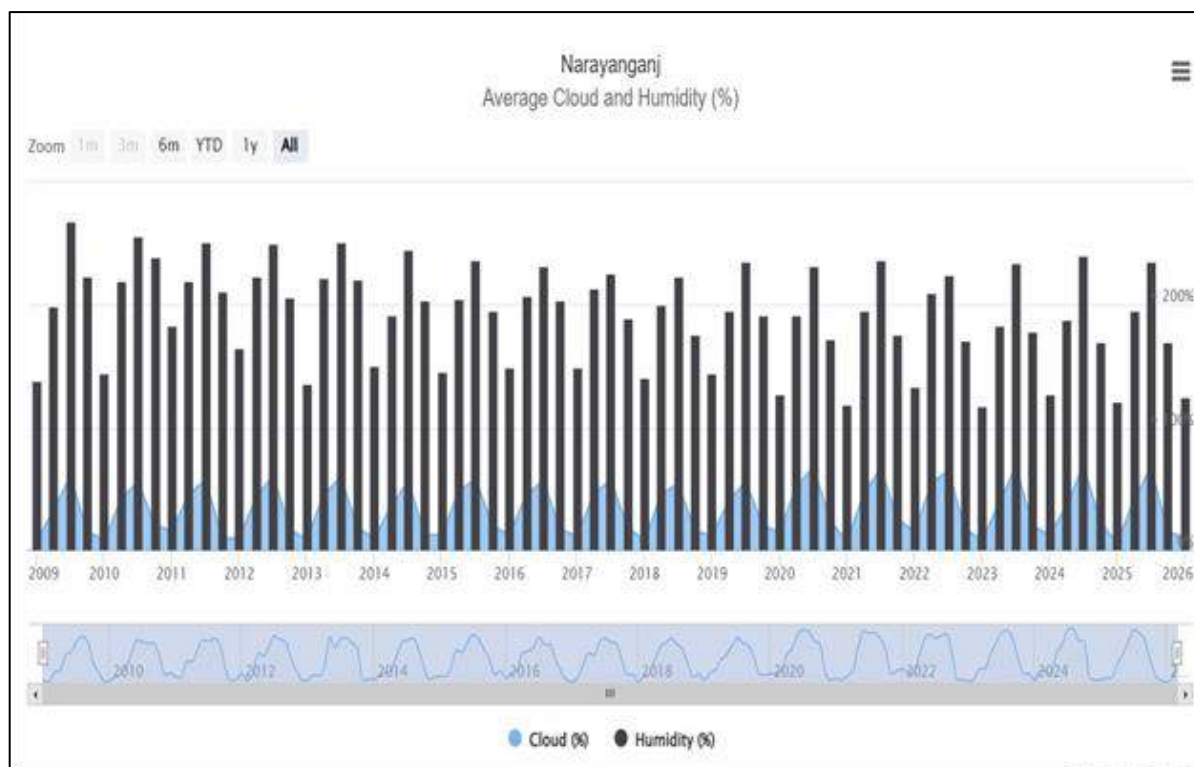


Figure 6-6: Monthly Maximum, Minimum and Average Humidity at study area.

6.3.2 Climate Change

The climatic condition of the study area is classified as a tropical monsoon climate, characterized by distinct seasonal variations. The year is broadly divided into four seasons: pre-monsoon (March–May), monsoon (June–September), post-monsoon (October–November), and dry winter (December–February). Long-term climatic data indicate that the region receives an average annual rainfall of more than 2,000 mm, of which approximately 80–90% occurs during the monsoon period (May–October).

The climatic profile shows that the monthly average temperature typically ranges between 25°C and 31°C, while relative humidity remains high, generally between 70% and 90%, particularly during the monsoon months. Evaporation rates vary seasonally, ranging from approximately 75 mm to 130 mm, while wind velocity also fluctuates across seasons, with higher speeds observed during the pre-monsoon and monsoon periods.

These climatic variations directly influence hydrological behavior, including surface runoff, drainage patterns, and water quality within the surrounding river systems. Increased rainfall intensity during monsoon months contributes significantly to peak

discharge conditions, while dry season conditions are characterized by lower rainfall, reduced flow, and higher evapotranspiration effects.

Overall, the long-term climatic data highlight a highly seasonal and monsoon-dominated climate system, where rainfall, temperature, humidity, and wind patterns exhibit strong temporal variability.

Table 6.6: The long-term monthly average climatic data

Month	Average Rainfall (mm)	No. of Rainy Days	Maximum air temperature (°C)	Minimum air temperature (°C)	Relative Humidity (%)	Evaporation (mm)	Wind Velocity (km/hr)	Season
Jan	7.7	2	25.4	12.7	70	104	3.7	Winter
Feb	28.9	3	28.1	15.5	66	79	3.7	
Mar	65.6	5	32.5	20.4	63	81	5.6	Pre-monsoon
Apr	156.3	10	33.7	23.6	71	77	9.2	
May	339.4	14	32.9	24.5	79	78	9.2	
Jun	340.4	14	32.1	26.1	86	83	7.4	Monsoon
Jul	373.1	17	31.4	26.2	87	87	7.4	
Aug	316.5	16	31.6	26.3	86	130	7.4	
Sep	300.4	13	31.6	25.9	86	118	5.6	Post-monsoon
Oct	172.3	7	31.6	23.8	81	106	3.7	
Nov	34.4	2	29.6	19.2	74	75	1.8	Winter
Dec	12.8	1	26.4	14.1	74	105	1.8	

Source: <http://www.basin-info.net/river-basins/bangladeshi-river-basin-bangladesh/climate>

6.3.3 Land Resources

6.3.3.1 Land use & Land Cover

The assessment of Land Use and Land Cover (LULC) within and around the proposed Green Life Hospital Ltd. (Cancer Unit) site provides an understanding of the existing physical environment and development characteristics of the area. This analysis is important for evaluating site suitability, identifying environmentally sensitive features, and ensuring sustainable planning and environmental compliance.

The project site is located within Sector-08 of Purbachal New Town, a planned urban township developed by RAJUK. The land is designated for institutional use under the approved master plan. At present, the project plot is vacant and development-ready, with no permanent structures or ongoing activities.

Existing Land Use Pattern:

Within the immediate project boundary, the land is classified as institutional and is free from agricultural activities, residential settlements, or commercial operations. The surrounding area within a broader influence zone (approximately 5 km radius) reflects a mixed urban development pattern, including:

- Planned residential sectors
- Institutional and educational facilities
- Road networks and utility corridors
- Open spaces and designated green areas
- Planned lakes and drainage channels.

Agricultural land use is largely absent in the immediate surroundings, as former agricultural lands have been converted into serviced urban plots under the township development program.

Environmental Characteristics:

The broader area includes water bodies, low-lying lands, vegetation cover, and open spaces that contribute to natural drainage and ecological balance. The planned lakes and canals within Purbachal play a significant role in stormwater management and flood control.

No protected forests, ecologically critical areas (ECA), wildlife habitats, or environmentally sensitive zones are located within or immediately adjacent to the project site. The land use pattern is consistent with planned urban expansion and institutional development.

Development Suitability:

The existing land use and land cover conditions confirm that the project site is suitable for healthcare infrastructure development. The designated institutional zoning, absence of incompatible land uses, and availability of supporting infrastructure ensure compatibility with surrounding development.

The LULC assessment supports informed decision-making and ensures that the proposed hospital development aligns with environmental sustainability, urban planning regulations, and long-term land management objectives.

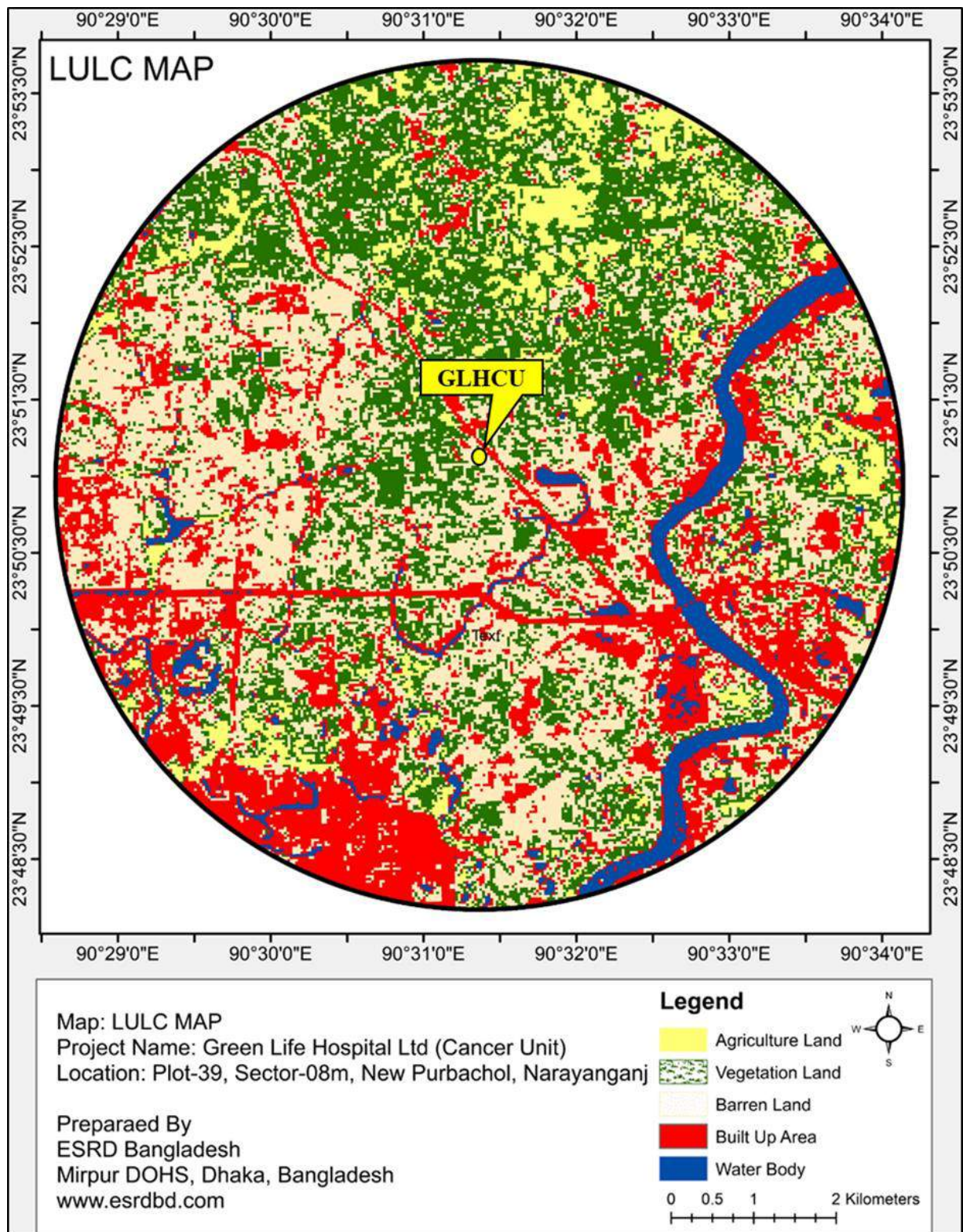


Figure 6-7: 5 km Land Use Map of the proposed project.

6.3.3.2 Geology

The geological setting of the GLHLCU project area is shown in the Geological Map. Geologically, the site is located within the central Bengal Basin, which is characterized by recent to sub-recent alluvial deposits.

The subsurface geology predominantly consists of unconsolidated alluvial sediments, including silty clay, clayey silt, fine sand, and occasional sand lenses. These materials were deposited through long-term fluvial processes associated with the Ganges–Brahmaputra–Meghna river system. Such geological formations are typical of low-lying floodplain regions of central Bangladesh.

From an engineering perspective, these geological conditions are generally suitable for building construction. However, due to the fine-grained nature of the soil and potential variability in subsurface layers, appropriate geotechnical investigation and foundation design are essential to ensure structural stability, particularly for a multi-storey healthcare facility.

6.3.3.2.1 Soil Quality

Table 6.7: Soil quality analysis report.

Parameters	Unit	SQ-1	SQ-2	SQ-3	SQ-4
pH value	None	4.22 (1:2.5) at 25 deg C	4.78 (1:2.5) at 25 deg C	5.06 (1:2.5) at 25 deg C	5.02 (1:2.5) at 25 deg C
Barium (as Ba)	mg/kg	14	10	8	13
Copper (as Cu)	mg/kg	22	58	74	110
Iron (as Fe)	mg/kg	6.2	11	30	14
Manganese (as Mn)	mg/kg	251	439	552	891
Nitrate (as NO ₃)	mg/kg	6.2	<4.0	<4.0	<4.0
Selenium (as Se)	mg/kg	<0.25	<0.25	<0.25	<0.25
Cadmium (as Cd)	mg/kg	<2.0	<2.0	<2.0	<2.0
Lead (as Pb)	mg/kg	15	12	27	18
Mercury (as Hg)	mg/kg	<0.1	<0.1	<0.1	<0.1
Molybdenum (as Mo)	mg/kg	<2.0	<2.0	<2.0	<2.0
Nickel (as Ni)	mg/kg	18	17	15	16
Arsenic (as As)	mg/kg	<0.25	<0.25	<0.25	<0.25

Parameters	Unit	SQ-1	SQ-2	SQ-3	SQ-4
Total Chromium (as Cr)	mg/kg	40	34	33	35
Available Nitrogen (as N)	mg/kg	202	297	381	230
Nitrite (as NO ₂)	mg/kg	0.84	<0.5	<0.5	<0.5
Texture	None	Clay Loam	Clay Loam	Clay Loam	Clay Loam
Electrical conductivity (at 25 °C)	µs/cm	92 (1:2)	84 (1:2)	91 (1:2)	99 (1:2)
Potassium (as K)	mg/kg	1310	1540	640	1390
Available Potassium (as K)	mg/kg	104	183	176	185
Sodium Adsorption Ration (as SAR)	None	0.40	0.13	0.37	0.18
Cation Exchange Capacity	meq/100 gm	2.6	7.3	8.9	7.6
Total Petroleum Hydrocarbon (as TPH)	mg/kg	<0.05	<0.05	<0.05	<0.05
Phosphate (as PO ₄)	mg/kg	12	19	36	30
Phosphorus (as P)	mg/kg	181	202	328	256
Porosity	%	48	51	49	50
Total Hydrocarbon	mg/kg	<0.05	<0.05	<0.05	<0.05
Particle Size Distribution	%	Sand:39% Silt:25% Clay:36%	Sand:43% Silt:20% Clay:37%	Sand:42% Silt:19% Clay:39%	Sand:45% Silt:23% Clay:32%
Nitrogen (as N)	mg/kg	420	616	638	459

Source: ESIA Report for Water Distribution and Supply Project, Purbachal New Town.

The texture of the soil is found as Clayey Loam in the study area. pH of the soil sample ranged from 4.22 to 5.06. In our study area, arsenic was also found at the below detection limit (0.25 mg/kg). The electrical conductivity of the study area ranged between 84 to 99 µs/cm. The nitrogen, phosphorus, and potassium of the soil ranged between 181 to 328 mg/kg, 4.1 to 12 mg/kg, and 104 to 185 mg/kg respectively.

6.3.4 Topography, Contour and Hydrological Map of the Study Area

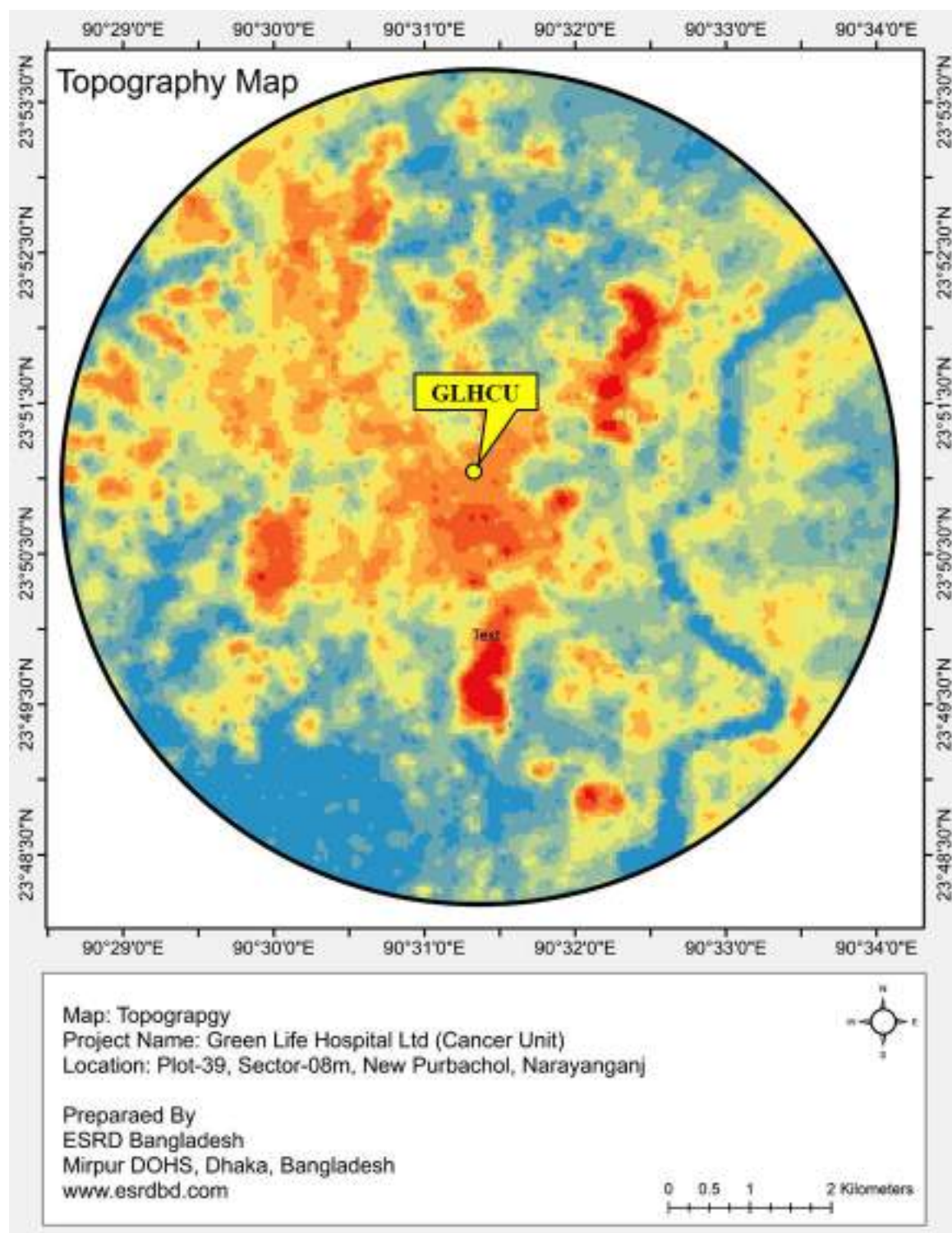


Figure 6-8: Topography Map of the Study Area.

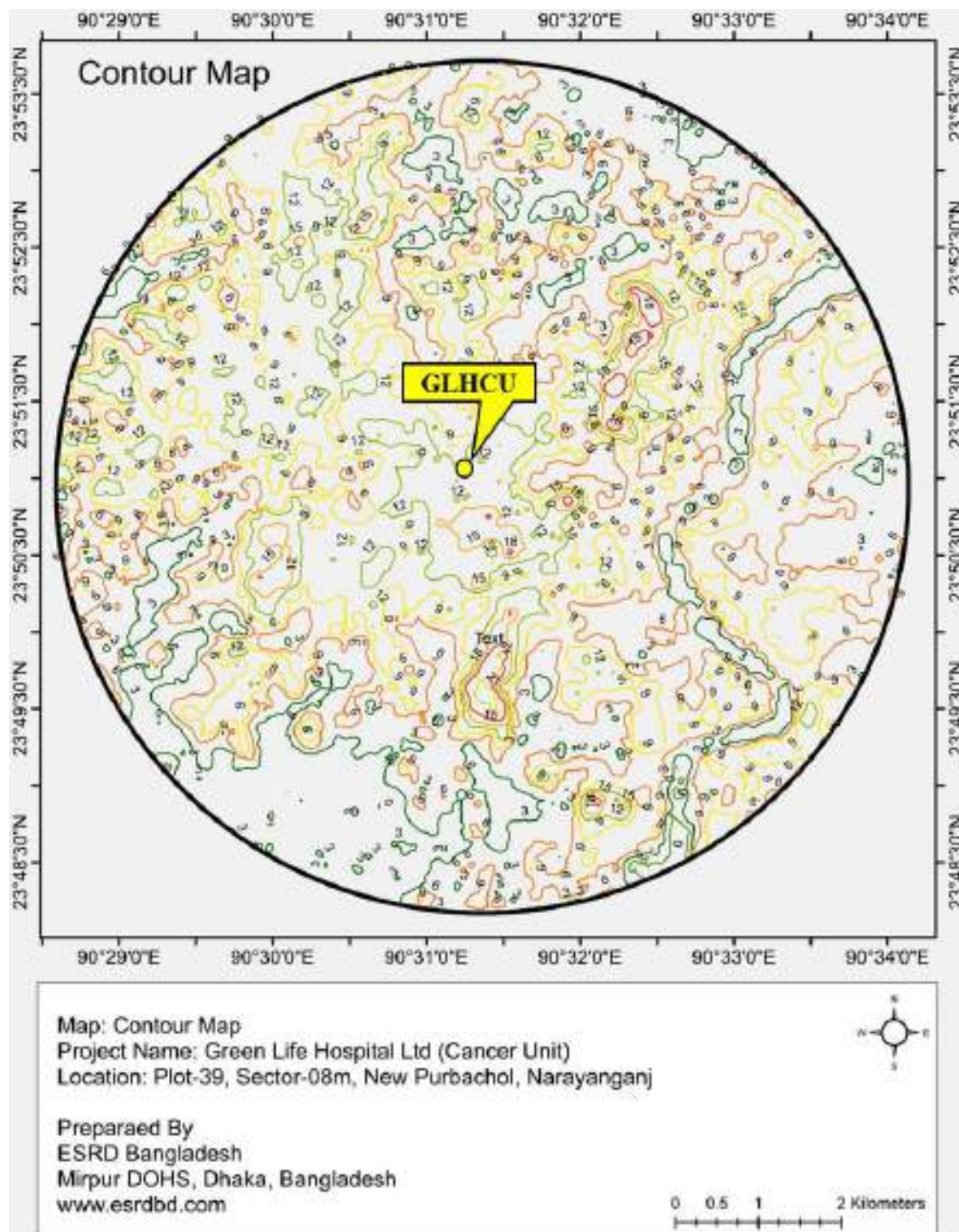


Figure 6-9: Contour Map of the Study Area.

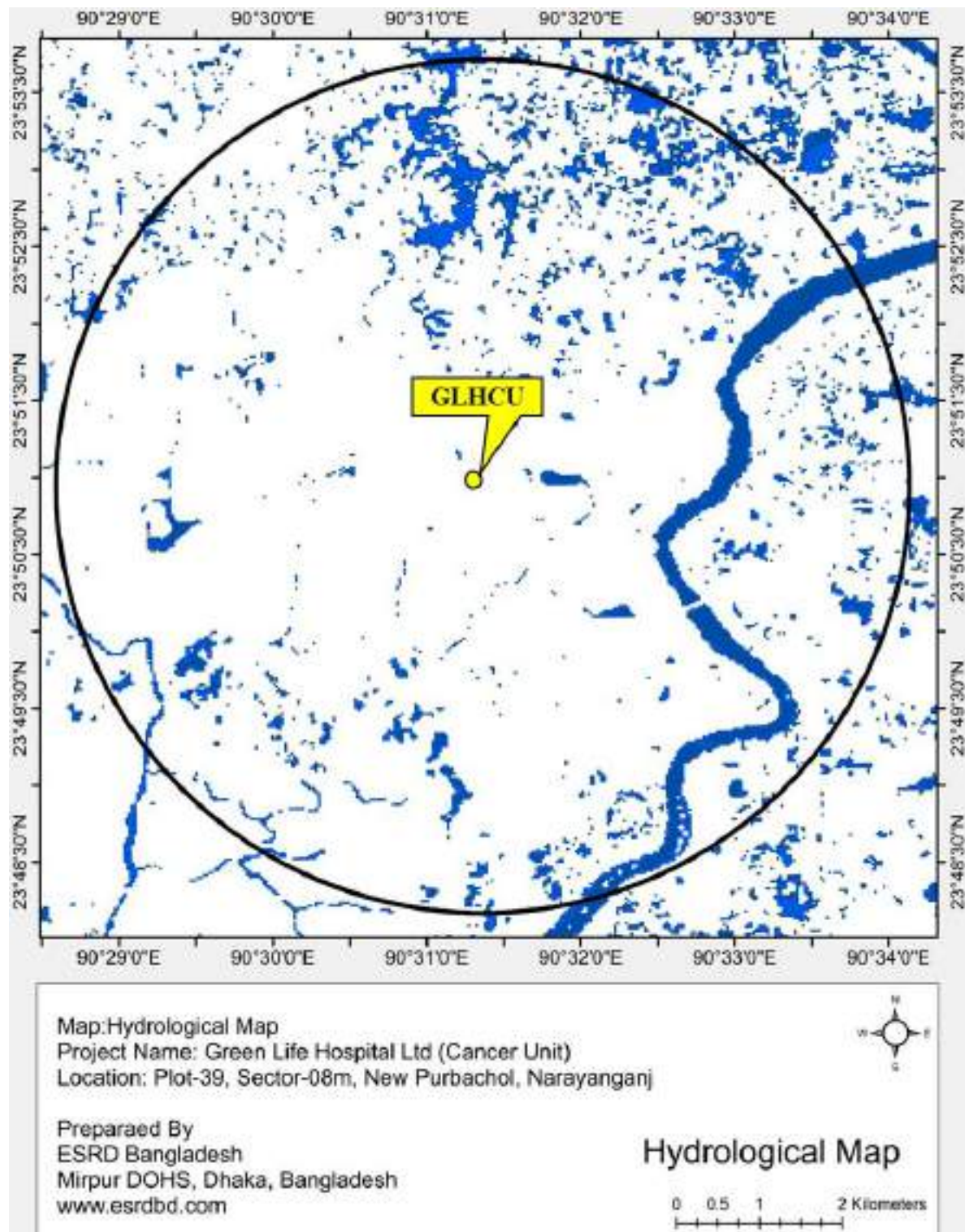


Figure 6-10: Hydrological Map of the Study Area.

6.3.5 Natural Hazards

6.3.5.1 Seismicity

The proposed Green Life Hospital Ltd. (Cancer Unit) site falls within Seismic Zone III of Bangladesh, as per the Bangladesh National Building Code (BNBC). This zone is categorized as a moderate seismic risk area, with a seismic coefficient of $Z = 0.28$, indicating a moderate level of ground shaking potential during earthquake events.

Bangladesh lies in an active tectonic region influenced by the interaction of the Indian and Eurasian plates. Although the project area is not located in the highest-risk seismic zones (Zone IV), moderate earthquakes may still occur and can potentially cause structural and infrastructural damage if proper engineering measures are not adopted.

The key seismic hazards relevant to the project area include moderate to strong ground shaking, which may affect building stability and essential hospital utilities, as well as localized soil liquefaction risk, particularly in areas with loose, water-saturated soils. Such conditions may impact foundations and underground services if not properly addressed during design and construction.

To ensure seismic safety and resilience of the proposed hospital, all structural designs will strictly comply with BNBC seismic design provisions for Zone III. The project will incorporate earthquake-resistant structural systems, reinforced concrete design, and appropriate ductility measures to absorb seismic energy. Special attention will be given to geotechnical investigations and foundation design, including the use of suitable foundation systems in areas with weak or soft soil conditions.

In addition, critical hospital facilities such as intensive care units, operation theatres, radiotherapy units, and emergency services will be designed with enhanced structural safety considerations to ensure uninterrupted functionality during seismic events. Overall, adherence to BNBC guidelines, proper site-specific geotechnical assessment, and earthquake-resilient design will significantly reduce seismic risk and ensure the safety of patients, staff, and infrastructure.

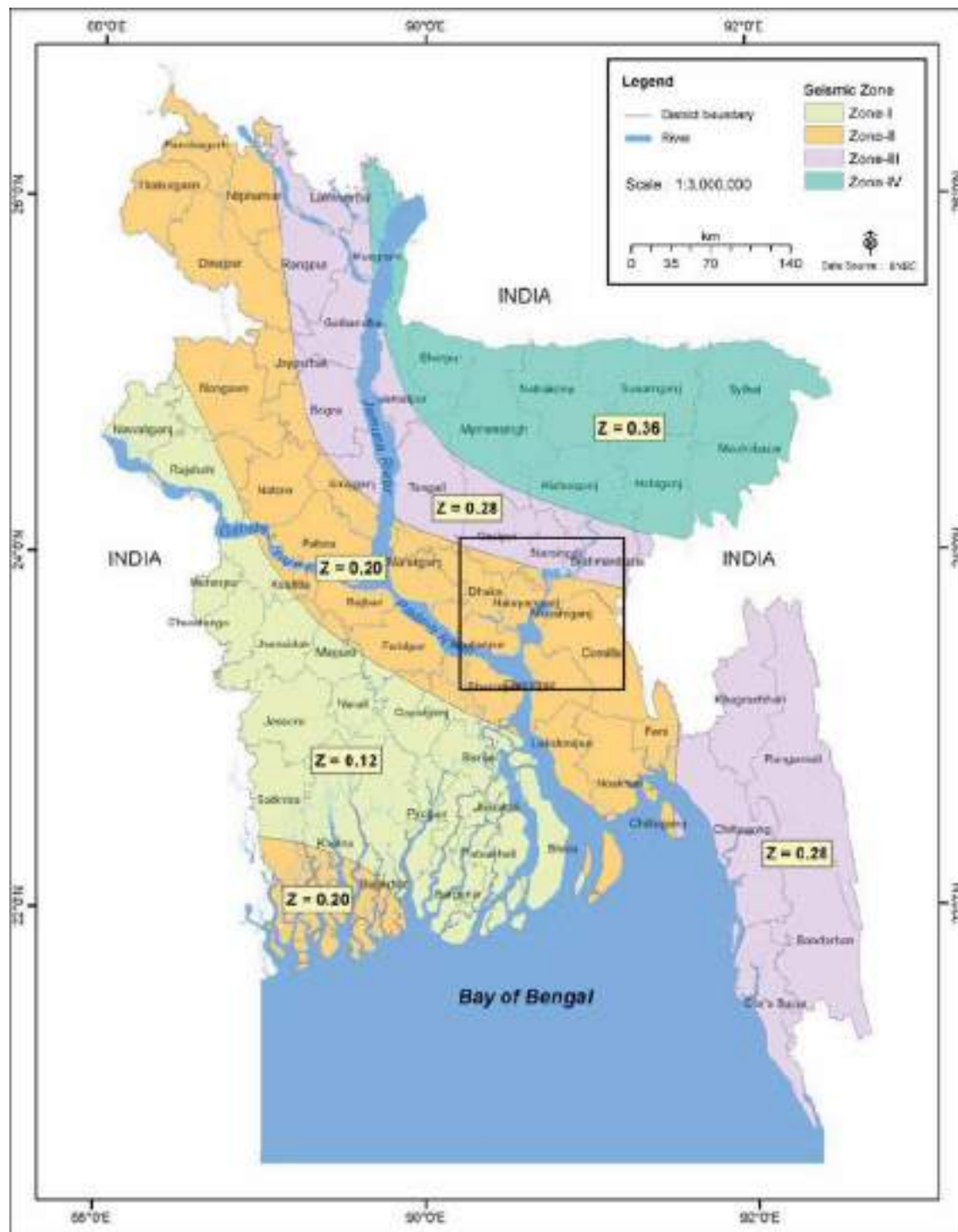


Figure 6-11: Earthquake zoning map of Bangladesh.

6.3.5.2 Cyclone

The proposed Green Life Hospital Ltd. (Cancer Unit) is located in an inland area of Bangladesh and is not within the direct high-risk coastal cyclone zones. However, based on national cyclone risk patterns, the area may still experience indirect effects of tropical cyclones, particularly strong winds and intense rainfall generated from cyclonic systems originating in the Bay of Bengal.

Although major impacts such as storm surges are not expected in this region, cyclonic events can still pose risks to infrastructure through high wind pressure, structural stress, and heavy rainfall-induced waterlogging. Intense rainfall during cyclone periods may temporarily overwhelm local drainage systems, potentially affecting accessibility and routine hospital operations.

To address these risks, cyclone resilience has been integrated into the project planning and design. All hospital buildings and supporting structures will be designed in accordance with BNBC wind load requirements and relevant international standards, ensuring resistance against high wind speeds. Reinforced structural systems, secure roofing, and impact-resistant architectural features will be incorporated to enhance overall building stability.

The hospital's drainage and stormwater management system will be designed to efficiently handle heavy rainfall events, minimizing the risk of water accumulation within the premises. In addition, critical utilities such as power supply and communication systems will be designed with adequate redundancy to ensure uninterrupted hospital services during extreme weather conditions.

Emergency preparedness measures will also be established, including early warning response coordination, evacuation planning, and staff training to ensure rapid response during cyclone events. Through proper structural design, resilient infrastructure systems, and effective emergency planning, the proposed hospital will remain safe, functional, and operationally stable even during severe weather conditions associated with cyclonic events.

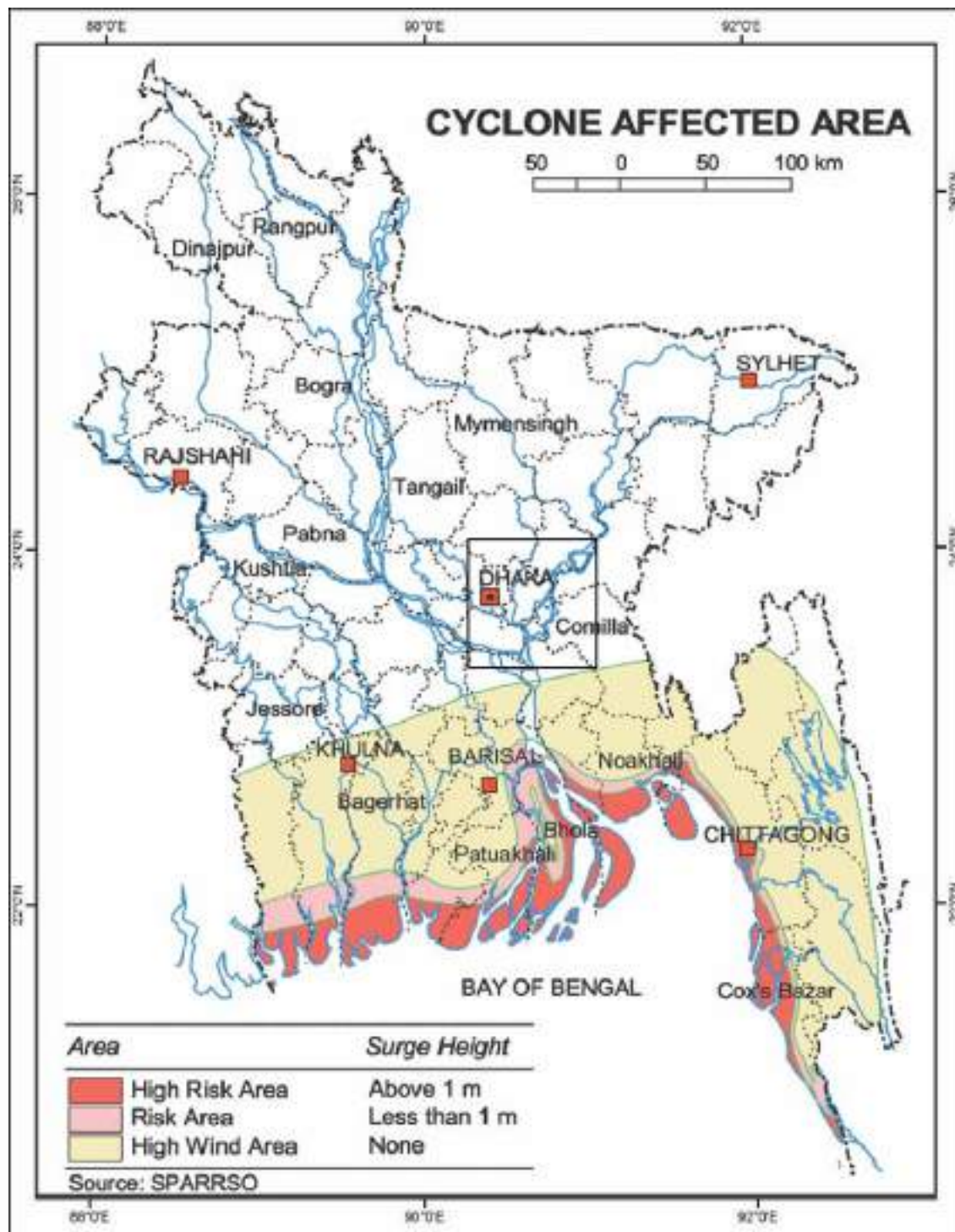


Figure 6-12: Cyclone Prone area Map of Bangladesh.

6.3.6 Water Quality Monitoring

As part of water quality monitoring, a comprehensive water sampling and analysis initiative was undertaken to assess the baseline water quality within the study area. The objective of this assessment was to evaluate the physicochemical and bacteriological characteristics of the water sources, ensuring a reliable understanding of the existing water quality conditions and potential environmental concerns.

6.3.6.1 Sampling Strategy and Locations:

To ensure representative coverage of the study area, water samples were collected from selected surface water bodies. The selection process considered hydrological significance, potential pollution sources, and spatial distribution to provide an accurate depiction of water quality.

Surface Water Sampling: Major surface water bodies, particularly the Tongi Khal, were identified as key sampling points. A total of eight (8) surface water samples were collected from different locations along the Khal. A summary of the sampling locations, including their geographic coordinates and water source types, is provided in Table 6.8.

Table 6.8: Details of Surface Water Sampling Locations

Sampling Code	Geographic location
SW-1	23°50'49.10"N, 90°31'26.98"E
SW-2	23°50'55.70"N, 90°31'22.93"E
SW-3	23°51'2.58"N, 90°31'18.86"E
SW-4	23°51'13.11"N, 90°31'10.78"E
SW-5	23°51'7.36"N, 90°31'4.83"E
SW-6	23°51'9.02"N, 90°30'49.01"E
SW-7	23°51'5.46"N, 90°30'37.90"E
SW-8	23°51'1.72"N, 90°30'24.78"E

6.3.6.2 Sampling Methodology and Analytical Approach:

Water samples were collected following standard procedures to ensure accuracy and reliability. The methodology adhered to Standard Methods for the Examination of Water and Wastewater (23rd Edition), published by the American Public Health Association (APHA), supplemented by on-site field testing kits for rapid assessment.

Key aspects of the sampling process included:

- Collection of grab samples in sterilized bottles to prevent contamination
- Use of 500 ml pre-sterilized PET bottles for bacteriological analysis
- Immediate preservation of samples using standard storage and cooling techniques
- Proper labeling and documentation, including GPS coordinates, collection time, and date
- Secure transportation of samples to an accredited laboratory for detailed testing.

The collected samples were analyzed for a range of physicochemical, microbiological, and heavy metal parameters to evaluate their compliance with environmental water quality standards.

Table 6.9: Water Quality Analysis Methods.

SN	Parameter	Unit	Test
1	pH	-	pHep® HI 98107 Pocket-sized pH Meter
2	TSS	mg/l	Photometric Method1
3	COD	mg/l	Reactor Digestion Method2
4	BOD	mg/l	BOD Incubator
5	TDS	mg/l	HANNAH TDS Meter

Table 6.10: Surface Water Quality of the Project Area.

SN	Parameters	Unit	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
1	COD	mg/l	6	8	5	33	7	9	11	8
2	TDS	mg/l	110	120	120	120	130	125	115	128
4	pH	-	6.5	6.2	6.3	6.5	6.2	6.4	6.3	6.4
5	TSS	mg/l	7	15	6	9	10	8	12	9

Source: Analysis Report, Analysis by CEL, WTB.

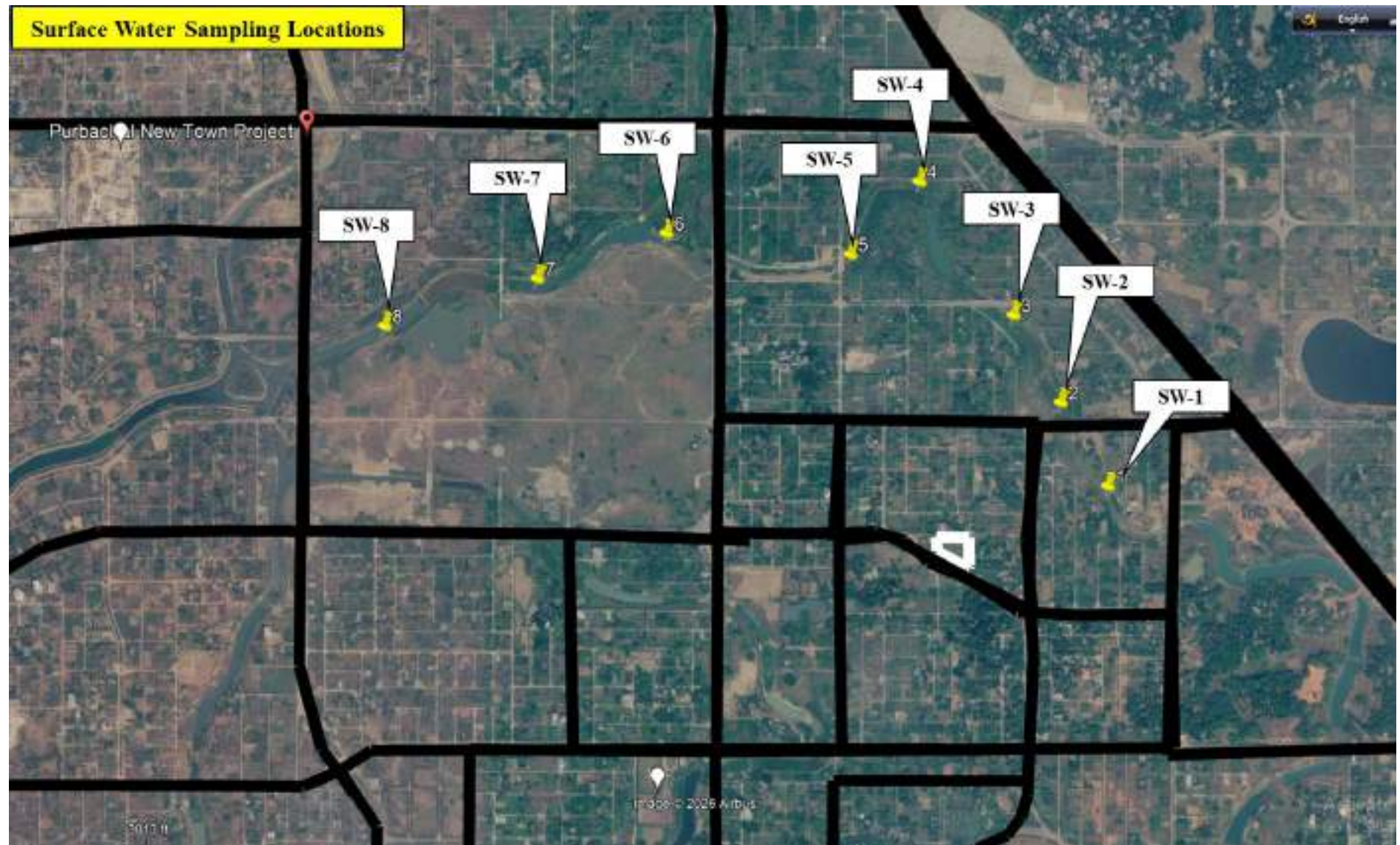


Figure 6-13: Water Sampling Locations.

6.3.7 Air Quality Assessment

Ambient air quality was monitored at Four (04) locations. Air quality were measured to verify the current quality of air. The parameters of air quality including Particulate Matter 2.5 (PM_{2.5}) and 10 (PM₁₀), Sulfur Dioxide (SO₂), Nitrogen Oxides (NO₂) and Carbon Monoxide (CO). The aim was to collect the present air quality data and to compare the data with the air quality data during baseline and future project activities to check if there is any high air pollution level due to the construction activities and to design adequate mitigation measures, as applicable. Air quality monitoring locations with their coordinates and monitoring photos can be found in Table 6.16 & and Figure 6.15.

The portable OCEANUS AQM-09 Air Quality Monitoring Station shown in Figure 6.14 was used to collect measure and document critical pollutants including Carbon monoxide, Nitrogen dioxide, Sulfur dioxide and Particulates Matter.



Figure 6-14: Ambient Air Quality Monitoring Equipment (OCENAS: AQM-09).

Sampling and analysis of ambient air quality was conducted by referring to the recommendation of the United States Environmental Protection Agency (USEPA). Air quality data was measured automatically every one minute and directly recorded onsite for measured parameters (PM₁₀, PM_{2.5}, SO₂, NO₂ and CO) as shown in Table 6.11. Different analysis methods, such as Particulates 90° Infrared Light Scattering for particulate matters (PM₁₀, PM_{2.5}), and electrochemical sensors for toxic gases (SO₂, NO₂ and CO) are integrated in the device.

Table 6.11: Methods of Air Quality Sampling and Analysis.

Parameter	Instrument Name	Methods of Testing	Analysis Method
PM _{2.5}	OCENAUS AQM-09	On Site Recording	Light Scattering Nephometer
PM ₁₀	OCENAUS AQM-09	On Site Recording	Light Scattering Nephometer
Sulfur dioxide (SO ₂)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical
Oxides of Nitrogen (NO _x)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical
Carbon monoxide (CO)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical

Table 6.12: Air Quality Monitoring Locations.

Location	Locations	GPS Coordinates
AQ-01	West Side of the Project Site	23°50'45.96"N, 90°31'9.91"E
AQ-02	North side of the Project	23°50'46.20"N, 90°31'15.75"E
AQ-03	East side of the Project (Sabiha Chatter)	23°50'41.12"N, 90°31'19.71"E
AQ-04	South side of the Project	23°50'43.79"N, 90°31'13.75"E



Figure 6-15: Photography of Air Quality Monitoring.

Total five (05) parameters—PM_{2.5}, PM₁₀, SO₂, NO₂ (NO_x), and CO—were analyzed to assess the existing ambient air quality conditions at the project area. The monitoring results are summarized in Table 6.13. Overall, the results indicate that the concentration of all measured air pollutants at the monitored locations remains within the permissible limits prescribed under the Air Pollution Control Rules, 2022 (Bangladesh). The fine particulate matter (PM_{2.5}) concentration ranges from 49.56 µg/m³ to 60.32 µg/m³, while PM₁₀ ranges from 73.98 µg/m³ to 98.56 µg/m³, indicating moderately clean ambient air conditions with localized variations likely due to traffic and nearby anthropogenic activities.

Table 6.13: Results of the Ambient Air Quality Analysis.

Location ID	PM _{2.5} µg/m ³	PM ₁₀ µg/m ³	SO ₂ µg/m ³	NO _x µg/m ³	CO mg/m ³
AQ 01	50.23	79.34	13.87	13.76	1.08
AQ 02	49.56	73.98	16.34	11.99	0.67
AQ 03	58.34	98.56	27.23	16.34	1.54
AQ 04	60.32	97.43	14.43	10.98	0.99
Duration (Hours)	24	24	24	24	8
Bangladesh Standard*	65	150	80	80	5

* Standard: Air Pollution Control Rules on 26th July 2022; vide S.R.O No. 255-Law/2022 and Environment Conservation Rules (ECR) 1997 through its subsequent amendment on 19th July, 2005; vide S.R.O. No.220-Law/2005



Figure 6-16: Air Quality Monitoring Sampling Points.

6.3.7.1 Interpretation of Ambient Air Quality Analysis

A total of Six (04) samples were collected from the project site, and the data were analyzed in the ECIL laboratory. All area categorically falls in the Industrial zone. Sample was collected in the Summer season (June, 2026).

The temperature and humidity were recorded at a range from 25.9 to 34.3 degree Celsius and 64 to 70%. All lab test report has been incorporated in annexure 1. According to the latest update Air Pollution Control Rules (APCR) on 26th July 2022, Schedule 1 (Ambient Air Quality Standards), PM₁₀, PM_{2.5}, NO_x, SO_x, O₃, and CO are considered as the priority air pollutants in Bangladesh. That's why, these parameters are recorded additionally CO₂ and analyzed to monitor the air condition in the project boundary. However, after analyzing the data, it has been observed that the value of all parameters in all location is below the BD standard (see graph 6.17).

6.3.7.1.1 PM_{2.5} & PM₁₀

The concentration of PM_{2.5} across the monitoring locations ranged from 49.56 µg/m³ to 60.32 µg/m³. The highest concentration (60.32 µg/m³) was recorded at AAQM-4 (South Side), while the lowest value (49.56 µg/m³) was observed at AAQM-2 (North Side). All measured values remain within the Bangladesh APCR 2022 standard of 65 µg/m³, but exceed the IFC EHS guideline value of 25 µg/m³ at all monitoring locations. The relatively elevated PM_{2.5} concentrations may be attributed to vehicular emissions, road dust resuspension, nearby construction activities, and localized commercial activities along the project corridor.

The concentration of PM₁₀ varied from 73.98 µg/m³ to 98.56 µg/m³. The highest concentration (98.56 µg/m³) was measured at AAQM-3 (East Side), while the lowest value (73.98 µg/m³) was recorded at AAQM-2 (North Side). All recorded values comply with the Bangladesh APCR 2022 standard of 150 µg/m³ but exceed the IFC EHS guideline value of 50 µg/m³. The elevated PM₁₀ levels are likely associated with traffic movement, roadside dust, exposed soil surfaces, and ongoing human activities within the project influence area.

6.3.7.2 SO₂ & NO_x

Nitrogen oxides (NO_x) concentrations ranged from 10.98 µg/m³ to 16.34 µg/m³. The highest concentration (16.34 µg/m³) was recorded at AAQM-3 (East Side), while the lowest value (10.98 µg/m³) was observed at AAQM-4 (South Side). All measured concentrations are well below both the Bangladesh APCR 2022 standard of 80 µg/m³ and

the IFC EHS guideline value of $200 \mu\text{g}/\text{m}^3$ (1-hour). The presence of NO_x is mainly associated with vehicle exhaust emissions and combustion activities in the surrounding area.

Sulfur oxides (SO_x) concentrations varied from $13.87 \mu\text{g}/\text{m}^3$ to $27.23 \mu\text{g}/\text{m}^3$. The highest concentration ($27.23 \mu\text{g}/\text{m}^3$) was recorded at AAQM 3 (East Side), while the lowest value ($13.87 \mu\text{g}/\text{m}^3$) was observed at AAQM-1 (West Side).

All measured values comply with the Bangladesh APCR 2022 standard of $80 \mu\text{g}/\text{m}^3$. However, the concentration at AAQM-3 exceeds the IFC EHS guideline value of $20 \mu\text{g}/\text{m}^3$, indicating localized influence from fuel combustion sources, vehicular emissions, or nearby commercial activities. Overall, SO_x levels remain relatively low and do not indicate significant sulfur related air pollution.

6.3.7.3 Carbon monoxide (CO)

Carbon monoxide (CO) concentrations ranged from $0.67 \text{ mg}/\text{m}^3$ to $1.54 \text{ mg}/\text{m}^3$. The highest concentration ($1.54 \text{ mg}/\text{m}^3$) was recorded at AAQM-3 (East Side), while the lowest value ($0.67 \text{ mg}/\text{m}^3$) was observed at AAQM-2 (North Side). All measured values are significantly below the Bangladesh APCR 2022 standard of $5 \text{ mg}/\text{m}^3$, indicating that combustion-related emissions in the area are relatively low and do not pose any significant air quality concern. The observed CO levels are primarily influenced by vehicular traffic and localized fuel combustion sources.

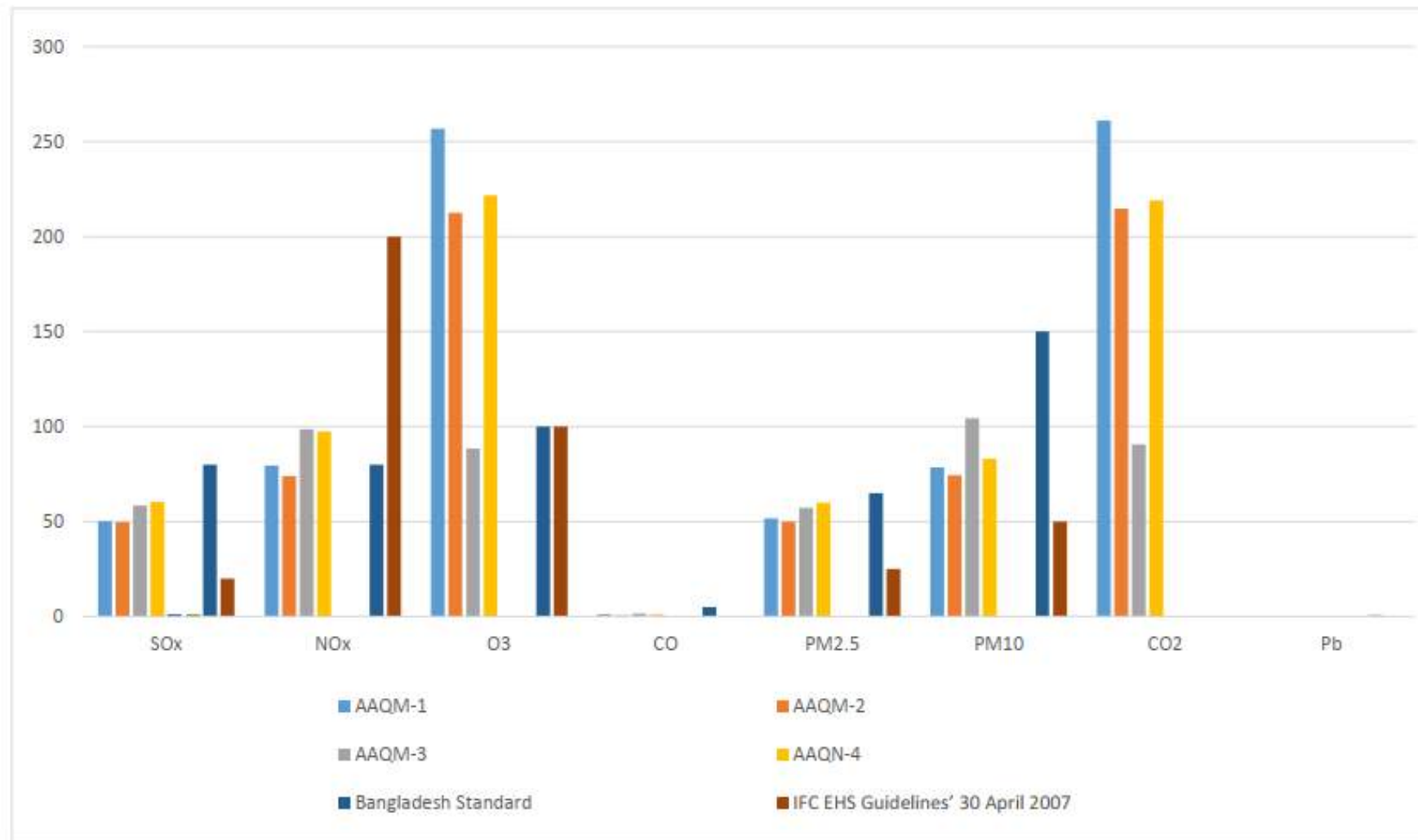


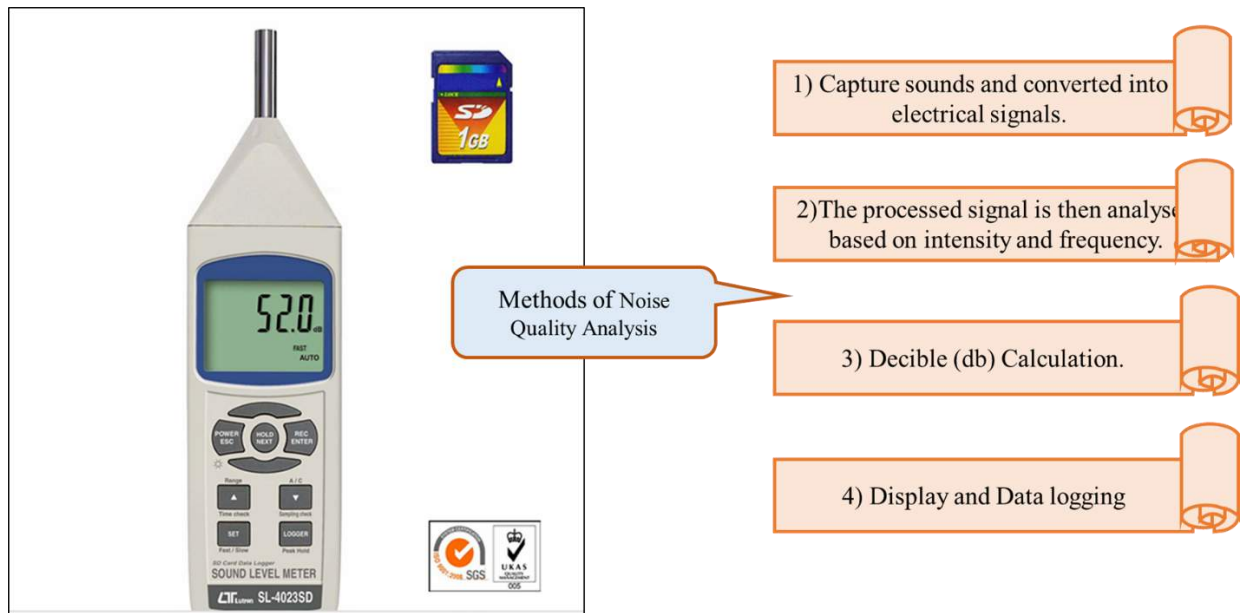
Figure 6-17: Scenario of Ambient Air Quality in the Project Site (Compare with BD & IFC Standard).

The significant reason behind remaining all the parameters within the BD standard level is illustrated as a tabular form in the following table:

Monitoring Points	Relevant Possible Reason as the sample has maintained the BD standard level
AAQM-1 to AAQM-4	All monitored air quality parameters remained within the Bangladesh APCR 2022 standard limits due to limited emission sources, moderate traffic movement, absence of major industries, use of cleaner fuels, presence of surrounding vegetation, and adequate natural dispersion of pollutants. In conclusion, all the parameters in the monitoring locations were observed within in the BD/DOE standard level which mean no negative aspects might be occurred in the project corridor.

6.3.8 Noise Quality

During the site visit, we have measure some noise level from the different site of the project area. Noise levels were recorded at eight (8) locations surroundings the project area during the sampling time. Noise levels were recorded in the form of sound pressure levels with the help of a digital sound level meter. The details of noise monitoring locations are given in following table. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations. These locations are chosen in such a way that a representative data could be recorded all over the block.



Sound Level Meter- 4023SD

Figure 6-18: Methods of Noise Quality Analysis.





Figure 6-19: Photography of Noise Quality Monitoring.

Table 6.14: Measured Noise Quality at the Project Site.

Location ID	Latitude & Longitude	Noise Level dB(A) Day			Noise Level dB(A) Night			Applicable Standard* dB(A) for Mixed Area	
		Max	Min	Avg	Max	Min	Avg	Day	Night
NQ-01	23°50'45.65"N, 90°31'11.04"E	58.7	44.2	53.33	50.4	34.6	43.44	60	50
NQ-02	23°50'46.06"N, 90°31'15.64"E	72.5	37.6	48.93	50.4	34.4	43.40	60	50
NQ-03	23°50'46.04"N, 90°31'19.86"E	70.4	45.3	54.89	50.7	44.2	48.12	60	50
NQ-04	23°50'41.54"N, 90°31'20.11"E	72.4	45.3	54.99	50.2	36.5	44.15	60	50
NQ-05	23°50'43.03"N, 90°31'15.44"E	69.8	37.4	50.87	50.1	34.2	43.74	60	50
NQ-06	23°50'46.23"N, 90°31'8.25"E	69.9	42.1	56.93	51.8	40.1	48.37	60	50
NQ-07	23°50'47.92"N, 90°31'14.48"E	72.2	38.5	49.51	50.4	33.6	44.08	60	50
NQ-08	23°50'45.07"N, 90°31'14.00"E	67.4	38.5	49.45	50.5	34.6	43.21	60	50

(Sampling Date: 11.06.2026. Performed by ESRD & CEL Team, WTB.)

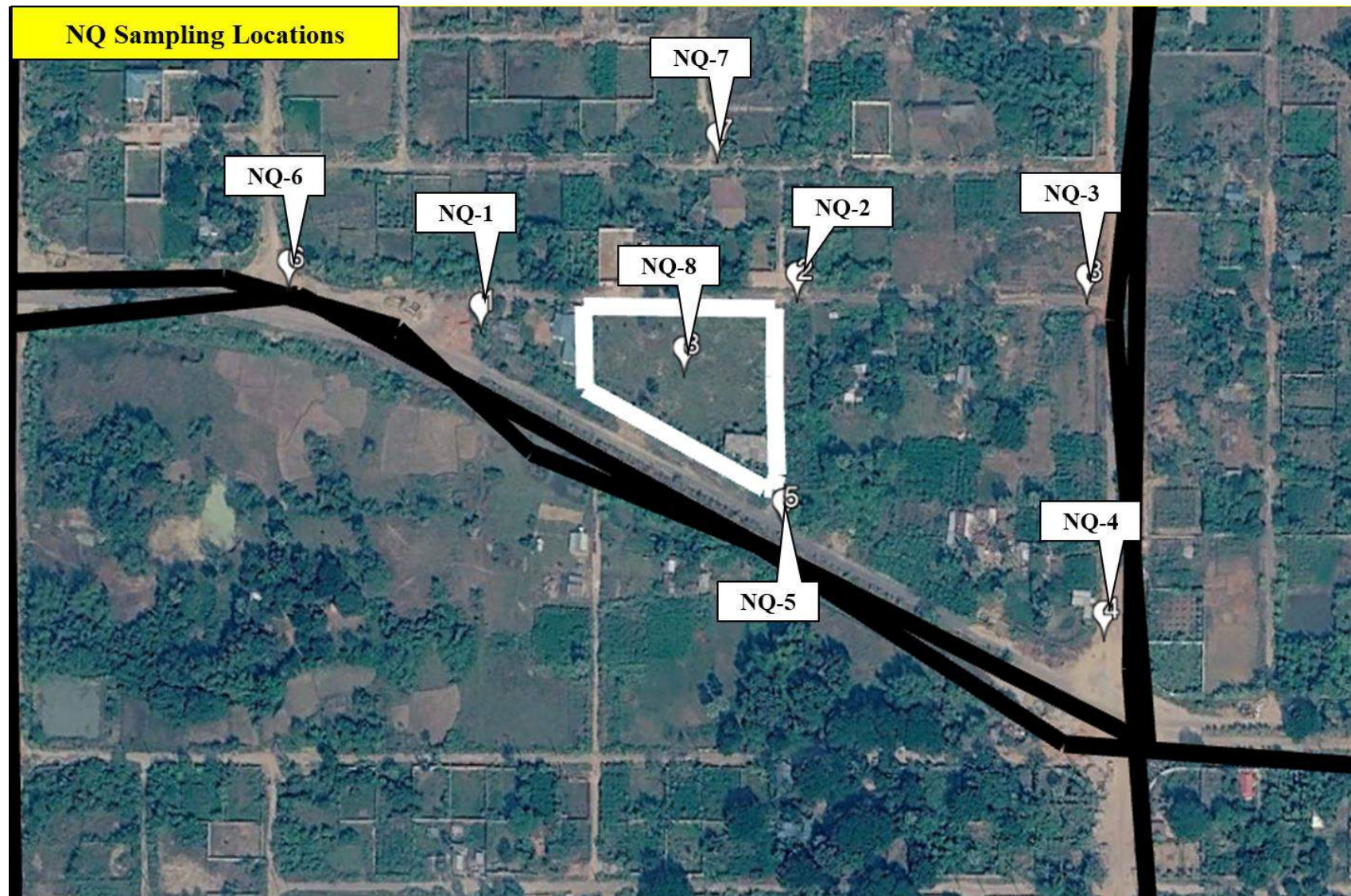


Figure 6-20: Noise Level Monitoring Sampling Points.

6.4 Biological Environment

IUCN, The World Conservation Union, has divided Bangladesh into 25 Bio-ecological Zones (Nishat et al, 2002) in the context of physiographic and biological diversity. The study area has fallen under bio-ecological zones of Brahmaputra-Jamuna Floodplain. The area (both directly and indirectly impacted area) occupies terrestrial as well as aquatic ecosystems. Each of the bio-ecological zones represents the overall ecological situation of an area of the country.

6.4.1 Flora

Flora relates to all aquatic and terrestrial based plants. Plants are vital for ecosystem function and are used as resources for human food, shelter, clothing and other products. Construction and developments often have the potential to impact flora. Potential impacts to flora can include:

- a reduction in diversity,
- a change in species composition and the destruction of plant life, species or communities, and/or
- Changes to species, population distribution or health.

The project area a wide variety of jute, aus, transplanted and broadcast aman as well as rabi crops are producing extensively. On the highest platforms, banana, betel leaf, sugarcane and vegetables are major crops, together with aus, jute and transplanted aman. On lower platforms the latter are major crops in the monsoon season and vegetables in the dry season. Among rice crops boro covers the largest area followed by aman and aus. Other crops include wheat, potato, pulses, sweet potato, spices, cheena, kaun etc. The groves that surround the village homesteads represent various types of commonly planted trees. These are mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*), kalojam (*Syzygium cumini*), betelnut pulm (*Areca catechu*), coconut palm (*cocos nucifera*), guava (*Psidium guajava*), jambura (*Citrus decumana*), mandar (*Erythrina veriegata*), kadam (*Anthocephalus cadamba*), sheelkoroy (*Albizia procera*), sajna (*Moringa obifera*), dalim (*Punica granatum*), palash (*Butea monosperna*), etc. Common way side trees are tetul (*Tamaraindus indica*), neem (*Azadirachta indica*), hijol (*Barringtonia acutangula*), banyan (*Ficus bengalensis*), ashatha (*Ficus religlosa*), raintree (*Samanca saman*), pitraj (*Aphanamixls polystachia*), simul (*Bobbax ceiba*), krishnachura (*Delonix regia*), debdaru (*Polyalathia longifolia*), etc.

Moreover, some vegetations like kachuripana (*Telanthera philoxeroides*), topapana (*Pistiastratioteslemna spirodela*), khudipana (*Lemnapau cicastata*), paniphal (*Trapabispinosa*), etc. are seen in different ponds of the district. And in the shallower waters are found species of shapla, padma, kalmi, helencha and the like. Besides, various herbs, shrubs and thickets along with some climbers and twiners are seen in the village homesteads of this district. Few epiphytes and parasites on the large trees are not uncommon. People with aesthetic values grow some flower plants at their homestead.

a. Flora

Homestead vegetation at the Project site is in well condition and bearing the important of plant community in terms of diversity. Most of the houses are vegetated by local cultivated plants and a big portion of the coverage occupied by wild shrubs and herbs. Common planted tree species are Aam (*Mangifer aindica*), Kathal (*Artocarpusheterophyllus*), Tal (*Borassusflabelifer*), Sissoo (*Swietenia asissoo*), Supari (*Areca catechu*), Mehogani (*Swietenia mahagoni*), Kola (*Musa sp*), Boro (*Zizyphus mauritiana*), Narikel (*Cocos nucifera*) and Supari (*Areca catechu*) occupied the top canopy. Among the shrubs Kachu (*Colocasiaesculenta*) is the most common of all species. This type of vegetation has a major contribution for meeting food, fodder, medicine, fuel and other household requirements to the local people. Homesteads vegetation also supports good shelter for many wildlife species. There is no act affecting to vegetation, during both construction and operation. Types of crops on the char are very common species such as wheat, paddy, beans etc. The plant species are provided with their abundance and usage in the following Table.





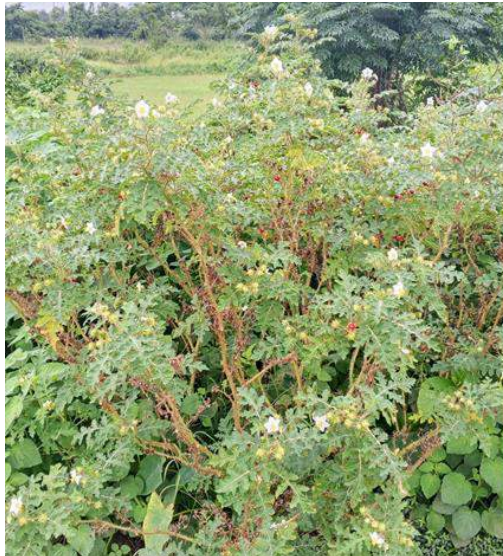




Figure 6-21: Photographs showing the vegetation in and around the study area.

Table 6.15: Floral Status with Distribution, Abundance and Usage at the Study Area.

SN	Scientific Name	Family	Local Name	Local Status	IUCN Status	Usage	Habit
Plant species in GLHLCU surrounding area							
1.	<i>Aegle marmelos</i>	Rutaceae	Bel	R	LC	Fruit and Medicine	Tree
2.	<i>Areca catechu</i>	Palmae	Supari	VC	LC	Fruit and Timber	Tree
3.	<i>Artocarpus heterophyllus</i>	Moraceae	Kathalnim	C	LC	Fruit, Timber and fuelwood	Tree
4.	<i>Azadirachta indica</i>	Meliaceae		C	LC	Timber and medicine	Tree
5.	<i>Borassus flabellifer</i>	Palmae	Tal	R	LC	Fruit, Fuel wood and Timber	Tree
6.	<i>Carica papaya</i>	Caricaceae	Papay	C	LC	Fruit	Shrub
7.	<i>Cocos nucifera</i>	Palmae	Narikel	VC	LC	Fruit and Fuelwood	Tree
8.	<i>Litchi chinensis</i>	Sapindaceae	Lichu	C	LC	Fruit	Tree
9.	<i>Mangifera indica</i>	Anacardiaceae	Aam	VC	LC	Fruit and Timber	Tree
10.	<i>Psidium guajava</i>	Myrtaceae	Peyara	C	LC	Fruit	Shrub
11.	<i>Swietenia mahagoni</i>	Meliaceae	Mahogoni	VC	LC	Timber and medicine	Tree
12.	<i>Syzygium cumini</i>	Myrtaceae	Kaloram	C	LC	Fruit	Tree
13.	<i>Zizyphus mauritiana</i>	Rhamnaceae	Baroi	C	LC	Fruit	Tree
14.	<i>Cynodon dactylon</i>	Gramineae	Durba	VC	LC	Grass	Herb
15.	<i>Colocasia esculenta</i>	Araceae	Kachu	C	LC	Vegetable	Herb
16.	<i>Acacia auriculiformis</i>	Mimosaceae	Akashmoni	C	LC	Timber	Tree
17.	<i>Albizia lebbek</i>	Mimosaceae	Kalokoroi	C	LC	Timber	Tree
18.	<i>Averrhoa carambola</i>	Averrhoaceae	Kamranga	C	LC	Fruit	Tree
Local status: VC – Very Common, C – Common, R – Rare, VR – Very rare							
IUCN status: VU-Vulnerable, NT-Near Threatened, LC-Least Concern							

6.4.2 Fauna

During the construction phase, potential impacts to fauna may come from:

- i) disturbance of individual animals.
- ii) localized decline in the quality of habitat (removal of original plants); and
- iii) Poaching of edible animals and birds by construction workers using equipment and machines.

The present floristic status of projected area is given below-

6.4.2.1 Mammals

The following table provides the name and ecological condition of mammals at the project side.

Table 6.16: List of Mammals at Project Surrounding Area.

SN	Scientific Name	Common Name	IUCN status	Occurrence of species		
				Primary Survey	Local people consultation	Published Literature
1	Scotozous dormeri	Dormer's Bat	LC		√	
2	Rattus rattus	House Rat	LC	√		
3	Mus musculus	House Mouse	LC		√	
4	Suncun murinus	House shrew	LC		√	
5	Platanista gangetica	River Dohin	EN		√	
IUCN Status code: CR – Critically Endangered, EN - Endangered, VU – Vulnerable, LC- Least Concern						

6.4.2.2 Birds

The common birds of the district include DOEL (*Copsychus saularis*), bhatshalik (*Acridotheres tristis*), tilaghugu (*Streptopelia chinensis*), tia (*Psittacula krameri*), babui (*Ploceus philippinus*), sparrow or charui (*Domesticus*), house crow (*Corvus splendens*), brahminy kite (*Haliaeetus*), cacatua (greater sulphur crested), machhranga (*Alcedo*), pond heron (*Ardeola lagrayi*), little cormorant (*Phalacrocorax*), cuckoo (*Cuculus micropterus*), kali pencha (*Glaucidium*), chotofingey (*Dicrurus macrocerus*), haldeypakhi (*Oriolus chinensis*), laxmipencha (*Tyto alba*), water rail (*Rallusa quaticus*), lesser whistling teal (*Dendrocygna vanica*), dahuk (*Amaurornis phoenicurus*), spotted munia (*Lonchura punctulata*), kaththokra (*Picus myrmecophonus*), etc.

Table 6.17: List of Birds at the Site.

SN	Scientific Name	English Name	Local Name	IUCN Status	Local Status	Birdlife Status	Occurrence of Species	
							Primary Survey	Local people consultation
1	Corvus splendens	House Crow	PatiKak	LC	CR	LC	Seen	√
2	Acridothera tristis	Common Myna	Bhat Shalik	LC	CR	LC	Seen	√
3	Passer domesticus	House Sparrow	PatiChorui	LC	CR	LC		√
4	Copsychus saularis	Oriental Magpie-Robin	UdoiDOEI	LC	CR	LC		√
5	Columba livia	Common Pigeon	Gola Paira	LC	CR	LC		√
6	Ardeola grayii	Indian Pond Heron	DeshiKanibok	LC	CR	LC	Seen	√
Local status: VC – Very Common, C – Common, R – Rare, VR – Very rare								
IUCN status: VU-Vulnerable, NT-Near Threatened, LC-Least Concern								

Besides, many migratory birds visit the district during winter season. They are mainly seen in wet land areas. However, some of them are also seen in this district. These include common pochard (*Aythya ferina*), plover (*Charadrius leschenaultianus*), herring gull (*Larus argentatus*), marsh harrier (*Circus aeruginosus*), common tern (*Sterna hirsuta*), tufted duck (*Aythya fuligula*), little ringed plover (*Charadrius dubius*), grey laggoose (*Anser anser*), common teal (*Nettion coromandelianus*), pintail (*Anas platyrhynchos*), common shelduck (*Tadorna ferruginea*), brahminy duck (*Fadorna farruginea*), pintailed snipe (*Gallinago stenura*), fantail snipe (*Gallinago gallinago*), tree pipit (*Anthus hodgsoni*), brown shrike (*Lanius cristatus*), grey wagtail (*Motacilla cinerea*), common sand piper (*Tringa hypoleucos*), large pariah kite (*Milvus migrans lineatus*), common swallow (*Hirundo rustica*), etc.

6.4.2.3 Reptiles and Amphibians

Some known reptiles of this District are ganges soft shell (*Trionyx gangeticus*), common roofed turtle (*Kachuga galapaga*), yellow turtle (*Morenia petersi*), shanda (*Gekko gecko*), house lizard (*Hemidactylus brooki*), gharginishap (*Lycodon jaya*), rat snake (*Ptyas nigromarginatus*), painashap (*Enhydra hydrys*), banded krait (*Bungarus fasciatus*) and common cobra (*Naja naja*). Common amphibians include bull frog (*Rana tigrina*), skipper

frog (*Rana cyanophlyctis*), cricket frog (*Rana limnocharis*) and common toad (*Bufo melanostictus*).

Table 6.18: List of Amphibians at the Site.

SN	Scientific Name	English Name	Local Name	Family	IUCN	Local	Occurrence of species		
					Status	Status	Primary Survey	Local people consultation	Published Literature
1	<i>Duttaphrynus</i>	Common	Kunjo	Bufo	LC	CR			
	<i>melanostictus</i>	Toad	Bang				√		
2	<i>Fejervarya limnocharis</i>	Cricket Frog	Jhijhi Bang	Dicroglossidae	LC	C		√	
Local Status code: CR-Common Resident, C-Common, UR-Uncommon Resident, RR-Rare Resident, V-Vagrant, WV-Winter Visitor; UWV-Uncommon Winter Visitor IUCN Status code: CR – Critically Endangered, EN - Endangered, VU - Vulnerable, LC - Least Concern									

Table 6.19: List of reptiles at the Site.

SN	Scientific Name	English Name	Local Name Family	IUCN Status	Local Status	Occurrence of species		
						Primary Survey	Local people consultation	Published Literature
1	<i>Pangshura tectum</i>	Indian Roofed Turtle	Kori/Hali Kasim	-	C		√	
2	<i>Hemidactylus brookii</i>	Brooks House Gecko	Tiktiki	LC	CR	√		
3	<i>Varanus bengalensis</i>	Bengal Monitor	GuiShap	LC	CR		√	
4	<i>Xenochrophis scator</i>	Checker ed Keelback	DhoraShap	LC	C		√	

6.4.2.4 Fishes

Different water bodies like rivers, canals, beels and ponds constitute habitats for fish population. The common fishes that are usually found here are ruhi (*Labeoruhita*), mrigel (*Cirrhinus mrigala*), katla (*Catla catla*), kalbaush (*Labeo calbasu*), chital (*Notopterus chitala*), pabda (*Ompok pabda*), pangas (*Pangasius pangasius*), shing (*Heteropneustes*

fassilis), magur(*Clarias batrachus*), koi (*anabas testudineus*), boal(*Wallagoattu*), gazar(*Channama ruius*), shoil(*Channas triaxtus*), tengra(*Mystusvittatus*), sharpuni (*Puntius sarana*), phali(*Notopterus notopterus*)etc. In addition, some exotic variety of fishes like tilapia (*Oreochromis mossumbicus*), nailotica(*Oreochromisnailoticus*), grass carp (*Cteopharyn godonidella*) and mirror carp (*Cyprinuscaurio*) have also become popular in this area.

Table 6.20: List of Fish Observed nearest Waterbody of the study area.

SN	Scientific Name	Local Name	Common English name	IUCN status
1	<i>Puntius ticto</i>	Puti	Ticto Barb	LC
2	<i>Labiorohita</i>	Rui	Rohu	LC
3	<i>Catlacatla</i>	Catla	Katla	LC
4	<i>Mystusvittatus</i>	Tangra	Striped dwarf Catfish	LC
5	<i>Barbonymusgonionotus</i>	Sorputi	Olive Barb	LC
6	<i>Anabustestudineus</i>	Koi	Climbing Perch	LC
7	<i>Channastrata</i>	Shol	Snakehead murrel	LC
8	<i>Macrobrachiumrosenbergii</i>	Galdachingri	Tiger prawn	LC
9	<i>Oreochromismossambicus</i>	Telapia	Mozambique tilapia	LC
10	<i>Hypophthalmichthys Molitrix</i>	Silver carp	Silver carp	LC
11	<i>Pangasiuspangasius</i>	Pangas	Yellowtail catfish	LC
12	<i>Rita rita</i>	Rita	Rita	LC
13	<i>Sperataseenghala</i>	Air	Giant river-catfish	LC
14	<i>Lepidosephalusguntia</i>	Gutum	Guntia Loach	LC
15	<i>Ompokpabda</i>	Pabda	Pabo catfish	LC
16	<i>Channapanchtatus</i>	Taki	Spotted snakehead	LC
17	<i>Tenualosailisha</i>	Illish	Hilsa shad	LC
18	<i>Wallago attu</i>	Boal	Wallago	LC
19	<i>Awaousguamensis</i>	Baila	-	LC
20	<i>Labeobata</i>	Bata	Bata	LC
21	<i>Salmotomabacaila</i>	Chela	Large razorbelly minnow	LC
22	<i>Pseudapocryptes Elongates</i>	Chewa	-	LC
23	<i>Chitalachitala</i>	Chitol	Clown Knifefish	LC
24	<i>Mystuscavasius</i>	KabashiTengra	Gangetic mystus	LC
25	<i>Sicamugilcascasia</i>	Kechhki	Yellowtail mullet	LC
26	<i>Ailiichthyspunctata</i>	Kajuli	Jamunaailia	LC
27	<i>Catlacatla</i>	Katol	Catla	LC
28	<i>Amblypharyngodonmola</i>	Mola	Molacarpulet	LC

During the operational years, the most common impact is the reduction of faunal habitats by infrastructure development and associated industrial activities. Management measures include, development of alternative wildlife habitat sites by planting native flora leading to the support of a wide range of species including birds.



Figure 6-22: Photographs of Fish Species Observed in the Study Area.

6.5 Social Economic Condition

Overview

Rupganj Upazila (Narayanganj District) area 176.48 sq km, located in between 23°42' and 23°54' north latitudes and in between 90°28' and 90°37' east longitudes. It is bounded by Kaliganj (Gazipur) and Palash upazilas on the north, Sonargaon upazila on the south, Araihaazar and Narsingdi Sadar upazilas on the east, Demra, Khilgaon, Badda and Khilkhet Thanas on the west.

Population: Total 534868; male 279544, female 255324; Muslim 506423, Hindu 28179, Buddhist 40, Christian 164 and others 62.

Administration Rupganj Thana was turned into an upazila in 1983.

Upazila								
Municipality	Union	Mouza	Village	Population		Density (per sq km)	Literacy rate (%)	
				Urban	Rural		Urban	Rural
2	7	116	224	232356	302512	3031	49.8 (2001)	53.1
Kanchan Municipality								
Area (sq km)	Ward	Mahalla	Population	Density (per sq km)		Literacy rate (%)		
16.97	9	29	49468	2915		53.0		
Tarabo Municipality								
Area (sq km)	Ward	Mahalla	Population	Density (per sq km)		Literacy rate (%)		
19.39	9	21	150709	7773		56.3		
Upazila Town								
Area (sq km)	Mouza	Population	Density (per sq km)		Literacy rate (%)			
25.59 (2001)	9	32179	2795 (2001)		59.9			

Union				
Name of union and GO code	Area (acre)	Population		Literacy rate (%)
		Male	Female	
Kayet Para 55	6494	33580	32620	53.5
Golakandail 39	4587	33470	29277	55.3
Daudpur 31	6912	21901	20020	50.3
Bulta 15	2381	26596	23380	56.2
Bholaba 22	4259	16681	17327	49.8
Mura Para 63	2184	16946	15647	59.8
Rupganj 79	7222	24073	23173	51.2

Source: Bangladesh Population Census 2001 and 2011, Bangladesh Bureau of Statistics.

Water bodies: Main rivers: Shitalakshya, Balu.

Archaeological heritage and relics: Bajra Mosque, residence of Mura Para Zamindar, Mura Para Shahi Mosque, At-ani Mosque and Tara Mosque at Gandharbapur, Brahmangaon Jami Mosque, Golakandail Kalim Shah Jami Mosque.

War of Liberation: In 1971 the Pak army conducted mass killing and plundering; they also set many houses of the upazila on fire. On 21 November an encounter was held between the freedom fighters and the Pak army at Bholabo in which one freedom fighter was killed. The Rupasi Kanchan Road has been renamed as 'Shahid Bakul Road' in honor of his memory. Two memorial monuments have been built in the upazila.

Religious institutions: Mosque 290, temple 10, tomb 3. Noted religious institutions: Mura Para Shahi Mosque, Gandharbapur Ata-ani Mosque, Gandharbapur Tara Mosque, Brahmangaon Jami Mosque, Golakandail Kalim Shah Jami Mosque, Tomb and Mosque of Baba Saleh (1504).

Literacy rate and educational institutions: Average literacy 54.8%; male 57.5%, female 51.9%. Educational institutions: college 3, secondary school 27, primary school 82, collegiate school 1, vocational school 2, kindergarten 3, madrasa 47. Noted educational

institutions: Mura Para Degree College (1901), Mura Para Pilot High School (1901), Kanchan Bharat Chandra High School (1929).

Cultural organizations: Library 4, club 12, cinema hall 4, women organisation 7, playground 7.

Main sources of income: Agriculture 22.72%, non-agricultural labourer 3.14%, industry 9.19%, commerce 21%, transport and communication 6.58%, service 19.75%, construction 1.98%, religious service 0.18%, rent and remittance 3% and others 12.46%.

Ownership of agricultural land: Landowner 44.07%, landless 55.93%; agricultural landowner: urban 46.97% and rural 43.44%.

Main crops: Paddy, jute, wheat, sugarcane, mustard, vegetables.

Extinct or nearly extinct crops: Kaun, barley, china.

Main fruits: Mango, jackfruit, litchi, banana, papaya, blackberry, guava.

Fisheries, dairies and poultry: Fishery 84, dairy 8, poultry 90.

Communication facilities Roads: pucca 176.58 km, semi-pucca 148.74 km, mud road 388.66 km; waterway 43.47 km.

Extinct or nearly extinct traditional transport: Palanquin, bullock cart.

Noted manufactories: Rice mill, flour mill, Jute mill, cotton mill, paper mill, hosiery industry, bakery, bidi factory.

Cottage industries: Goldsmith, blacksmith, Muslin and Jamdani fabrics, weaving, brass and bell-metal work, wood work, embroidery.

Hats, bazars and fairs: Hats and bazars are 42, fairs 5, most noted of which are Kanchan Hat, Golakandail Hat, Bholaba Hat, Mura Para Hat, Tarabo Hat, Kanchan Mela, Mura Para Dashami Mela, Golakandail Mela, Paschimgaon Baul Mela and Sabaspur Kali Mela.

Main exports: Vegetables, hosiery goods, Muslin and Jamdani fabrics.

Access to electricity: All the unions of the upazila are under rural electrification net-work. However 93.1% of the dwelling households have access to electricity.

Natural resources: Natural gas has been detected at Kanta of this upazila.

Sources of drinking water: Tube-well 94.7%, tap 1.8% and others 3.5%.

Sanitation: 66.0% of dwelling households of the upazila use sanitary latrines and 31.9% of dwelling households use non-sanitary latrines; 2.1% of households do not have latrine facilities.

Health centers: Hospital 2, family planning centre 9, health complex 1, clinic 2, diagnostic centre 3.

NGO activities: Operationally important NGOs are BRAC, CARITAS, ASA, CARE, PIDIM.
[Khairul Alam Pulak]

References Bangladesh Population Census 2001 and 2011, Bangladesh Bureau of Statistics; Cultural survey report of Rupganj Upazila 2007.

Chapter-07

Impact Identification, Prediction, and Evaluation

7 Impact Identification, Prediction, and Evaluation

7.1 Introduction

This chapter presents the methodology adopted for identifying, predicting, and evaluating the potential environmental and socio-economic impacts associated with the proposed Green Life Hospital Ltd. (Cancer Unit) at Purbachal, Dhaka. The assessment considers both the construction phase and the operational phase of the project.

The objective of the impact assessment is to identify potential adverse and beneficial impacts arising from project activities and to evaluate their significance based on the sensitivity of environmental receptors and the magnitude of the anticipated impacts. The assessment has been conducted using baseline environmental data, field observations, stakeholder consultations, professional judgment, and applicable national and international guidelines.

Potential impacts have been categorized into physical, biological, socio-economic, occupational health and safety, and public health aspects. The assessment also considers cumulative and indirect impacts that may arise during the lifecycle of the project.

7.2 Impact Identification

Impact identification involves a systematic evaluation of project activities and their potential interactions with the surrounding environment. The objective is to identify all foreseeable environmental and social impacts that may occur during the construction and operation of the proposed hospital.

Literature Review and Desk Study: Relevant literature, environmental regulations, healthcare facility guidelines, previous environmental assessment reports, and published information on similar hospital projects were reviewed to identify potential environmental and social issues commonly associated with healthcare facilities.

Field Surveys and Baseline Data Collection: Site visits and environmental surveys were conducted to establish baseline conditions of the project area. The following environmental and socio-economic components were assessed:

- Ambient air quality;
- Surface water and groundwater conditions;
- Soil characteristics and existing land use;
- Noise environment;

- Traffic conditions and accessibility;
- Flora and fauna in and around the project site;
- Existing socio-economic conditions and nearby settlements;
- Presence of environmentally sensitive receptors.

Stakeholder Engagement: Consultations with local residents, nearby institutions, project representatives, and other stakeholders were conducted to understand existing concerns and expectations regarding the proposed development. Key issues raised included traffic management, construction-related disturbances, healthcare service accessibility, and environmental management.

Impact Checklists: A structured environmental checklist was used during field investigations to ensure comprehensive identification of potential impacts. The checklist covered the following areas:

- Air quality and dust generation;
- Noise and vibration;
- Surface water and drainage;
- Waste generation and management;
- Public health and safety;
- Occupational health and safety;
- Traffic and transportation;
- Visual and aesthetic impacts;
- Socio-economic benefits and community wellbeing.

7.3 Impact Prediction

Following the identification of potential impacts, an assessment was undertaken to predict the magnitude, extent, duration, and significance of each impact.

1. Quantitative and Qualitative Assessment:

Potential impacts associated with construction and operation activities were assessed using a combination of quantitative measurements and qualitative evaluation techniques.

Examples include:

- Prediction of dust and emissions from construction equipment and vehicles;
- Assessment of wastewater generation and treatment requirements;
- Estimation of healthcare waste generation and management needs;
- Prediction of traffic movement and associated impacts;

- Assessment of operational noise from generators, HVAC systems, and hospital activities.
- 2. **Expert Judgment:** Where numerical modelling was not required or feasible, experienced environmental professionals evaluated impacts based on project characteristics, baseline conditions, and comparable healthcare developments.
- 3. **Scenario Analysis:** Different project scenarios were considered to evaluate potential impacts under varying operating conditions, including:
 - Normal hospital operation;
 - Peak patient and visitor occupancy
 - Emergency situations;
 - Construction activities.
- 4. **Stakeholder Considerations:** Community concerns identified during consultations were incorporated into the impact prediction process to ensure that potential effects on nearby residents and institutions were adequately considered.
- 5. **Compliance with Standards:** Predicted impacts were evaluated against applicable national regulations, including:
 - Bangladesh Environmental Conservation Act, 1995;
 - Environmental Conservation Rules, 2023 (as amended);
 - Medical Waste Management Rules and Guidelines;
 - National Building Code;
 - Relevant international good practices and healthcare environmental management guidelines.

7.4 Impact Evaluation

The significance of identified impacts was evaluated based on the magnitude of impact and the sensitivity of the affected environmental or social receptor. This approach enables prioritization of mitigation measures and environmental management actions.

7.4.1 Magnitude and Sensitivity:

Each impact was assessed based on: Magnitude (extent, duration, intensity, and scale of impact); and Sensitivity of the affected receptor (human health, air quality, water resources, ecological resources, community infrastructure, etc.). The classification helps determine the severity of each impact.

Table 7.1: Parameters for determining magnitude.

Category	Consequence Level	Impact Level
Major	4	Lasts for 20 years or more.
Moderate	3	Lasts for 10-20 years.
Minor	2	Lasts for 3 years or less.
Minimal	1	Temporary impacts with no lasting effects.

Table 7.2: Criteria for determining sensitivity.

Sensitivity	Ranking	Definition
Very High	4	Little opportunity for mitigation.
High	3	Limited opportunity for mitigation
Moderate	2	Moderate opportunity for mitigation
Low	1	High opportunity for mitigation.

Significance Calculation: The significance of an impact is determined using the formula:

$$\text{Impact Significance} = \text{Magnitude} \times \text{Sensitivity}$$

Table 7.3: Significance of Impact Criteria.

Sensitivity	Magnitude			
	Very High (4)	High (3)	Medium (2)	Minor (1)
Very High (4)	16	12	8	4
High (3)	12	9	6	3
Moderate (2)	8	6	4	2
Minor (1)	4	3	2	1
13-16	Extreme- Beneficial	Positive Activity of the Project		
13-16	Extreme- Adverse	Activity should not be proceeded in current form.		
8-12	High	Activity should be modified to include some remedial planning		
4-6	Moderate	Activity can operate subject to management and for modification		
1-3	Low	No immense action required		

The prediction of impacts also includes the duration of impacts in terms of short-term or long-term, nature of impact, and reversibility of the impact. The criterion for impact assessment is illustrated in the Table.

Table 7.4: Impact Assessment Criteria.

Impact Characteristics	Categories
Nature of Impact	Positive: Any activities that significantly increases environmental, social and economic development. Negative: Any disruption, destruction or harmful alteration to any living plant or animal or to their habitat or ecological functions.
Duration of the Impact	Short term: Lasting only till the duration of the construction phase. Medium Term: Lasting from a few months to a year Long term: Lasting for a period much greater than medium term impacts.
Reversibility of the impact	Reversible: When a receptor resumes the impact Irreversible: When a receptor cannot resume the project impact.

7.4.2 Impact Significance Matrix:

A significance matrix has been used to evaluate and prioritize potential impacts associated with the project. The matrix combines impact magnitude and receptor sensitivity to determine the overall significance level.

The methodology facilitates identification of key environmental aspects requiring mitigation and management measures. Particular attention has been given to impacts associated with:

- Construction-related dust and noise;
- Wastewater generation and disposal;
- Medical and hazardous waste management;
- Traffic and transportation;
- Energy and water consumption;
- Occupational health and safety;
- Community health and safety;
- Socio-economic benefits and employment generation.

The significance matrix provides the basis for developing appropriate mitigation measures and environmental management plans to ensure that adverse impacts are minimized and beneficial impacts are enhanced throughout the project lifecycle.

Table 7.5: Impact Significance Matrix during Construction.

Environmental Aspect	Activities	Nature		Impact Type		Duration		Sensitivity	Magnitude	Significance
		Positive	Negative	Reversible	Irreversible	ST	LT			
Air Pollution	Dust generation from site clearing, excavation, earthworks, and transportation of construction materials		✓	✓		✓		2	1	Minor Adverse (2)
	Emissions from construction vehicles, generators, and machinery		✓	✓		✓		2	1	Moderate Adverse (4)
	Cement handling, mixing, and storage activities		✓	✓		✓		2	1	Minor Adverse (2)
Water Pollution	Surface runoff carrying sediments and construction debris during rainfall events		✓	✓		✓		2	2	Moderate Adverse (4)
	Improper disposal of wastewater from construction activities		✓	✓		✓		2	1	Minor Adverse (2)
Noise Pollution	Operation of construction equipment and machinery		✓	✓		✓		2	1	Minor Adverse (2)
	Movement of construction vehicles and material transportation		✓	✓		✓		2	2	Moderate Adverse (4)
Soil	Leakage or spillage of fuel, lubricants, and chemicals from machinery		✓	✓		✓		2	1	Minor Adverse (2)
	Improper management of construction waste and excavated materials		✓	✓		✓		1	2	Minor Adverse (2)
Ecosystem	Temporary disturbance to roadside vegetation and urban		✓	✓		✓		1	2	Minor Adverse (2)

Environmental Aspect	Activities	Nature		Impact Type		Duration		Sensitivity	Magnitude	Significance
		Positive	Negative	Reversible	Irreversible	ST	LT			
	green spaces due to construction activities									
	Dust and noise affecting local urban biodiversity		✓	✓		✓		1	2	Minor Adverse (2)
Occupational health and safety	Exposure of workers to dust, noise, construction hazards, and accidental injuries		✓	✓			✓	3	4	High Adverse (12)
	Working at height, electrical works, and operation of heavy equipment		✓	✓			✓	3	4	High Adverse (12)
Socio economic	Employment generation for local skilled and unskilled workforce	✓			✓		✓	3	4	High Beneficial (12)
	Increased business opportunities and local economic activities	✓			✓	✓		3	4	High Beneficial (12)
	Improvement of healthcare infrastructure and specialized cancer treatment facilities	✓			✓		✓	4	4	Extreme Beneficial (16)
	Enhanced access to quality cancer diagnosis and treatment services	✓			✓		✓	4	4	Extreme Beneficial (16)
	Improved public health and community well-being	✓			✓		✓	4	4	Extreme Beneficial (16)
	Temporary inconvenience due to construction activities and vehicle movement		✓		✓	✓		2	1	Minor Adverse (2)

Table 7.6: Impact Significance Matrix during Operation.

Environmental Aspect	Activities	Nature		Impact Type		Duration		Sensitivity	Magnitude	Significance
		Positive	Negative	Reversible	Irreversible	ST	LT			
Air Pollution	Emission from ambulance movement, staff vehicles, DG set operation and hospital utilities		✓	✓			✓	2	3	Moderate Adverse (6)
Water Pollution	Hospital wastewater, laboratory effluent and domestic sewage generation without proper treatment		✓		✓		✓	2	3	Moderate Adverse (6)
Noise Pollution	Noise from ambulance movement, generators, HVAC system and hospital operations		✓	✓			✓	1	3	Minor Adverse (3)
Soil	Improper disposal of biomedical waste, chemicals and sludge leakage		✓	✓			✓	1	3	Minor Adverse (3)
Ecosystem	Emission, noise, solid waste and effluent from hospital operation activities		✓	✓			✓	1	3	Minor Adverse (3)
Occupational health and safety	Exposure to infectious waste, needle injury, chemical handling and fire/electrical hazards		✓		✓		✓	3	4	High Adverse (12)
Biomedical Waste Management	Improper segregation, storage and disposal of infectious waste		✓		✓		✓	3	4	High Adverse (12)
Chemical Management	Improper storage and handling of laboratory chemicals and disinfectants		✓		✓		✓	2	3	Moderate Adverse (6)

Environmental Aspect	Activities	Nature		Impact Type		Duration		Sensitivity	Magnitude	Significance
		Positive	Negative	Reversible	Irreversible	ST	LT			
Socio economic	Employment generation for local skilled and unskilled workers	✓			✓		✓	4	4	Extreme Beneficial (16)
	Improved healthcare services and living standard improvement	✓			✓		✓	4	3	High Beneficial (12)
	Growth of pharmacy, diagnostics and local business activities	✓			✓		✓	4	4	Extreme Beneficial (16)
	Improved transport and emergency healthcare access	✓			✓		✓	3	3	High Beneficial (9)
	Improvement of road network and transport system.	✓			✓		✓	4	4	Extreme Beneficial (16)
	Increased patient flow causing local infrastructure pressure		✓		✓	✓		2	3	Moderate Adverse (6)

7.4.3 Mitigation Measures

For the GLHLCU project, all significant adverse environmental and social impacts identified during the impact assessment have been addressed through a set of structured and site-specific mitigation measures. The purpose of these measures is to prevent, minimize, or control potential environmental degradation and social disruption during both construction and operation phases.

The key mitigation measures proposed for the GLHLCU project are as follows:

- **Air Quality Management:** Regular water spraying on exposed surfaces, unpaved roads, and construction materials will be ensured to control dust emissions. All vehicles and construction equipment will be properly maintained to reduce exhaust emissions. Low-emission machinery will be encouraged where feasible. A green buffer zone with suitable plantation will be developed around the project boundary to further reduce dust and air pollution dispersion.
- **Water Environment Protection:** An appropriate wastewater treatment system (STP/ETP as applicable) will be installed to treat all domestic and process wastewater before discharge. Proper drainage systems will be developed to manage stormwater and prevent contamination of nearby water bodies. Strict prohibition will be maintained against discharge of untreated effluent into the environment.
- **Noise Control Measures:** Construction activities will be planned during daytime hours to minimize disturbance to surrounding receptors. All machinery will be equipped with proper silencers and maintained regularly. Temporary noise barriers will be installed in sensitive areas where required. Workers exposed to high noise levels will be provided with adequate PPE such as ear protection.
- **Ecological Protection and Landscaping:** Existing vegetation within the project area will be preserved as far as practicable. A structured plantation program using native species will be implemented to compensate for any unavoidable vegetation loss. Green landscaping within the project premises will be developed to enhance ecological balance and visual aesthetics.
- **Socio-Economic Enhancement Measures:** Priority will be given to local labor recruitment during construction and operation phases. The project will support local economic activities through indirect employment and service opportunities. Regular stakeholder consultations will be conducted to ensure community concerns are addressed in a timely manner.

These mitigation measures are integral components of the GLHLCU Environmental Management Plan (EMP) and are essential for ensuring environmentally sound and socially responsible project implementation.

7.5 Conclusion

The impact assessment for the GLHLCU project indicates both beneficial and adverse environmental and socio-economic implications.

The project is expected to generate significant positive impacts, particularly in terms of employment creation, improvement of local infrastructure, stimulation of economic activities, and enhancement of land value in the surrounding area. These benefits will contribute to overall regional development and improved socio-economic conditions.

On the other hand, potential adverse impacts are mainly associated with the construction phase and include temporary air and noise pollution, increased wastewater and solid waste generation, and minor disturbances to the local ecological and social environment. However, these impacts are largely temporary, localized, and reversible in nature.

With the implementation of the proposed mitigation measures, Environmental Management Plan (EMP), and continuous environmental monitoring, these negative impacts can be effectively minimized to acceptable levels.

In conclusion, the GLHLCU project is considered environmentally and socially feasible, provided that all mitigation measures and regulatory compliance requirements are strictly implemented throughout the project lifecycle.

Chapter-08

Environmental Impact and Mitigation Measure

8 Environmental Impact and Mitigation Measure:

The Environmental Impact and Mitigation chapter focuses on identifying the potential environmental impacts associated with the the GLHLCU project and proposing effective mitigation measures to reduce or eliminate these impacts. The potential impacts identified are based on the activities in both the construction and operation phases of the project. The chapter also presents strategies for minimizing these impacts to ensure compliance with environmental regulations and contribute to sustainable development

8.1 Impact on Air Quality

8.1.1 Construction Phase

The construction phase of the GLHLCU project will involve site preparation, excavation, earth filling, transportation and storage of construction materials, operation of construction machinery and generators, welding, painting, steel fabrication, and other civil works. These activities may generate fugitive dust, particulate matter (PM), and exhaust emissions from construction equipment and vehicles, resulting in temporary deterioration of ambient air quality within and around the project area.

The principal air quality concerns during construction are expected to arise from dust emissions associated with earthworks, material handling, stockpiling of construction materials, and vehicular movement on unpaved surfaces. In addition, combustion emissions from diesel-powered equipment and generators may contribute to localized increases in pollutants such as particulate matter (PM₁₀ and PM_{2.5}), nitrogen oxides (NO_x), sulfur dioxide (SO₂), and carbon monoxide (CO).

Given the temporary and localized nature of construction activities, the anticipated impacts on ambient air quality are expected to be short-term, reversible, and of moderate significance. Nevertheless, effective environmental management measures will be implemented to minimize emissions and ensure compliance with national environmental standards and good international industry practices.

Mitigation Measures:

To minimize adverse impacts on air quality during the construction phase, the following mitigation measures will be adopted:

- ✓ Regular water spraying will be carried out on exposed surfaces, excavation areas, construction roads, and stockpiles, particularly during dry and windy conditions, to suppress dust generation.

- ✓ Construction materials such as sand, soil, cement, and aggregates will be stored in designated areas and adequately covered to prevent wind-blown dust.
- ✓ Trucks transporting loose construction materials will be properly covered during transit.
- ✓ Vehicle movement within the project site will be regulated through designated routes and speed restrictions to minimize dust emissions.
- ✓ Construction debris and excavated materials will be promptly removed or stored in designated covered locations.
- ✓ All construction machinery, generators, and vehicles will be regularly inspected and maintained to ensure efficient operation and reduced exhaust emissions.
- ✓ Equipment and vehicles exhibiting excessive smoke emissions will not be permitted to operate on-site.
- ✓ Idling of construction vehicles and equipment will be minimized to reduce unnecessary fuel consumption and air emissions.
- ✓ Dust-generating activities, including material mixing and cutting operations, will be confined to designated work areas whenever practicable.
- ✓ Temporary barricades, screens, or protective enclosures will be installed around active construction zones where necessary to limit dust dispersion beyond the project boundary.
- ✓ Open burning of construction waste, vegetation, or any other materials will be strictly prohibited.
- ✓ Workers exposed to dust-generating activities will be provided with appropriate personal protective equipment (PPE), including dust masks and respirators where required.
- ✓ A green buffer zone and landscaping program will be developed around the project boundary and open spaces to improve local air quality and provide a natural barrier against airborne particulates.
- ✓ Periodic ambient air quality monitoring will be conducted throughout the construction period for key parameters, including PM_{2.5}, PM₁₀, CO, NO₂, and SO₂, to verify compliance with applicable environmental standards.
- ✓ Local stakeholders and nearby communities will be informed of major construction activities, and appropriate measures will be undertaken to minimize nuisance caused by dust and emissions.

With the implementation of the above mitigation measures, potential air quality impacts during the construction phase are expected to remain localized, temporary, and within acceptable environmental limits. Consequently, the residual impact on ambient air quality is anticipated to be minor and manageable.

8.1.2 Operation Phase

During the operational phase of the GLHLCU Cancer Hospital, impacts on ambient air quality are expected to be minimal. As a specialized healthcare facility, the project does not involve any industrial or large-scale emission sources; therefore, air quality impacts will mainly be limited to routine hospital operations.

Potential emission sources include standby diesel generators during power interruptions, internal vehicular movement (ambulances, staff, patients, and service vehicles), HVAC system operation, and minor emissions from healthcare waste handling and laboratory activities. These may generate small quantities of pollutants such as PM, NO_x, CO, and SO₂; however, emissions will be intermittent and localized.

Given the planned infrastructure with paved roads, organized traffic flow, proper parking facilities, and controlled hospital operations, vehicular emissions and associated air quality impacts are expected to remain low. Special attention will also be given to maintaining indoor air quality in sensitive areas such as operation theatres, ICUs, chemotherapy units, radiotherapy units, laboratories, and patient care areas through proper ventilation and air filtration systems.

Overall, the operational phase impacts on air quality are expected to be negligible to minor, localized, and well within acceptable environmental limits.

Mitigation Measures:

To ensure that air quality remains within acceptable standards during the operational phase of the GLHLCU Cancer Hospital, the following mitigation measures will be implemented:

- ✓ Standby diesel generators will be equipped with proper exhaust stacks and operated only during power failures and essential testing to minimize emissions.
- ✓ Regular maintenance and servicing of generators, HVAC systems, and other mechanical equipment will be carried out to ensure efficient operation and reduced pollutant release.
- ✓ Internal roads, parking areas, and access routes will be kept clean and well-maintained to prevent dust generation.

- ✓ Effective traffic management will be implemented to minimize congestion, unnecessary idling, and associated vehicle emissions within the hospital premises.
- ✓ Adequate parking facilities and organized vehicle circulation systems will be provided for ambulances, staff, patients, and visitors.
- ✓ Healthcare waste, pharmaceutical waste, and laboratory waste will be managed in compliance with applicable healthcare waste management guidelines to prevent odor and air contamination.
- ✓ Proper ventilation and high-efficiency air filtration systems will be maintained in critical areas such as operation theatres, ICUs, chemotherapy units, radiotherapy units, laboratories, and isolation wards to ensure optimal indoor air quality.
- ✓ Safe handling and storage procedures will be followed for medical gases, chemicals, and disinfectants to prevent accidental releases.
- ✓ Green landscaping and tree plantation within the hospital premises will be maintained to improve microclimate conditions and enhance local air quality.
- ✓ Periodic ambient air quality monitoring (PM_{2.5}, PM₁₀, NO_x, SO₂, CO) will be conducted to ensure compliance with national standards and verify the effectiveness of control measures.
- ✓ Environmental awareness and good housekeeping practices will be promoted among hospital staff and facility management personnel.

These measures will ensure that any potential air quality impacts remain minimal, localized, and well-controlled throughout the operational phase.

8.2 Impact on Water Resources

8.2.1 Construction Phase

During the construction phase of the GLHLCU Cancer Hospital, potential impacts on water resources may arise primarily from surface runoff carrying sediments, construction materials, oils, and other pollutants. Such runoff, if not properly managed, may lead to temporary deterioration of nearby surface water quality. In addition, dust deposition from construction activities and improper handling of materials may contribute indirectly to water contamination during rainfall events.

Although no existing natural water bodies are expected to be directly altered or diverted by the project, construction activities may still increase the risk of localized water pollution through uncontrolled runoff and poor site management. Therefore, effective preventive

measures are essential to protect surrounding surface and groundwater quality throughout the construction period.

Mitigation Measures:

To minimize potential impacts on water resources, the following mitigation measures will be implemented:

- ✓ **Excavation Management:** Excavation activities will be scheduled, as far as practicable, during dry weather conditions, and will be avoided during heavy rainfall to reduce erosion and sediment runoff.
- ✓ **Material Storage and Handling:** Construction materials, excavated soil, and debris will be stored in designated, covered, and well-contained areas to prevent washout during rainfall events.
- ✓ **Sediment and Runoff Control:** Silt fences, sediment traps, and barriers will be installed where necessary to prevent sediment-laden runoff from leaving the construction site.
- ✓ **Stormwater Management:** A properly designed stormwater drainage system will be implemented to collect, channel, and safely discharge runoff. Sediment control structures will be incorporated to reduce pollutant transport to surrounding areas.
- ✓ **Dust and Erosion Control:** Regular water sprinkling will be carried out on exposed surfaces and unpaved areas to minimize dust generation and reduce erosion potential.
- ✓ **Water Reuse and Conservation:** Water used for construction activities such as curing, equipment cleaning, and wheel washing will be reused wherever feasible to minimize freshwater consumption and wastewater generation.
- ✓ **Waste Management (3R Approach):** A structured waste management system based on the principles of Reduce, Reuse, and Recycle will be implemented. Construction waste will be properly segregated and disposed of in approved facilities to prevent contamination of land and water resources.
- ✓ **Sanitation Facilities:** Adequate temporary sanitation facilities will be provided for construction workers, and their proper maintenance will be ensured to prevent direct discharge of sewage into the environment.
- ✓ **Wastewater Management:** Domestic wastewater from labor camps will be treated through septic tanks and soak pits or other approved systems prior to disposal, ensuring no direct discharge into surface water bodies.

With the implementation of these measures, potential impacts on water resources during the construction phase of the GLHLCU Cancer Hospital are expected to be temporary, localized, and effectively manageable, ensuring protection of surrounding water quality and associated ecosystems.

8.2.2 Operation Phase

During the operational phase of the GLHLCU Cancer Hospital, water will be extensively used for patient care, sanitation, laboratory activities, housekeeping, laundry, kitchen operations, and other support services. Accordingly, wastewater will be generated from domestic sources as well as specialized healthcare activities, including laboratories, operation theatres, chemotherapy preparation areas, and diagnostic units. This wastewater may contain organic matter, suspended solids, disinfectants, trace chemicals, and pharmaceutical residues.

If not properly managed, such effluents may pose risks of localized contamination to surface and groundwater resources. However, the hospital will strictly ensure that no untreated wastewater is discharged into the environment at any stage. With the proposed advanced treatment systems in place, the potential impact on water resources is expected to be minor, controlled, and environmentally sustainable.

Mitigation Measures:

To ensure effective protection and sustainable management of water resources, the following measures will be implemented:

- ✓ **Integrated ETP–STP System:** A centralized Effluent Treatment Plant (ETP) and Sewage Treatment Plant (STP) will be installed to treat all hospital-generated wastewater, including domestic sewage and process effluents. The system will be designed in compliance with Department of Environment (DoE) standards.
- ✓ **Pre-treatment of Specialized Effluent:** Wastewater generated from laboratories, chemotherapy units, equipment cleaning, and other specialized healthcare activities will undergo appropriate pre-treatment (such as neutralization, disinfection, and chemical conditioning) before entering the main treatment system.
- ✓ **Zero Liquid Discharge (ZLD) System:** In addition to the ETP–STP system, a Zero Liquid Discharge (ZLD) facility will be implemented to ensure that no liquid effluent is released into the external environment. Treated wastewater will be

further processed through advanced treatment technologies (such as filtration, membrane systems, or evaporation) and fully reused within the facility.

- ✓ **Water Reuse and Recycling:** Recovered water from the treatment system will be reused for non-potable purposes such as landscaping, flushing, cleaning, and other utility services, thereby minimizing freshwater demand.
- ✓ **Stormwater Management:** A properly designed stormwater drainage system will be developed to collect runoff from roofs, roads, and open areas. Sediment control measures and oil/grease traps will be installed where necessary to prevent contamination.
- ✓ **Rainwater Harvesting System:** The hospital will incorporate rainwater harvesting and storage systems to collect rooftop runoff for reuse in non-potable applications, contributing to water conservation and reducing stormwater load.
- ✓ **Water Conservation Measures:** Water-efficient fixtures and sustainable water management practices will be implemented throughout the hospital to reduce overall consumption and wastewater generation.
- ✓ **Monitoring and Compliance:** Regular monitoring of influent and treated effluent quality will be conducted to ensure the effective performance of the ETP–STP–ZLD system and compliance with applicable environmental standards.
- ✓ **Good Housekeeping Practices:** Proper spill control, drainage maintenance, and safe chemical handling procedures will be maintained to prevent accidental contamination of the water system.

With the implementation of the integrated ETP–STP system, ZLD facility, rainwater harvesting, and comprehensive water management practices, the GLHLCU Cancer Hospital will achieve highly sustainable water resource management. As a result, the operational impact on water resources will remain negligible, fully controlled, and environmentally sound.

8.3 Noise and Vibration

8.3.1 Construction Phase

During the construction phase of the GLHLCU Cancer Hospital, noise and vibration will be generated from site preparation activities, excavation, construction works, operation of heavy machinery, material transportation, and use of generators and other equipment. These activities may result in temporary increases in ambient noise levels within and around the project site.

However, it is important to note that the project site is located in an area where surrounding residential settlements and permanent built-up structures are currently limited or yet to be significantly developed. As a result, the number of sensitive noise receptors in the immediate vicinity is low. Therefore, the overall noise impact on surrounding communities is expected to be minimal and localized in nature.

The primary noise exposure will be limited to on-site workers, which may result in temporary discomfort, communication difficulties, fatigue, and occupational health risks if not properly managed. Nevertheless, these impacts are considered short-term and reversible, confined mainly to the active construction phase.

Mitigation Measures:

To minimize noise and vibration impacts during construction, the following measures will be implemented:

- ✓ All construction equipment and machinery will comply with the noise standards prescribed by the Department of Environment (DoE), Bangladesh.
- ✓ Regular maintenance of vehicles, generators, and machinery will be carried out to ensure smooth operation and reduced noise generation.
- ✓ High-noise construction activities will be restricted to daytime hours to minimize disturbance.
- ✓ Noise-generating equipment will be fitted with silencers, mufflers, and acoustic enclosures wherever feasible.
- ✓ Temporary noise barriers will be installed around high-intensity activity zones if required.
- ✓ Workers exposed to high noise levels will be provided with appropriate PPE such as earplugs and earmuffs, and their use will be enforced.
- ✓ Occupational health monitoring, including hearing assessment for workers in high-noise areas, will be conducted periodically.
- ✓ Regular noise monitoring will be carried out at the site boundary to ensure compliance with applicable standards.
- ✓ Traffic movement of heavy vehicles will be managed and scheduled to reduce unnecessary noise generation.

With the above measures in place, construction-related noise impacts are expected to remain temporary, localized, and of low significance due to the absence of significant nearby sensitive receptors.

8.3.2 Operation Phase

During the operational phase of the GLHLCU Cancer Hospital, noise generation will mainly arise from routine hospital activities such as movement of ambulances, patient and visitor vehicles, operation of standby diesel generators, HVAC systems, elevators, air compressors, medical equipment, and internal service activities (e.g., laundry, kitchen, and waste handling).

Given the nature of the facility as a healthcare institution, no industrial production activities will be carried out. Although noise will be generated from the above-mentioned sources, it is expected to remain localized, intermittent, and within acceptable limits.

It is also noted that the surrounding area is not yet densely developed with residential or sensitive institutional receptors, which further reduces the potential for significant off-site noise impacts. The primary exposure will be limited to hospital users, staff, and on-site workers.

However, special attention is required to maintain a calm and controlled acoustic environment, particularly in sensitive areas such as operation theatres, intensive care units, chemotherapy units, wards, and patient recovery zones where low-noise conditions are essential for patient comfort and recovery.

Mitigation Measures:

To ensure effective noise control during the operational phase, the following measures will be implemented:

- ✓ Standby diesel generators and mechanical equipment will be installed with acoustic enclosures and proper silencers to minimize noise emissions.
- ✓ Regular maintenance of HVAC systems, generators, elevators, and other mechanical equipment will be carried out to ensure smooth and low-noise operation.
- ✓ Generator operation will be restricted to emergency use and scheduled testing only.
- ✓ Internal traffic movement will be properly managed to avoid unnecessary vehicle congestion and idling within the hospital premises.
- ✓ Ambulance movement routes will be planned to minimize noise disturbance to sensitive hospital zones.
- ✓ High-noise equipment areas (e.g., generator rooms, mechanical rooms, laundry units) will be acoustically treated where necessary.

- ✓ Adequate landscaping and green buffer zones will be maintained within the hospital premises to help attenuate noise and improve the overall environment.
- ✓ Hospital staff working in high-noise areas will be provided with appropriate hearing protection where required.
- ✓ Routine noise monitoring will be conducted within the hospital premises to ensure that noise levels remain within acceptable standards, particularly in patient care and critical treatment areas.
- ✓ Preventive maintenance and good housekeeping practices will be followed to avoid vibration and noise from malfunctioning equipment.

Through the implementation of these measures, operational noise impacts of the GLHLCU Cancer Hospital are expected to remain low, localized, and well within acceptable environmental and occupational standards, ensuring a quiet and healing environment for patients as well as a safe working condition for staff.

8.4 Impact on Land Resources

8.4.1 Construction Phase

During the construction phase of the GLHLCU Cancer Hospital, impacts on land resources will be minimal as the project site is already a well-developed and established land area. No major land filling, large-scale earthworks, or alteration of natural topography will be required for project implementation.

Construction activities will mainly involve foundation works, structural development, utility installation, and internal site arrangements. Therefore, changes to existing landform or geological conditions are expected to be negligible and confined only to localized and temporary surface disturbances.

Since the site does not involve undisturbed natural terrain, impacts related to topography, erosion, or slope instability are not significant under normal conditions.

However, minor risks to soil quality may still arise from movement of construction machinery, storage of materials, and accidental spillage of fuel, oil, or construction-related chemicals. If not properly managed, these may lead to localized soil contamination within the project boundary.

To ensure protection of land resources, the following mitigation measures will be implemented:

- ✓ **Minimal Earth Disturbance:** Construction will be carried out within the already developed site footprint, avoiding unnecessary excavation or land modification.

- ✓ **Topsoil Management (if applicable):** Any available topsoil from landscaped or green areas will be carefully preserved and reused for landscaping purposes.
- ✓ **Controlled Material Storage:** Construction materials, fuel, and chemicals will be stored in designated, covered, and impermeable areas to prevent soil contamination.
- ✓ **Equipment Maintenance:** Regular maintenance of vehicles and machinery will be ensured to prevent oil and fuel leakage.
- ✓ **Spill Prevention and Response:** A spill management plan will be implemented, including availability of spill kits and trained personnel for immediate response.

Regarding drainage, only minor temporary disruptions may occur due to construction activities within the existing developed site. These impacts will be short-term and easily manageable through proper site planning.

- ✓ **Proper Drainage Management:** Existing drainage systems will be maintained and, where necessary, improved to ensure uninterrupted surface runoff.
- ✓ **Good Housekeeping Practices:** Construction debris and materials will be properly managed to avoid blockage of drains.
- ✓ **Localized Protection Measures:** Temporary measures will be applied only where construction activities directly interact with drainage points.

Overall, since the project is located on an already developed site with no requirement for major land alteration, the impacts on land resources during the construction phase of the GLHLCU Cancer Hospital are expected to be negligible, localized, and temporary, with no long-term adverse effect on landform or geology.

8.4.2 Operation Phase

During the operational phase of the GLHLCU Cancer Hospital, impacts on land resources are expected to be minimal due to the absence of industrial activities. However, minor risks to soil quality may arise from routine hospital operations such as movement of vehicles, maintenance activities, storage and handling of chemicals, pharmaceuticals, and generation of solid and biomedical waste.

Improper management of biomedical waste, laboratory chemicals, disinfectants, or accidental leakage of fuel and oils from standby generators and service vehicles may lead to localized soil contamination within the hospital premises if not properly controlled. Therefore, proper environmental management practices will be essential to prevent any deterioration of soil quality.

In addition, increased impervious surfaces such as buildings, internal roads, parking areas, and paved walkways may slightly increase surface runoff, which requires proper drainage planning to avoid water stagnation and localized land degradation.

Mitigation Measures:

To minimize potential impacts on land resources during the operational phase, the following measures will be implemented:

- ✓ **Proper Waste Management System:** Biomedical waste, hazardous waste, laboratory waste, and municipal solid waste will be segregated, stored, handled, and disposed of in accordance with Department of Environment (DoE) and healthcare waste management guidelines to prevent soil contamination.
- ✓ **Safe Storage and Handling of Chemicals:** Pharmaceuticals, disinfectants, laboratory reagents, and cleaning chemicals will be stored in designated, secured, and impermeable areas with spill control provisions.
- ✓ **Leak Prevention and Maintenance:** Regular inspection and maintenance of standby generators, fuel storage systems, and service vehicles will be conducted to prevent leakage of oil or fuel onto soil surfaces.
- ✓ **Zero Liquid Discharge (ZLD) Integration:** The hospital will adopt an integrated wastewater treatment approach (ETP–STP with ZLD system), ensuring that no untreated effluent is discharged into the environment, thereby preventing indirect soil and groundwater contamination.
- ✓ **Stormwater and Drainage Management:** A properly designed stormwater drainage system will be implemented to collect and safely discharge runoff from roofs, roads, and paved areas, preventing waterlogging and soil erosion.
- ✓ **Rainwater Harvesting System:** Rooftop rainwater harvesting and storage facilities will be installed to reduce surface runoff and promote sustainable water management.
- ✓ **Regular Maintenance of Drainage System:** Drainage networks, catch pits, and related infrastructure will be regularly cleaned and maintained, particularly before the monsoon season, to ensure smooth flow and prevent blockage.

Overall, with the implementation of proper waste management systems, ZLD-based wastewater control, and effective drainage planning, the operational phase impacts on land resources for the GLHLCU Cancer Hospital are expected to remain negligible, localized, and well within acceptable environmental limits.

8.5 Impact on Ecosystem (flora and fauna)

8.5.1 Construction Phase

During the construction phase of the GLHLCU Cancer Hospital, potential impacts on local ecosystems (flora and fauna) are expected to be limited and site-specific. The project site is located within an already developed and modified area; therefore, no significant natural habitat, forested area, or ecologically sensitive ecosystem is present within or immediately surrounding the project boundary.

However, minor and temporary disturbances may occur due to construction activities such as site clearing, movement of machinery, generation of construction waste, and presence of workers. If not properly managed, these activities may indirectly affect surrounding environmental quality through dust generation, noise, and improper waste handling.

The temporary influx of construction workers may also lead to generation of solid waste, including construction debris and domestic waste. Improper disposal of such waste could cause localized environmental nuisance and may indirectly affect nearby terrestrial and aquatic environments if runoff occurs during rainfall events.

Overall, the potential impacts on flora and fauna during the construction phase are expected to be minimal, localized, and reversible, given the absence of significant natural habitat within the project area.

Mitigation Measures:

To minimize potential impacts on ecosystems, the following measures will be implemented:

- ✓ **Proper Waste Management System:** All construction, domestic, and hazardous wastes will be properly segregated, stored, and disposed of in accordance with Department of Environment (DoE) and national environmental guidelines.
- ✓ **Waste Segregation and Recycling:** Construction materials such as metal, wood, plastic, and packaging waste will be segregated at source and sent to authorized recycling facilities wherever possible.
- ✓ **Safe Disposal of Hazardous Waste:** Waste oil, paints, chemicals, and other hazardous materials will be stored in designated, labeled, and secured containers and disposed of through approved channels.
- ✓ **Controlled Site Management:** Construction activities will be confined within the project boundary to avoid disturbance to any surrounding vegetation or habitats.

- ✓ **Runoff and Pollution Control:** Proper drainage and site management practices will be implemented to prevent waste materials and sediments from entering nearby land or water systems.
- ✓ **Worker Awareness:** Construction workers will be trained on environmental protection practices, including proper waste disposal and prevention of ecological disturbance.
- ✓ **Housekeeping and Monitoring:** Regular site inspections will be conducted to ensure cleanliness, proper waste handling, and compliance with environmental management procedures.
- ✓ **Resource Efficiency:** Efficient use of construction materials and preference for reusable materials will be encouraged to minimize waste generation at source.

With the implementation of these measures, the construction phase impacts on flora and fauna are expected to remain negligible, temporary, and fully reversible, with no significant long-term effect on the local ecosystem.

8.5.2 Operation Phase

During the operational phase of the GLHLCU Cancer Hospital, limited impacts on the local ecosystem (flora and fauna) are expected due to routine healthcare activities. The hospital will generate various types of waste, including municipal solid waste, biomedical waste, laboratory waste, and wastewater from patient care, diagnostic, and support services. If not properly managed, these wastes may indirectly affect surrounding environmental quality through soil, water, or air pathways, which could in turn have minor implications for local ecological conditions.

However, the project site is located in a developed and disturbed area with limited natural habitat; therefore, no significant impact on terrestrial or aquatic ecosystems is anticipated. Potential ecological impacts are expected to be indirect, localized, and manageable through proper environmental controls.

Mitigation Measures:

To ensure protection of the surrounding ecosystem during the operational phase, the following measures will be implemented:

- ✓ **Waste Segregation and Management:** All waste generated within the hospital, including biomedical, hazardous, recyclable, and general waste, will be properly

segregated at source and managed in accordance with Department of Environment (DoE) and healthcare waste management guidelines.

- ✓ **Biomedical and Hazardous Waste Control:** Infectious and hazardous wastes will be stored in designated, secure, and labeled containers and disposed of through licensed waste management service providers to prevent environmental contamination.
- ✓ **Recycling and Resource Recovery:** Recyclable materials such as plastics, paper, glass, and metals will be segregated and sent to authorized recycling facilities to reduce overall waste load.
- ✓ **Wastewater Treatment and Reuse:** All wastewater generated from the hospital will be treated through an integrated ETP–STP system with ZLD provisions, ensuring that no untreated effluent is discharged into the environment. Treated water will be reused for non-potable purposes such as landscaping and cleaning, thereby reducing environmental stress on water bodies.
- ✓ **Stormwater Management:** A proper stormwater drainage system will be maintained to ensure that runoff does not come into contact with waste materials, preventing contamination of surrounding land and water resources.
- ✓ **Green Landscaping and Buffer Zones:** Green areas and landscaped zones will be developed within the hospital premises using native plant species to enhance local microclimate conditions and provide a soft ecological buffer.
- ✓ **Safe Handling of Chemicals:** Laboratory reagents, disinfectants, pharmaceuticals, and other chemicals will be handled, stored, and disposed of following strict safety protocols to prevent accidental release into the environment.
- ✓ **Awareness and Training:** Hospital staff and support personnel will be trained on proper waste handling, environmental hygiene, and pollution prevention practices.
- ✓ **Monitoring and Compliance:** Regular monitoring and record-keeping of waste generation, treatment, and disposal will be maintained to ensure compliance with applicable environmental regulations.

With the implementation of these measures, the operational phase impacts on the local ecosystem are expected to remain negligible, indirect, and fully controlled, ensuring that the GLHLCU Cancer Hospital operates in an environmentally sustainable and ecologically responsible manner.

8.6 Offensive Odor

8.6.1 Construction Phase

During the construction phase of the GLHLCU Cancer Hospital, the generation of offensive odors is not expected to be a significant environmental concern. Construction activities will mainly involve site preparation, structural works, material handling, and operation of construction machinery, which do not typically produce odorous emissions.

Any minor and temporary odors that may arise, such as from vehicle exhaust or limited use of construction materials (e.g., paints, solvents, or curing compounds), are expected to be localized, short-term, and easily dispersed due to open site conditions.

Given the nature of the project and the absence of odor-generating industrial or waste processing activities during construction, the potential impact related to offensive odor is considered negligible. Therefore, no specific odor control measures beyond standard good construction practices are required at this stage.

8.6.2 Operation Phase

During the operational phase of the GLHLCU Cancer Hospital, the generation of offensive odors is expected to be limited and localized. Potential odor sources may include solid waste handling (particularly organic and biomedical waste), wastewater collection and treatment systems (STP/ETP units), kitchen and cafeteria operations, laundry services, and laboratory or pathology activities.

If not properly managed, decomposition of organic waste, malfunctioning of wastewater treatment systems, or improper storage of biomedical waste may lead to unpleasant odors, which could affect indoor environmental quality and, to a limited extent, the surrounding hospital environment. However, significant off-site odor impacts are not anticipated due to the controlled nature of hospital operations.

Mitigation Measures:

To prevent and control odor-related impacts during the operational phase, the following measures will be implemented:

- ✓ **Proper Waste Segregation and Handling:** All hospital waste, including general, biomedical, and organic waste, will be segregated at source and stored in covered, sealed, and designated containers to prevent odor generation.

- ✓ **Timely Waste Collection and Disposal:** Waste will be collected regularly and transported to authorized disposal or treatment facilities to avoid decomposition and odor formation within the premises.
- ✓ **Efficient Wastewater Treatment (ETP–STP with ZLD Integration):** All wastewater will be treated through an integrated ETP–STP system with ZLD provisions. Proper operation and maintenance of the system will be ensured to prevent odor emissions from sewage or sludge.
- ✓ **Proper Sludge Management:** Sludge generated from wastewater treatment units will be handled, dewatered, and disposed of in a hygienic manner to avoid odor nuisance.
- ✓ **Ventilation and Air Control Systems:** Adequate ventilation will be maintained in waste storage areas, kitchen zones, laboratory spaces, and wastewater treatment units to disperse any potential odors effectively.
- ✓ **Good Housekeeping Practices:** Regular cleaning and sanitation of all hospital areas, especially waste handling and food preparation zones, will be ensured to maintain hygienic conditions.
- ✓ **Green Landscaping:** Internal green spaces and landscaping will be developed to improve microclimatic conditions and help reduce any minor odor dispersion.
- ✓ **Monitoring and Complaint Management:** Periodic inspections will be carried out to identify potential odor sources, and any complaints will be addressed promptly through corrective actions.

Overall, with proper design, operation, and maintenance of hospital systems, offensive odor impacts during the operational phase of the GLHLCU Cancer Hospital are expected to be negligible, localized, and well-controlled, ensuring a clean and comfortable environment for patients, staff, and visitors.

8.7 Waste

8.7.1 Construction Phase

During the construction phase of the GLHLCU Cancer Hospital, different types of waste will be generated from construction activities, site preparation, material handling, and workforce-related operations. These include construction debris such as concrete, bricks, sand, steel scraps, wood, plastics, packaging materials, paint residues, and small quantities of hazardous waste such as used oil, lubricants, and chemical containers. In addition,

domestic waste from construction workers, including food waste and general refuse, will also be generated.

If not properly managed, construction waste may lead to localized environmental impacts such as soil and water contamination, dust generation, blockage of drainage systems, and deterioration of site hygiene conditions. Accumulation of unmanaged waste may also create health and safety risks for workers and reduce overall environmental quality within and around the project site.

However, as the project site is a controlled development area, these impacts are expected to be temporary, localized, and manageable through proper waste handling practices.

Mitigation Measures:

To minimize environmental impacts from construction waste, the following measures will be implemented:

- ✓ **Waste Segregation at Source:** All construction and domestic waste will be segregated at the point of generation into recyclable, non-recyclable, and hazardous categories to ensure proper handling and disposal.
- ✓ **Proper Waste Storage and Collection:** Clearly designated and covered waste collection bins will be placed throughout the construction site and worker areas to prevent littering and uncontrolled disposal.
- ✓ **Reuse and Recycling:** Reusable construction materials such as steel, wood, and concrete fragments will be collected and reused wherever feasible. Recyclable materials will be sent to authorized recycling facilities.
- ✓ **Safe Disposal of Waste:** Non-recyclable waste will be disposed of at approved landfill sites, while hazardous waste such as waste oil, paint residues, and chemical containers will be handled separately and disposed of through licensed facilities.
- ✓ **3R Principle (Reduce, Reuse, Recycle):** The project will adopt the 3R approach to minimize waste generation, optimize material use, and promote sustainable construction practices.
- ✓ **Proper Material Storage:** Construction materials will be stored in designated, covered areas to prevent scattering, contamination, and runoff during rainfall.
- ✓ **Housekeeping and Site Cleanliness:** Regular cleaning of the construction site will be maintained to prevent accumulation of waste and reduce dust and environmental nuisance.

- ✓ **Training and Awareness:** Workers will be trained on proper waste handling procedures and environmental protection practices to ensure compliance at all levels.
- ✓ **Regulatory Compliance and Record Keeping:** All waste management activities will comply with applicable national and Department of Environment (DoE) guidelines, and proper records of waste generation and disposal will be maintained for monitoring and audit purposes.

Through the implementation of these measures, the environmental impacts associated with construction waste generation will be effectively controlled, ensuring a clean, safe, and environmentally responsible construction process for the GLHLCU Cancer Hospital.

8.7.2 Operation Phase

During the operational phase of the GLHLCU Cancer Hospital, a variety of wastes will be generated from healthcare services, diagnostic activities, patient care, laboratory operations, kitchen and cafeteria services, housekeeping, and administrative functions. These wastes are generally categorized into medical (biomedical) waste and non-medical (general) waste.

Medical waste may include infectious waste, pathological waste, sharps, pharmaceutical waste, laboratory waste, contaminated dressings, and other hazardous healthcare materials. Non-medical waste will include biodegradable and non-biodegradable household-type waste generated from patients, visitors, staff, and support services such as food waste, paper, plastics, and packaging materials.

If not properly managed, hospital waste can pose significant risks to public health, occupational safety, and the environment through contamination of soil, water, and air, as well as potential spread of infection. Therefore, strict waste management protocols are essential for safe and sustainable hospital operations.

Mitigation Measures

To ensure safe and environmentally sound waste management within the hospital, the following measures will be implemented:

- ✓ **Waste Segregation at Source:** All hospital waste will be segregated at the point of generation into color-coded categories such as infectious, hazardous, sharps, recyclable, and general waste in accordance with Department of Environment (DoE) and healthcare waste management guidelines.

- ✓ **Safe Collection and Storage:** Waste will be collected in labeled, leak-proof, and covered containers and stored in a designated secured waste storage area to prevent exposure, odor, and contamination.
- ✓ **Biomedical Waste Management:** Infectious and hazardous medical waste, including sharps will be handled separately and disposed of through licensed biomedical waste treatment facilities following national regulations.
- ✓ **Integration with ETP–STP System (ZLD Approach):** All wastewater generated from hospital activities will be treated through an integrated Effluent Treatment Plant (ETP) and Sewage Treatment Plant (STP) system with Zero Liquid Discharge (ZLD) provisions, ensuring no untreated effluent is released into the environment.
- ✓ **Recycling and Resource Recovery:** Recyclable non-medical waste such as paper, plastic, glass, and metal will be segregated and sent to authorized recycling facilities.
- ✓ **Safe Handling of Chemical and Pharmaceutical Waste:** Laboratory chemicals, expired medicines, and pharmaceutical waste will be stored separately and disposed of through approved hazardous waste management channels.
- ✓ **Internal Waste Management System:** A dedicated hospital waste management unit will be established to oversee segregation, collection, transport, treatment, and disposal activities in compliance with regulatory requirements.
- ✓ **Training and Awareness:** Regular training programs will be conducted for doctors, nurses, technicians, housekeeping staff, and waste handlers on proper waste management practices and infection control procedures.
- ✓ **Monitoring and Compliance:** Routine audits, inspections, and record-keeping will be maintained to ensure compliance with applicable environmental and healthcare waste management regulations.
- ✓ **Safe Transport and Final Disposal:** Waste will be transported in covered vehicles to authorized treatment and disposal facilities following strict safety protocols.

Through the implementation of these comprehensive measures, the GLHLCU Cancer Hospital will ensure environmentally safe, hygienic, and compliant waste management practices. This will minimize risks to human health and the environment while supporting sustainable healthcare operations.

8.8 Impact on livelihood, community health and safety, vulnerable group and gender issues)

8.8.1 Negative Impact both construction and operation phase

Although the proposed Green Life Hospital Ltd. (Cancer Unit) is a specialized healthcare facility with significant positive socio-economic benefits, certain limited negative impacts may arise during both construction and operation phases. These impacts are expected to be localized, temporary (mainly construction phase), and manageable through proper planning, monitoring, and implementation of mitigation measures.

Disturbance to Existing Social Infrastructure and Services:

During the construction phase, temporary and localized disturbances may occur due to the movement of construction materials, equipment, and workforce within the project site and surrounding road network. This may result in minor traffic congestion, noise, and short-term inconvenience to road users and nearby service routes.

However, as the project is located within a planned institutional area under RAJUK with well-developed urban infrastructure, these impacts are expected to be limited, short-term, and fully manageable. A proper Construction Traffic Management Plan will be implemented to ensure safe vehicle movement, minimize disruption, and maintain uninterrupted access to surrounding facilities and essential services.

During the operation phase, minor increases in traffic flow may occur due to patients, visitors, ambulances, and staff movement. However, this impact is expected to be routine in nature and will be effectively managed through organized parking and internal traffic circulation systems.

Local Conflicts of Interest:

As the project is being developed within a planned institutional zone and does not involve displacement of any local communities, the likelihood of land-related or community-level conflicts is considered negligible.

However, during the construction phase, minor social concerns may arise related to workforce movement, engagement of external labor, and site access management. These issues will be managed through proper communication with stakeholders, controlled site access, and community-sensitive construction practices. Where feasible, priority will be given to local employment to enhance positive community relations.

During the operation phase, social interaction will be mainly institutional in nature and is not expected to create any significant conflict of interest.

Infectious Disease Risk:

During the construction phase, the influx of external workers may introduce a minimal risk of communicable diseases. This risk will be controlled through pre-employment health screening, periodic medical check-ups, and awareness programs on hygiene, sanitation, and preventive healthcare practices.

During the operation phase, as a healthcare facility, there is an inherent risk of hospital-acquired infections (HAIs) among patients, staff, and visitors if infection control protocols are not strictly followed. However, this risk will be effectively managed through strict hospital infection prevention and control (IPC) measures, including hygiene protocols, sterilization systems, and controlled clinical procedures.

Occupational Health and Safety Risks:

Construction activities involve inherent occupational hazards such as falls from height, machinery-related injuries, electrical risks, and exposure to construction environments. Without proper control measures, these may pose risks to worker health and safety.

During operation, occupational risks may also exist for healthcare workers, particularly those involved in laboratory work, waste handling, emergency care, and exposure to medical equipment and infectious materials.

To mitigate these risks, a comprehensive Occupational Health and Safety (OHS) management system will be implemented, including hazard identification, risk assessment, safety training, emergency preparedness, and mandatory use of Personal Protective Equipment (PPE) such as helmets, gloves, safety shoes, masks, and protective gowns. Regular safety supervision and audits will ensure compliance throughout both phases.

Traffic and Accident Risks:

During the construction phase, increased movement of construction vehicles and heavy equipment may create temporary traffic disturbances and accident risks in surrounding areas. These impacts are expected to be minor, localized, and short-term.

During the operation phase, continuous movement of ambulances, patient vehicles, staff transport, and service vehicles may create routine traffic pressure, particularly during peak hours.

Appropriate mitigation measures such as designated entry and exit routes, internal traffic circulation planning, speed control, pedestrian safety management, warning signage, and coordination with local traffic authorities (if required) will be implemented to ensure road safety and minimize risks.

Gender and Social Safety Considerations (Both Phases):

During both construction and operation phases, potential gender-related issues may include safety concerns for female workers, staff, patients, and visitors, particularly in relation to workplace environment and site security.

These risks will be managed through:

- ✓ Gender-sensitive facility design
- ✓ Secure and monitored working environment
- ✓ Separate sanitation and waiting facilities where necessary
- ✓ Strict anti-harassment and workplace safety policies
- ✓ Awareness and training programs on gender equality and safety.

With proper implementation of these measures, gender-related risks are expected to remain minimal.

8.8.2 Positive Impact both the Construction & Operation Phase

Employment Generation:

The project will generate significant direct and indirect employment opportunities during both construction and operational phases. Direct employment will include healthcare professionals, administrative staff, technicians, security personnel, cleaners, and maintenance workers.

Indirect employment will be created in supporting sectors such as transport services, food supply, pharmacies, accommodation services, and other small businesses in the surrounding area.

Skill Development and Capacity Building:

The project will contribute to skill enhancement through on-the-job training, exposure to modern healthcare systems, and capacity-building opportunities for both medical and non-medical staff. This will improve long-term employability and strengthen the local skilled workforce base.

Improved Community Health Services:

The most significant positive impact of the project will be improved access to specialized cancer diagnosis, treatment, and care services. The establishment of the GLHLCU Cancer Hospital will strengthen the regional healthcare system and significantly enhance public health outcomes.

Local Economic Benefits:

The hospital will stimulate local economic activities through increased demand for goods and services. Small and medium-scale businesses in the surrounding areas are expected to benefit indirectly, contributing to income generation and economic stability in the locality.

Infrastructure and Service Improvement:

The project will contribute to improved urban infrastructure within the Purbachal area, including enhanced accessibility, better mobility, and strengthened healthcare-related facilities. These improvements will indirectly benefit surrounding developments and residents.

Improvement in Living Standards:

Overall, the project is expected to positively influence the quality of life of the surrounding population through improved healthcare access, employment opportunities, and enhanced socio-economic conditions.

Vulnerable Groups:

No project-affected vulnerable groups are identified, as the project is located on RAJUK-leased institutional land without displacement.

However, the hospital will provide major positive benefits to health-vulnerable groups, including cancer patients, elderly persons, and patients requiring continuous and specialized medical care. Improved accessibility, emergency care, and patient-friendly infrastructure will enhance healthcare equity and inclusion.

Gender Benefits and Inclusion:

The project will promote gender inclusion by ensuring equal employment opportunities and safe working conditions for both male and female staff. The hospital environment will support a higher participation of female healthcare professionals.

Gender-sensitive infrastructure such as separate facilities, privacy provisions, and harassment-free workplace policies will be ensured during both construction and operation phases. This will contribute to a safe, inclusive, and respectful working environment.

Overall Assessment:

Overall, the socio-economic impacts of the proposed GLHLCU Cancer Hospital are expected to be **largely positive**, particularly in terms of improved healthcare services, employment generation, skill development, and local economic benefits. The identified negative impacts are temporary, localized, and can be effectively managed through standard mitigation and management measures.

Chapter-09

Traffic Impact Assessment

9 Traffic Impact Assessment

9.1 Introduction

Traffic Impact Assessment (TIA) plays a crucial role in the planning and development of infrastructure projects, urban expansions, and commercial developments. It is a comprehensive evaluation process that assesses the potential impact of a proposed project on the traffic flow, transportation infrastructure, and overall mobility in a specific area.

The proposed project is “**Proposed (20 storied + 3 Level Basement) Green Life Hospital Ltd. (Cancer Unit)**” located at Plot-039, Road-108, Sector-08, Purbachal New Town, under Narayanganj District, Bangladesh, within the master-planned township of Purbachal New Town.

Geographically, the hospital building is positioned at 23°50'45.18" North latitude and 90°31'14.08" East longitude. The site enjoys excellent connectivity through a hierarchy of internal and regional roads. Direct access is provided via Road-108 (width 100ft) of Sector-08, which connects seamlessly with the township's internal road system. These roads are designed to safely accommodate light and heavy vehicles, ensuring smooth movement for ambulances, service vehicles, and general traffic.

Table 9.1: Description of the Project at a Glance.

Name of Project	:	Proposed (20 storied + 3 Level Basement) Green Life Hospital Ltd. (Cancer Unit)”
Project Location	:	Plot-039, Road-108, Sector-08, Purbachal New Town
Coordinate of the Project	:	23°50'45.18"N, 90°31'14.08"E
Total Land Area	:	4,336 sq.m
Total Gross Built Area	:	47,325 sq.m
Main Road-108	:	Width 30.480 m or 100 ft
Service Road-313	:	Width 9.144 m or 30ft
Occupancy Type	:	Hospital (Cancer Unit)
Road width surrounding project	:	100 ft wide road and 30 ft wide road
Number of floors above ground	:	20
Basement	:	2 + 1 (semi basement lower ground floor)
Parking facility	:	173
Vehicle Movement	:	Loop-based, allowing entry from one side and exit from another without reversing.

9.2 Parking Facilities

As it is a proposed hospital building, adequate parking facilities has been provided as per the building construction rules-2008, RAJUK and Dhaka Transport Coordination Authority (DTCA).

Table 9.2: Parking Facilities of the Project.

CAR PARKING SCHEDULE						
	Min Parking Req	Max Parking Allowed	Location		Car Parking Provided	
Car Parking (Phase 1)	63	95	Level B1	Staff	40	92
				Accessible	2	
				Staff Bus	2	
				LD Truck	1	
				Frz Van	1	
				BiCycle (36)	3.6	
				Mtr Bike (54)	13.5	
			Level 1 (GL)	Short Trm	7	
				Ambulance	2	
				Staff Bus (2)		
Car Parking (Phase 2)	78	117		Rickshaw / CNG		81
			Level 3	Guest	6	
			Level 3U	Guest	14	
			Level 4	Guest	41	
				Accessible	4	
				Guest	18	
			Level 5	Guest	14	
				Accessible	4	
	141	212	Total		173	

9.3 Traffic Location Points

As per the DTCA guidelines, the selection of these locations was based on their strategic importance, traffic carrying capacity, and proximity to the project site. All selected locations are situated within approximately 500 m of the project site, which represents the primary zone of influence for project-generated traffic.

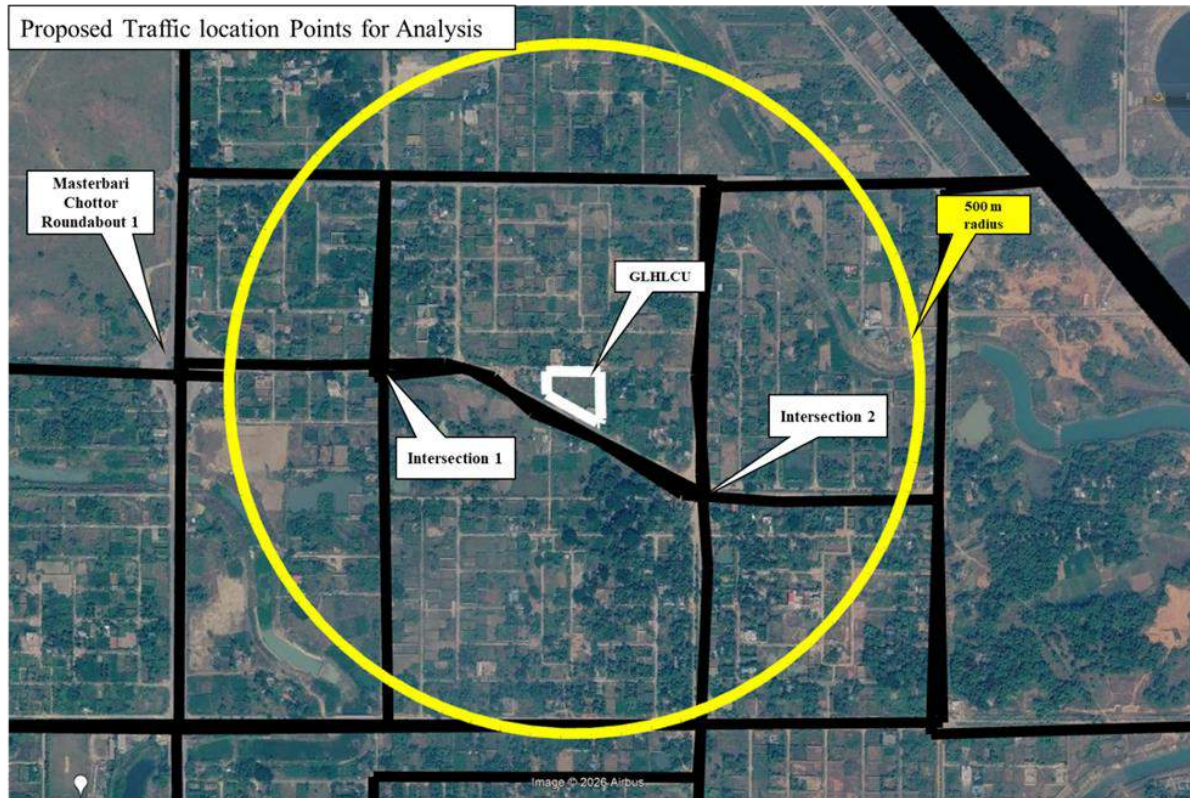


Figure 9-1: 4 Important Traffic Points within 500 m Radius.

9.4 Future Traffic Growth and Traffic Distribution Analysis

Accordingly, the following three locations have been selected for traffic modeling and analysis:

1. Master Bari Chattar Roundabout – 100 ft width
2. Intersection–1 (near the project site)- 100 ft width
3. Intersection–2 (near the project site)- 100 ft width

Detailed traffic counts were carried out at the both intersections, during the weekday and weekend 7.00 am to 11 pm almost 16 hours. The peak hour traffic volumes morning (11.00 am -12.00 am) and evening (6.00 pm- 7.00 pm), at the intersections detailed traffic counts attached in annexure.

9.5 Existing Traffic Movement Pattern

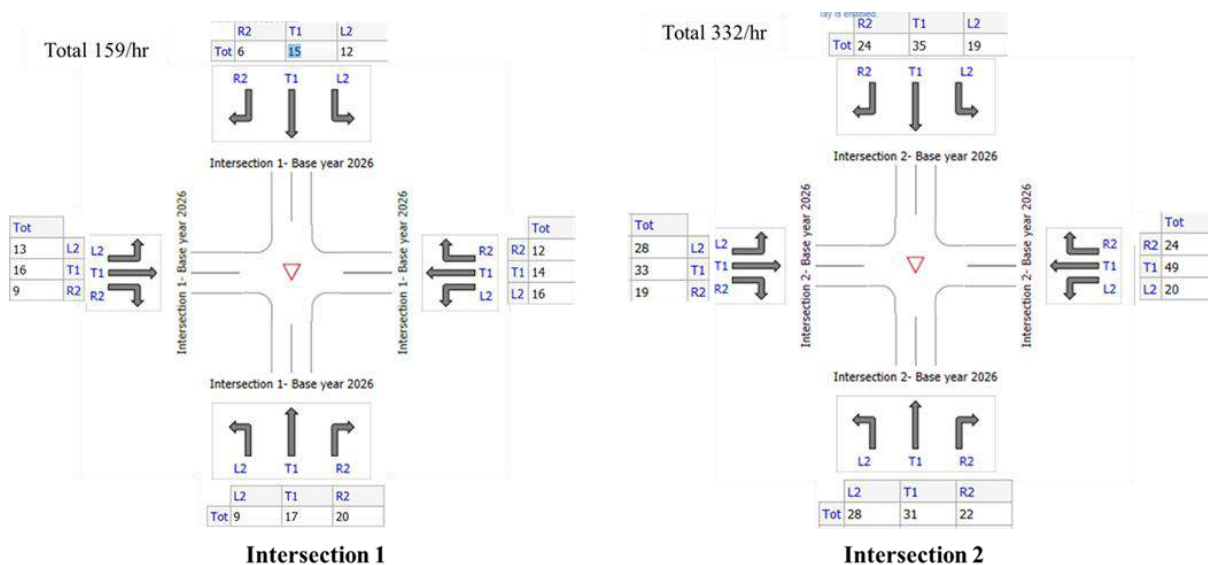


Figure 9-2: Existing Traffic Movement Pattern of Intersection 1 & Intersection 2.

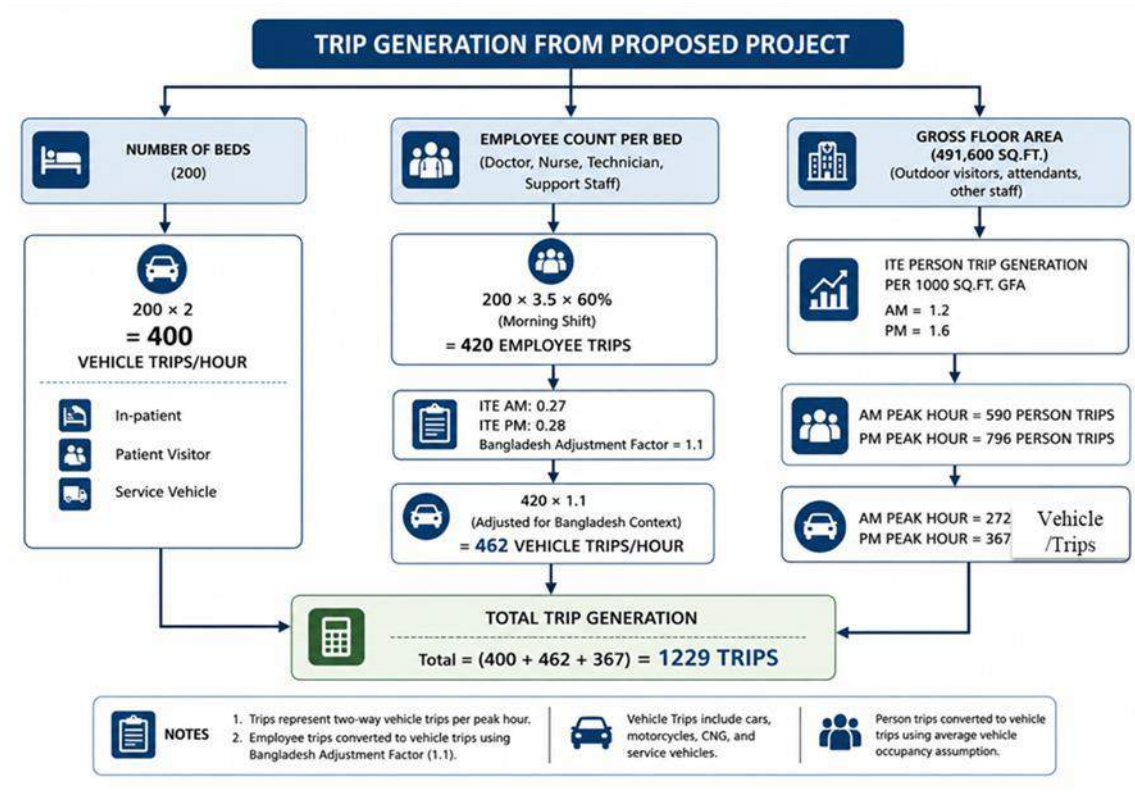
9.6 Summary of Survey Findings

From the traffic survey results, it is observed that vehicle movement is highest during the morning peak hour (11:00 am–12:00 pm) and the evening peak hour (6:00 pm–7:00 pm). These time periods represent the critical hours for assessing traffic performance and potential impacts of the proposed development.

Table 9.3: Summary of Survey Findings (Highest Volume of Vehicle/peak hr).

Vehicle Flow Count Area	Highest Volume of Vehicle/peak hr
Roundabout 1	887 (709 PCU)
Intersection 1	169 (120 PCU)
Intersection 2	332 (248 PCU)

9.7 Estimated Total Trips from the Project:



Source

Table 6.1 Typical Staff-to-Bed Ratio (from international practice)

Hospital Type	Employees per Bed
General Hospital	1.5-2.5
Teaching Hospital	2.5-3.5
Specialized Cancer Hospital	3-4

Hospital (610)

Vehicle Trip Ends vs: Employees
On x: Weekday
Peak Hour of Adjacent Street Traffic:
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
Number of Studies: 17
Avg. Num. of Employees: 2450
Directional Distribution: 75% entering, 25% exiting

Vehicle Trip Generation per Employee

Average Rate	Range of Rates	Standard Dev
0.27	0.20 - 0.45	0.10

Hospital (610)

Vehicle Trip Ends vs: Employees
On x: Weekday
Peak Hour of Adjacent Street Traffic:
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 14
Avg. Num. of Employees: 2443
Directional Distribution: 27% entering, 73% exiting

Vehicle Trip Generation per Employee

Average Rate	Range of Rates	Standard Dev
0.28	0.19 - 1.08	0.13

Hospital (610)

Person Trip Ends vs: 1000 Sq. Ft. GFA
On x: Weekday
Peak Hour of Adjacent Street Traffic:
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
Number of Studies: 3
1000 Sq. Ft. GFA: 2187
Directional Distribution: 22% entering, 78% exiting

Person Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Dev
1.20	0.66 - 1.39	1.48

Hospital (610)

Person Trip Ends vs: 1000 Sq. Ft. GFA
On x: Weekday
Peak Hour of Adjacent Street Traffic:
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 1
1000 Sq. Ft. GFA: 3842
Directional Distribution: 22% entering, 78% exiting

Person Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Dev
1.62	1.62 - 1.62	-

The total hospital-generated trips during the peak hour are estimated at 1,229 trips (max). Of these, 400 trips correspond to in-patients/bed-related movements, which are not subjected to mode choice analysis. The **remaining (1,229 – 400) = 829 trips** represent trips associated with out-patients, visitors, staff, and service-related movements. These trips have therefore been considered for mode choice analysis and subsequent traffic assignment, in order to realistically distribute travel demand across different transport modes and assess their impact on the surrounding road network.

Table 9.4: Final Traffic from proposed project and modal split.

Mode	Mode share	Trips 829 (max)/peak hr	PCU (URSTP)	Calculation	Peak Hour PCU
Car	10.3%	85	1	(85 x 1)	85
Bus	13.5%	112	2	(112 x 2)	224
3 wheeler	20%	166	0.6	(166 x 0.6)	100
Rickshaw	32 %	265	0.6	(265 x 0.6)	159
Motorcycle	17 %	141	0.3	(141 x 0.3)	42
Bicycle	7 %	58	0.5	(58 x 0.5)	29
Total each peak time without in-patient trip				PCU 639	
Ambulance in patient trip				PCU 400	
Total				PCU 1039	

Accordingly, including the in-patient-related trips, the total peak-hour traffic demand generated by the proposed development is estimated as (639+ 400) = 1039 PCU per peak hour, calculated by combining 639 PCU from externally generated vehicular trips and 400 PCU attributable to in-patient/bed-related movements.

9.8 Summary of Future Estimating Traffic Flow in 2030 and 2050

Table 9.5: Final Peak Hour Vehicle Volumes at Key Intersections/Roundabouts (2026, 2030, 2050) With and Without the Project:

Vehicle Flow Count Area	Highest Volume of Vehicle 2026/peak hr	Highest Volume of Vehicle 2030/peak hr		Highest Volume of Vehicle 2050/peak hr	
		Without Project	With Project	Without Project	With Project
Roundabout 1	887 (709 PCU)	1030 (PCU 833)	1446 PCU	2200 (PCU 1795)	2389 PCU
Intersection 1	160 (120 PCU)	171 (PCU 129)	516 PCU	415 (PCU 316)	732 PCU
Intersection 2	332 (248 PCU)	389 (PCU 289)	1012 PCU	848 (PCU 632)	1255 PCU

9.9 Capacity Analysis of Base Year- 2026- Roundabout 1- Master Bari Chatter

As the project is situated in the well-planned area by RAJUK, the amount of traffic is controlled to other areas. The proposed project will produce a negligible amount of traffic compared to existing traffic, and it can be considered that the single development will not affect the existing traffic condition.

 Site: 101 [Roundabout 1- Master Bari Chatter (2026)]

New Site

Site Category: (None)

Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	A	A

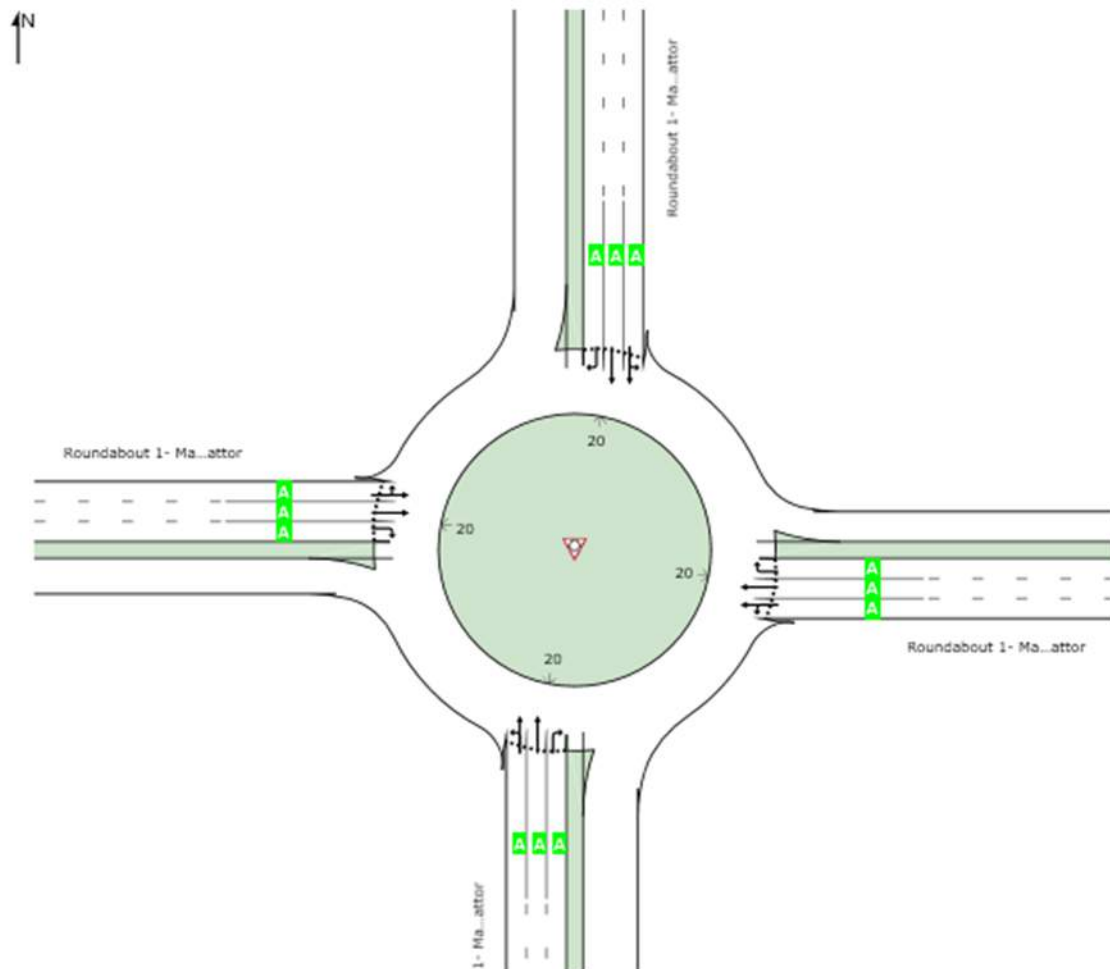
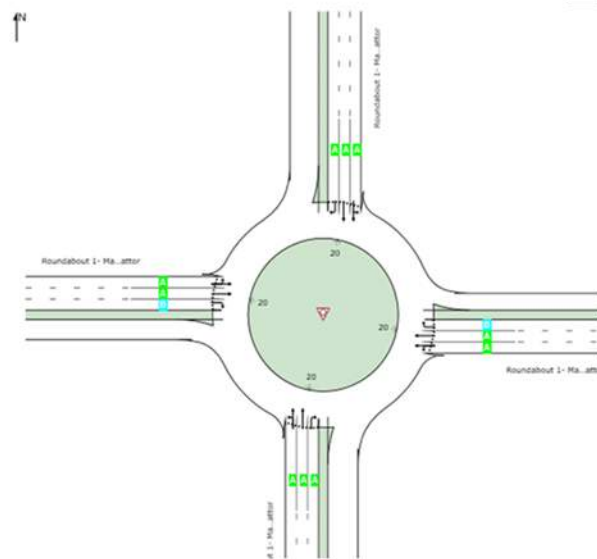


Figure 9-3: Existing Traffic Condition of Project Area (2026).

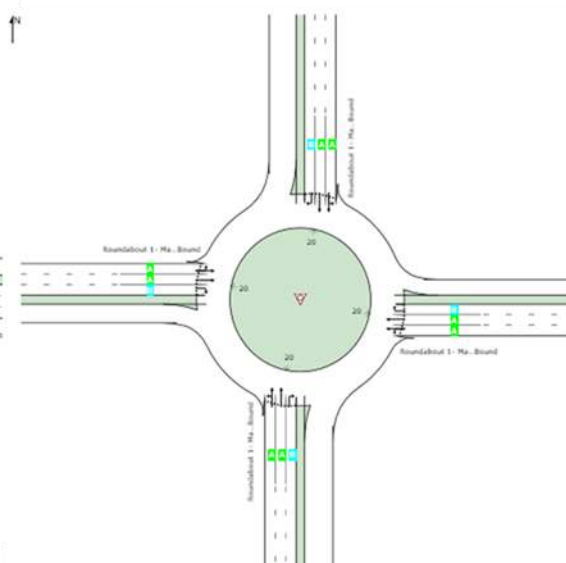
New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	A	A



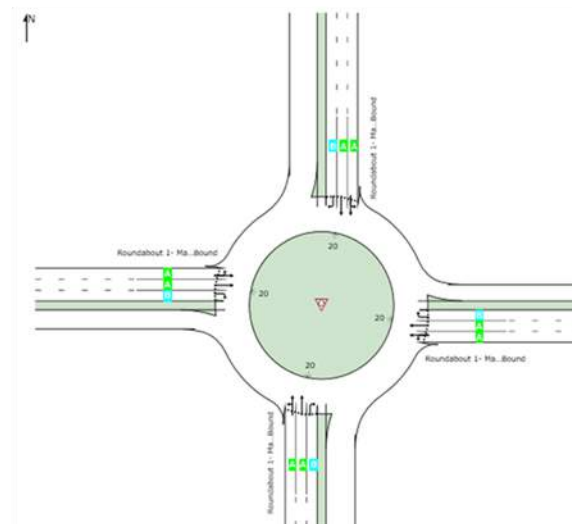
New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	A	A



New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	A	A



Traffic Impact Assessment

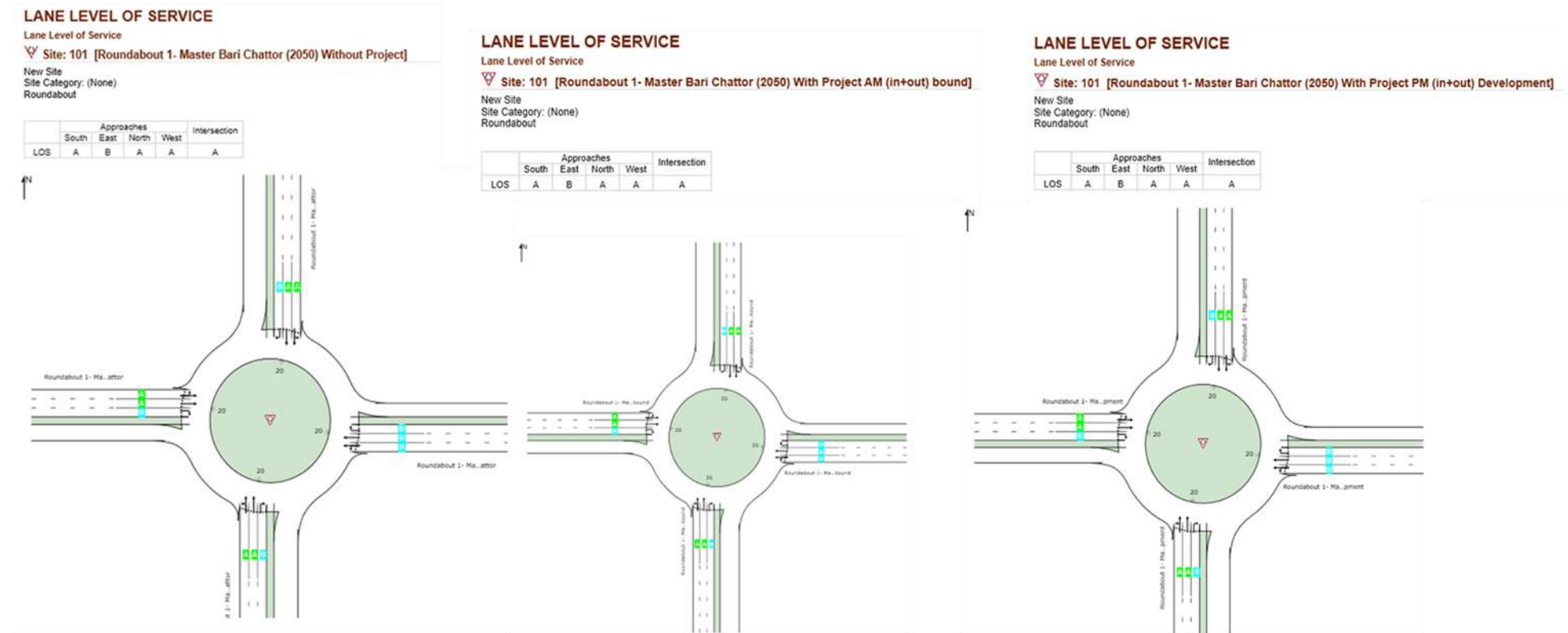


Figure 9-5: Level of Service at Roundabout 1- Master Bari Chattr with and without project (2050).

9.10 Summary of Lane Level of Service (LOS):

The lane-level operational analysis for Roundabout 1 (Master Bari Chatter) was conducted for the design years 2030 and 2050, under both Without Project and With Project scenarios. The analysis results indicate that in 2030, all approaches (South, East, North, and West) operate at Level of Service (LOS) A in both scenarios, reflecting excellent traffic conditions with minimal delay and stable flow.

For the 2050 operational year, the roundabout continues to perform satisfactorily. Under the With Project scenario, the East approach operates at LOS B, while all other approaches and the overall intersection maintain LOS A and LOS B.

Overall, the results demonstrate that the roundabout is expected to function efficiently in both future scenarios, with no critical congestion anticipated, and the proposed project does not significantly deteriorate lane-level or intersection-level performance. Also MRT 1 will play a significant role in maintaining or improving the road's level of service.

Table 9.6: LOS Summary at Roundabout 1- Master Bari Chatter.

Roundabout 1- Master Bari Chatter								
	NB-Through	NB-Right	SB-Through	SB-Right	WB-Through	WB-Right	EB-Through	EB-Right
2026	A	A	A	A	A	A	A	A
2030 (without Project)	A	A	A	A	A	B	A	B
2030 (With project)	A	B	A	B	A	B	A	B
2050 (without Project)	A	B	A	B	A	B	B	B
2050 (With project)	A	B	A	B	A	B	B	B

9.11 Capacity Analysis of Vehicle Flow Point 1 (Intersection 1)

The selected intersection, located in close proximity to the proposed project site, has been identified as a critical point for traffic impact assessment due to its strategic functional and operational importance. This intersection acts as the primary access and dispersal node connecting the project site with the surrounding local road network as well as the adjacent arterial road. Consequently, a significant proportion of project-generated traffic is expected to pass through this junction during both peak and off-peak hours.

LANE LEVEL OF SERVICE

Lane Level of Service

▽ Site: 101v [Intersection 1- Base year 2026]

New Site

Site Category: (None)

Giveaway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA

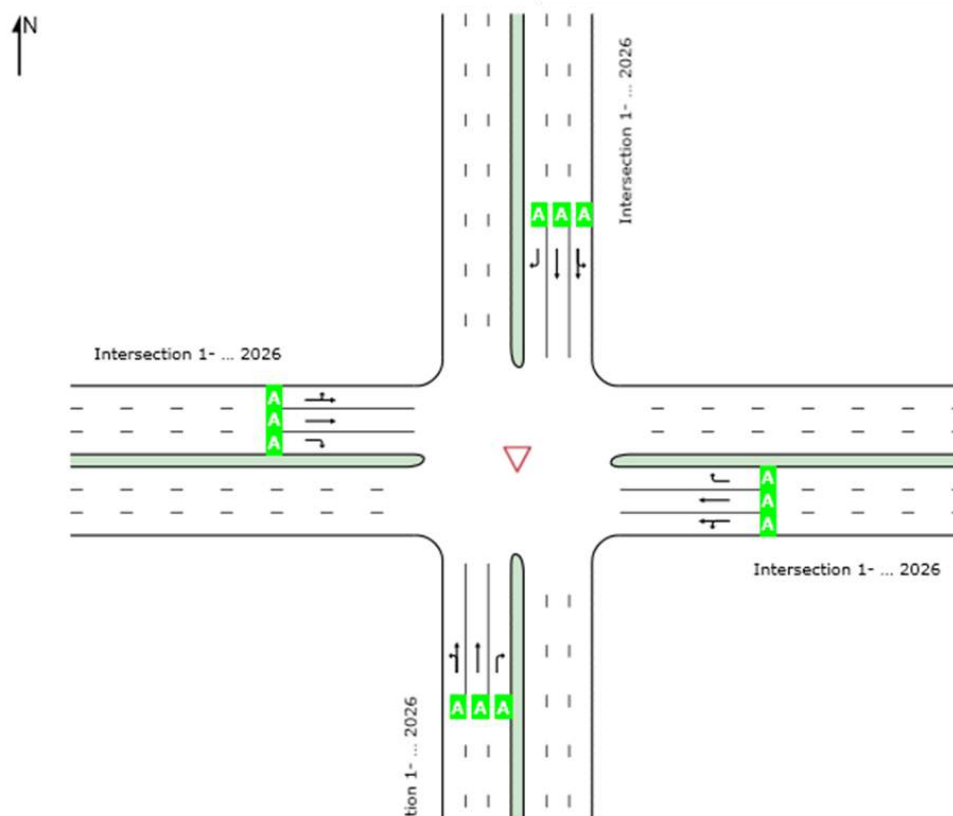


Figure 9-6: Existing Level of Service at Intersection 1 close to the project.

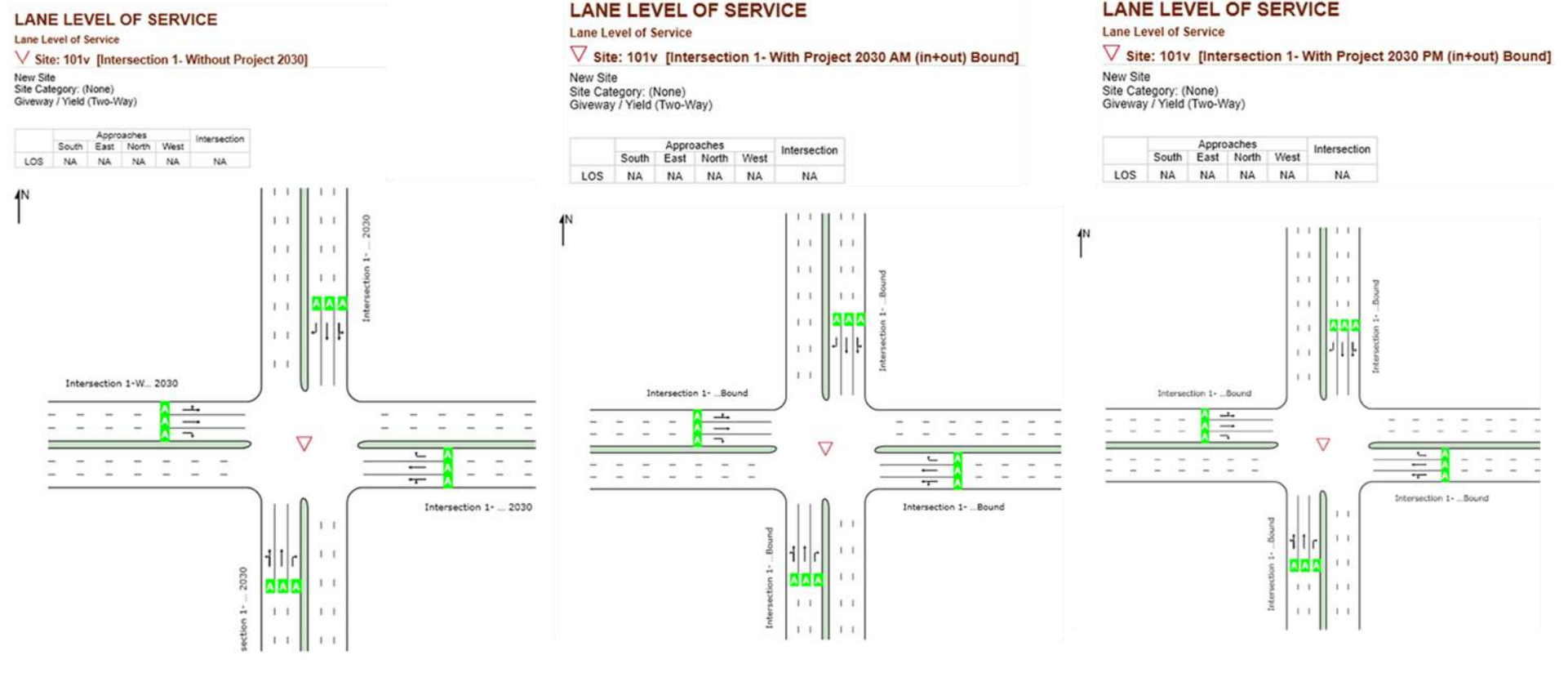


Figure 9-7: Level of Service at Intersection 1 with and without project in 2030.

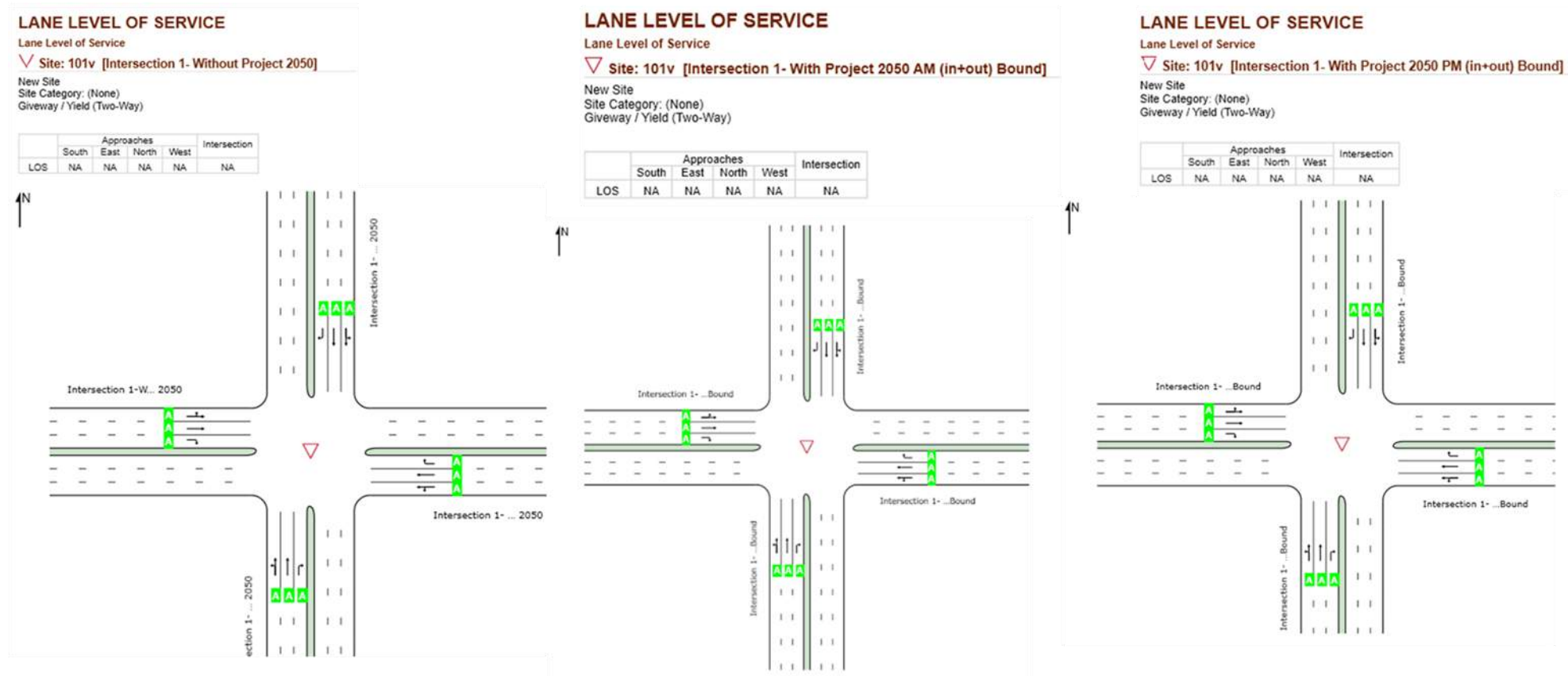


Figure 9-8: Level of Service at Intersection 1 with and without project in 2050.

9.12 Summary of Lane Level of Service (LOS):

The lane-level operational analysis for Intersection 1 which is close to the project was conducted for the design years 2030 and 2050, under both Without Project and With Project scenarios. The analysis results indicate that in 2030 and 2050, all approaches (South, East, North, and West) operate at Level of Service (LOS) A in both scenarios, reflecting excellent traffic conditions with minimal delay and stable flow.

Table 9.7: LOS Summary at Intersection 1.

Intersection 1								
	NB-Through	NB-Right	SB-Through	SB-Right	WB-Through	WB-Right	EB-Through	EB-Right
2026	A	A	A	A	A	A	A	A
2030 (without Project)	A	A	A	A	A	A	A	A
2030 (With project)	A	A	A	A	A	A	A	A
2050 (without Project)	A	A	A	A	A	A	A	A
2050 (With project)	A	A	A	A	A	A	A	A

9.13 Capacity Analysis of Intersection-2 (Sabiha Chatter)

The intersection is situated approximately 179.6 m from the proposed project site, placing it well within the project's immediate traffic influence area. It functions as a major traffic node connecting Sector 8 with Sector 6, Sector 7, and Sector 5, and the primary arterial corridors of Purbachal.

LANE LEVEL OF SERVICE

Lane Level of Service

▽ Site: 101v [Intersection 2- Base year 2026]

New Site

Site Category: (None)

Giveaway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA

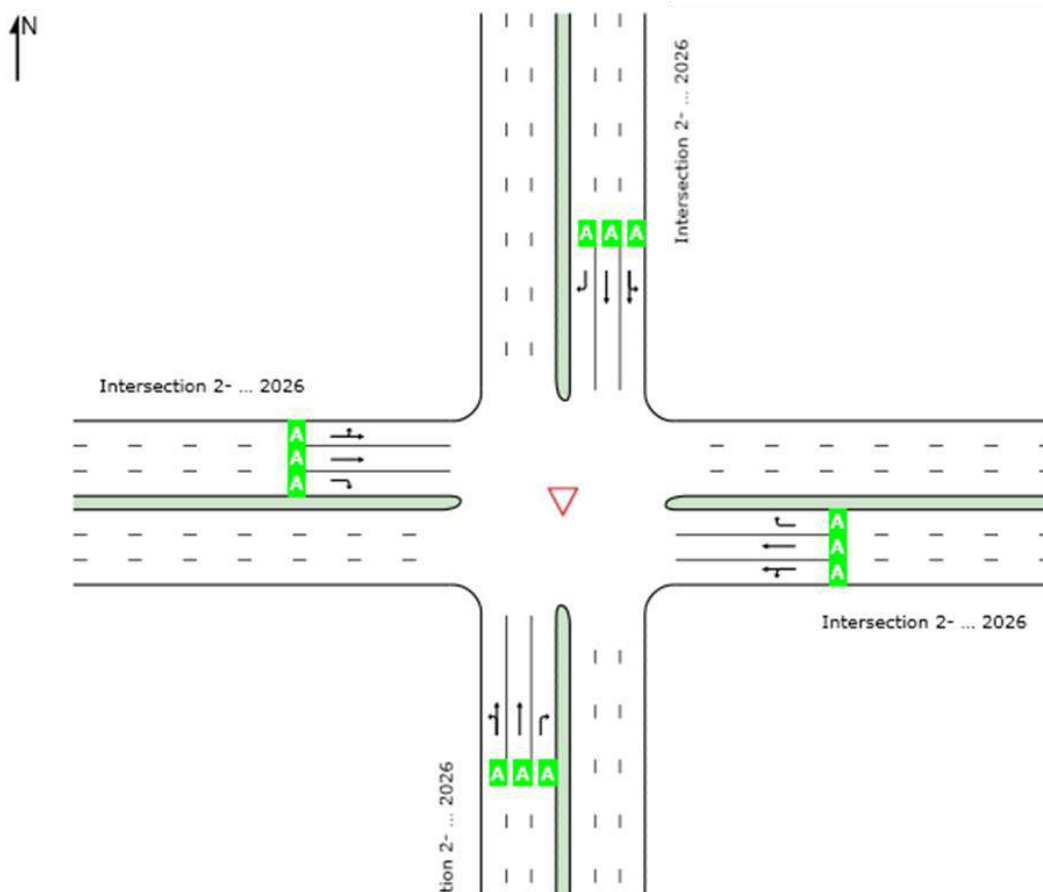


Figure 9-9: Existing Level of Service at Intersection 2 close to the project.

LANE LEVEL OF SERVICE

Lane Level of Service

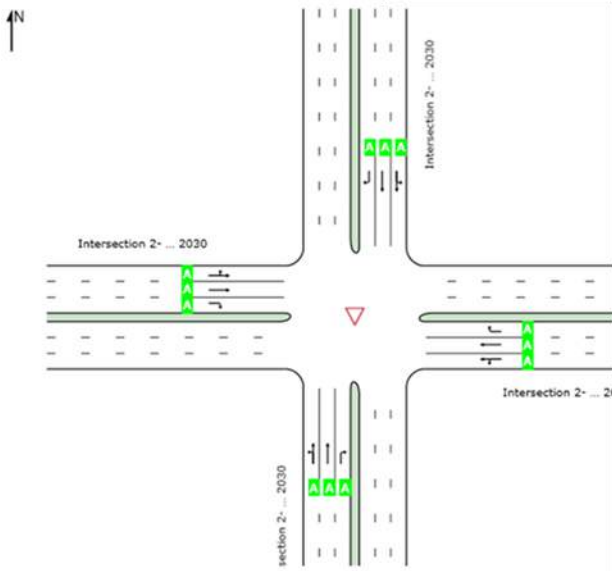
Site: 101v [Intersection 2- Without Project- 2030]

New Site

Site Category: (None)

Giveway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA



LANE LEVEL OF SERVICE

Lane Level of Service

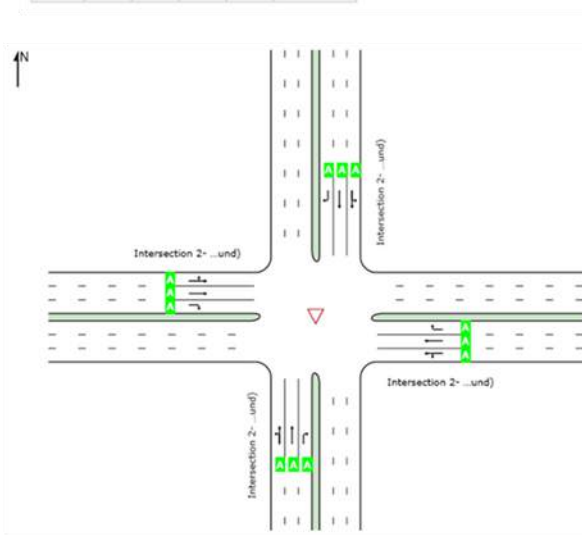
Site: 101v [Intersection 2- With Project- 2030 (AM inbound+outbound)]

New Site

Site Category: (None)

Giveway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA



LANE LEVEL OF SERVICE

Lane Level of Service

Site: 101v [Intersection 2- With Project- 2030 (PM inbound+outbound)]

New Site

Site Category: (None)

Giveway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA

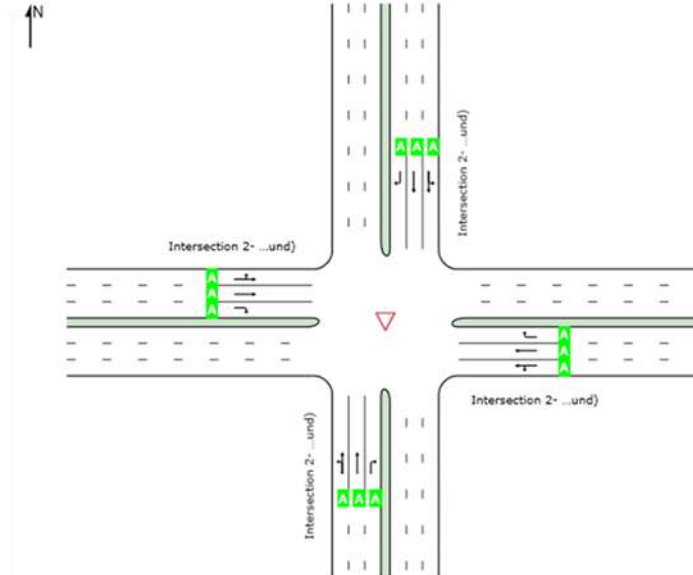


Figure 9-10: Level of Service at Intersection 2 with and without project in 2030.

LANE LEVEL OF SERVICE

Lane Level of Service

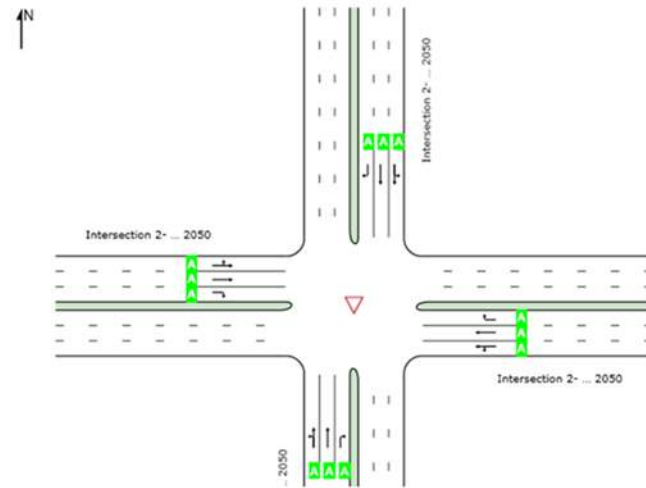
▽ Site: 101v [Intersection 2- Without Project- 2050]

New Site

Site Category: (None)

Giveaway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA

**LANE LEVEL OF SERVICE**

Lane Level of Service

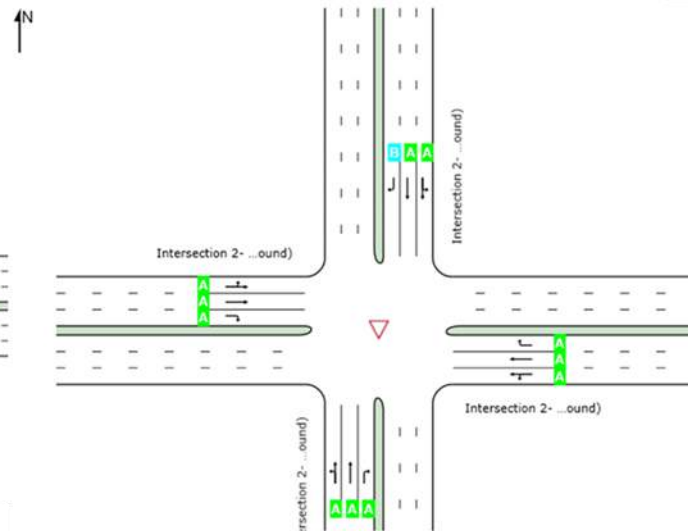
▽ Site: 101v [Intersection 2- With Project- 2050 (AM inbound+outbound)]

New Site

Site Category: (None)

Giveaway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA

**LANE LEVEL OF SERVICE**

Lane Level of Service

▽ Site: 101v [Intersection 2- With Project- 2050 (PM inbound+outbound)]

New Site

Site Category: (None)

Giveaway / Yield (Two-Way)

	Approaches				Intersection
	South	East	North	West	
LOS	NA	NA	NA	NA	NA

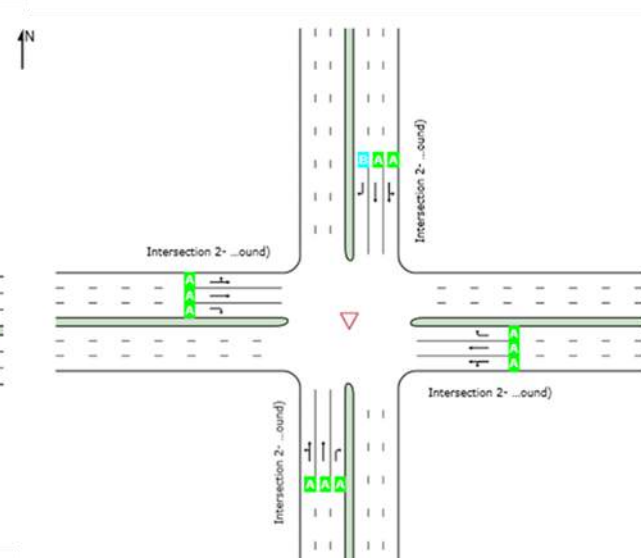


Figure 9-11: Level of Service at Intersection 2 with and without project in 2050.

9.14 Summary of Lane Level of Service (LOS):

The lane-level operational analysis for Intersection 2 which is close to the project was conducted for the design years 2030 and 2050, under both Without Project and With Project scenarios. The analysis results indicate that in 2030 and 2050, all approaches (South, East, North, and West) operate at Level of Service (LOS) A in both scenarios, reflecting excellent traffic conditions with minimal delay and stable flow.

Table 9.8: LOS Summary at Intersection 2.

Intersection 2								
	NB-Through	NB-Right	SB-Through	SB-Right	WB-Through	WB-Right	EB-Through	EB-Right
2026	A	A	A	A	A	A	A	A
2030 (without Project)	A	A	A	A	A	A	A	A
2030 (With project)	A	A	A	A	A	A	A	A
2050 (without Project)	A	A	A	A	A	A	A	A
2050 (With project)	A	B	A	A	A	A	A	A

9.15 Result Summary

The signalized & un-signalized Intersection Design and Research Aid (SIDRA) computer software was used to analyses the traffic conditions at the affected intersections.

The operational performance of the surrounding road network was assessed for Roundabout 1 (Master Bari Chatter) and Intersections 1 and 2 for the base year 2026, and future years 2030 and 2050, under both Without Project and With Project scenarios.

Table 9.9: Performance Analysis Summary for Roundabout 1.

Performance Indicator	Base Year (Existing)	After-5 Years (Without Project)	After-5 Years (With Project)	Difference (Year)	After 20 Years (Without Project)	After 20 Years (With Project)	Difference (Year)
	2026	2030	2030	d = c-b	2050	2050	g = f-e
V/C Ratio	0.12	0.15	0.17	0.02	0.39	0.41	0.02
Delay (Seconds)	6.6	6.6	7.4	0.8	8.8	9.1	0.3

Performance Indicator	Base Year (Existing)	After-5 Years (Without Project)	After-5 Years (With Project)	Difference (Year)	After 20 Years (Without Project)	After 20 Years (With Project)	Difference (Year)
Queue Length (Meters)	6.2	7.5	9	1.5	24.8	26.2	1.4
Level of Service (LOS)	A	A	A	A	A	A	A

Table 9.10: Performance Analysis Summary for Intersection 1.

Performance Indicator	Base Year (Existing)	After-5 Years (Without Project)	After-5 Years (With Project)	Difference (Year)	After 20 Years (Without Project)	After 20 Years (With Project)	Difference (Year)
	2026	2030	2030	d = c-b	2050	2050	g = f-e
V/C Ratio	0.015	0.017	0.114	0.09	0.04	0.15	0.11
Delay (Seconds)	4.5	4.5	5.1	0.6	4.6	5.1	0.5
Queue Length (Meters)	0.5	0.5	3.1	2.6	1.3	4.1	2.8
Level of Service (LOS)	A	A	A	A	A	A	A

Table 9.11: Performance Analysis Summary for Intersection 2 (Sabiha Chatter).

Performance Indicator	Base Year (Existing)	After-5 Years (Without Project)	After-5 Years (With Project)	Difference (Year)	After 20 Years (Without Project)	After 20 Years (With Project)	Difference (Year)
	2026	2030	2030	d = c-b	2050	2050	g = f-e
V/C Ratio	0.026	0.029	0.239	0.21	0.07	0.339	0.26
Delay (Seconds)	4.5	4.5	5.6	1.1	4.8	6.2	1.4
Queue Length (Meters)	1	1.1	6.3	5.2	2.8	10.9	8.1
Level of Service (LOS)	A	A	A	A	A	A	A

Overall, the analysis confirms that the project-generated traffic results in only marginal increases in operational parameters, and the surrounding road network is capable of accommodating future traffic demand up to 2050 without deterioration of service quality.

9.16 Conclusion and Recommendation

No Major Upgrades Required:

- All intersections and roundabouts maintain LOS A even after 20 years with project traffic.
- The V/C ratios and delays are well within acceptable limits for urban arterial roads.

Mitigation Measures

- Prohibit on-street parking along roads leading to the hospital to avoid lane blockage and ensure smooth traffic flow, especially during peak hours.
- Provide designated areas within the hospital premises for patient drop-off, staff, and ambulance parking to prevent roadside stoppage.
- Deploy traffic guards during peak hospital hours to manage flow and prevent congestion at entry points and exit points.
- Provide standard traffic signs and road markings in accordance with relevant road safety guidelines to improve traffic operations.

Chapter-10

Cumulative Impact Assessment

10 Cumulative Impact Assessment

10.1 Introduction

Cumulative Impact Assessment (CIA) is conducted to evaluate the combined environmental, social, and economic effects arising from the proposed Green Life Hospital Ltd. (Cancer Unit) together with existing and planned developments in the surrounding area of Purbachal New Town.

Although the proposed project is a standalone healthcare facility, it will operate within a rapidly developing planned urban area under RAJUK. Therefore, cumulative impacts may arise from combined effects of increased vehicular movement, urban infrastructure development, utility demand, and nearby institutional/commercial activities.

This chapter identifies potential cumulative impacts and recommends appropriate mitigation measures to ensure environmentally sustainable and socially responsible hospital development.

10.2 Objective of the Cumulative Impact Assessment

The objectives of this CIA are to:

- ✓ Identify cumulative environmental and social impacts arising from the hospital and surrounding urban/institutional developments
- ✓ Assess combined impacts on air quality, traffic, water resources, noise, and community health
- ✓ Evaluate long-term and short-term cumulative effects on urban services and infrastructure
- ✓ Recommend mitigation and management measures to minimize adverse cumulative impacts
- ✓ Ensure sustainable integration of the hospital within the planned urban environment.

10.3 Methodology

The CIA has been carried out using the following approach:

1. **Baseline Review:** Assessment of existing environmental and socio-economic conditions in Purbachal New Town and surrounding areas
2. **Identification of Surrounding Developments:** Consideration of residential, institutional, commercial, and infrastructure development activities in the region
3. **Impact Interaction Analysis:** Evaluation of how hospital activities interact with surrounding urban systems (traffic, utilities, air quality, waste management)

4. **Cumulative Effect Assessment:** Identification of additive and synergistic impacts
5. **Mitigation Identification:** Development of control measures to minimize cumulative effects
6. **Monitoring Framework:** Recommendation for long-term environmental and operational monitoring.

10.4 Development Context of the Area

The project is located within Purbachal New Town, a planned urban development area under RAJUK. The surrounding environment is gradually transforming into a mixed-use zone comprising:

- Residential developments
- Institutional facilities (schools, hospitals, offices)
- Road and transport infrastructure expansion
- Utility service networks (water, electricity, drainage systems).

Since the area is undergoing structured urbanization, cumulative impacts are primarily associated with urban growth rather than heavy industrial emissions.

10.5 Environmental Sensitivity of the Area

The environmental sensitivity of the area is considered moderate due to ongoing urban development activities. Key sensitivities include:

Air Quality:

Cumulative air emissions may arise from increased vehicular movement (patients, staff, ambulances, service vehicles) and ongoing construction activities in the surrounding area. These impacts are expected to be localized and moderate.

Water Resources:

Increased demand for water supply due to urban development and hospital operations may contribute to pressure on local water systems. However, impacts are manageable with proper conservation and recycling measures.

Noise Environment:

Noise may increase due to traffic movement, construction activities in nearby plots, and hospital operational activities (ambulance movement, utility systems). These impacts will be intermittent and localized.

Drainage and Urban Runoff:

Expansion of built-up areas may increase stormwater runoff, requiring proper drainage management to prevent localized waterlogging.

Urban Biodiversity:

The area has limited natural biodiversity due to planned urban development; therefore, cumulative ecological impacts are expected to be minimal.

10.6 Social and Economic Context

Cumulative socio-economic impacts are generally positive; however, some localized pressures may occur:

Health and Well-being:

The hospital will significantly improve healthcare access in the region. However, increased population movement may create minor stress on transport and public services.

Traffic and Transportation:

Combined traffic from residential development, institutional facilities, and hospital operations may increase congestion during peak hours.

Employment:

Cumulative developments will generate employment opportunities; however, competition for skilled healthcare professionals and service workers may increase.

Urban Services:

Increased demand for utilities such as water, electricity, and waste management services may place additional load on municipal systems.

10.7 Identification and Assessment of Cumulative Impacts

10.7.1 Environmental Impacts

Environmental Factor	Impact Description	Significance of Impact	Likelihood of Impact
Air Quality	Increased vehicular emissions from hospital and surrounding urban development	Moderate	Likely
Water Quality	Increased demand on water supply and wastewater generation	Moderate	Likely
Noise Pollution	Traffic, ambulance movement, and nearby construction activities	Moderate	Likely
Stormwater Drainage	Increased runoff due to urbanization and paved surfaces	Moderate	Possible
Urban Ecology	Minimal ecological impact due to already developed/planned urban area	Low	Unlikely

10.7.2 Social and Economic Impacts

Social/Economic Factor	Impact Description	Significance of Impact	Likelihood of Impact
Healthcare Access	Significant improvement in specialized cancer treatment services	High (Positive)	Certain
Traffic Congestion	Combined urban traffic may increase congestion during peak hours	Moderate	Likely
Employment	Increased job opportunities in healthcare and support services	High (Positive)	Certain
Utility Demand	Increased pressure on water, electricity, and waste systems	Moderate	Likely
Public Services	Improved institutional development but higher service demand	Moderate	Likely

10.8 Mitigation Measures**1. Air Quality Management**

- ✓ Promotion of low-emission transport (ambulances and hospital vehicles)
- ✓ Proper traffic circulation planning within hospital premises
- ✓ Regular monitoring of air quality in sensitive zones
- ✓ Green landscaping and plantation within hospital boundary.

2. Water Resource Management

- ✓ Installation of ETP + STP integrated treatment system
- ✓ Water recycling and reuse for non-potable purposes
- ✓ Implementation of water-efficient hospital systems
- ✓ Rainwater harvesting and storage facilities.

3. Noise Control

- ✓ Acoustic treatment in critical hospital units (ICU, OT, generator rooms)
- ✓ Maintenance of silent zones within hospital premises
- ✓ Controlled ambulance movement and traffic management
- ✓ Use of low-noise equipment where feasible

4. Traffic Management

- ✓ Dedicated entry and exit points for ambulances and service vehicles
- ✓ Internal traffic circulation planning
- ✓ Coordination with RAJUK/traffic authority if required

- ✓ Signage and speed control within hospital premises

5. Community Health and Safety

- ✓ Strict Infection Prevention and Control (IPC) system
- ✓ Proper medical waste management system
- ✓ Emergency preparedness and response system
- ✓ Health awareness and patient safety protocols.

10.9 Conclusion

The cumulative impact assessment indicates that the proposed Green Life Hospital Ltd. (Cancer Unit), when combined with ongoing and planned developments in Purbachal New Town, may result in moderate cumulative impacts primarily related to traffic, utilities, and urban services.

However, no significant adverse environmental or social impacts are expected due to the planned nature of the area and absence of heavy industrial activities. With proper implementation of mitigation measures such as ETP-STP systems, traffic management, noise control, and environmental monitoring, the cumulative impacts can be effectively managed.

Overall, the project is expected to generate significant positive cumulative impacts, particularly in terms of improved healthcare services, employment generation, and regional socio-economic development.

Chapter-11

Public Consultation

11 Public Consultation

11.1 Public Consultation Process

In accordance with the Environmental Conservation Rules (ECR) 2023 of Bangladesh, public consultation and disclosure constitute a key requirement of the Environmental Impact Assessment (EIA) process for the proposed **Green Life Hospital Ltd. (Cancer Unit)**. The process is designed to ensure transparency, meaningful stakeholder engagement, and incorporation of public views in project planning and decision-making.

11.2 Public Consultation Meetings (PCMs)

Public Consultation Meetings (PCMs) will be conducted with relevant stakeholders in the surrounding influence area of the proposed hospital project. These meetings will provide detailed information regarding the project description, anticipated environmental and social impacts, and proposed mitigation measures.

The PCMs will also serve as an open platform for stakeholders to express their opinions, concerns, and recommendations. All feedback received will be carefully reviewed and incorporated, where applicable, into the EIA report and project design to ensure environmentally responsible and socially acceptable development.

11.3 Public Disclosure Activities

To ensure transparency and wide dissemination of project information, public disclosure will be carried out through multiple channels, including:

- Distribution of printed information materials (leaflets, brochures, and information sheets) among local communities and stakeholders;
- Publication of official public notices in both Bangla and English national and local newspapers, in compliance with ECR 2023 requirements;
- Coordination with the Department of Environment (DoE), Narayanganj office, for regulatory guidance and disclosure procedures.

11.4 Public Hearing

A formal Public Consultation and Disclosure Meeting will be held as part of the EIA approval process. The exact date of the public hearing will be **announced in advance through both Bangla and English national newspapers**, in coordination with the Department of Environment (DoE), Narayanganj office, in accordance with ECR 2023 requirements.

The public hearing will provide a structured platform for open discussion among stakeholders, project proponents, and DoE officials. All concerns, suggestions, and feedback raised during the session will be properly documented and considered in the final EIA report to ensure transparency, compliance and sustainable project implementation.

Chapter-12

Environmental Management and Monitoring Plan

12 Environmental Management and Monitoring Plan

12.1 Introduction

This Environmental Management Plan (EMP) has been prepared as an integral component of the Environmental Impact Assessment (EIA) for the proposed Green Life Hospital Ltd. (Cancer Unit) located at Plot-039, Road-108, Sector-08, Purbachal New Town, Narayanganj, Bangladesh. The EMP provides a comprehensive framework for managing, monitoring, and mitigating the potential environmental and social impacts associated with the construction and operation of the proposed specialized cancer hospital.

The primary purpose of the EMP is to ensure that all project activities are implemented in an environmentally sound and socially responsible manner while maintaining compliance with the applicable environmental laws, regulations, and guidelines of Bangladesh, including the Environmental Conservation Act (ECA), 1995, the Environmental Conservation Rules (ECR), 2023, the Medical Waste (Management and Processing) Rules, 2008, and other relevant standards prescribed by the Department of Environment (DoE).

As a specialized healthcare facility, the hospital will generate a range of environmental aspects including medical waste, wastewater, air emissions from standby generators, noise, chemical and pharmaceutical wastes, and occupational health and safety concerns. Therefore, the EMP establishes specific mitigation measures, monitoring requirements, institutional responsibilities, emergency preparedness procedures, and reporting mechanisms to ensure effective environmental performance throughout the project lifecycle.

The EMP also serves as a management tool for promoting sustainable healthcare infrastructure development by protecting environmental quality, safeguarding public health, ensuring worker safety, and enhancing the overall environmental performance of the hospital. The plan covers the construction phase, operational phase, and future decommissioning considerations, thereby facilitating continuous environmental improvement and regulatory compliance.

12.2 Objectives of the EMP

The primary objectives of the EMP are:

- ✓ Ensure compliance with all applicable environmental laws, regulations, standards, and permit conditions issued by the Department of Environment (DoE) and other regulatory authorities.

- ✓ Prevent, minimize, or mitigate adverse environmental and social impacts associated with the construction and operation of the proposed Cancer Unit.
- ✓ Establish effective management measures for medical waste, hazardous waste, wastewater, air emissions, noise, chemical handling, and resource consumption.
- ✓ Protect public health, patient safety, worker welfare, and surrounding communities from potential environmental risks arising from hospital activities.
- ✓ Promote environmentally sustainable healthcare practices through efficient utilization of energy, water, and other natural resources.
- ✓ Establish environmental monitoring programs to evaluate environmental performance and verify the effectiveness of mitigation measures.
- ✓ Strengthen occupational health and safety (OHS) management systems to ensure a safe working environment for healthcare professionals, patients, contractors, and support staff.
- ✓ Ensure proper implementation of the Medical Waste Management Plan (MWMP), including segregation, collection, storage, transportation, treatment, and final disposal of healthcare waste.
- ✓ Enhance environmental awareness and capacity building among hospital personnel through regular training, education, and emergency preparedness programs.
- ✓ Establish procedures for environmental reporting, auditing, corrective actions, and continuous improvement to maintain long-term environmental compliance and sustainability.
- ✓ Promote transparent communication and stakeholder engagement by addressing environmental concerns and maintaining effective grievance management mechanisms.

12.3 Environmental Management Framework

The Environmental Management Plan has been developed to address the key environmental and social aspects associated with the project, including:

- Medical and hazardous waste management;
- Wastewater generation and treatment;
- Air quality management;
- Noise and vibration control;
- Chemical and pharmaceutical waste handling;
- Occupational health and safety;

- Infection prevention and control;
- Community health and safety;
- Resource conservation and energy efficiency;
- Emergency preparedness and response;
- Environmental monitoring and reporting.

Successful implementation of this EMP will ensure that the proposed Green Life Hospital Ltd. (Cancer Unit) operates in accordance with national environmental requirements and international good healthcare practices while providing safe, efficient, and environmentally responsible healthcare services to the community.

12.4 Mitigation Plan

The proposed Green Life Hospital Ltd. (Cancer Unit) is expected to provide specialized oncology healthcare services and significantly improve access to advanced cancer treatment facilities in Purbachal New Town and surrounding regions. While the project will generate substantial social and healthcare benefits, hospital construction and operational activities may also create environmental and occupational health risks if not properly managed.

Potential environmental concerns include generation of medical and hazardous waste, wastewater discharge, air emissions from emergency generators, noise generation, chemical handling, infection risks, and occupational health and safety issues. Therefore, a comprehensive Environmental Management Plan (EMP) has been developed to prevent, minimize, and control potential adverse impacts throughout the project lifecycle.

The Project Proponent shall be responsible for implementing all mitigation measures and ensuring compliance with applicable environmental, occupational health and safety, and healthcare waste management regulations.

12.4.1 EMP Implementation Phases

12.4.1.1 Construction Phase

The EMP during the construction phase will focus on:

- Dust and air quality management;
- Construction waste management;
- Noise and vibration control;
- Soil erosion and stormwater management;

- Occupational health and safety of workers;
- Traffic and community safety management;
- Prevention of pollution from fuels, oils, and construction materials.

12.4.1.2 Operational Phase

The EMP during the operational phase will focus on:

- Medical Waste Management Plan (MWMP) implementation;
- Wastewater collection, treatment, and disposal through ETP-STP;
- Air emission management from DG sets;
- Infection prevention and control measures;
- Chemical and pharmaceutical waste management;
- Occupational health and safety management;
- Emergency preparedness and response;
- Environmental monitoring and reporting;
- Community health and safety protection.

The Environmental Management Plan has been designed to ensure that Green Life Hospital Ltd. (Cancer Unit) operates in an environmentally responsible, socially acceptable, and sustainable manner while providing high-quality healthcare services to the community.

Table 12.1: Environmental Mitigation and Management Plan (Construction Phase).

Aspect	Potential Significant impact	Mitigation Measures	Responsible Party	Parameter to monitoring	Frequency	Location
Land Environment	Temporary disturbance of land surface due to excavation, foundation construction, and movement of construction equipment.	• Restrict construction activities within designated project boundaries. • Preserve topsoil for future landscaping activities where applicable. • Rehabilitate disturbed areas immediately after completion of construction works. • Maintain good housekeeping practices throughout the site.	Contractor, Project Manager, EHS Team	Land disturbance, site condition	Monthly	Demarcated project site boundary
Water Resources	Sediment-laden runoff, wastewater generation from workers' facilities, and accidental contamination from construction materials and chemicals.	• Install temporary drainage and sediment control measures. • Ensure proper sanitation facilities for workers. • Prevent discharge of untreated wastewater into drains. • Store fuel, lubricants, and chemicals on paved and protected surfaces. • Regular inspection of drainage systems, especially during the rainy season.	Contractor, Project Manager, EHS Team	pH, BOD, COD, TSS, Oil & Grease	Quarterly	Project site and nearby drainage network
Air Quality	Dust generation from excavation, earthworks, transportation of materials, and construction activities.	• Regular water spraying on exposed surfaces and access roads. • Cover construction materials during storage and transportation. • Restrict vehicle speed within the project area. • Maintain construction machinery and vehicles properly.	Contractor, Project Manager, EHS Team	PM _{2.5} , PM ₁₀ , Dust level	Monthly	Within project site boundary

Aspect	Potential Significant impact	Mitigation Measures	Responsible Party	Parameter to monitoring	Frequency	Location
		• Avoid open burning of waste materials.				
Noise Quality	Noise generated from construction machinery, generators, and vehicle movement.	• Restrict noisy construction activities to daytime hours. • Maintain equipment regularly to reduce excessive noise. • Provide hearing protection to workers. • Avoid unnecessary use of horns and alarms. • Install temporary noise barriers where required.	Contractor, Project Manager, EHS Team	Noise level (dBA)	Monthly	Site boundary and nearby sensitive locations
Soil Quality	Soil contamination due to accidental spillage of fuel, oil, paint, and construction chemicals.	• Designate secure storage areas for chemicals and fuels. • Maintain spill kits on-site. • Clean accidental spills immediately. • Ensure proper collection and disposal of construction waste.	Contractor, Project Manager, EHS Team	Spill incidents, waste disposal records	Monthly	Construction site
Solid waste	Generation of construction debris, packaging materials, and domestic waste from workers.	• Segregate waste at source. • Reuse and recycle construction materials whenever feasible. • Dispose waste through approved waste management facilities. • Implement the 3R (Reduce, Reuse, Recycle) strategy. • Maintain waste inventory records.	Contractor, Project Manager, EHS Team	Waste generation and disposal records.	Weekly	Project site and worker facilities
Worker Camp and Sanitation	Generation of domestic wastewater, poor hygiene conditions, and disease transmission risks.	• Provide adequate sanitation facilities for workers. • Ensure safe drinking water supply. • Conduct regular cleaning and maintenance.	Contractor, Project Manager, EHS Team	Sanitation condition, health records	Weekly	Worker facilities

Aspect	Potential Significant impact	Mitigation Measures	Responsible Party	Parameter to monitoring	Frequency	Location
		• Provide separate toilet facilities for male and female workers. • Implement proper waste collection and disposal systems.				
Community Health and Safety	Temporary inconvenience due to dust, noise, and construction vehicle movement.	• Install warning signs, barricades, and safety fencing around the construction area. • Ensure adequate site lighting. • Implement a traffic management plan. • Maintain communication with nearby stakeholders and authorities. • Establish a grievance redress mechanism.	Contractor, Project Manager, EHS Team	Community complaints, incident records	Monthly	Project site and surrounding roads
Traffic and Transportation	Increased movement of construction vehicles causing temporary traffic congestion and safety risks.	• Designate entry and exit routes for construction vehicles. • Schedule material transportation during non-peak traffic periods where feasible. • Install traffic signage and warning boards. • Employ traffic marshals during peak construction activities if required.	Contractor, Project Manager, EHS Team	Traffic incidents, vehicle movement records	Monthly	Access roads and project entrance
Occupational Health and Safety	Worker injuries, falls, electrical hazards, fire incidents, and equipment-related accidents.	• Mandatory use of PPE (helmet, gloves, safety shoes, reflective vest, mask). • Conduct safety induction and regular toolbox meetings. • Maintain first-aid facilities and trained personnel. • Install fire extinguishers and emergency response equipment.	Contractor, Project Manager, EHS Team	Accident records, PPE compliance, safety training records	Daily	Entire construction site

Aspect	Potential Significant impact	Mitigation Measures	Responsible Party	Parameter to monitoring	Frequency	Location
		• Conduct regular safety inspections and audits.				
Livelihood and Socio-Economic Conditions	Minor temporary inconvenience due to construction activities and vehicle movement.	• Prioritize local employment opportunities where feasible. • Minimize disturbance to surrounding road users. • Maintain safe access to nearby facilities and infrastructure. • Address community concerns promptly through stakeholder engagement.	Contractor, Project Manager, EHS Team	Employment records, grievance records	Quarterly	Surrounding area
Gender and Worker Welfare	Potential workplace inequality, harassment, or inadequate welfare facilities.	• Ensure equal employment opportunities and non-discriminatory practices. • Provide separate sanitation and changing facilities for male and female workers. • Establish a confidential grievance mechanism. • Ensure safe and respectful working conditions for all workers.	Contractor, Project Manager, EHS Team	Worker welfare records, grievances	Quarterly	Construction site
Visual Environment and Urban Aesthetics	Temporary visual impacts due to construction activities and material storage.	• Maintain site cleanliness and proper housekeeping. • Store construction materials in designated areas. • Remove debris regularly. • Restore and landscape disturbed areas after construction completion.	Contractor, Project Manager, EHS Team	Site cleanliness and housekeeping records	Weekly	Project site

Table 12.2: Environmental Mitigation and Management Plan (Operation Phase)

Aspect	Potential significant impact	Potential Management/Mitigation Measures	Responsible for		Parameter to monitoring	Frequency	Location
			Implementation	Monitor			
Air Emission & Indoor Air Quality	• Spread of airborne infections (TB, influenza, hospital-acquired infections) • DG set emissions affecting local air quality • Vehicular emissions from patient/ambulance traffic	• Maintain proper ventilation and HVAC with HEPA filtration in critical areas • Infection control protocol in wards and isolation units • DG sets with adequate stack height and compliance with DoE standards • DG operation only during power failure • Regular maintenance of ventilation systems • Controlled vehicular access and anti-idling policy.	Hospital EHS & Facility Management Team	Hospital EHS Officer / Administrator	PM _{2.5} , PM ₁₀ , NO _x , CO, indoor air quality index	Quarterly	Hospital premises
Water Quality (Wastewater & Groundwater)	• Contamination from hospital effluent and laboratory wastewater • Risk of pathogen contamination if untreated discharge occurs	• Operation of Effluent Treatment Plant (ETP) for hospital wastewater • Proper segregation of domestic, lab, and medical wastewater • Compliance with DoE discharge standards • Regular monitoring of ETP performance • Reuse of treated water for gardening/flushing	Hospital Engineering & EHS Team	Hospital EHS Officer / Facility Manager	pH, BOD, COD, TSS, TDS, microbial load	Quarterly (as per DoE)	Within hospital boundary

Aspect	Potential significant impact	Potential Management/Mitigation Measures	Responsible for		Parameter to monitoring	Frequency	Location
			Implementation	Monitor			
		where feasible Prevention of groundwater over-extraction.					
Noise Pollution	- Disturbance to patients affecting recovery - Equipment noise (DG sets, HVAC, medical machinery)	- Acoustic treatment in critical care and ICU zones - Noise insulation for DG sets and mechanical rooms - Use of low-noise equipment - Restriction of noisy activities in patient care areas - Green buffer and landscaped zones around hospital	Hospital Facility Management	EHS Officer / Hospital Administration	Noise level (dB) in wards and boundary	Quarterly	Hospital premises
Biomedical & Solid Waste Management	- Infection risk from improper biomedical waste handling - Soil and environmental contamination.	- Strict segregation of biomedical waste (yellow, red, blue, white bins) - Storage in designated secure area - Handing over to authorized Common Biomedical Waste Treatment Facility (CBWTF) - Compliance with Bangladesh Medical	Hospital EHS & Waste Management Unit	Infection Control Committee / EHS Officer	Waste segregation compliance, disposal records	Continuous	Hospital premises

Aspect	Potential significant impact	Potential Management/Mitigation Measures	Responsible for		Parameter to monitoring	Frequency	Location
			Implementation	Monitor			
		Waste Rules / DoE guidelines • Implementation of 3R principles for non-hazardous waste • Staff training on waste handling.					
Chemical & Hazardous Material Handling	• Chemical exposure (lab reagents, disinfectants, pharmaceuticals) • Accidental spillage	• Proper labeling and storage of chemicals • Secondary containment for hazardous liquids • MSDS availability in all labs and pharmacy areas • Trained staff for handling chemicals • Spill response kits in laboratories and storage areas	Hospital EHS & Waste Management Unit	EHS Officer / Lab In-charge	Chemical inventory, spill incidents	Continuous	Hospital premises
Infection Control & Odor Management	• Spread of hospital-acquired infections • Odor from waste and septic systems	• Strict infection prevention and control (IPC) protocol • Proper ventilation in waste storage and treatment areas • Timely removal of biomedical waste • Use of disinfectants and odor control systems • Housekeeping and sanitation SOPs.	Hospital EHS & Waste Management Unit	EHS Officer	Infection rate, odor complaints	Continuous	Hospital premises

Aspect	Potential significant impact	Potential Management/Mitigation Measures	Responsible for		Parameter to monitoring	Frequency	Location
			Implementation	Monitor			
Soil & Environmental Contamination	- Leakage from waste storage or septic systems - Improper disposal of hazardous waste	- Impervious flooring in waste storage areas - Proper drainage and wastewater treatment - Safe disposal of expired medicines and hazardous waste - No direct discharge to soil or open land	Hospital EHS & Waste Management Unit	EHS Officer	Waste disposal records	Continuously	Within project boundary
Health & Safety (Patients, Staff, Visitors)	- Occupational injuries, needle-stick injuries - Fire hazards and emergency risks - Electrical/mechanical accidents.	- Fire safety system (alarm, extinguishers, hydrants) - Emergency evacuation plan and drills - PPE for healthcare workers - Safety signage and restricted access zones - Regular training and drills - Incident reporting system	Hospital Administration & EHS Team	Safety Committee / EHS Officer	TRIR, LTIFR, incident reports, training records	Monthly / Quarterly	Hospital premises
Public Health & Community Impact	- Traffic congestion - Noise and air impact on surrounding community	- Ambulance priority lane and traffic management plan - Controlled parking system - Green buffer development - Community health awareness programs	Hospital Administration	EHS Officer / Management	Patient flow, traffic records	Regular	Hospital surrounding area

12.5 Medical Waste Management Study & Plan (MWMP)

12.5.1 Introduction:

The proposed Green Life Hospital Limited Cancer Unit (GLHLCU) will provide specialized oncology, diagnostic, radiotherapy, chemotherapy, laboratory, and inpatient healthcare services. Such activities inevitably generate a variety of healthcare wastes that may pose risks to public health and the environment if not managed properly. Therefore, a comprehensive Medical Waste Management Study and Plan (MWMP) has been developed to ensure the environmentally sound management of all waste streams generated during the operational phase of the hospital.

The MWMP aims to establish a systematic framework for waste minimization, segregation, collection, transportation, treatment, storage, and final disposal of healthcare wastes in accordance with national regulations and international best practices. Particular emphasis has been given to the management of infectious waste, pathological waste, pharmaceutical waste, sharps waste, liquid waste, and any radioactive waste associated with diagnostic and therapeutic procedures.

12.5.2 Scope of Study:

The scope of the study covers the identification, characterization, handling, treatment, storage, transportation, and disposal of all waste streams expected to be generated from the proposed cancer hospital. The assessment also includes occupational health and safety requirements, radiation safety considerations, emergency response measures, monitoring procedures, and institutional responsibilities for effective implementation of the waste management system.

12.5.2.1 Waste Characterization:

Based on the proposed services and operational activities of GLHLCU, healthcare wastes are categorized into the following groups:

General Waste (Non-Hazardous and Non-Infectious Waste):

General waste includes paper, cardboard, packaging materials, food and kitchen waste, wrappers, plastic containers, plastic bottles, medicine strips, office waste, clean glass bottles, and other domestic-type wastes that do not pose biological, chemical, or radiological hazards.

Hazardous Healthcare Waste:

Hazardous healthcare waste includes infectious waste, anatomical and pathological materials, contaminated dressings, used gauze and bandages, contaminated syringes,

biological specimens, microbiological cultures, expired pharmaceuticals, chemical reagents, laboratory chemicals, and chemotherapy-related wastes.

Sharps Waste:

Sharps waste consists of used needles, syringes with needles, scalpel blades, surgical pins, lancets, broken glassware, and other sharp objects capable of causing injury or infection.

Liquid Waste:

Liquid waste includes wastewater generated from patient wards, operation theatres, laboratories, diagnostic facilities, laundry units, cleaning operations, and administration areas.

Radioactive Waste:

Radioactive waste may be generated from radiotherapy, nuclear medicine procedures, radioisotope applications, contaminated absorbent materials, and radiation monitoring activities. Such waste requires specialized handling and disposal procedures under the supervision of qualified radiation safety personnel.

12.5.3 Assessment Components:

To ensure compliance with applicable environmental, healthcare, and radiation safety regulations throughout the operational lifecycle of the Cancer Unit, the following key components have been incorporated into the waste management system:

12.5.3.1 Regulatory Compliance

The proposed waste management system has been designed in accordance with:

- Medical Waste (Management and Processing) Rules, 2008, Bangladesh;
- Environment Conservation Act (ECA), 1995 and Environment Conservation Rules (ECR), 2023;
- Bangladesh Atomic Energy Regulatory Authority (BAERA) Regulations;
- International Atomic Energy Agency (IAEA) Safety Standards;
- World Health Organization (WHO) Healthcare Waste Management Guidelines.

12.5.3.2 On-site Segregation System (Color-Coded Bins):

Source segregation will be rigidly enforced at the exact point of generation using a standardized, color-coded bin matrix:

- o **Yellow Bins (Leak-proof):** For Infectious and Pathological waste.
- o **Red Bins (Puncture-proof):** Exclusively for Sharps.
- o **Black Bins:** For Non-hazardous General/Domestic waste.

12.5.3.3 Temporary Storage:

A secure, centralized **Central Medical Waste Storage Room** will be constructed within the hospital site. The structural design will feature impermeable concrete flooring, active ventilation, secondary containment for liquid chemical traps, specialized wash areas, and strict access controls to prevent scavenging, insect vector breeding, or unauthorized entry.

12.5.3.4 Internal Waste Transport System:

Waste will be collected and moved daily using dedicated, fully enclosed, leak-proof transport trolleys. Internal transit routes are mapped along isolated service corridors during off-peak hours to entirely bypass public elevators, food preparation zones, and clean linen supplies.

12.5.3.5 Treatment Method:

On-site Decontamination: Installation of an advanced **Autoclave/Microwave** system to sterilize highly infectious laboratory waste and medical plastics prior to disposal.

Off-site Licensed Facility: Secure containment, documentation, and transfer of hazardous chemical wastes, and pathological remains to a DoE-licensed specialized vendor for high-temperature thermal destruction (**Incineration**) or chemical neutralization.

Final Disposal Arrangement: Non-hazardous deactivated residues from on-site treatment along with general municipal solid waste will be handed over to the authorized waste collectors or the city corporation.

Liquid waste

Liquid waste generated from the hospital is treated through proper treatment system and after treatment, it is excreted into the drainage system.

Radioactive waste

If any radioactive waste is generated, it is securely stored and handled as per the regulations of the Bangladesh Atomic Energy Commission, using lead-lined silver containers, and disposed of through authorized agencies.

Occupational Health & Safety (OHS) for Handlers: All waste handling personnel will be equipped with heavy-duty Personal Protective Equipment (PPE), including thick puncture-resistant gloves, protective aprons, face shields, and steel-toed boots.

Emergency Spill Management: Localized "Spill Kits" (comprising chemical absorbents, granular disinfectants, biohazard bags, and neutralizers) will be permanently deployed across all chemotherapy wards and pathology labs, governed by strict Standard Operating Procedures (SOPs) for accidental spill isolation.

12.5.3.6 Environmental Safety and Radiation Waste Management:

Our cancer hospital maintains full compliance with the International Atomic Energy Agency (IAEA) Safety Standards for the safe management of radioactive waste generated from LINAC- based external beam radiotherapy and high-dose-rate (HDR) brachytherapy for cervical cancer. As per IAEA guidelines, our facility follows a structured waste-management system covering waste minimization, segregation, secure storage, documentation, and controlled disposal. Since LINAC machines do not produce radioactive waste, only routine quality-control materials and non-radioactive consumables are generated, which are managed as general medical waste. For brachytherapy, all sealed radioactive sources are handled under strict regulatory control, with predisposal management, inventory tracking, shielded storage, and return-to- supplier protocols in accordance with IAEA recommendations for sealed source management.

No radioactive material is released into the environment at any stage. Our radiation safety program includes continuous monitoring, staff training, emergency preparedness, and record- keeping to ensure that individuals, society, and the environment remain fully protected from radiological hazards, consistent with the Joint Convention and IAEA Waste and Environmental Safety standards.

1. Radiation Sources used in the facility:

LINAC Radiotherapy

- Uses high-energy X-rays generated electrically.
- No radioactive material is produced, stored, or disposed.
- Therefore, LINAC does not generate radioactive waste.

HDR Brachytherapy

- Uses sealed radioactive sources (Ir-192 or Co-60).
- Sources remain fully encapsulated, shielded, and never opened.
- All sources are managed under strict regulatory control.

2. Environmental Safety Policy

Our hospital is committed to:

- Protecting patients, staff, the public, and the environment
- Ensuring zero release of radioactive material into air, water, or soil
- Maintaining ALARA (As Low As Reasonably Achievable) principles
- Implementing continuous radiation monitoring

- Ensuring safe waste segregation, storage, and disposal.

4. Radiation Waste Management System



4.1 Waste from LINAC Radiotherapy

- LINAC produces no radioactive waste.
- Only non-radioactive consumables (PPE, QA phantoms, packaging) are generated.
- These are managed as general medical waste per DoE and WHO guidelines.

4.2 Waste from HDR Brachytherapy

A. Sealed Source Management

- All radioactive sources are sealed, shielded, and never opened.
- No radioactive material is released during treatment.
- Spent sources are returned to the manufacturer under BAERA-approved protocols.

B. Predisposal Waste Management

- No liquid or solid radioactive waste is generated.
- All applicators, catheters, and instruments are non-radioactive after source removal.
- These are sterilized and reused or disposed as standard medical waste.

C. Emergency Source Handling

- A BAERA-approved Radiation Safety Officer (RSO) supervises all operations.
- Emergency procedures include:
 - Source retraction protocols
 - Area evacuation
 - Radiation survey meter verification
 - Incident reporting to BAERA.

5. Radiation Protection Measures



5.1 Facility Shielding

- LINAC bunker constructed with high-density concrete.
- HDR brachytherapy suite equipped with shielded walls, controlled access.
- All shielding designs follow IAEA and BAERA dose-limit requirements.

5.2 Personnel Monitoring

- All radiation staff wear:
 - Thermoluminescent dosimeters (TLDs)
 - Pocket dosimeters
- Dose records maintained for lifetime tracking.

12.5.4 Operational Compliance and Monitoring Checklist

The following structured compliance matrix shall be implemented by the hospital's Environmental Safety Officer to ensure continuous monitoring, auditing, and regulatory compliance during the operational phase of the Green Life Hospital Limited Cancer Unit (GLHLCU).

SL	Monitoring Parameter	Verification Frequency	Responsible Entity	Target / Compliance Metric
1	Source Segregation Efficiency	Daily (Per Shift)	Ward In-Charge / Nursing Staff	Zero mixing of hazardous healthcare waste with general domestic waste streams.
2	Color-Coded Bin Infrastructure	Weekly	Facility Manager	100% availability of properly labeled, color-coded, and undamaged bins in all patient care and clinical areas.
3	Autoclave Treatment Effectiveness	Every Treatment Cycle	Laboratory Technician / Equipment Operator	Complete sterilization confirmed through biological indicators and recorded pressure-temperature cycle logs.
4	PPE Compliance for Waste Handlers	Daily (Start of Shift)	Occupational Safety Officer	100% use of approved PPE, including puncture-resistant gloves, masks, aprons, and

SL	Monitoring Parameter	Verification Frequency	Responsible Entity	Target / Compliance Metric
				safety boots by waste handling personnel.
5	Hazardous Waste Manifest Control	Per Consignment	Administration / Licensed Waste Vendor	Properly completed and signed chain-of-custody documentation for all off-site transportation of hazardous waste.
6	Spill Kit Availability and Accessibility	Monthly	Safety Auditor	Spill response kits fully stocked, functional, and readily accessible in oncology, chemotherapy, laboratory, and high-risk areas.

12.5.4.1 Additional Recommended Monitoring Parameters

To strengthen the hospital's environmental and occupational safety management system, the following additional parameters may also be incorporated into the operational monitoring program:

- Waste storage room cleanliness and ventilation condition.
- Internal waste transportation route hygiene and leak prevention.
- Training and awareness status of healthcare and housekeeping staff.
- Vaccination status of waste handlers (Hepatitis-B and Tetanus).
- Waste generation quantity tracking by department.
- Effluent treatment system performance and discharge quality.
- Radiation monitoring records and dosimetry compliance for radiation workers.
- Incident and accident reporting related to waste handling and spill events.

12.5.5 Conclusion

The Operational Compliance and Monitoring Checklist provides a practical and systematic mechanism for ensuring that medical waste management activities at GLHLCU remain compliant with national regulations, WHO guidelines, and international best practices. Regular monitoring, documentation, and corrective actions will help maintain high standards of environmental protection, occupational safety, and healthcare waste management throughout the hospital's operational phase.

12.6 Wastewater & Effluent Treatment Study (ETP Design Study)

12.6.1 Total Flow and Design Capacity

The combined average wastewater generation is therefore 194 m³/day. Applying a modest safety factor to accommodate peak loading, future variation and operational reliability, the plant is designed for a nominal capacity of 200 m³/day.

Table 12.3: Total flow and design capacity

Wastewater Source	Basis	Generation (m ³ /day)
Hospital beds (200 beds)	450 L/bed/day	90
Population (2,600 persons/day)	40 L/person/day	104
Total Average Generation	—	194
Design Capacity (with safety factor)	—	200
Operation hr	—	22hr
Design average flow (Domestic)		4 m ³ /h
Design average flow (Sewage)		5.09 m ³ /h
Total Design average flow:	—	9.09 m³/h

12.6.2 Design Influent and Effluent Characteristics

Table 12.4 Design Inlet and Outlet water characteristics.

SN	Water Quality Parameters	Unit	Inlet water (STP)	Inlet Load Kg	Outlet water (STP)	ECR, 2023
1.	pH	-	5-10		6.0 ~ 9.0	6.0 ~ 9.0
2.	Chemical Oxygen Demand (COD)	mg/l	≤ 800	160	< 125	< 125
3.	Biochemical Oxygen Demand (BOD)	mg/l	≤ 300	60	<30	<30
4.	Total Suspended Solid (TSS)	mg/l	≤ 300	60	<100	<100
5.	Oil & Grease	mg/l	≤ 50	10	< 10	< 10
6.	Temperature	°C	30 - 40	-	< 30	< 30
7.	Total Coliform	Cfu/100ml	uncountable		<1000	<1000
8.	TN	mg/l	≤ 100	20	≤ 50	≤ 50
9.	PO ₄	mg/l	≤ 50	10	≤ 15	≤ 15

Load concentration= (mg/l x Q)/ 1000

12.6.3 Treatment Process Description

The treatment train follows a physical – chemical – biological – membrane – disinfection sequence, with dedicated sludge handling. The unit sequence and tank references below and the Process Block Diagram.

The detailed drawing design calculation are attached in Annexure-4.

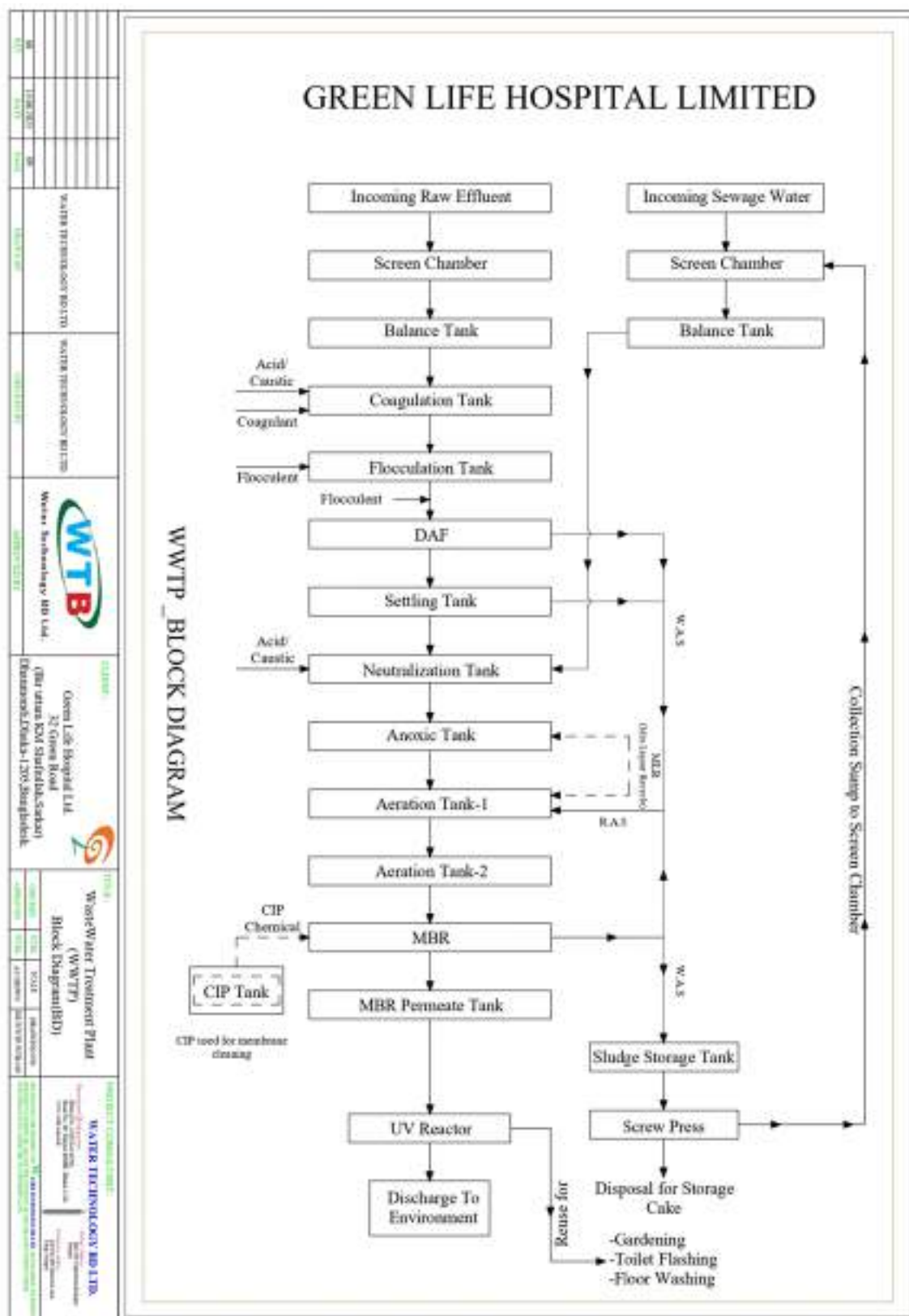
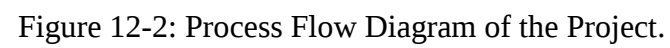


Figure 12-1: Process Flow Block Diagram



12.7 Monitoring Plan

Environmental monitoring is an essential component of the Environmental Management Plan (EMP) for the proposed Green Life Hospital Limited Cancer Unit (GLHLCU). The monitoring program has been developed to ensure that all mitigation measures are effectively implemented, environmental performance is continuously evaluated, and compliance with applicable national regulations and international best practices is maintained throughout the operational phase of the hospital.

The monitoring results will provide a basis for corrective actions, continuous improvement, and reporting to regulatory authorities, including the Department of Environment (DoE) and other relevant agencies.

12.7.1 Monitoring Objectives

The primary objectives of the environmental monitoring program are to:

- Assess the effectiveness of environmental mitigation measures;
- Ensure compliance with environmental laws, regulations, standards, and permit conditions;
- Identify any unforeseen environmental impacts arising from hospital operations;
- Monitor occupational health and safety performance;
- Ensure proper management of medical waste, wastewater, and radiation-related activities;
- Protect public health, hospital staff, patients, visitors, and the surrounding environment;
- Facilitate continual environmental performance improvement.

12.7.2 Monitoring Areas

The environmental monitoring program shall cover the following key areas:

- Wastewater and Effluent Quality
- Noise Environment
- Medical Waste Management
- Hazardous and Chemical Waste Management
- Occupational Health and Safety (OHS)
- Radiation Safety and Monitoring
- Energy and Resource Consumption
- Emergency Preparedness and Response

- Environmental Compliance and Documentation.

12.7.3 Monitoring Indicators

The establishment of the proposed project may lead to environmental risks and disruptions during both the construction and operational phases. To ensure the project's sustainability and minimize adverse effects, a robust environmental monitoring program must be implemented. Monitoring will help detect potential environmental damages early and allow for effective mitigation measures.

The following key monitoring indicators should be assessed periodically to ensure compliance with environmental regulations and best practices:

1. Occupational Health and Safety (OHS)

Objective: Ensure a safe and healthy working environment for hospital staff, contractors, waste handlers, and visitors.

Key Parameters:

- Personal Protective Equipment (PPE) compliance;
- Number of occupational accidents and injuries;
- Availability of first-aid facilities and emergency medical support;
- Fire safety equipment functionality;
- Staff health surveillance and vaccination records;
- Emergency drills and training programs.

Monitoring Frequency: Monthly inspection and annual audit.

Responsible Authority: Environmental, Health and Safety (EHS) Unit and Hospital Administration.

2. Air Quality

Objective: Ensure that hospital operations do not adversely affect local air quality.

Key Parameters:

- Odor generation from waste storage areas;
- Emissions from emergency generators.

Monitoring Frequency: Quarterly.

Responsible Authority: EHS Unit through accredited environmental laboratories.

3. Wastewater and Effluent Quality

Objective: Ensure compliance with DoE discharge standards and prevent water pollution.

Key Parameters:

- pH, BOD), COD), TSS, and coliform.
- Flow rate and treatment efficiency of the wastewater treatment system.

Monitoring Frequency: Bi-annually as per DoE.

Responsible Authority: EHS Unit and Wastewater Treatment Plant Operator.

4. Noise Levels

Objective: Maintain hospital noise levels within acceptable limits for patient comfort and environmental compliance.

Key Parameters:

- Daytime and nighttime noise levels (dB(A));
- Noise from generators, HVAC systems, ambulances, and other mechanical equipment.

Monitoring Frequency: Quarterly.

Responsible Authority: EHS Unit.

5. Medical Waste Management

Objective: Ensure safe handling, segregation, treatment, transportation, and disposal of healthcare waste.

Key Parameters:

- Waste segregation efficiency;
- Quantity of medical waste generated;
- Functionality of color-coded bin system;
- Autoclave sterilization efficiency;
- Waste storage conditions;
- Waste manifest and disposal records;
- Compliance with Medical Waste Management Rules.

Monitoring Frequency: Daily monitoring and monthly audits.

Responsible Authority: Waste Management Officer and EHS Unit.

7. Hazardous Chemical Waste Management

Objective: Prevent environmental contamination and occupational exposure from hazardous chemicals and chemotherapy-related waste.

Key Parameters:

- Chemical storage conditions;
- Inventory records;

- Spill incidents and corrective actions;
- Hazardous waste transportation documentations.

Monitoring Frequency: Continuous with periodic audits.

Responsible Authority: Pharmacy Department, Oncology Department, and EHS Unit.

8. Radiation Safety Monitoring

Objective: Ensure radiation exposure remains within regulatory limits and that radioactive materials are managed safely.

Key Parameters:

- Personal dosimetry records (TLD badges);
- Radiation exposure levels in treatment and controlled areas;
- Radiation survey meter readings;
- Source inventory and tracking records;
- Compliance with BAERA requirements;
- Emergency response preparedness.

Monitoring Frequency: Monthly and as required by BAER.

Responsible Authority: Radiation Safety Officer (RSO).

9. Energy and Water Consumption

Objective: Promote efficient resource utilization and sustainability.

Key Parameters:

- Electricity consumption;
- Generator fuel consumption;
- Water consumption;
- Energy-saving initiatives;
- Water conservation measures.

Monitoring Frequency: Monthly.

Responsible Authority: Facility Management Department.

10. Emergency Preparedness and Response

Objective: Ensure readiness for emergencies involving fire, chemical spills, radiation incidents, medical waste spills, and natural disasters.

Key Parameters:

- Availability of emergency equipment;

- Spill kit readiness;
- Fire extinguisher inspection records;
- Emergency drill performance;
- Incident response time.

Monitoring Frequency: Monthly inspection and annual mock drills.

Responsible Authority: Safety Officer and Emergency Response Team.

12.7.4 Monitoring Reporting and Documentation

All environmental monitoring data shall be recorded, analyzed, and maintained by the EHS Unit. Monitoring reports shall be prepared on a quarterly and annual basis and submitted to hospital management and relevant regulatory authorities as required.

Any non-compliance identified during monitoring activities shall be investigated promptly, and appropriate corrective and preventive actions shall be implemented. Continuous monitoring and reporting will ensure that the proposed GLHLCU operates in an environmentally responsible manner while maintaining compliance with the Department of Environment (DoE), Medical Waste Management Rules, WHO Guidelines, and BAERA regulatory requirements.

Table 12.5: Monitoring Plan for the Construction Phase.

S.N	Monitoring Aspect	Source of Impact	Monitoring Methods & Parameters	Monitoring Location	Frequency	Executing Agency	Enforcement Agency
01	Employment & Local Workforce Engagement	Construction labor demand	Contractor's employment records, number of local workers engaged	Project vicinity	Monthly	Contractor	Project Proponent / Hospital Management
02	Soil Erosion	Excavation, land clearing, grading, earthworks	Visual inspection, erosion extent assessment, effectiveness of erosion control measures	Project site	During rainy season	Contractor	Project Proponent / EHS Unit
03	Greenbelt Development	Plantation and landscaping activities	Survival rate of planted species, vegetation density assessment	Project site	Half-yearly	Contractor	Project Proponent / EHS Unit
04	Air Quality	Construction vehicles, dust from materials and activities	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO monitoring	Construction site	Continuous during construction	Contractor	Department of Environment (DoE)
05	Waste Management	Construction debris and material disposal	Waste handling, segregation, storage, and disposal practices	Project site	Regular during construction	Contractor	Project Proponent / EHS Unit
06	Noise Level	Heavy machinery, transport, construction activities	Day & night noise level monitoring (dB(A))	Construction site & sensitive receptors	Regular	Contractor	DoE / Project Proponent
07	Social Environment	Employment, community disturbance, labor issues	Labor law compliance, employment records, community feedback	Surrounding project area	Half-yearly	Contractor	Project Proponent / Local Authority (if applicable)
08	Occupational Health & Safety (OHS)	Workplace hazards, construction accidents	Incident reports, safety audits, near-miss reporting, PPE compliance	Construction site & labor camp	Regular during construction	Contractor	Project Proponent / EHS Unit

Table 12.6: Monitoring Plan for the Operation Phase.

S.N	Monitoring Aspect	Source of Impact	Monitoring Methods and Parameters	Monitoring Location	Frequency	Executing Agency	Enforcement Agency
01	Noise Levels	Hospital operations, DG sets, HVAC systems, ambulance movement	Noise level monitoring (day and night) in dB(A) as per national standards	Noise-sensitive areas within hospital premises and boundary	Quarterly	EHS Unit of GLHLCU	Administration (EHS/Plant Manager) & DoE
02	Biological Environment	Landscaping, green area development, plantation activities	Survival rate of planted species, condition of greenbelt, basic biodiversity observations	Hospital campus green areas and surrounding buffer zone	Quarterly	EHS Unit of GLHLCU	Hospital Administration & DoE
03	Wastewater & Effluent Quality	Hospital wastewater from wards, labs, operation theatres, and utility areas	Physico-chemical and microbiological parameters (pH, BOD ₅ , COD, TSS, coliform) as per DoE	Effluent Treatment Plant (ETP) outlet	Bi-annually / as per DoE requirement	EHS Unit & ETP Operator	Hospital Administration & DoE
04	Solid & Medical Waste Management	Generation of general waste, infectious waste, sharps, and pathological waste	Waste segregation efficiency, storage conditions, autoclave/incineration performance, waste records	Waste storage, treatment, and disposal areas	Daily inspection & Monthly audit	Waste Management Unit & EHS Unit	Hospital Administration & DoE
05	Soil Pollution	Improper waste disposal, chemical spills, leakage from storage areas	Visual inspection and periodic soil quality testing for contamination indicators	Waste handling and chemical storage areas	Periodic / As required	EHS Unit of GLHLCU	Hospital Administration & DoE
06	Worker Health & Safety (OHS)	Occupational hazards, infection risks, chemical exposure, accidents	PPE compliance, incident records, occupational illness tracking, fire	All operational areas of hospital	Monthly / As per H&S plan	EHS Unit & Hospital Safety Committee	Hospital Administration & DoE

S.N	Monitoring Aspect	Source of Impact	Monitoring Methods and Parameters	Monitoring Location	Frequency	Executing Agency	Enforcement Agency
			safety inspection, emergency preparedness				
07	Radiation Safety & Risk Management	Diagnostic and therapeutic radiation sources (e.g., oncology/radiology units)	Personal dosimetry (TLD badges), radiation leakage monitoring, equipment calibration, source inventory	Radiology, oncology, and controlled radiation areas	Monthly & continuous monitoring	Radiation Safety Officer (RSO)	BAERA, Hospital Administration & DoE (as applicable)
08	Disaster Preparedness & Emergency Response	Fire incidents, chemical spills, radiation emergencies, natural disasters	Emergency drills, evacuation response time, fire safety system inspection, ERP implementation	Entire hospital premises	Continuous monitoring + Annual mock drills	Safety Officer & Emergency Response Team	Hospital Administration & DoE

12.8 Occupational Health and Safety (OHS) Management Plan

The Occupational Health and Safety (OHS) Management Plan for the proposed Green Life Hospital Limited Cancer Unit (GLHLCU) has been developed to establish a comprehensive framework for protecting the health, safety, and well-being of all patients, healthcare professionals, support staff, contractors, and visitors.

The plan systematically identifies occupational hazards associated with oncology services, diagnostic procedures, laboratory operations, and hospital support services, and defines appropriate control measures, monitoring mechanisms, emergency preparedness systems, and reporting arrangements.

This plan ensures compliance with applicable national regulations as well as internationally recognized standards on occupational health and safety, infection prevention and control (IPC), radiation protection, and healthcare safety management.

12.8.1 Objective

The objective of this OHS Management Plan is to establish and maintain a safe, secure, and health-protective working environment within GLHLCU by identifying, assessing, preventing, and controlling occupational health and safety risks associated with clinical, diagnostic, laboratory, radiological, and support service activities.

The plan further aims to ensure effective implementation of engineering controls, administrative controls, and personal protective equipment (PPE), supported by continuous training, monitoring, health surveillance, and incident management systems to achieve high standards of occupational safety performance.

12.8.2 Scope

This OHS Management Plan applies to all operational, clinical, diagnostic, and support service activities within the GLHLCU, including:

- Radiation oncology services (including LINAC-based radiotherapy systems)
- Diagnostic imaging and radiological services
- Chemotherapy preparation and administration units
- Inpatient wards, outpatient departments, and patient care areas
- Laboratory and pharmacy services
- Biomedical waste handling, storage, treatment, and disposal systems
- Electrical, mechanical, and facility maintenance works

- Administrative and general service areas
- Contractors, service providers, and visitors within hospital premises.

12.8.3 Occupational Exposure and Key Hazards

Personnel working in GLHLCU may be exposed to several occupational hazards depending on job functions and departmental activities. Key hazards include:

- Ionizing radiation exposure in radiotherapy and imaging units (e.g., LINAC systems)
- Exposure to hazardous chemotherapy drugs during preparation and administration
- Biological hazards, including exposure to infectious agents in clinical and laboratory settings
- Chemical exposure from disinfectants, reagents, and pharmaceutical substances
- Electrical hazards and equipment-related risks associated with medical devices and utilities
- Sharps injuries and biomedical waste-related exposures
- Ergonomic hazards such as patient handling, repetitive tasks, and prolonged clinical duties
- Fire hazards and emergency-related risks within hospital operational areas.

All identified hazards shall be managed through a combination of engineering controls, administrative procedures, and mandatory use of appropriate PPE.

12.8.4 Key Occupational Health and Safety Measures

The following occupational health and safety measures shall be implemented across all relevant hospital functions:

Activity / Area	Potential Hazards	Proposed Management Measures
Radiation Therapy Units	Exposure to ionizing radiation affecting staff, patients, and attendants	Shielded treatment bunkers using lead/concrete barriers; controlled access zoning; personal dosimetry; adherence to ALARA principle; operation by trained and licensed radiation personnel
Chemotherapy & Oncology Areas	inhalation, skin contact, or spills	Biological safety cabinets; closed-system drug transfer devices; strict PPE use (gloves, gowns, masks, eye protection); spill management protocols; dedicated preparation areas

Activity / Area	Potential Hazards	Proposed Management Measures
Diagnostic & Imaging Facilities	Radiation exposure, electrical hazards, equipment malfunction	Shielded rooms; interlock systems; warning signage; routine calibration and maintenance; controlled access during operation
Laboratory & Pharmacy Services	Chemical exposure, biological hazards, contamination risks	MSDS availability; proper labeling and segregation; secure chemical storage; fume hoods and ventilation systems; spill response kits
Biomedical Waste Management	Infection risks, needle-stick injuries, environmental contamination	Color-coded segregation at source; safe storage and transport; authorized disposal; trained handlers; strict PPE compliance
Electrical & Medical Equipment Safety	Electric shock, fire hazards, equipment failure	Preventive maintenance; proper grounding and insulation; safety standards compliance; emergency shutdown systems
Infection Control & Clinical Areas	Hospital-acquired infections (HAIs), cross-contamination	IPC protocols; hand hygiene compliance; sterilization and disinfection systems; isolation procedures where required
General Hospital Operations	Slips, trips, falls, ergonomic stress	Good housekeeping; anti-slip flooring; signage; ergonomic design; regular safety awareness programs

12.8.5 Training and Awareness

A structured training and capacity-building program shall be implemented for all personnel categories to ensure effective implementation of OHS practices:

- **Induction Training:** Mandatory orientation for all staff, contractors, and visitors covering hospital safety rules, infection control, radiation safety, and emergency procedures
- **Refresher Training:** Periodic training on radiation protection, chemotherapy handling, biomedical waste management, fire safety, and emergency response
- **Specialized Training:** Advanced training for Radiation Safety Officers, oncology nurses, laboratory staff, and hazardous drug handlers
- **Toolbox Talks & Awareness Sessions:** Regular short briefings to reinforce safe practices and address department-specific risks.

12.8.6 Monitoring, Inspection and Reporting

A structured monitoring and reporting system shall be implemented to ensure continuous improvement of occupational safety performance:

- Routine daily inspections of clinical, laboratory, and radiation areas
- Continuous radiation exposure monitoring using personal dosimeters
- Incident reporting system covering injuries, exposures, near-misses, and unsafe conditions
- Periodic internal safety audits and third-party external audits
- Health surveillance and periodic medical examinations for high-risk staff.

12.8.7 Emergency Preparedness and Response

A comprehensive Emergency Response Plan (ERP) shall be implemented to address potential emergencies, including:

- Radiation incidents and equipment malfunction
- Chemical spills involving drugs and laboratory reagents
- Fire incidents, electrical hazards, and evacuation emergencies
- Medical emergencies involving patients, staff, and visitors.

Key provisions include:

- Clearly defined emergency response procedures and roles
- Dedicated Emergency Response Team (ERT) and communication system
- Regular mock drills and simulation exercises (minimum quarterly)
- First aid facilities and trained responders at strategic locations
- Alarm systems, evacuation routes, and emergency signage.

12.8.8 Roles and Responsibilities

Implementation of the OHS Management Plan shall be ensured through defined institutional responsibilities:

- **Hospital Management:** Overall responsibility for policy enforcement, resource allocation, and safety governance
- **Radiation Safety Officer (RSO) / HSE Unit:** Monitoring compliance, training, inspections, and reporting
- **Department Heads:** Ensuring implementation of safety procedures within respective departments

- **Healthcare Workers and Support Staff:** Compliance with SOPs, PPE usage, IPC practices, and hazard reporting
- **Contractors and Visitors:** Compliance with hospital safety rules and restricted area access control.

12.8.9 Occupational Health Surveillance and Annual Reporting

A structured occupational health surveillance program shall be implemented for all employees, with special focus on high-risk groups such as radiation workers, oncology staff, laboratory personnel, and biomedical waste handlers:

- Pre-employment and periodic medical examinations
- Routine health monitoring and fitness assessments
- Radiation dose tracking using personal dosimeters
- Monitoring of exposure to chemicals and infectious agents
- Confidential occupational health record maintenance.

An Annual Occupational Health and Safety Report shall be prepared and submitted by facility management, including:

- Summary of workforce health status and fitness for duty
- Occupational exposure levels (radiation, chemical, biological risks)
- Incident and injury records with corrective actions
- Evaluation of OHS system effectiveness
- Recommendations for continuous improvement.

This system ensures continuous strengthening of occupational health and safety performance and supports full compliance with regulatory and audit requirements.

12.9 Budget for the Environmental Management and Monitoring

This section presents the estimated budget for Environmental Management, Environmental Monitoring, Occupational Health & Safety (OHS), and related manpower requirements during the operation phase of the proposed GLHL Cancer Unit at Purbachal New Town.

The cost estimates are indicative in nature and may be refined during detailed design and operational planning stages.

12.9.1 Environmental Monitoring Cost

Environmental monitoring activities will be implemented to ensure compliance with national environmental standards, including air quality, water quality, noise levels, biomedical waste management performance, and greenbelt maintenance.

Table 12.7: Estimated Annual Environmental Monitoring Cost

Item	Parameters	Cost (BDT)
Water Quality Monitoring (Inlet & Outlet)	pH, COD, BOD, TSS, Coliform	1,00,000.00
Noise Level Monitoring	noise levels	30,000.00
Biomedical Waste Management Monitoring	Handling, segregation, disposal compliance	5,00,000.00
Greenbelt Monitoring & Maintenance	Plantation care and upkeep	50,000.00
Total Estimated Annual Environmental Monitoring Cost		6,80,000.00

12.9.2 Occupational Health & Safety (OHS) Cost

Provision is made for occupational health and safety measures to ensure a safe working environment for all hospital personnel.

Table 12.8: Health & Safety Measures Management Cost

SN	Events	Cost
01	PPE and basic safety materials (gloves, masks, gowns, goggles, safety shoes, first aid kits, etc.)	50, 000.00

12.9.3 Environmental & OHS Manpower Cost

Dedicated personnel will be engaged for environmental management, monitoring, and occupational safety supervision.

Table 12.9: Estimated Annual Manpower Cost (BDT).

SN	Designation	No. of Personnel	Monthly Cost	Annual Cost
01	EHS/EMS Officer	1	60,000.00	7,20,000.00
02	Support Staff	4	25,000.00	12,00,000.00
	Total Personnel Cost			19,20,000.00

12.9.4 Total Environmental Management Costs

In the operation phase, the total annual costs for environmental management will include monitoring, personnel, and health & safety management:

Table 12.10: Summary of Estimated Annual Cost.

SN	Events	Cost
01	Environmental Monitoring Cost	6,80,000.00
02	Personnel Costs	19,20,000.00
03	Health & Safety Costs	50,000.00

12.10 Environmental Management Team (EMT) – GLHL Cancer Unit

To ensure effective implementation of the Environmental Management Plan (EMP), Occupational Health and Safety (OHS) system, biomedical waste management, infection prevention and control (IPC), and environmental compliance during the operation phase of the proposed GLHL Cancer Unit at Purbachal New Town, a dedicated Environmental Management Team (EMT) will be established.

The EMT will be responsible for maintaining a safe and hygienic hospital environment, ensuring proper waste and wastewater management, minimizing occupational risks, and ensuring compliance with Department of Environment (DoE) and relevant healthcare environmental standards.

The team will operate under the supervision of the Hospital Administration and will coordinate with clinical, engineering, laboratory, and support departments.

(a) EHS/EMS Officer – Team Lead (01 Position)

Reports to: Hospital Administration / Medical Superintendent

The EHS/EMS Officer will act as the central focal point for all environmental, health, safety, and waste management activities within the hospital.

Key Responsibilities:

- Overall implementation and supervision of EMP, EMS, OHS, and infection control support systems.
- Ensure compliance with DoE regulations and applicable national and healthcare environmental standards.

- Develop and enforce hospital-wide environmental procedures including biomedical waste management, wastewater management, sanitation, and hygiene control.
- Conduct routine inspections across all hospital units including ICU, wards, OT, laboratory, radiology, radiotherapy, chemotherapy, and utility areas.
- Monitor environmental performance including waste handling practices, wastewater discharge, sanitation conditions, and general hospital environment.
- Ensure proper segregation, storage, transport, and disposal of biomedical waste in compliance with regulatory requirements.
- Coordinate occupational health and safety measures including hazard identification, PPE compliance, and risk mitigation.
- Maintain environmental records, monitoring reports, incident logs, and compliance documentation.
- Organize training and awareness programs on environmental safety, infection prevention, and occupational health for all hospital staff.
- Coordinate emergency preparedness and response activities including fire safety, chemical spill management, and evacuation procedures.
- Liaise with Department of Environment (DoE), auditors, and external regulatory agencies.

(b) Support Staff (04 Positions)

Includes: ETP Operator, Waste Management Staff, Electrical/Utility Staff, and Infection Control & Environmental Hygiene Assistant.

This support team is responsible for the day-to-day operation of environmental systems, biomedical waste handling, utility safety, and hospital hygiene support functions.

Reports to: EHS/EMS Officer

1. ETP Operator (01)

- Operate and monitor Effluent Treatment Plant (ETP) and ensure compliance with discharge standards.
- Maintain proper functioning of treatment units, pumps, dosing systems, and mechanical components.
- Conduct routine operational checks and maintain process records.
- Assist in sampling and basic monitoring of influent and effluent quality.

- Ensure safe handling, treatment, and disposal of sludge and residues.
- Report any malfunction or abnormal operational condition to the EHS/EMS Officer.

2. Waste Management Staff (01)

- Implement biomedical waste segregation system using color-coded containers.
- Collect, handle, and transport waste from clinical and non-clinical areas safely.
- Ensure proper labeling, packaging, and temporary storage of waste.
- Coordinate with licensed waste management contractors for final disposal.
- Maintain cleanliness and hygiene of waste storage and handling areas.
- Prevent leakage, spillage, and improper handling of infectious waste.

3. Electrical / Utility Staff (01)

- Ensure safe operation and maintenance of hospital electrical systems, including backup power (generator/UPS).
- Monitor electrical panels, wiring, grounding, and equipment safety conditions.
- Support uninterrupted power supply for critical hospital units such as ICU, OT, radiotherapy, and laboratory.
- Identify and report electrical faults, overloads, and safety hazards.
- Assist in preventive maintenance and emergency shutdown procedures when required.

4. Infection Control & Environmental Hygiene Assistant (01)

- Support infection prevention and control (IPC) activities across hospital areas.
- Monitor hygiene conditions in wards, ICU, OT, laboratory, and treatment areas.
- Assist in cleaning supervision of high-risk clinical zones.
- Ensure availability and proper use of disinfectants, hand hygiene facilities, and sanitation materials.
- Support biomedical waste handling team in maintaining infection-safe practices.
- Report infection risks, contamination issues, or hygiene lapses to the EHS/EMS Officer.
- Assist in maintaining overall environmental cleanliness and hospital sanitation standards.

Overall Function of EMT

The Environmental Management Team ensures:

- Safe, hygienic, and infection-controlled hospital environment
- Proper biomedical waste and wastewater management system
- Continuous occupational health and safety compliance
- Effective environmental monitoring and regulatory compliance
- Emergency preparedness and incident response capability
- Integration of environmental safeguards into daily hospital operations.

Chapter-13

Emergency Response Plan

13 Emergency Response Plan

13.1 Introduction

The proposed Green Life Hospital Ltd. Cancer Unit (GLHLCU) will be a specialized tertiary healthcare facility dedicated to cancer diagnosis, treatment, and supportive care services. The facility will include advanced oncology infrastructure such as chemotherapy units, radiotherapy facilities, diagnostic laboratories, imaging centers, operating theatres, intensive care units, medical gas systems, and healthcare waste management systems.

Healthcare facilities are inherently sensitive environments where the safety of patients, healthcare professionals, visitors, and surrounding communities must be ensured at all times. Although the proposed hospital is designed in compliance with national regulatory requirements and internationally accepted healthcare standards, the possibility of accidental or emergency situations cannot be completely eliminated.

Potential emergencies may arise from fire incidents, electrical failures, medical gas leakage, radiation-related events, infectious disease outbreaks, utility disruptions, natural disasters, or other unforeseen incidents.

To address these risks, an Emergency Response Plan (ERP) has been developed to establish a structured framework for preparedness, communication, emergency response, evacuation, recovery, and continuous improvement. The ERP aims to minimize adverse impacts, protect human health and the environment, ensure continuity of critical healthcare services, and maintain regulatory compliance.

This ERP has been prepared in accordance with applicable national legal frameworks, including the Bangladesh Labour Act 2006 (amended), BNBC, Medical Waste (Management and Processing) Rules 2008, ECR 2023, Fire Safety regulations, and relevant international EHS guidelines for healthcare facilities.

13.2 Objectives of the Emergency Response Plan

The primary objectives of the Emergency Response Plan are to:

- Protect patients, healthcare workers, visitors, contractors, and surrounding communities from injury, illness, and loss of life;
- Prevent or minimize environmental impacts arising from accidental releases of hazardous substances, biomedical waste, wastewater, chemicals, or radioactive materials;

- Establish a structured and coordinated emergency management system within the hospital;
- Ensure rapid detection, reporting, communication, and control of emergency situations;
- Facilitate safe and orderly evacuation of patients, staff, and visitors;
- Maintain continuity of essential healthcare services during emergencies;
- Ensure effective coordination with local authorities, emergency responders, and regulatory agencies;
- Strengthen institutional preparedness through training, awareness, and emergency drills;
- Promote continual improvement in emergency preparedness and response performance.

13.3 Potential Emergency Scenarios

Considering the nature of the proposed oncology facility, the following emergency scenarios have been identified:

Fire and Explosion: Potential sources include electrical systems, generators, medical equipment, pharmacy storage areas, fuel storage facilities, and oxygen-enriched environments.

Medical Gas Leakage: Leakage from oxygen, medical air, vacuum systems, or associated pipelines may create fire hazards and operational risks.

Radiation Emergencies: Incidents involving LINAC, CT Simulator, PET-CT, or other radiation-producing equipment may result from equipment malfunction, procedural failure, or accidental exposure.

Biomedical Waste Incidents: Improper handling, storage, transportation, or disposal of infectious and hazardous healthcare waste may pose risks to public health and the environment.

Infectious Disease Outbreaks: Healthcare facilities remain vulnerable to outbreaks of communicable diseases that may affect patients, staff, and visitors.

Utility Failure: Disruptions to electricity, water supply, HVAC systems, communication systems, or medical gas supply can significantly affect healthcare operations.

Natural Hazards: The facility may be exposed to earthquakes, severe storms, heavy rainfall, flooding, lightning, and other climate-related hazards.

Mass Casualty Incidents: The hospital may be required to respond to emergencies involving large numbers of casualties resulting from accidents, disasters, or public health emergencies.

13.4 Emergency Management Organization

An Emergency Response Team (ERT) shall be established comprising representatives from hospital administration, clinical services, engineering, safety, security, and support departments.

The ERT shall function under a defined chain of command and remain available 24/7..

Table 13.1: Composition of Emergency Response Team.

Position	Responsibility
Hospital Director / CEO	Overall Emergency Commander
EHS Manager	Emergency Coordinator
Chief Medical Officer	Clinical Response Coordinator
Nursing Superintendent	Patient Evacuation Coordinator
Facility Manager	Utility and Infrastructure Management
Radiation Safety Officer	Radiation Emergency Management
Fire Safety Officer	Fire Emergency Response
Security Supervisor	Site Security and Access Control
Communication Officer	Internal and External Communication

The ERT shall be responsible for coordinating all preparedness, response, evacuation, rescue, communication, and recovery activities.

13.5 Emergency Control Center

An Emergency Control Center (ECC) shall be established within the hospital premises to coordinate emergency response activities.

The ECC shall maintain:

- Emergency contact directory;
- Building layouts and evacuation maps;
- Utility network drawings;
- Medical gas system drawings;
- Fire protection system layouts;
- Hazardous material inventory;

- Radiation safety information;
- Emergency communication equipment;
- Incident reporting records; and
- Emergency resource inventories.

The ECC shall function as the central command point during emergency situations.

13.6 Emergency Communication System

An effective communication system is essential for emergency management.

The hospital shall maintain:

- Automatic fire alarm system;
- Public address (PA) system;
- Emergency notification system;
- Mobile and landline communication;
- Two-way radio communication;
- Emergency contact lists; and
- Emergency reporting procedures.

Emergency contact numbers shall be prominently displayed throughout the facility.

13.7 Evacuation Procedures

Safe evacuation is one of the most critical components of emergency preparedness.

The hospital shall establish comprehensive evacuation procedures that include:

- Clearly marked evacuation routes;
- Illuminated exit signage;
- Designated assembly points;
- Horizontal and vertical evacuation strategies;
- Emergency evacuation equipment;
- Special arrangements for critically ill and immobile patients;
- Headcount and accountability procedures.

Special attention shall be given to patients in intensive care units, operating theatres, radiotherapy units, and chemotherapy wards.

Emergency evacuation drills shall be conducted at least once every quarter.

13.8 Fire Emergency Response

Fire represents one of the most significant risks within healthcare facilities due to the presence of electrical systems, oxygen-rich environments, combustible materials, and sensitive medical equipment.

The hospital shall implement the following fire safety measures:

- Automatic fire detection and alarm systems;
- Fire hydrant systems and hose reels;
- Portable fire extinguishers;
- Emergency lighting systems;
- Clearly marked emergency exits;
- Fire-resistant building materials where applicable;
- Emergency shutdown procedures for electrical systems;
- Routine inspection and maintenance of firefighting equipment.

During a fire incident, evacuation shall be initiated immediately, emergency responders shall be notified, and firefighting operations shall be conducted by trained personnel until external assistance arrives.

13.9 Medical Gas Leakage Response

The hospital will utilize medical gases including oxygen, medical air, and vacuum systems.

In the event of a gas leak:

- The affected system shall be isolated immediately;
- Access to the area shall be restricted;
- Adequate ventilation shall be ensured;
- Ignition sources shall be eliminated;
- Emergency maintenance personnel shall be mobilized;
- The area shall be inspected before reoccupation.

13.10 Radiation Emergency Response

Radiotherapy and diagnostic imaging facilities may involve radiation-related risks.

The hospital shall establish radiation emergency procedures under the supervision of the Radiation Safety Officer (RSO).

Response measures include:

- Immediate suspension of operations;

- Isolation of affected areas;
- Radiation monitoring and assessment;
- Medical evaluation of exposed individuals;
- Incident reporting and investigation;
- Regulatory notification where required.

All radiation-related emergencies shall be managed in accordance with national radiation safety regulations.

13.11 Biomedical Waste Incident Management

Accidental release, spill, or exposure to biomedical waste may pose significant health and environmental risks.

The response procedure shall include:

- Area isolation;
- Use of PPE;
- Disinfection and decontamination;
- Safe collection and containment of waste;
- Proper disposal through approved treatment systems;
- Incident reporting and corrective action implementation.

13.12 Infectious Disease Outbreak Management

The hospital shall maintain a comprehensive Infection Prevention and Control (IPC) Program.

Outbreak management measures include:

- Isolation of infected patients;
- Contact tracing;
- Enhanced cleaning and disinfection;
- Use of PPE;
- Visitor restrictions where necessary;
- Monitoring and surveillance;
- Coordination with public health authorities.

13.13 Utility Failure Response

Emergency preparedness measures shall address failures of:

- Electricity supply;

- Water supply;
- HVAC systems;
- Medical gas systems;
- Communication systems.

Backup generators and essential utility redundancy systems shall be maintained to ensure uninterrupted operation of critical healthcare services.

13.14 Medical Emergency and First Aid

The hospital shall maintain a fully functional emergency medical response system including:

- First-aid facilities;
- Emergency medicines and equipment;
- Ambulance services;
- Trained first responders;
- CPR and life-support capabilities.

All incidents shall be documented and investigated.

13.15 Emergency Response to Natural Hazards (Earthquake)

The hospital shall implement earthquake preparedness measures including structural safety assessments, emergency evacuation procedures, and post-event inspection protocols.

13.16 Training and Mock Drills

Regular training programs shall be conducted to enhance emergency preparedness.

Training shall cover:

- Fire safety;
- First aid and CPR;
- Evacuation procedures;
- Radiation safety;
- Biomedical waste management;
- Disaster preparedness.

Mock drills shall be conducted periodically and documented for continual improvement.

13.17 Incident Reporting, Investigation and Documentation

All emergencies, accidents, near-misses, and unsafe conditions shall be reported immediately.

The investigation process shall identify:

- Root causes;
- Corrective actions;
- Preventive measures;
- Lessons learned.

Relevant records shall be maintained by the EHS Department and reviewed periodically.

13.18 Review and Continuous Improvement

The Emergency Response Plan shall be reviewed at least annually or following any significant incident, regulatory change, or operational modification.

Findings from emergency drills, incident investigations, audits, and stakeholder feedback shall be incorporated into future revisions of the ERP to ensure continual improvement and maintain a high level of preparedness throughout the operational life of the proposed Green Life Hospital Ltd. Cancer Unit.

Chapter-14

Conclusion and Recommendations

14 Conclusion and Recommendations

14.1 Conclusion

The Environmental Impact Assessment (EIA) for the proposed GLHL Cancer Unit at Purbachal New Town provides a comprehensive evaluation of potential environmental, occupational health, and socio-economic impacts associated with the development and operation of a specialized cancer treatment facility.

The assessment indicates that during the construction phase, limited short-term environmental impacts may occur, including dust generation, noise, vibration, and temporary disturbance to the surrounding environment. During the operational phase, potential impacts are mainly associated with biomedical waste generation, wastewater discharge, chemical handling (laboratory reagents), radiation safety risks in radiotherapy units, and increased energy consumption.

However, these impacts are anticipated to be site-specific, manageable, and reversible, provided that appropriate mitigation measures and environmental management systems are effectively implemented.

The report confirms that with the implementation of a structured Environmental Management Plan (EMP), Occupational Health and Safety (OHS) system, Infection Prevention and Control (IPC) measures, and continuous environmental monitoring, the project will not cause any significant adverse environmental impact.

On the positive side, the proposed cancer unit will significantly contribute to improving healthcare services in the region, enhance access to specialized cancer treatment, generate employment opportunities, and support overall socio-economic development.

Therefore, the project is considered environmentally acceptable and sustainable, subject to strict implementation of recommended mitigation and management measures.

14.2 Recommendations

To ensure environmentally sound and safe operation of the proposed GLHL Cancer Unit, the following recommendations are made:

- ✓ A comprehensive Environmental Management Plan (EMP) and Occupational Health and Safety (OHS) system shall be strictly implemented during both construction and operation phases.
- ✓ A dedicated system for biomedical waste management shall be established in

compliance with DoE guidelines, ensuring proper segregation, handling, storage, and disposal.

- ✓ A functional Effluent Treatment Plant (ETP) and proper wastewater management system shall be installed, and treated water shall meet applicable discharge standards.
- ✓ Strict radiation safety measures shall be implemented in radiotherapy units, including shielding design, access control, dosimetry monitoring, and trained Radiation Safety Officers (RSO).
- ✓ Proper infection prevention and control (IPC) measures shall be enforced throughout the hospital, particularly in ICU, OT, wards, and chemotherapy units.
- ✓ A structured occupational health surveillance program shall be implemented for hospital staff, especially for radiation workers, laboratory personnel, and waste handlers.
- ✓ Regular environmental monitoring of air quality, noise levels, wastewater quality, and indoor environmental conditions shall be conducted as per monitoring plan.
- ✓ A trained Environmental Management Team (EMT) shall be maintained to ensure day-to-day compliance and effective implementation of environmental safeguards.
- ✓ A well-defined emergency preparedness and response system shall be established, covering fire safety, chemical spills, radiation incidents, and evacuation procedures.
- ✓ Comprehensive training and capacity-building programs shall be conducted for all healthcare workers, technicians, and support staff on OHS, IPC, and environmental safety.
- ✓ Energy-efficient design, proper ventilation systems, and sustainable hospital infrastructure should be promoted to reduce environmental footprint.
- ✓ A green landscaping and plantation program shall be implemented to improve microclimate and environmental aesthetics of the hospital premises.
- ✓ Priority should be given to local employment opportunities, where applicable, to enhance socio-economic benefits.
- ✓ The project must ensure strict compliance with all applicable national environmental laws and DoE regulations throughout its lifecycle.

With proper implementation of the recommended mitigation measures, environmental management systems, and regulatory compliance mechanisms, the proposed GLHL Cancer Unit is expected to operate in an environmentally sustainable, socially beneficial,

and medically efficient manner without causing significant adverse impacts on the surrounding environment.