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Environmental Impact Assessment (EIA) for Khilkhet Abason Prokolpo Khilkhet, Dhaka

August 2023

CEGIS
Center for Environmental and Geographic Information Services

Final Report

Environmental Impact Assessment

of Khilkhet Abason Prokolpo, Khilkhet, Dhaka

Acknowledgments

The Center for Environmental and Geographic Information Services (CEGIS), a Public Trust under the aegis of the Ministry of Water Resources, extends its heartfelt gratitude to Mr. Md. Tofazzel Hossain Miah, the esteemed Principal Secretary to the Prime Minister and President of BCS Housing Society in Dhaka, for entrusting CEGIS with conducting the "Environmental Impact Assessment (EIA) of Khilkhet Housing Project."

CEGIS also wishes to convey its deepest appreciation to the distinguished senior members of the Society for their ready, guidance. Mr. Md. Tayfur Rahman of the BCS Housing Society in Dhaka deserves our thanks for facilitating the availability of reports, documents, and project maps during field visits and arranging meetings with relevant officials to obtain the necessary information.

The study team would like to express its profound gratitude to the local people for their participation and feedback during the field visit. Their concerns and insights have been invaluable in completing the study.

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Abbreviation and Acronyms

AEZ	Agro-ecological Zone
B	Boron
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BCS	Bangladesh Civil Service
BMD	Bangladesh Meteorology Department
BNBC	Bangladesh National Building Code
BoD	Biochemical oxygen demand
BWDB	Bangladesh Water Development Board
Ca	Calcium
CAS	Catch Assessment Survey
CEGIS	Center for Environmental and Geographic Information Services
CNG	Compressed Natural Gas
CO	Carbone Mono-Oxide
CRM	Closed Reflux Method
DAE	Department of Agricultural Extension
DAP	Detail Area Plan
dB	decibel
DNCC	Dhaka North City Corporation
DEM	Digital Elevation Model
DG	Director General
DMDP	Dhaka Metropolitan Development Plan
DO	Dissolved Oxygen
DoE	Department of Environment
DoF	Department of Fisheries
DPHE	Department of Public Health and Engineering
ECA	Environment Conservation Act
ECR	Environment Conservation Rules
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FAO	Food and Agricultural Organization
FAP	Flood Action Plan

FAR	Floor Area Ration
FC	Faecal Coliform
FGD	Focus Group Discussions
FPCO	Flood Plan Co-ordination Organization
FRSS	Fish resources service system
FWIP	Future-With-Project
FWOP	Future-Without-Project
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GOB	Government of Bangladesh
GPS	Global Positioning System
GWT	Ground water table
HBB	Herring-Bone-Band
HH	Household
HIES	Household Income and Expenditure Survey
HTW	Hand Tube- Well
IEC	Important Environmental Component
IESC	Important Environmental and Social Components
IUCN	International Union for Conservation of Nature
K	Potassium
Kg	Kilogram
KII	Key Informants Interview
LGI	Local Government Institution
MFP	Membrane Filtration Procedure
Mg	Magnesium
MGC	Maximum Ground Coverage
MICS	Multiple Indicator Cluster Survey
Mo	Molybdenum (Mo)
MP	Muriate of Potash
MSL	Mean Sea Level
N	Nitrogen
NCA	Net cultivable area
NF	Not found
NGO	Non-Government Organization
NOC	No Objection Certificate

NOx	Oxides of Nitrogen
NWRD	National Water Resources Database
OM	Organic matter
OSHA	Occupational Safety and Health Administration
P	Phosphorus
PCM	Public Consultation Meeting
PDM	Public Disclosure Meeting
PM	Particulate Matters
PM10	Respirable Dust Content
$PM_{2.5}$	Fine Particulate Matter
PO_4	Phosphate
PPM	Parts per million
PPR	Peste Des Petits Ruminants
PRA	Participatory Rural Appraisal
PRECIS	Providing Regional Climates for Impacts Studies
PWAP	Pond Water Availability Period
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Karipakkha
RRA	Rapid Rural Appraisal
RWH	Rainwater Harvesting
S	Sulphur
SIS	Small Indigenous Species
SOLARIS	Soil and Land Resources Information System
SO_2	Sulphur Dioxide
SPM	Suspended Particulate Matter
SRDI	Soil Resources Development Institute
SRES	Special Report: Emissions Scenarios
SS	Suspended Solid
STP	Sewerage Treatment Plant
STW	Shallow Tube Well
TC	Total Coliform
TDS	Total Dissolved Solids
TK	Taka
ToR	Terms of reference
TSP	Triple Super Phosphate

TSS	Total Suspended Solids
UNDP	United Nations Development Programme
WARPO	Water Resources Planning Organization
WASA	Water Supply and Sewerage Authority
WB	World Bank

Glossary

River	Flowing in nature, feed water to and drain out the water of the catchment area through drainage channel (Khal)
Khal	A small channel through which the water flows. These may or may not be perennial
Beel	A saucer-shaped depression, which generally retains water throughout the year
Floodplain	Seasonally inundated land that gets inundated by the spillover of the river water during the rainy season
Semi-closed Water Body	Seasonal floodplain in which fishermen practice to culture fish using *banas*.
Connectivity	The movement of organisms from place to place through dispersal or migration

Executive Summary

Background

This report presents the EIA study for the development of the '*Khilkhet Housing Project*' by the BCS Housing Society. The overall objective of this EIA study is to provide information on the nature and extent of possible environmental impacts resulting from the proposed residential project and other associated concurrent works. This information will appropriately help to suggest mitigation measures and develop an environmental management plan to mitigate adverse environmental impacts, offset them, or reduce them to acceptable levels.

Dhaka is a rapidly growing city that has become very busy and densely populated over time. Due to the centralized administrative and institutional arrangements and limited urban areas that offer similar opportunities, many people have migrated to Dhaka from rural areas (SENES Consultants Limited and Techno Consult International Limited, 2007). To accommodate this increasing population, Dhaka is gradually expanding both vertically and horizontally. In addition to government initiatives, various land development companies are undertaking residential development projects in the urban outskirts of Dhaka city.

The BCS Housing Society began developing the Khilkhet Housing Project in 2017, which spans approximately 104.3355 acres of land. It aims to help accommodate Dhaka City's rapidly growing population and urban needs using the urban fringe area. The project site is located near the 300-foot-Purbachol highway and is bordered by the Balu River to the northeast and the Jamuna housing area to the southwest. The Khilkhet Housing Project is located in the Khilkhet Thana of Dhaka District. The project area comprises three mauzas, Mostul, Talna, and Dhelna, of Khilkhet Thana, Dhaka District. As per the Detail Area Plan (DAP) 2016-2035 of RAJUK, the project area is proposed as Mixed Used Zone (predominantly residential area). The BCS Housing Society received conditional guidance from RAJUK to develop the area.

The Center for Environmental and Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources (MoWR), has been assigned to carry out this EIA study.

Residential development

The most important activities during the pre-construction, construction and operation phases for the development of residential areas, which will result in possible impacts are sand filling for land development, land levelling, mobilization of construction materials for infrastructural development, construction of road and installation of utility services.

Approach and methodology

The Environmental Impact Assessment (EIA) study for the "Khilkhet Housing Project" followed the guidelines for water sector project assessments established by the Flood Plan Co-ordination Organization (FPCO) in 1992 and subsequently updated by the Water Resources Planning Organization (WARPO) in 2002.

Baseline Condition

The baseline conditions have been compiled for the physical environment (water and land), biological environment (ecology and fish resources), environmental quality (air, water and noise) and socio-economic environment.

Water Resources

During monsoon season, the project area is susceptible to flooding from the Balu River and surrounding water sources. According to DAP, the area is classified as a General flood flow zone. Local reports indicate that significant flooding has not occurred in recent years, but in 1988 and 2004, the water level rose to approximately 10-15 feet above the ground and remained stagnant for about 10-15 days.

Agriculture Resources

The project area was a single-cropped agriculture land, which has been gradually filled up for the proposed project.

Biological Environment

Ecological Resources

The project area is located in the Brahmaputra-Jamuna floodplain, a single bio-ecological zone. The region includes a variety of ecosystems, such as wetlands, seasonal floodplains, homesteads, crop fields, grasslands, and roadside vegetation. The wetlands in the area come in different types, both perennial and seasonal, and they play a vital role in providing habitats for aquatic plants, fish, and water birds. Currently, around 95% of the project area has been developed, and it is covered with tall grasses that offer nesting, roosting, and feeding habitat for birds, small mammals, reptiles, and other insects that thrive in grasslands.

There are about 40 fish species in the area, among which Small Indigenous Species (SIS) such as Taki, Punti, Tengra, Koi, Kholisa, Shingh etc. are noticeable. The annual fish production from captured fisheries is estimated to be approximately 122 MT, while culture fisheries yield around 73 MT in the study area. Unfortunately, this housing project might experience an annual loss of 5 MT in captured fish production.

The housing project is currently in the development stage. It is estimated that by 2035, there will be 2862 households in the area. In the greater study area, there are around 5,17,120 households with a total population of 21,71,903. Presently, only 55% of the population is employed. Regarding utility services, the sanitary conditions are good, with 73% of people using supplied drinking water. 25% of people use Hand Tube-wells (HTWs) as their drinking water source. All households have access to electricity, but no gas supply line is available.

Environmental Impacts have been assessed, and a management plan has been developed based on the Important Environmental Components (IEC). Some of the major impacts with their mitigation measures are described here:

Environmental Impacts

Probable Negative Impacts

Drainage congestion: Land fill works may block the existing drainage channels and create drainage congestion.

Ground water depletion: GWT may decline at a rate of 0.6 m/yr, and in future, the GWT may drop to 14 m below the ground surface. The rate of subsurface infiltration would decrease, and groundwater abstraction would increase. Around 36~40% reduction of groundwater availability may take place in the dry season.

Crop production loss: 95 acres of land will be losing crop production.

Wetland habitat and ecosystem habitat: The land filling process reduces the wetland and creates concern for its ecosystem and relevant aquatic vegetation and wildlife. The land development activities may also affect ecosystem health due to habitat conversion.

Fish habitat and fish production loss: In the FWIP scenario, the net loss of fish production would be about 5 tons annually.

Probable Positive Impacts

Flooding: The study suggests that the entire project area will be free from regular monsoon flooding. Surrounding flooding impacts due to the project is negligible.

Employment opportunities: All development works including construction work will open wide opportunities for the day laborers. Moreover, different employment opportunities will be created for the locals after the completion of residential development. This housing project will create approximately 800 job opportunities in the service sector.

Investment opportunities: Housing development will create more investment opportunities for the local people.

Land price: Residential development in the urban fringe area will gradually increase the land price of the study area, which will highly favour the landowners.

Population migration: To get a better and healthy environment, away from urban crowd, people will feel encouraged to migrate to this area.

Environmental Management Plan

Physical environment

- Existing canals inside the project area should be re-excavated and maintained properly.
- Rainwater Harvesting (RWH) facilities should be promoted at domestic level to reduce underground water use for domestic purpose. One central RWH system may be introduced by constructing artificial ponds for water retention and ground water recharge.
- Walk ways should be constructed on both sides of canals through proper landscaping. All the landscaping works should be planned considering local plant species.

Biological environment

- Canal re-excavation and conservation in natural form, creating water retention area by maintaining 1 m water depth in compliance with DAP for facilitating game fisheries and angling. The spoils from re-excavation works can be used for remaining land development works within the project area.
- Existing canals must be kept free from all types of land filling and must be conserved their connectivity with surrounding major water bodies and river.

nvironmental quality

Workers operating equipment that generates noise of ≥85 dB continuously for 8 hours or more should use ear muffs (OSHA);

All vehicles, equipment and machinery used should comply with the relevant ECR norms and other rules;

Greenbelts and plantations or LID concepts may be used to reduce noise levels and solve drainage problems;

Construction materials should be covered with clean tarpaulin in good condition. The tarpaulin should be properly secured;

Stockpiles of all construction materials should be at least 100m away from nearby water bodies;

Proper treatment of existing surface water prior to use for drinking or any other direct use should be ensured.

Socio-economic environment

A green belt program considering local plant species should be implemented to keep the project area quiet with the feel of a rural residential touch.

Every development project has certain negative impacts but that should not lead to the cancellation of development works. Instead, sustainable development requires prompt implementation of measures to minimize or offset the impact within acceptable limits. It is the responsibility of the concerned authority to take proper measures for implementation and monitoring and ensure strict compliance with relevant national legislation and environmental standards of Bangladesh.

1. Introduction

1.1 Background

The main purpose of this study is to identify the key environmental concerns likely to be impacted by the project named '*Khilkhet Housing Project*' by the BCS Housing Society. This housing project will also contribute towards accommodating the rapidly growing population and various urban uses of Dhaka City through the utilization of the urban fringe area. This EIA study has assessed the possible impact of the project and its proposed interventions and has developed an environmental management plan to enhance the positive impact and reduce the negative impacts.

Dhaka is one of the fastest-growing cities in the world and has now turned into one of the busiest and densely populated cities globally. Centralized administrative and institutional arrangements have drawn all major financial, social, and cultural activities of the country in Dhaka. These factors coupled with a lack of alternative urban agglomeration with similar opportunities have resulted in the influx of a large number of people from rural areas of the country to Dhaka (SENES Consultants Limited and Techno Consult International Limited 2007). Statistics show that the population of Dhaka Metropolitan Area covering 1,353 sq. km has increased from 6.8 million in 1991 to 23.21 million in 2022 (United Nations, 2022). This exploding population creates an extreme shortage of serviced land for housing to meet the growing demands.

To accommodate this increasing population, Dhaka is gradually expanding both vertically and horizontally. The intense development in the inner-city areas by replacing ancient low-density structures with multi-storied high-density uses has become a very common phenomenon in recent years. However, such trends of redevelopment in inner city areas with higher density have created severe pressure on infrastructure and civic amenities which, to a certain extent, cannot offer healthy living conditions (Jabeen 2012). In line with this, the government, through its various organizations like Rajdhani Unnayan Kartripokkho (RAJUK), Public Works Department (PWD) and other development authorities, has taken several initiatives for land development for housing purposes in the areas outside Dhaka. Along with the government initiative, different private land development companies/societies also play a very significant role in this regard. In the periphery of Dhaka city, a good number of private residential projects already exist (either in the development phase or in full operations).

As per the Detail Area Plan 2016-2035 (DAP) of RAJUK, the project area is designated as a growth management area and partially as a rural settlement zone. In addition, this housing project received the ToR from the Department of Environment (DoE) on 26.07.2023. Under such circumstances, CEGIS has been assigned to conduct the EIA study for the BCS Housing Society Project.

1.2 Project Objectives

The main objective of the project is to contribute towards accommodating the rapidly growing population and various urban uses of Dhaka City through utilizing urban fringe areas.

1.3 Study Area

The Khilkhet Abashon Prokolpo (Figure 1.1) is in Khilkhet Thana of Dhaka District. The total project area is approximately 104 acres (approx 315 Bighas). The project area comprises three mauzas: Mostul, Tolna, and Dhelna, of Khilkhet Thana, Dhaka District. This project site is close to the 300-foot road near Purbachol and two major rivers - the Tungi Khal and the Balu River respectively which run through the southern and northeastern side of the project area.

For the EIA study, the Project Influence Area (impact zone) for the proposed residential project has been considered as 27,040 acres since the proposed project is likely to pose potential environmental impacts within this area. The study area includes six mauzas. Details of the administrative unit within this study area are shown in Figure 1.1 shows the study area as well as the project area.

1.4 Scope of Work

The scope of work of the study includes to:

- To comply with various policies, guidelines and documents such as DAP, Real Estate Act 2010, Bangladesh National Building Code and Dhaka Mega City Building Construction Rules, 2008.
- To describe the proposed project and associated works together with the requirements for carrying out proposed developments;
- To identify and describe the elements of the environment likely to be affected by the proposed developments;
- To establish the baseline environmental scenario of the project area;
- To identify, predict and evaluate environmental impacts expected during the pre-construction, construction and operation phases of the proposed developments;
- To assess the opinions of the public/stakeholders observed in the consultation in identifying the environmental issues;
- To develop mitigation measures to minimize pollution, environmental disturbance and nuisance during different phases of development;
- To design and specify the monitoring requirements necessary to ensure the implementation and the effectiveness of the mitigation measures suggested; and
- To work out the cost of environmental mitigation and monitoring requirements.

1.5 Limitations

Establishing a comprehensive narrative of the baseline situation in the project area is critical for identifying the impacts of the proposed project interventions. In this assessment, the baseline of the project area in the pre-project condition was observed partially because around 80% of the land has already been developed. Time was other major constraint, as the EIA study essentially requires seasonal variations data. As such, important, relevant data such as data for water quality, hydrological analyses, and other seasonal baseline data could be collected for monsoon only, whereas secondary data was utilized to represent the study area's lean period state due to time constraints. This may not be able to portray the exact field scenario but rather a representative substitution.

1.6 EIA Study Team

A multi-disciplinary team of CEGIS comprising the following professionals conducted the EIA study.

1. Mr. Kazi Kamrull Hassan, Team Leader
2. Mr. Tanvir Ahmed, Water Resources Specialist
3. Mr. Md. Amanat Ullah, Ecologist
4. Mr. Abdul Halim Farhad Sikder, Soil and Agriculture Specialist
5. Mr. Md. Atikul Islam, Fisheries Specialist
6. Mr. Md. Ashis Mawla, Sociologist
7. Mr. S.M. Shafi-Ul-Alam, GIS and Remote Sensing Specialist

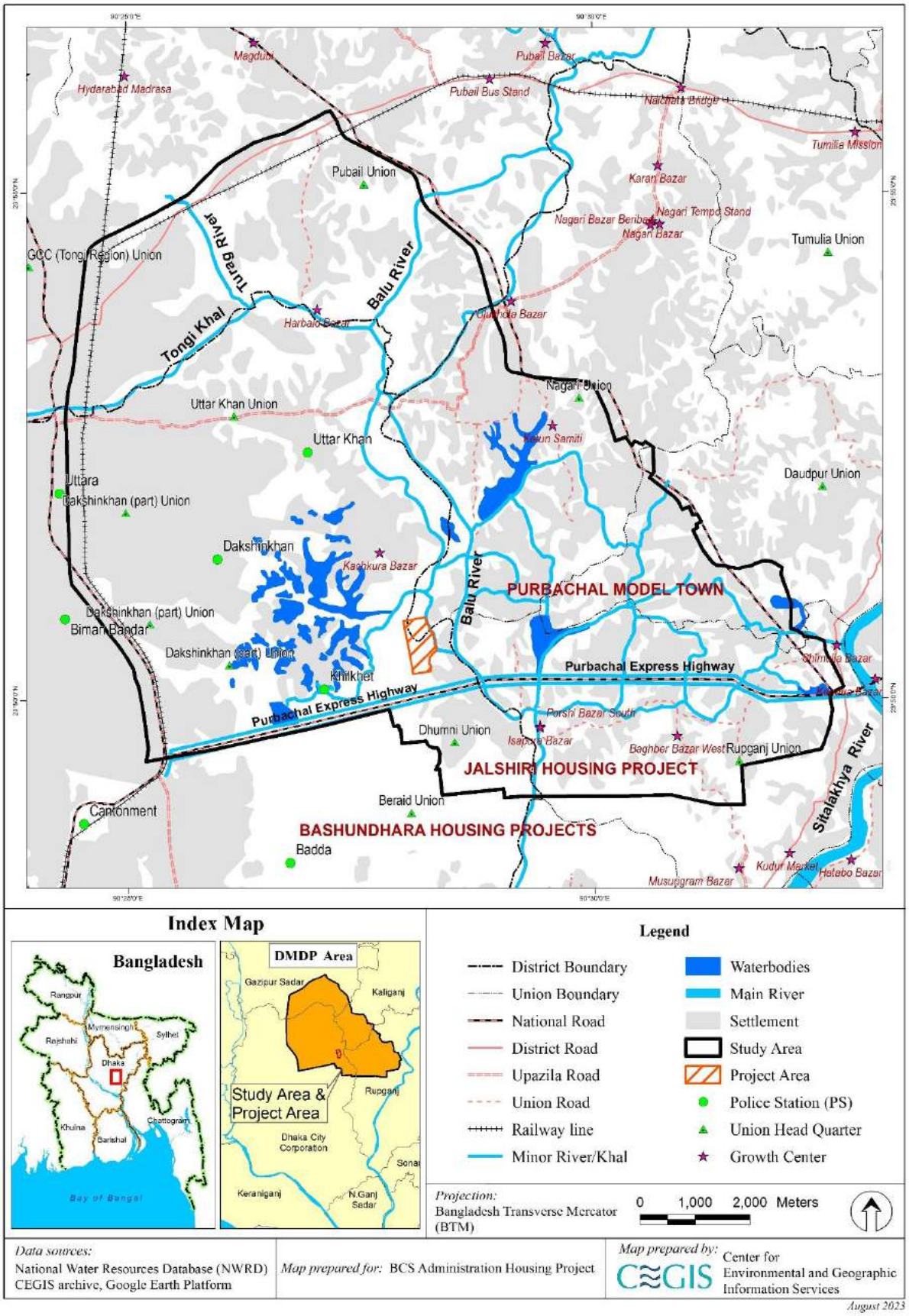


Figure 1.1: Study area of Khilkhet Housing

1.7 Report Layout

Chapter 1 of the report is an Introduction. It gives an overview of the objective, the scope of the study and its limitations. The legal/ policy frameworks along with environmental standards are summarized in **Chapter 2. Chapter 3** describes the methodology followed for the EIA study. In **Chapter 4,** concise documentation is given on the proposed project activities and facilities including project features. **Chapter 5** summarizes the environmental baseline data on physical, ecological, and socioeconomic parameters. **Chapter 6** summarizes the consultation with interested parties, different stakeholders, and the public regarding the project. **Chapter 7** specifies the important environmental components likely to be impacted by the proposed project interventions. **Chapter 8** outlines the environmental impacts during the pre-construction, construction and post-construction phases and measures to offset/mitigate the probable adverse impacts**. Chapter 9** provides an environmental management plan aimed at minimizing the negative environmental impacts and enhancing the positive impacts of the project. The Environmental monitoring requirements for the effective implementation of mitigating measures during the development phase, which delineated in this chapter. **Chapter 10** summarizes the conclusion and recommendations of major findings of the EIA study based on which recommendations have been made.

2. Legal Framework and Guidelines

Building construction for any purpose is not limited to within a creative exercise of a designer, but to ensure sustainable and safe buildings that can be used for the exact purposes with positive impacts on the surrounding area. Therefore, they must comply with the planning rule, environmental rule/act, and Building Code. In this note, a review of relevant policy, strategy and regulatory issues is very important for any project proponent before the actual execution of a program or plan. Every construction/erection/excavation within the jurisdiction of RAJUK requires permission/approval from the Authorized Officer or Building Construction Committee appointed under the provision of the Town Improvement Act, 1953. Any type of building construction needs planning permission, and they must conform with the land use provision of Master Plan/Urban Area Plan/Detailed Area Plans.

The proposed project must also comply with the relevant legislation and planning requirements of Bangladesh. Therefore, this chapter will discuss relevant environmental, building construction and residential development-related policies, rules, and acts to intervene in line with Government Policies and guidelines. Since a detailed study of all these rules and regulations would be both time and space-consuming, this section will only give a brief idea of those parts relevant to the proposed residential development project.

2.1 Planning and Development Guidelines

RAJUK initiated the Dhaka Metropolitan Development Plan (DMDP) project in the early 1990s. The DMDP Structure Plan sets a 20-year (1995-2015) long-term development strategy for the metro Dhaka sub-region which contains three-tier plan packages: Structure Plan, Urban Plan and Detailed Area Plan (DAP). The Detailed Area Plan (DAP) is a vital part of the DMDP as far as spatial development and control are concerned. It is prepared following the policies and guidelines made in the Structure Plan and Urban Area Plan.

2.2 Detailed Area Plan

For preparing the Detailed Area Plan (DAP), the whole of the RAJUK area has been divided into several groups and the project area lies in the North-east corner of Dhaka Metropolitan Area.

As per DAP, the project area falls within the growth management area.

Land Use Permit Procedures

The Land Use Permit Procedures commenced with the submission of a formal application by the applicant to the Chairman of RAJUK. The applicant must submit along with other information and documents a mouza map showing his plot including plot number, mouza name etc. The Land use Permit Planner (LPP) will then check the applicant's desired land use for compliance with the land use desired by the applicant with the land use zone containing the plot and the uses permitted therein (RAJUK 2010).

If the desired use is not found in the permitted or conditionally permitted lists of the zone, the LPP shall reject the proposed land use since it is not allowed in the zone.

- At this stage, if the rejection decision taken by the LPP is not satisfactory to the applicant, he/she can appeal to the Nagar Unnayan Committee (NUC).
- If the decision of the NUC goes in favour of the applicant, LPP shall issue the permit.

- If the applicant is not satisfied with the decision of the NUC he/she may go to the Court for decision. If the LPP is convinced that the desired use should be allowed, he may recommend it to the Land use Permit Committee (LPC) for furnishing reasons in his favour.
- LPC, if convinced by the reasoning, will send the case to the NUC with the recommendation to permit desired land use in the New Use category. If the NUC is also convinced about permitting the use as recommended by the LPC, it may decide so and authorize the LPP to issue a permit for the desired land use in the New Use category (RAJUK, 2010).

2.2.1 Private Housing Land Development Act 2004

The act is applicable for master plan areas as per the Town Improvement Act, 1953 (E.B. Act. XIII of 1953) and the Building Construction Act, 1952 (E.B. Act II of 1952). Conditions for approval of the private housing project are the following:

- The project will be completed **within a maximum of 10 years** as per the approved final layout plan.
- The approved plan cannot be changed or no inclusion of an area within the plan is allowed.
- The proposed project should not disrupt the natural flow of water bodies and should be above the highest flood level.
- The proposed project should not create any water logging in the surrounding area.
- If the area is outside the DCC and Dhaka WASA area, then the entrepreneur will take the initiative to construct Wastewater and Sewerage Treatment Plant and Composting Plant at his/her own expense.
- The project should be implemented as per The Building Construction Act, 1952 (E.B. Act II of 1953), Dhaka Mega City Building Construction Rules, 2008 and the National Building Code.
- Environmental Impact Assessment report should be submitted to the authority as per the Bangladesh Environmental Conservation Act (1995, Amended in 2000 & 2002).
- The gross density of population per acre will be a maximum of 350 persons in the proposed residential project.
- Seventy percentage of the land of the proposed project will be saleable and the rest will be strictly reserved for utility services which should be mentioned in the layout plan (Ministry of Housing and Public Works 2004).

2.2.2 Dhaka Mega City Building Construction Rules, 2008

According to this rule, the project directly linked with any regional highway or close to main roads is considered as large and specialized projects. Presumably, the proposed project falls under this type of project and the following section will describe only those issues applicable for large and specialized projects. As per this rule, the building design has to be approved through the following four steps.

- Land use clearance
- Special Project Permit for large and specialized projects

- Building Permit
- Occupancy Certificate

i. Land Use Clearance

For special projects, without land use clearance, building construction will not be permitted. The validity of land use clearance is 24 months upon receiving the approval.

ii. Special Project Permit

Prior to applying for building construction approval, a special project permit is to be collected from the Special Project Approval Committee. To apply for this permit, a set of documents should be submitted such as land use clearance, ownership relevant documents, total floor areas and number of floors, FAR, demand of water and source, electricity requirement and supply source, steps of construction activities, starting and completion period, detail design drawing in 1:1000 scale. The validity of this permit is 24 months.

iii. Building Permit

Along with land use clearance and special project permit documents, the site plan, layout plan and other documents have to be submitted for acquiring a building permit. For a Special Project with more than one building, a key plan is to be prepared and submitted.

iv. Occupancy Certificate

After completion of the building (partial/ full), an occupancy certificate is to be collected. Along with the application the following documents are to be submitted for approval.

- Completion report
- As built architectural design (lay out, floor plan, elevation etc.).
- Structural design (foundation design based on soil test, drawing of septic tank, soak pit etc.).
- Building services (layout plan and design of electric and water supply, sewerage, drainage, gas supply, electric circuit diagram etc.).(Ministry of Housing and Public Works 2008)

Setback rules

Every building should follow the setback rules (Table 2.1).

Table 2.1: Set Back Rules

Area	Set Back (Meter)		
	Front	Back	Sides
2 Katha or below	1.50	1.00	0.80
Above 2 katha to upto 3 katha	1.50	1.00	1.00
Above 3 katha to upto 4 katha	1.50	1.50	1.00
Above 4 katha to upto 5 katha	1.50	2.00	1.25
Above 5 katha to upto 6 katha	1.50	2.00	1.25
Above 6 katha to upto 7 katha	1.50	2.00	1.25

Area	Set Back (Meter)		
	Front	Back	Sides
Above 7 katha to upto 8 katha	1.50	2.00	1.25
Above 8 katha to upto 9 katha	1.50	2.00	1.25
Above 9 katha to upto 10 katha	1.50	2.00	1.25

(Source: Ministry of Housing and Public Works, 2008)

Residential area by private organization/company, road width will be as per **Private Housing Land Development Act 2004.** The maximum Road width, Floor Area Ration (FAR), and Maximum Ground Coverage (MGC) for residential housing are given in table 2.2.

Table 2.2: Road Width, FAR and MGC for Residential Project

Area	Road Width (Meter)	FAR	MGC (%)
2 Katha or below	6	3.15	67.5
Above 2 katha to upto 3 katha	6	3.35	65.0
Above 3 katha to upto 4 katha	6	3.50	62.5
Above 4 katha to upto 5 katha	6	3.5	62.5
Above 5 katha to upto 6 katha	6	3.75	60
Above 6 katha to upto 7 katha	6	3.75	60
Above 7 katha to upto 8 katha	6	4.00	60
Above 8 katha to upto 9 katha	6	4.00	60
Above 9 katha to upto 10 katha	6	4.25	57.5

(Source: Ministry of Housing and Public Works, 2008)

2.2.3 Real Estate Development Act 2010

Prior to starting any real estate business in an area, the developer should be registered with the concerned authority. Each developer should improve, correct, re-approve, or renew the design from the concerned authority as per the **Private Housing Land Development Act 2004 and Dhaka Mega City Building Construction Rules, 2008**. The real estate development project should comply with the following conditions.

- All the civic facilities as per the Private Housing Land Development Act 2004 should be ensured for the real estate development project.
- The layout plan should be approved by the concerned authority.
- Qualified architects, engineers, and technical persons, as per the Building Construction Act, of 1952 (Act No. II of 1953) need to develop and monitor the architectural and structure design.
- The architectural and structural design should follow the Dhaka Mega City Building Construction Rules, 2008 and the Bangladesh National Building Code. For other technical issues, an international code will be followed.

- The approved design cannot be changed without prior permission from the concerned authorities. Otherwise, a maximum 2 years of imprisonment or a maximum 10 lac taka of penalty or both will be enforced to the developer.
- In case of any type of deviation in the provision of utility services, the penalty will be a maximum of five lakh taka or a maximum of 1 year of imprisonment without labour.

2.2.4 Bangladesh National Building Code (BNBC) 1993/2006

The code intends to establish minimum standards for design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings within Bangladesh to safeguard health, property and public welfare. For the development of land for the construction of a building, the provisions of this Code shall apply to the entire development work.

Application for Development Works: Applications for permit for a development work shall be accompanied by a layout plan drawn on a scale of 1:500 or greater and containing the following information:

- A north arrow and a scale bar;
- The location of all proposed and existing roads and their dimensions;
- Dimensions of the plots, the building lines and setbacks;
- The location of utility services;
- The identification number, size, dimensions, and use of all the plots in a tabular form;
- Information in a summary form indicating the total area of the site, area utilized for roads, open spaces, and other public places;
- The means of access to each subdivision of the site.

The permit that has been obtained under this Code shall be valid for 5 years. For projects of exceptionally large magnitude, the Building Official may extend the time of such permit. On the expiry of a permit, the owner shall obtain a fresh permit. Deviations from the approved plans may be permitted if approval for the deviation is obtained before undertaking the related work (HBRI 2006).

Occupancy Type and Size

Every building or portion thereof shall be classified according to its use or character of occupancy. A brief description of the nature of occupancy for residential projects is presented in Table 2.3.

Table 2.3: Nature of Use/Occupancy for Residential Project

Occupancy type	Sub-division	Nature of use or occupancy
Residential	A1	Detached single-family dwelling
	A2	Flats or apartments
	A3	Mess, boarding houses, dormitories, and hostels
	A4	Minimum standard housing
	A5	Hotels and lodging houses

Source: HBRI 2006

Residential Plot Size

- The minimum size of the plot shall be 65 m2.
- Corresponding to each type of residential development the sizes of the plots and the corresponding minimum widths of road frontage of the plots shall be as specified in Table 2.4, provided that:
- Plots accessible by link roads shall be considered to have a frontage equal to its width,
- Plots of irregular shape abutting the road shall be considered to have a frontage equal to their average width parallel to the road.
- Residential buildings shall be located at a distance of at least 30 m from roads with heavy traffic, for example, highways, where the external noise is 90 dB or higher, and
- The total open area in a plot on which a building of residential, industrial, storage, hazardous or miscellaneous occupancy is constructed shall not be less than 33 per cent of the plot area.

Table 2.4: Plot Sizes and Corresponding Minimum Frontages for Various Types of Residential Development

Type of Residential Development	Plot Size (m^2)	Minimum Frontage (m)
Approved row-type houses	65 (Minimum size)	4.5
"	Over 65 to 135	7
Detached houses	65 (Minimum size)	5.5
"	Over 65 to 135	7
"	Over 135 to 200	8
"	Over 200 to 265	10
"	Over 265	Above 10
Semi-detached houses	135 (Minimum size)	7
"	Over 135 to 200	8
"	Over 200 to 265	10
"	Over 265	Above 10

Source: HBRI 2006

- The limitations of plot sizes and frontages imposed may be waived for approved low-income housing including site and service schemes.
- The minimum size of the plot for a group housing development scheme and other special requirements for group housing developments shall be specified or approved by the respective city development authority.
- Common private roads or family roads serving not more than four plots shall be at least 2.5 m wide. Open space requirements, height, and area limitations of buildings on such plots shall be decided in view of the nearest public road.
- Common private roads or family roads serving more than four plots shall be at least 3.5 m wide. Notwithstanding any other requirement for front open space, a residential building may be permitted to be constructed at a minimum distance of 1.5 m from the front property line of such plots.
- Greenbelts and plantations or artificial mounds may be used to reduce noise levels. Strong

leafy trees shall be planted to act as noise baffles and shrubs or creepers to provide additional protection between tree trunks.

Residential Plots

Public roads or means of access on which a residential plot abuts shall satisfy the minimum width requirements depending on the type of development and plot size specified in Table 2.5.

Table 2.5: Minimum Widths of Public Means of Access to Residential Plots

Type of Development	Plot Size	Minimum Width of Access Road (m)	
	(m^2)	Existing[1] Development	New[2] Development
Approved row Type	65 (minimum size)	3.0	4.5
	Over 65 to 135	3.5	4.5
Detached	65 (minimum size)	2.5	4.75
	Over 65 to 135	2.5	6.0
	Over 135 to 200	2.5	7.5
	Over 200 to 265	2.5	9.0
	Over 265	Over 3.0	Over 9.0
Semi-detached	135 (minimum size)	2.5	6.0
	Over 135 to 200	2.5	7.5
	Over 200 to 265	2.5	9.0
	Over 265	Over 3.0	Over 9.0

Note :

1. Existing Development - Any approved residential development already in existence on the date of promulgation of this Code, with roads and streets for which the area planning authority does not have any scheme for future widening

2. New Development - Any new residential development implemented subsequent to the promulgation of this Code

Source: HBRI 2006

Community Space for a Group of Buildings in One Plot

For all plots on which more than one residential or residential-cum-business building is constructed, community space at the rate of 5% of the total floor area of all the buildings shall be provided either within the buildings or outside the premises. Roofs of such buildings shall not be considered community open spaces.

In dividing any land measuring a total of 0.4 hectares or more into residential or business plots, community open spaces shall be reserved for recreational purposes of the population for which the layout is planned. The minimum requirement of open spaces in a layout shall be as follows:

a) 15% of the area of the planned layout, or

b) 2000 m^2 for every 1000 persons.

The community open space in residential or business layouts shall either be provided in one place or planned in clusters or groups to serve the community. No such community open space plot shall be less than 400m^2 in area. The shape of the plot shall be such that the length is not more than 2.5 times its width (HBRI 2006).

2.2.5 Bangladesh Labor Law 2006

Health Injury: No work-room in any establishment shall be overcrowded to an extent injurious to the health of the workers employed therein. In every establishment wherein more than ten workers are ordinarily employed in any place above the ground floor or explosive or highly inflammable materials are used or stored, effective measures shall be taken to ensure that all the workers are familiar with the means of escape in case of fire and have been adequately trained in the routine to be followed in such case.

Drinking water: In every establishment, effective arrangements shall be made to provide and maintain a suitable point for a sufficient supply of wholesome drinking water.

Latrines and urinals: In every establishment, enough latrines and urinals of prescribed types shall be conveniently situated and accessible to workers at all times.

Dangerous operations: Where any operation in an establishment exposes any person employed to a serious risk of bodily injury, poisoning, or disease, the government will make rules applicable to such establishment:

- Specifying the operation and declaring it to be hazardous;
- Prohibiting or restricting the employment of women, adolescents, or children in the operation;
- Providing periodical medical examinations of persons employed;
- Protect all persons employed in the operations or the vicinity of the places and place a notice specifying the usage and precautions regarding the usage of any corrosive chemicals.

First-aid appliances: In every establishment, provision should be made for readily accessible first-aid boxes or cupboards equipped with the contents prescribed by rules during working hours. The number of such boxes or cupboards shall not be less than one for every one hundred fifty workers ordinarily employed in the establishment.

Information about dangerous buildings and machinery: Where any worker finds that any machinery used by the workers in any establishment is in a dangerous condition that is likely to cause physical injury to any worker at any time, he shall inform the employer. If the employer fails to take appropriate action on such information within three days and any injury is caused to any worker because of the use of such equipment, machinery or building, he shall be liable to pay compensation to the worker injured at a rate which may be double the rate of compensation payable for such injury as per this act.

2.3 Environmental Rules and Regulation

2.3.1 Environmental Conservation Act (1995, Amended in 2000 & 2002)

The Bangladesh Environment Conservation Act of 1995 (ECA '95) is currently the main legislation about environmental protection in Bangladesh. It mainly includes environmental clearance, promulgation of standards for quality of air, water, noise, soil, standard limit for discharging and emitting waste and formulation and declaration of environmental guidelines.

The Department of Environment (DoE) executes the Act under the leadership of the Director General (DG). Before any new project can start, as stipulated under the rules, the project promoter must obtain Environmental Clearance from the Director General. Failure to comply with any part of this Act may result in punishment of a maximum of 3 years imprisonment or a maximum fine of Tk. 300,000 or both.

2.3.2 *Bangladesh Environment Conservation Act (Amendment 2000)*

This amendment of the Act focuses on (1) ascertaining responsibility for Compensation in cases of damage to ecosystems; (2) increased provision of punitive measures both for fines and imprisonment; and (3) fixing authority on cognizance of offences.

2.3.3 Bangladesh Environment Conservation Act (Amendment 2002)

This amendment of the Act elaborates on (1) restriction on polluting automobiles; (2) restriction on the sale and production of environmentally harmful items like polythene bags; (3) assistance from law enforcement agencies for environmental actions; (4) break up of punitive measures; and (5) authority to try environmental cases.

2.3.4 Environmental Conservation Rules, 1997

These are the first set of rules, promulgated under the Environment Conservation Act of 1995 (so far there have been three amendments to this set of rules - February and August 2002 and April 2003). These rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc.; (ii) the requirement for and procedures to obtain environmental clearance; and (iii) the requirement for IEE and EIA according to categories of industrial and other development interventions. The process of obtaining clearance from the DoE is presented in Figure 2.1.

The proposed project consists of residential building, road construction, sewerage treat plant installation and utility services provision. In addition, there is an intention of developing an urban residential zone in an area with a rural flavour. Under the circumstances, the project lies within the Red Category Project.

Procedure for issuing Environmental Clearance Certificate

Firstly, a Location Clearance Certificate and then an Environmental Clearance Certificate shall be issued. The Director General may, without issuing a Location Clearance Certificate at the first instance, directly issue an Environmental Clearance Certificate if he considers it appropriate. The following documents shall be attached to an application:

For Red Category:

- Report on the feasibility of the project;
- Report on the ToR for EIA and its Process Flow Diagram;
- Environmental Impact Assessment report along with the Layout Plan, Process Flow Diagram, design, and time schedule of the Sewerage Treatment Plant ;
- No Objection Certificate of the local authority;
- Emergency plan;
- Other necessary information (where applicable);

Within sixty days of the receipt of the application, a Location Clearance Certificate shall be issued, or the application shall be rejected with appropriate reasons. Upon receiving the Location Clearance Certificate, the entrepreneur may start the following activities:

- Undertake activities for land development and infrastructure development;
- Install machinery including Sewerage Treatment Plant (STP)
- Apply for an Environmental Clearance Certificate. It's noteworthy that without the Environmental Clearance Certificate, the entrepreneur shall not have a gas line connection, in other words, shall not operate the project.

Validity

The period of validity of an Environmental Clearance Certificate shall be one year. Each Environmental Clearance Certificate shall have to be renewed at least thirty days before expiry of its validity period.

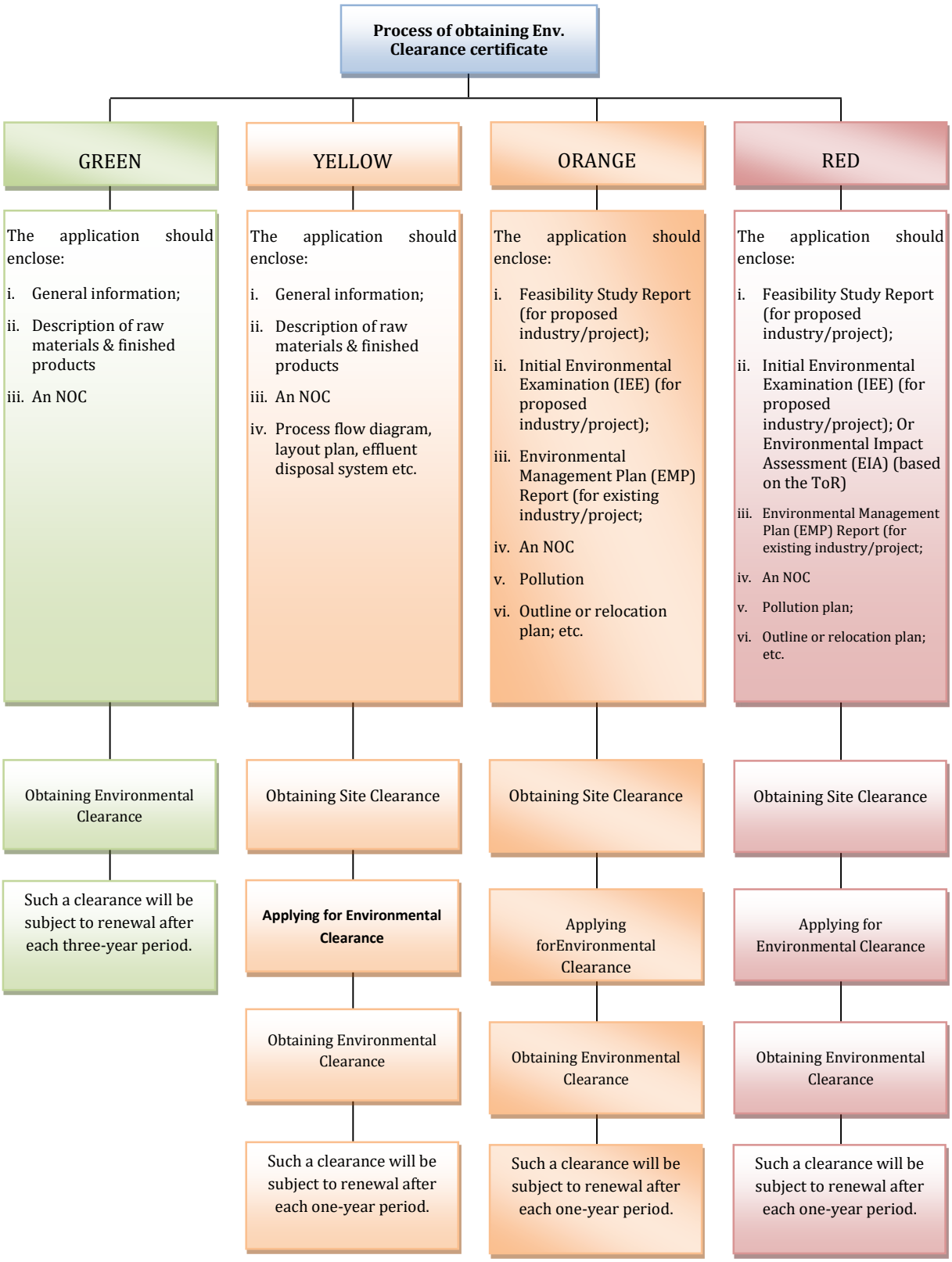


Figure 2.1: Steps to obtain Environmental Clearance from DoE

2.4 Environmental Quality Standards for Bangladesh

The Environmental Quality Standards for air quality, odor, and sewage discharge relevant to the proposed project are shown in the following tables.

Table 2.6: Bangladesh Standards for Ambient Air Quality

Sl. No.	Area	Unit	Suspended Particulate Matters (SPM)	Sulfur Dioxide (SO_2)	Carbon Mono oxide (CO)	Oxides Nitrogen (NO_x)
1	Residential and rural	micrograms per cubic meters	200	80	2000	80
2.	Commercial and mixed		400	100	5000	100

Source: Schedule-2, Rule 12, Environmental Conservation Rules of 1997 (Page 3123. Bangladesh Gazette, 28 August 1997) (Translation from original Bengali)

Note: *Suspended particulate matter means airborne particles of diameter of 10 micron or less.*

Table 2.7: Bangladesh Standards for Odor

Parameters	Values (ppm)
Acetaldehyde	0.5-5.0
Ammonia	1.0-5.0
Hydrogen Sulfide	0.02-0.2
Methyl Disulfide	0.009-0.1
Methyl Mercaptan	0.02-0.2
Methyl Sulfide	0.01-0.2
Styrene	0.4-2.0
Trimethylamine	0.005-0.07

Source: Schedule-8, Rule-12, Environmental Conservation Rules, 1997 (Translation from original Bengali)

Note:

Regulatory standards at emission/discharge outlets (apply to those outlets which are higher than 5 meters):

Q = 0.108 xHe2 cm

Where Q - gas emission rate (Nm3/hour)

He - effective height of the outlet (m)

Cm - above mentioned standard (ppm)

Where there is a range given for a parameter, the lower value will be used for warning and the higher value for initiation of legal procedure or punitive measures.

Table 2.8: Standards for Emission from Motor Vehicles

Parameter	Unit	Standard Limit
Black smoke	Hartridge Smoke Unit (HSU)	65
Carbon Monoxide	gm/k.m. per cent area	24, 04
Hydrocarbon	gm/k.m ppm	02 180
Oxides of Nitrogen		02 600

Source: Schedule-8, RuIe-I3, Environment Conservation Rules, 1997 (Translated to English)

Table 2.9:Table Standard for Inland surface water

Best Practice	pH	BOD	DO	Total Coliform
Source of drinking water for supply only after disinfecting:	6.5-8.5	2 or less	6 or above	50 or less
Water usable by fisheries	*6.5-8.5*	*6 or less*	*5 or more*	*5000 or less*

Table 2.10: Bangladesh Standards for Sewage Discharge

Parameters	Unit	Values
BoD	mg/L	40
Nitrate		250
Phosphate		35
Suspended Solid (SS)		100
Temperature	ºC	30
Coliforms	number/100ml	1000

Source: Schedule-8, RuIe-I3, Environment Conservation Rules, 1997 (Translated into English)

Note:

This limit shall apply to discharges into surface and inland water bodies.

Sewerage shall be chlorinated before final discharge.

2.4.1 The Sound Pollution (Control) Rules, 2006

The standard noise quality is given in table 2.11.

Table 2.11: Bangladesh Standards for Noise

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

Source: MoEF, 2006

Note:

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

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

2.4.2 Natural Water Bodies Protection Act 2000

According to this Act, the character of waterbodies, i.e., rivers, canals, tanks, or floodplains identified as waterbodies, in the master plans or the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of the concerned ministry.

Anyone disobeying this act will be subjected to a maximum of 5 years of imprisonment or a maximum BDT 50,000 penalty or both.

2.4.3 The Protection and Conservation of Fish Act, 1950 (Bengal Act Xviii Of 1950)

This Act provides power to the government to:

- Make and apply rules in any water or waters for the protection of fisheries.
- Prohibit or regulate the erection and use of fixed engines; the construction, temporary or permanent, of weirs, dams, bunds, embankments, and other structures.
- Prohibit the destruction of fish by explosives, guns, and bows in inland or coastal areas.
- Prohibit the destruction of fish using poisoning, pollution, and effluents.
- Prescribe the seasons during which fishing is allowed.
- Prohibit fishing in all waters during spawning periods.
- Specify the officials with the authority to detect breaches.

3. Approach and Methodology

This chapter discusses the methodology and approaches applied to this study. The guidelines for environmental impact assessment of water sector projects, developed by the Flood Plan Co-ordination Organization (FPCO) in 1992 and updated by the Water Resources Planning Organization (WARPO) in 2002, have been followed for conducting the Environmental Impact Assessment (EIA) study of "*Khilkhet Abason Prokolpo*".

3.1 EIA Process

The process followed for conducting the EIA study includes 9+1 steps as shown in Figure 3.1.

Figure 3.1: The EIA process

The activities undertaken at each of the 9+1 steps of the EIA process have been described in the following sections.

3.1.1 Project Design and Description

The infrastructure and real estate plan proposed for the "*Khilkhet Abason Prokolpo*" is the basis of this EIA study. Initial information and specifications of the infrastructures and layout plan have been obtained from the BCS Admin Housing Society. A base map has been developed by using recent high-resolution images and data in GIS data layers available at CEGIS. Thereafter, the EIA

the study team met the relevant officials of the BCS Admin Housing Society to collect detailed and specific information.

In addition, the EIA study team also made a reconnaissance survey to observe the existing infrastructures and other natural systems under the housing Project. Opinions of the local people on the performance of the existing infrastructures and their perceptions about the proposed infrastructures have also been noted.

3.1.2 Environmental and Social Baseline

Data Collection and Analysis

The baseline condition of the project influence area has been drawn according to information collected from primary and secondary data sources through literature review, field investigation and consultation with different stakeholders. The baseline condition has been established concerning Physical Environment, Environmental Quality, Biological Environment and Socio-economic environment.

a. Physical Environment

Water resource data on ground water availability, drainage pattern, ground and surface water quality and water use were collected from secondary sources and primary observation by the professionals of CEGIS supplemented by the feedback from the local people during field visits for baseline preparation in this study. The major rivers and khal systems were identified for hydrological and morphological investigation through historical and current data collection and analysis. Specific areas or points of interest were selected for collecting data on special hydrological and morphological events such as river-khal-beel network, water availability, drainage patterns, water quality (surface and ground water), flood, risk of sedimentation etc.

Meteorological data such as rainfall, evapotranspiration, temperature, sunshine hours, humidity, and wind speed have been collected and analyzed to assess the local climate that are directly related to the water resources of the study area and the project area. The Meteorological data for selected stations have been collected from the Bangladesh Meteorological Department (BMD).

The general geological features and the seismicity of the project and its surrounding areas were collected from available secondary literature and the Geological Survey of Bangladesh. The topographical data were collected from the Geological Survey of Bangladesh and the NWRD.

The Agro-ecological Region of the proposed project area has been identified using secondary sources (FAO/UNDP). The land use, land type, and soil texture data have also been collected from the Upazila Land and Soil Resources Utilization Guide (Upazila Nirdeshika) of the Soil Resources Development Institute (SRDI). The secondary data of these parameters have been verified at the field level through physical observations as well as in consultation with the local people.

Agriculture data on farming practices, existing cropping patterns, crop variety, crop yield, crop damage and agricultural inputs used are collected from primary sources through extensive field surveys and consultation with local people and concerned agricultural officials.

b. Biological Environment

The Fisheries data are collected considering the seasonal variance of dry and wet seasons. Prior to data collection, a checklist/questionnaire was developed. Information on bio-ecological zones and their characteristics have been collected from the publications of the International Union for Conservation of Nature (IUCN). Information on bio-ecological zones and their characteristics

have been collected from the publication of the International Union for Conservation of Nature (IUCN).

The Fish habitat classification has been made based on physical existence and was categorized into capture and culture fish habitats. The capture fish habitats include river, khal, floodplain, borrow pit and beel. The culture fish habitats included homestead culture fish ponds, commercial fish farms etc.

Capture and Culture Fish habitats: Capture fish habitat has been assessed through the fish market survey, micro-scale Catch Assessment Survey (CAS), habitat-based species diversity & composition, identification of species of conservation significance, identification of potential fish habitat prescribing to restore fish conservation, fish migration survey, habitat identification for fish conservation. The Culture fish habitat assessment was done through a homestead culture fish pond survey and a commercial fish farm survey.

The ecological component of the EIA study focused on terrestrial and aquatic ecology including both the floral and faunal resources that include fish, birds, reptiles, amphibians, mammals and many more. The information related to ecological resources collected included ecosystem and habitat information for identifying ecological changes and potential ecological impacts. Field investigation included physical observation and consultation with local people. Field visits were carried out to delineate the ecological baseline conditions. The inventory of common flora and fauna was developed based on a field survey and the database of IUCN. During the field visits, public consultation was carried out through Focus Group Discussions (FGD) and Key Informants Interview (KII) to identify the probable changes in the local ecological resources.

c. Environmental Quality

Air Quality: Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550) have been used to collect the air sample. For air quality testing **three locations** were selected. The names of the locations and the rationale for selecting these locations are described in Chapter 5.

Water Quality: Monitoring of the water quality directly depends on the selection of water quality parameters, sampling points, sampling frequency, evaluation criteria etc. Standard practices were followed for water quality monitoring. This study measured surface water quality parameters to reveal the present water quality status in the surroundings of project influenced area. In future, the same parameters in the same area will have to be monitored regularly to observe the changes (if any). To establish a strong baseline, the water quality monitoring results are not only presented but compared with the national and international standards. For testing the water quality, **three locations** were selected. The names of the locations and the rationale for selecting these locations are described in Chapter 5.

Noise: Noise levels were measured thrice a day (morning, afternoon, and evening) at selected locations. The locations were the same as the locations of air quality testing. Each time the noise level was recorded for five minutes with 30-second intervals by using a portable noise level meter. Depending on the site conditions and acoustic environment, the noise meter was set up and calibrated each time following the manufacturer's instruction manual. For noise quality testing, **three locations** were selected. The names of the locations and the rationale for selecting these locations are described in Chapter 5.

d. Socio-economic Environment

The socio-economic baseline information including information on the demography profile, literacy rate, housing conditions, occupation and employment, traffic and transport systems, and existing utility services like, gas water electricity and waste disposal are collected from the Bangladesh Bureau of Statistics (BBS), 2011 and relevant authorities. In addition, PRA and public consultations were also consulted to get additional information on the socio-economic condition of people and to validate the data obtained from secondary sources.

Utility Services: Utility services like water supply, electricity, gas and sewerage facility status in the study area have been identified from the field surveys.

Transportation System: Information on the transportation system of the study area was mainly gathered from the TIA report provided by BCS Housing Society.

3.1.3 Scoping

Scoping is the process of identifying the key environmental issues. A scoping process was followed here for selecting Important Environmental and Social Components (IESCs) that are likely to be impacted by the proposed housing project. Scoping is performed in two stages. Individual professionals of the EIA study team made a preliminary list of the components of their disciplines, which could be impacted by the project. The second stage included stakeholders' perceptions of environmental and social components. The professional judgments of the EIA team members, as well as the stakeholder's opinions obtained, were considered in selecting the IESCs.

3.1.4 Bounding

The areas likely to be impacted by the Khilkhet Housing project were delineated in consultation with the BCS Housing Society authority in addition to feedback received from the local people during the baseline consultations. A processed RS tool was used for this purpose. A project influence area/study area was delineated considering the hydrological situation of the area.

3.1.5 Major Field Investigation

Detailed data on IECs are collected from the field during the major field investigation stage. Information on the IECs is obtained through a mixed method including RRA, PRA and KII using checklists. Intensive consultation with the local people is carried out in each case to secure people's participation.

3.1.6 Environmental Impact

The environmental impact of the proposed housing project on the IECs is assessed in three phases of the project (Pre-Construction, Construction, and Post-construction phase). Impacts are the results of the interaction of specific project activities with the existing environmental settings.

The location-specific impacts of pre-construction and construction phases are estimated or delineated considering the phase-wise activities of the project.

The post-project impacts are estimated based on the differences in the changes between the Future-Without-Project (FWOP) condition and the Future-With-Project (FWIP) condition. The Future-Without-Project (FWOP) conditions are generated through trend analysis and consultation with the local people which describe the conditions of the IECs in the absence of the proposed interventions. The changes expected to be brought about due to the proposed

interventions are assessed to generate the Future-With-Project (FWIP) condition. Comparisons and projection methods are used for predicting the impacts.

The sequences of assessment of environmental and social impacts are as follows:

i) Changes in the status of the IECs pertaining to physical environment;

ii) Changes in the status of the IECs pertaining to meteorological conditions;

iii) Changes in the status of the IECs pertaining to land resources, agriculture;

iv) Changes in the status of the IECs pertaining to fisheries;

v) Changes in the status of the IECs pertaining to ecological resources; and

vi) Changes in the status of the IECs pertaining to socio-economic conditions.

3.2 Impact Quantification and Evaluation

At this stage, attempts are made to quantify the impacts of the proposed housing project on the IECs. However, it was not possible to quantify all impacts, especially the impacts on some of the environmental components. In those cases, qualitative impacts are assessed, and the scores are presented by (+) sign for positive impacts and (-) sign for negative impacts. The magnitudes of both positive and negative impacts are indicated on a scale of 1 to 5 on extent, magnitude, reversibility, duration and sustainability considerations.

The criteria for determining significance are generally specific for each environmental and social aspect but generally, the magnitude of each potential impact is defined along with the sensitivity of the receptor. The generic criteria for defining the magnitude and sensitivity used for the housing project are summarized below:

3.2.1 Magnitude

The assessment of magnitude has been undertaken in two steps. Firstly, the key issues associated with the project were categorized as beneficial or adverse. Secondly, potential impacts were categorized as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the potential impact;
- The spatial extent of the potential impact;
- Reversibility;
- Likelihood; and
- Legal standards and established professional criteria.

The magnitude of potential impacts of the project has generally been identified according to the categories outlined in Table 3.1

Table 3.1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Negligible/Nil
Duration of potential impact	Long term (more than 30 years)	Mid term lifespan of the project	Less than project lifespan	Temporary with no detectable potential impact

Parameter	Major	Moderate	Minor	Negligible/Nil
		(5 to 15 years)		
Spatial extent of the potential impact	Widespread far beyond project boundary	Beyond immediate project components, site boundary or local area	Within project boundary	Specific location within project component or site boundary with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions. (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in the national standards but breaches international lender/investor guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable

3.2.2 Sensitivity

The sensitivity of a receptor has been determined based on the review of the population (including proximity/numbers / vulnerability) and the presence of features on the site or the surrounding area. The criteria for determining receptor sensitivity of the Project's potential impacts are outlined in **Table 3.2.**

Table 3.2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	Vulnerable receptor with little or no capacity to absorb the proposed changes or minimal opportunities for mitigation.
High	Vulnerable receptors with little or no capacity to absorb the proposed changes or limited opportunities for mitigation.

Sensitivity Determination	Definition
Medium	Vulnerable receptor with some capacity to absorb the proposed changes or moderate opportunities for mitigation
Low / Negligible	Vulnerable receptors with a good capacity to absorb the proposed changes or/and good opportunities for mitigation

3.2.3 Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor were determined, and the significance of each potential impact established using the potential impact significance matrix is shown in Table 3.3 below:

Table 3.3: Assessment of Potential Impact Significance

Magnitude of Potential Impact	Sensitivity of Receptors			
	Very High	High	Medium	Low / Negligible
Major	Critical	Major	Moderate	Negligible
Moderate	Major	Major	Moderate	Negligible
Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

3.2.4 Mitigation Measures

After the impact assessment discussed above, appropriate mitigation measures are proposed to avoid, offset, mitigate/reduce, or compensate for the identified impacts. Generally, impacts having moderate to critical significance, according to Table 3.3, require appropriate avoidance/mitigation/compensatory measures to reduce the significance. Impacts having low to negligible significance would be left out as it is, requiring no mitigation measures.

Generally, preference is given to the avoidance of impact with the help of options available for the nature, timing, method/procedure, or scale of any project activity. If avoidance is not possible, appropriate mitigation and control measures are proposed to reduce the consequences of the significance of the predicted impacts. Finally, if it is not possible to reduce the impacts, compensatory measures are to be proposed.

3.2.5 Assessment of Residual Impacts

The final step in the impact assessment process was to determine the significance of the residual impacts, which essentially were the impacts, which might be experienced even after implementing the mitigation/compensatory measures. For any residual impacts having moderate significance, a monitoring mechanism is necessary to ensure that their significance does not further increase. No residual impact with major or critical significance is generally acceptable.

3.2.6 Environmental Management Plan

The Environmental Management Plan (EMP) is prepared with suggestions for mitigation measures for minimizing the effects of the negative impacts, enhancement measures for increasing the benefits of the positive impacts, compensation measures for compensating the negative impacts that cannot be mitigated and an environmental monitoring plan for monitoring

changes taking place through implementation of the project. The cost estimate for implementing the EMP has also been suggested for inclusion in the project cost estimate.

3.2.7 Public Consultation and Disclosure

In the overall process of the EIA study, people's participation was one of the major components that have been incorporated in each of the above-mentioned steps. Stakeholders from different sectors of the project area participated in the public consultation meetings (PCM) and feedback taken from them was considered in preparation of the EIA report. The overall objective of the PCM was to discuss the proposed interventions for the betterment of the project area. A public disclosure meeting was organized after the preparation of the draft final report, a summary of which was presented at the PDM. The EIA report was finalized after incorporating the feed-back and comments received from the PDM.

3.2.8 EIA Report Preparation

A report on the EIA study of Khilkhet Abason Prokolpo, located near the Purbachol of Dhaka District has been prepared incorporating the findings of the EIA study.

4. Project Description

A comprehensive footprint of the detail information of this project is provided in this chapter. The project is presently at the stage of gradual land filling; hence this chapter will discuss those along with the project location, and project activities/intervention at the pre-construction, construction and post-construction phases.

4.1 Introduction

The project site is located along 300-feet road with a total area of 412.29 Bighas (approximately 104.2806 acres). The project area is located within latitude of N 23˚50'14.99" to E 90˚27'57.32" and longitude of N 23˚50'48.93" to E 90˚28'18.61" while the study area lies within latitude of N 23˚51'15.98" to E 90˚24'36.68" and longitude of N 23˚55'48.68" to E 90˚32'40.77". The rational of the project as well as the study have already been discussed in Chapter 1. Unlike other construction projects, there is no scope for assessment of alternative locations as the location of the project area has already been selected and already started the development of the residential area while the government authorities are instructed to conduct the EIA study.

4.2 Project Implementation Cost

The total cost of the project is estimated to be Tk. 300 core.

4.3 Problems

The project intends to develop an urban essence in a rural setting. Therefore, the building construction work will encounter the following problems:

- Changes in local topography;
- Shifting of drainage path;
- Air, water, and noise pollution;
- Increasing the sewerage disposal; and
- Traffic problems such as accidents, increased traffic volume, inadequate accessibility, inadequate supply of vehicles for travelling, and excessive travel time.

4.4 Description of Interventions

4.4.1 Land Development

The project authority will develop the land and divide it into several plots to be completely ready for the construction of buildings. The plots will be developed in such a manner that the top level of the developed land remains above the flood level (7.5msl). The proposed plan of the project is given in Table 4.1.

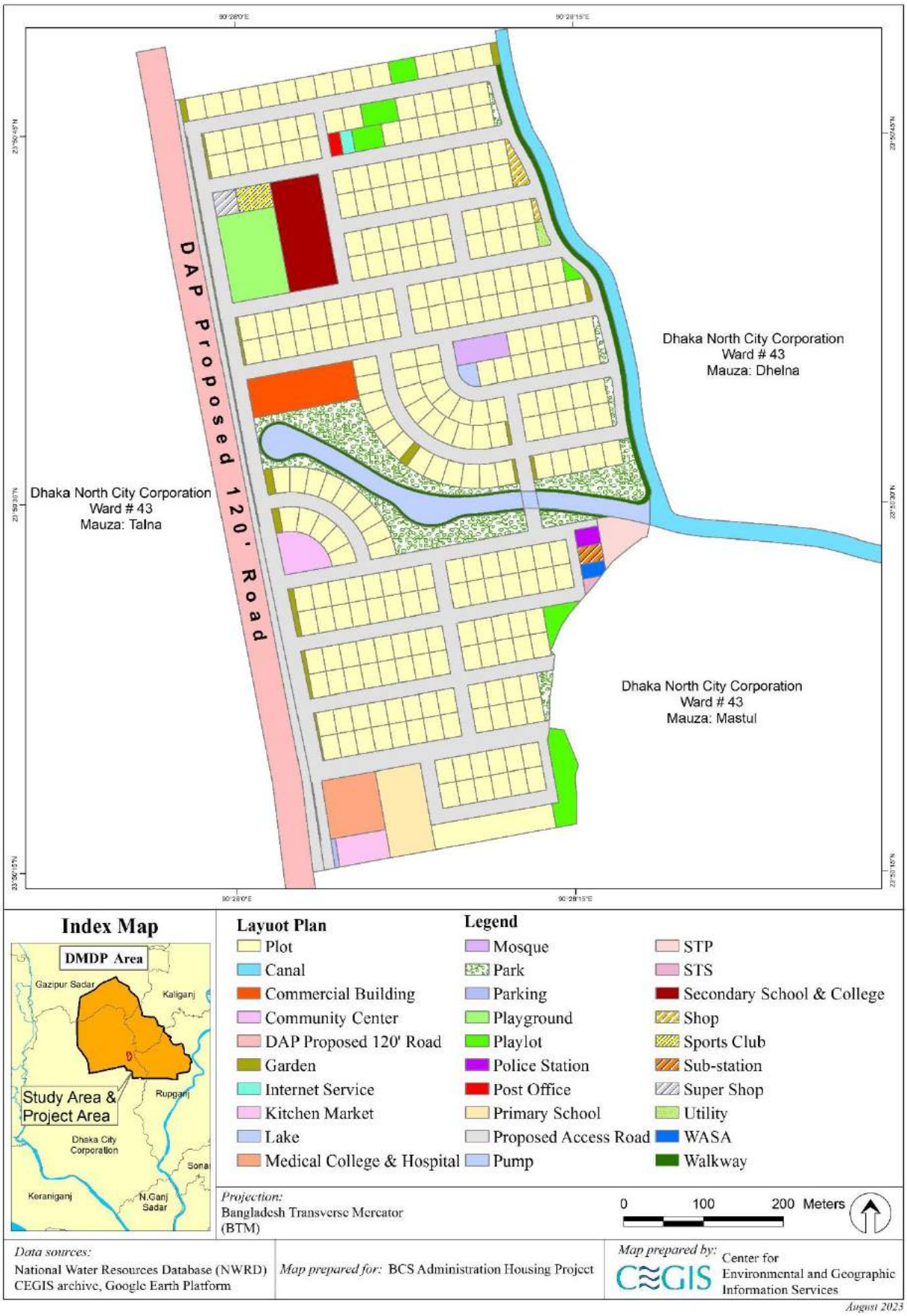


Figure 4.1: Layout Plan of Khilkhet Abason Prokolpo

Table 4.1: Proposed Khilkhet Abason Prokolpo Development Plan

Land Use	Number	Area (Acre)	Area (Bigha)	Percentage
Educational	***2***	**3.7101**	**3.24**	**4%**
Nursery School and Primary School	1	1.5634	1.56	-
Secondary School and College	1	2.1466	1.68	-
Health Care	***1***	**1.2636**	**1.26**	**1%**
Medical College and Hospital	1	1.2636	1.26	-
Religious	***1***	**0.6736**	**0.74**	**1%**
Mosque	1	0.6736	0.74	-
Sports and Community	***2***	**0.8769**	**0.74**	**1%**
Community Center	1	0.5463	-	-
Sports Club	1	0.3306	-	-
Utility Services	***8***	**1.4542**	-	**1%**
Sub-station	1	0.1653	-	-
WASA	1	0.1334	-	-
Post Office	1	0.1077	-	-
STP	1	0.6141	-	-
STS	1	0.0692	-	-
Internet	1	0.1077	-	-
Police Station	1	0.1653	-	-
Other Utility	1	0.0914	-	-
Recreational	***28***	**14.7511**	**-**	**14%**
Park	3	6.5183	1.11	-
Playground	1	1.9835	-	-
Playlot	4	1.0960	-	-
Lake	1	3.4834	1.11	-
Green Belt	13	1.2578	-	-
Green	6	0.4122	-	-
Commercial	***6***	**2.7839**	**1.11**	**3%**
Commercial	1	1.6169	-	-
Corner Shop	3	0.3807	-	-
Kitchen Market	1	0.5659	-	-
Super Shop	1	0.2204	-	-
Residential	***285***	**47.1126**	**-**	**45%**

Land Use	Number	Area (Acre)	Area (Bigha)	Percentage
Residential 10 katha plot	285	47.1126	-	-
Road		**31.3336**	**22.20**	**30%**
Road		29.8628	-	-
Walkway	3	1.4171	-	-
Parking	1	0.0537	-	-
Others		**0.3760**	**-**	**-**
Canal	2	0.3760	-	-
Total		**104.3355**		**100%**

Source: Layout Plan of BCS Admin Housing Society

4.4.2 Road Network

The road layout has been designed as per the Private Land Development Regulation 2004 and 2012. The total area covering all kinds of roads in the project area is 31.28 acres which is around 30 percent of the total project area. The proposed project is adjacent to the existing 300-foot-wide Purbachol highway, directly connected to Dhaka city. The construction of internal roads (including secondary and tertiary) planned and designed for the project are in progress and the development works are undertaken by BCS Housing Society. The proposed project is located beside the Purbachal New Town Project and 100' North South Road will be connected through the proposed site. 100 feet North-South Road is connected with 300' road which starts from Kuril and extends to Kanchan Bridge. There is an ongoing bridge construction activity over the 100-foot canal constructed by RAJUK and it will be the starting point of the project approach road (100') from the 300' road. It will enjoy a favourable communication network with other parts of the city. All the primary and feeder roads within the project area will be built in connection with the layout plan as prepared under the provisions of Private Land Development Regulation 2004, 2012, and 2015 (Revised). The primary road and secondary road will connect individual blocks of the project area. From that point onward, local roads will provide access to individual households.

The proposed road network under this study area is shown in Figure 4.2.

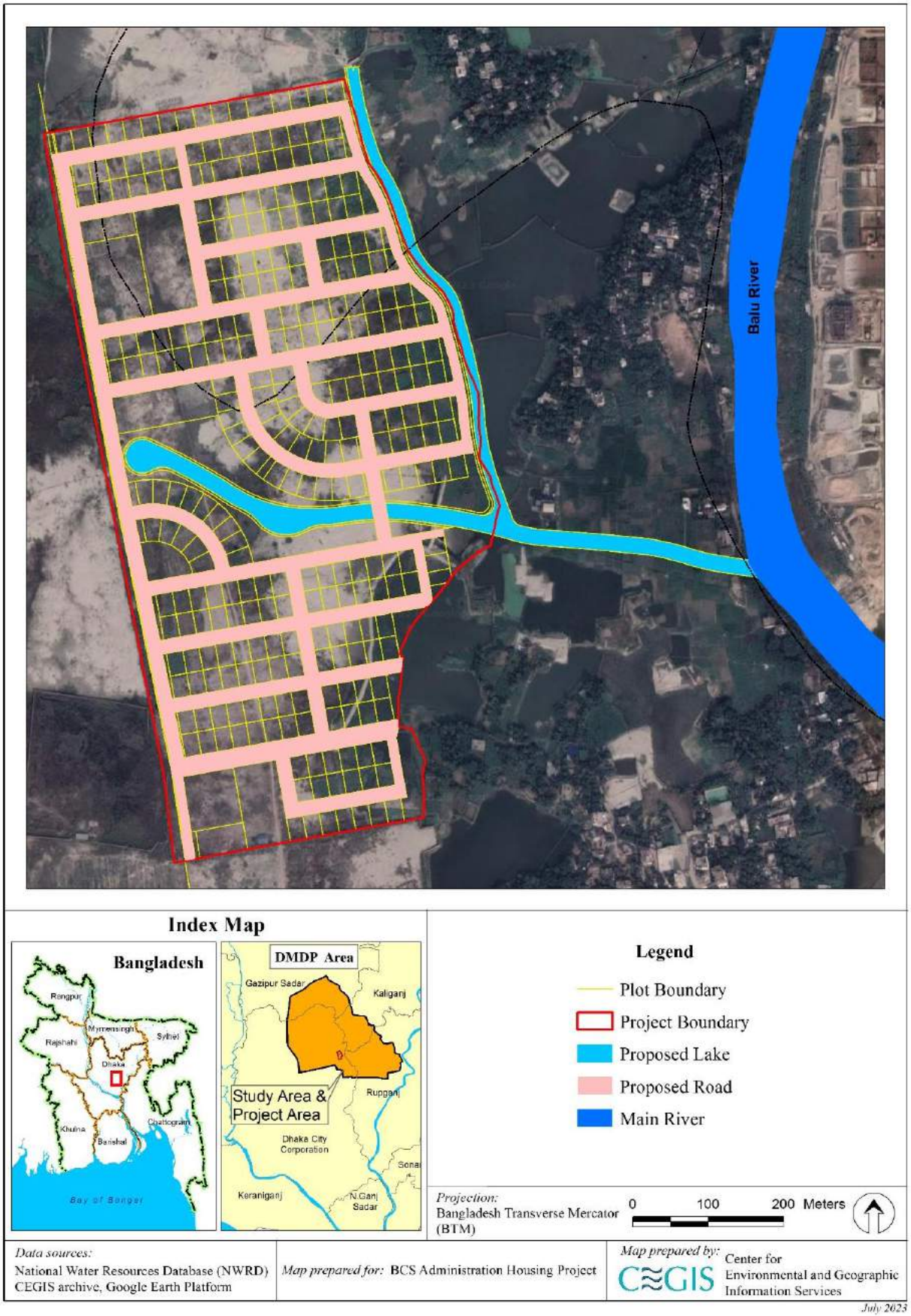


Figure 4.2: Proposed Road Network within Study Area

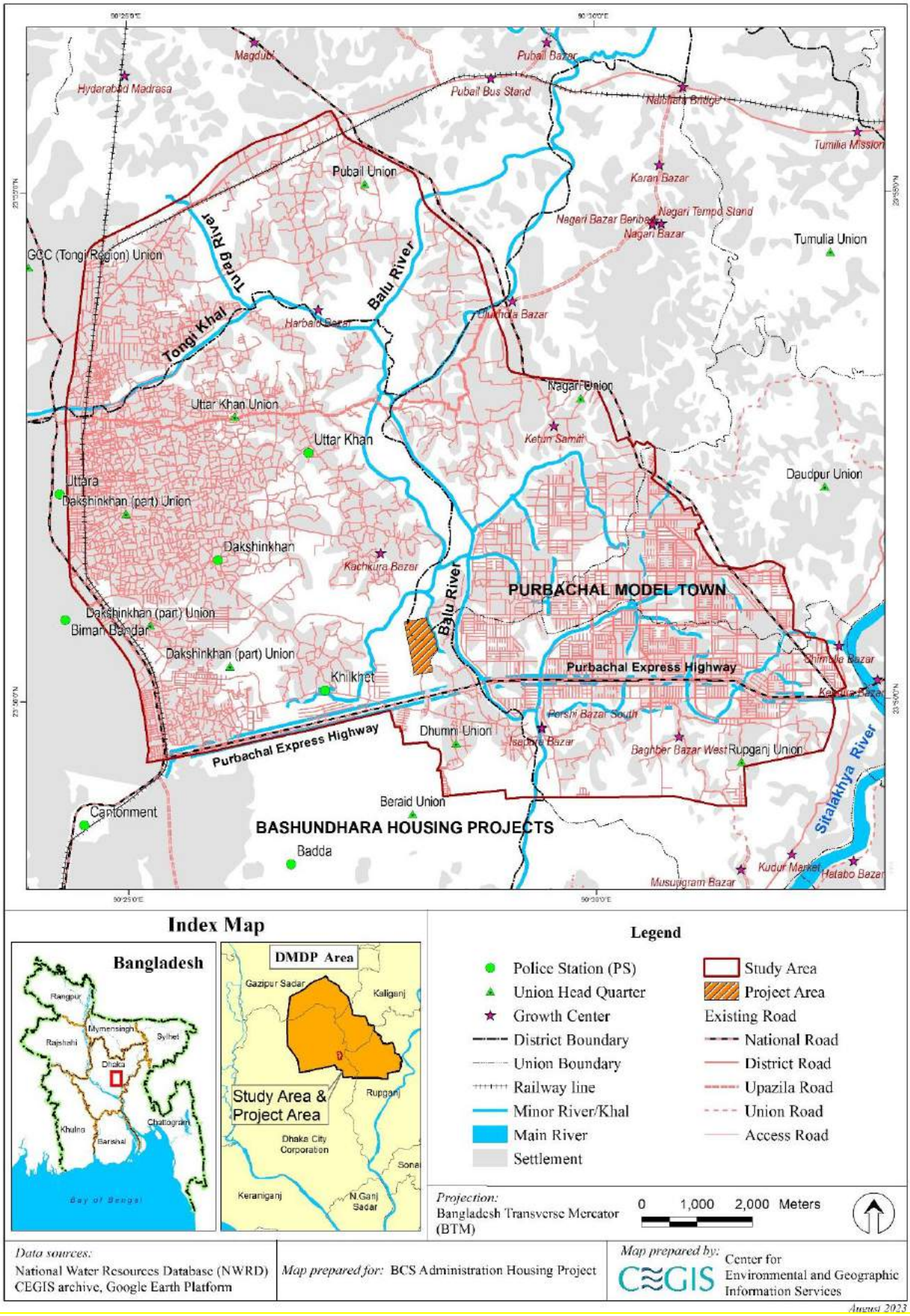


Figure 4.3: Existing Road Network of the Study Area

4.4.3 Drainage and Sewerage Facilities

The main canal (Figure 4.1) within the project boundary will be maintained to ensure natural drainage. Additionally, storm water drainage network will be designed and developed to avoid water logging inside the project area. Sewerage facilities will be installed which will be maintained by Dhaka WASA. The design of drainage and sewerage lines will be done by using the expertise of DWASA. A sewerage treatment plant is being built by Dhaka WASA inside the project area. The area of STP is 0.6141 acres. The STP will collect sewers from the project. The sewerage line will be installed and maintained by DWASA.

4.4.4 Power Station and Electricity Supply

The proposed Khilkhet Housing Project is situated western side of RAJUK approved Purbachal New Town Project. All facilities are available in the existing housing project. It will be easier to connect an electric line to the new project from the existing project with the approved designed of DESA/DESCO/PGCB & concern authority. Moreover, there will be several substations around the Purbachal & Bashundhara area. So, it will be easier to connect the electricity supply to the new project. A suitable plot in the layout plan be kept for electric authority.

4.4.5 Drinking Water Facilities

Water supply is available in the Bashundhara Housing area & Purbachal New Town Project. There are many water pumps installed by WASA in the existing project for the supply of pure drinking water for the dwellers of the area. So, it will be cost-effective to extend the water line to the new project. Suitable plots be kept in the layout plan for the construction of water pumps by WASA in the project.

The project authority has obtained clearance from Dhaka WASA to make necessary arrangements to ensure the supply of safe drinking water. Installation of deep tube-wells and water pumps are part of this process for which required land has also been allocated. There will be 5.39 million litres/day to fulfil the requirement of drinking water. One tube well and one water pump have already been found to exist in the project area.

4.4.6 Educational Facilities

To fulfil the educational requirements of the residents, several educational facilities have been proposed as per planning rules and guidelines. Nursery schools and primary schools have been placed within walking distance. The location of the proposed educational institutes is shown in **Figure 4.4** and their numbers along with the areas allocated are given in **Table 4.2** below:

Table 4.2: Number of Proposed Educational Institutes within the Project Area

Type of Educational Institute	Nos.	Area (Acre)
Nursery School and Primary School	01	1.5634
Secondary School and College	01	2.1466
Total	**02**	**3.7101**

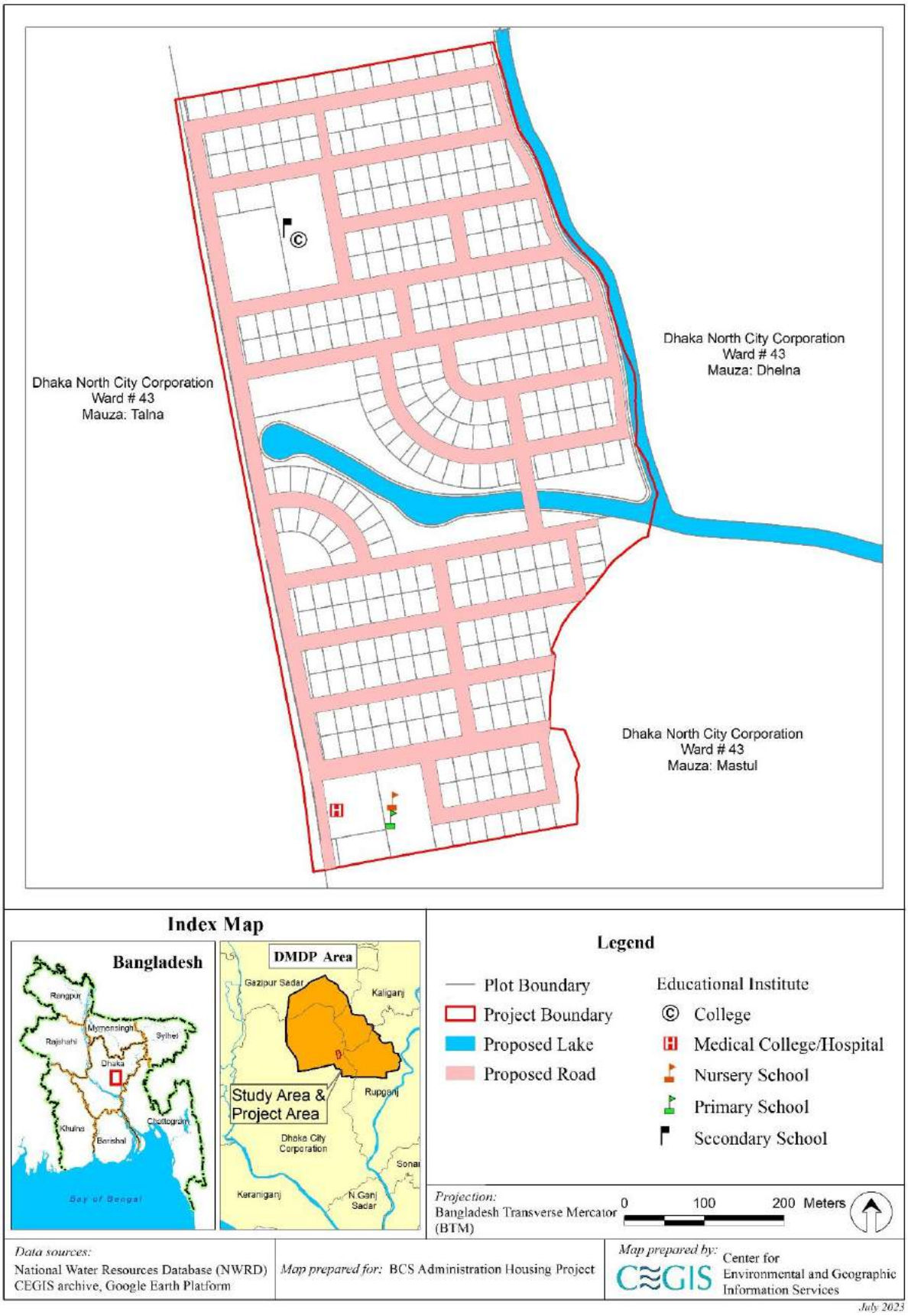


Figure 4.4: Proposed Educational Institutes inside the Project Area

4.4.7 Other Amenities

Provision of other amenities such as schools, colleges, Katcha bazaar, health care facilities, religious establishments, community centers, playgrounds etc. will be ensured following the standards as set in the Private Sector Land Development Regulation 2004, 2012 and 2015. Other amenities proposed within the project area are given in the following Table 4.3 and Figure 4.5.

Table 4.3: Distribution of Other Civic Amenities

Community and Utility Services	Nos.	Area (Acre)
Community Center	1	0.5463
Sports Club	1	0.3306
Sub-Station	1	0.1653
WASA	1	0.1334
Post Office	1	0.1077
STP	1	0.6141
STS	1	0.0692
Internet	1	0.1077
Police Station	1	0.1653
Other Utility	1	0.0914
Total		**2.3311**

The community development centres will include a community centre, social organization, first aid and immunization centre, library and a gymnasium. Mosques will be placed within easy walking distance. Apart from the community facilities, 2.78 acres of land has been allocated for commercial purpose. The commercial areas will include a kitchen market, super shop, corner shop, etc. Recreational facilities will be provided in the project area, which will include 05 play lots, 01 playgrounds and 04 parks. Landscaping around the lake will be made to keep the natural drainage area.

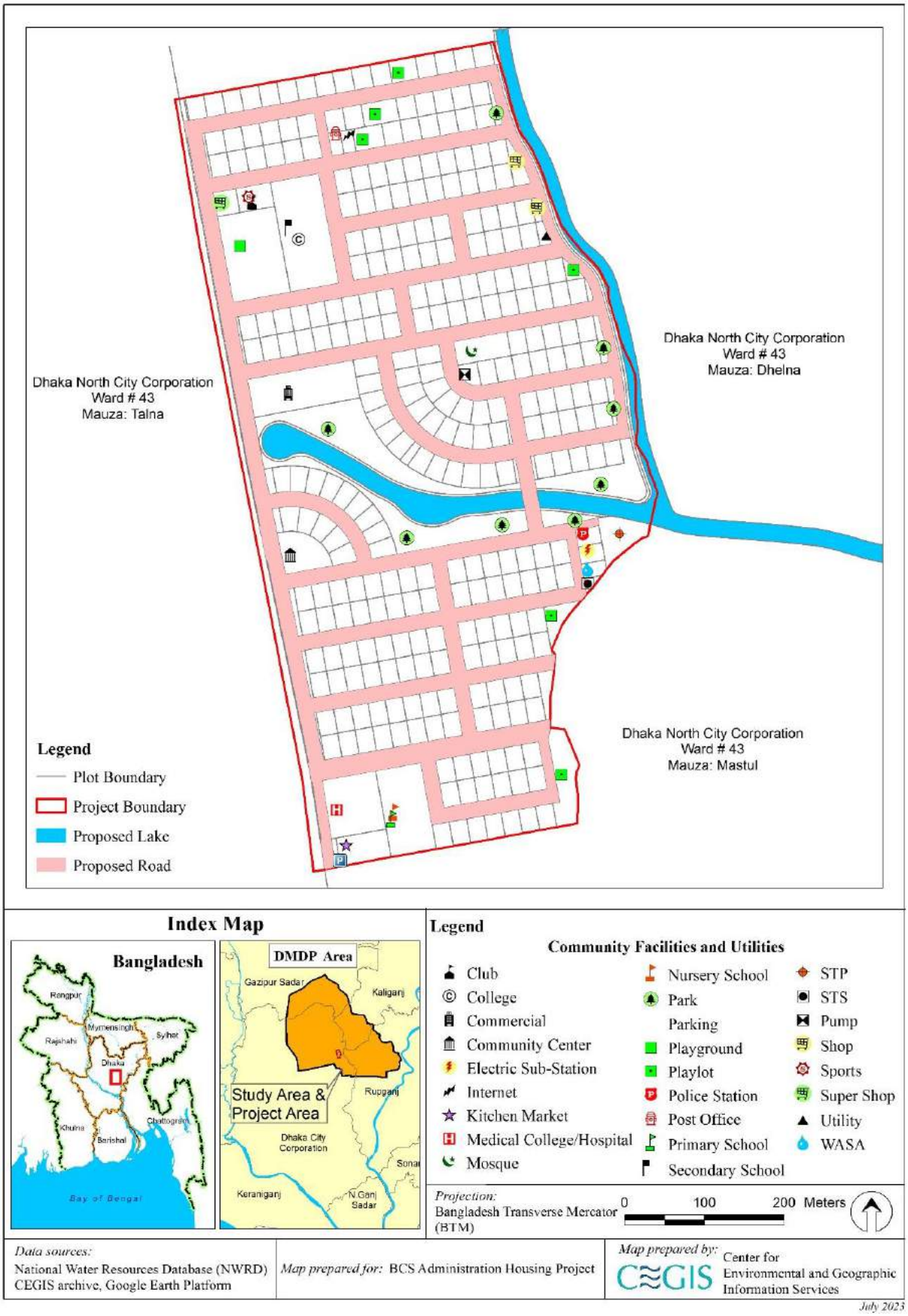


Figure 4.5: Proposed Community Facilities and Utility Services of the Project Area

4.5 Expected Benefits

4.5.1 Social Benefit

Residential development creates new societies that merge and mingle with other societies to create a congenial living atmosphere. It serves the purpose of shelter and provides different community facilities like educational institutes, health centres, places of worship, open spaces and recreational facilities. Therefore, people will enjoy all civic facilities within a boundary but will also make their lives easy and increase the community feeling along with cooperation and sharing.

4.5.2 Economic Benefit

The housing projects are financial resource intensive by the investment of both financial and human capital. Economically this project is highly feasible and is expected to generate huge revenue for the government through collection of taxes by providing services and from land development (transfer, purchase etc.). The labour market including the brokers, boatmen, laborers, contractors, drivers, traders etc. can be involved at every stage of the construction. Backwards and forward linkages to business and industrial activities are created. Hence, due to the implementation of the project, the flow of income takes place through the creation of job opportunities, escalation of land prices, creation of trading opportunities, etc.

4.5.3 Environmental Benefit

The expected environmental benefits from this project are maintained drainage of water flow through the preservation of the water bodies and designed storm water network, conservation of natural vegetation, recreational facilities, landscaping, and beautification. Other benefits include an increase in housing facilities, utility services, improved accessibility through the development of the road network, and the installation of a proper waste management system.

4.6 Activities during Pre-Construction, Construction and Post-Construction Phases

4.6.1 Pre-construction phase

The pre-construction phase involves the preparatory work, more specifically, it includes the following activities:

- Preparing the project layout;
- Purchasing land;
- Obtaining clearance from the DC office;
- Stakeholder consultation;
- Showcasing the project development activities on the bill board in the project site for public disclosure;

4.6.2 Construction Phase

Usually, most of the impacts occur during the construction phase. The construction activities include stockpiling, laying out the road network, creating plots, providing utility services, creating vegetation areas etc. The list of activities is the following:

- Procurement of labor;
- Clearing some of the vegetation from the project site;

- Filling up of small water bodies;
- Development of land through sand filling;
- Levelling of land using dumper;
- Procurement and management of construction materials;
- Construction of roads including all road elements (such as road divider, foot path, landscape elements and road side trees and vegetation) and different structures on the road;
- Installation of water supply systems;
- Installation of electricity systems;
- Installation of storm water drainage systems;
- Implementation of solid waste management system;
- Removal of the temporary structures (e.g. shelter and toilet for construction engineer, labours); and
- Collection and disposal of wastes (liquid and solid) generated during the construction period;
- Fill up the monitoring schedule and submit the monitoring report to DoE for further renew of EC certificate.

This phase might result in environmental problems like water, air (dust) pollution noise pollution, generation of solid waste. Therefore, during the EIA process, the impacts of these interventions are assessed and accordingly, measures are proposed.

4.6.3 Post Construction phase

In this phase, the plots are ready for delivery to the members of the housing authority. Minimal impacts are expected in the post-construction phase if the environmental guidelines and safety standards are properly maintained. This phase involves the following activities:

- Operation and maintenance of the infrastructure of the project;
- Operation and maintenance of sewerage treatment plant;
- Operation and maintenance of surface drainage channels;
- Operation and maintenance of Solid waste dumping and Compost plant operation for fertilizer production.

5. Environmental and Social Baseline

The baseline data has been compiled for physical environment (meteorological condition, water and land), biological environment (ecology, fish resources), environmental quality (air, water and noise) and socio-economic environment. Primary data related to the environmental attributes like air, noise level and water quality were collected through field studies. Various information on other aspects is obtained from field observations as well as secondary sources. The secondary data sources included the Bangladesh Bureau of Statistics (BBS), Bangladesh Water Development Board (BWDB), National Water Resources Database (NWRD), Water Resources Planning Organization (WARPO), Soil Resources Development Institute (SRDI), Bangladesh Meteorology Department (BMD), Department of Agricultural Extension (DAE), Department of Fisheries (DoF), International Union for Conservation of Nature (IUCN), and HIES 2010 (Household Income and Expenditure Survey). The primary sources include Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) and Focus Group Discussion (FGDs).

5.1 Meteorology

Meteorological data in terms of Rainfall, Temperature, Relative Humidity, Wind Speed, and Sunshine Hour were collected from NWRD (Dhaka BMD station) for the last 30 years from 1993 to 2022 and Evaporation and evapotranspiration were collected from Dhaka BMD station for years from 2001 to 2011 & 1979 to 2008 respectively.

5.1.1 Temperature

The monthly average temperature data for the last 30 years, from 1993 to 2022, shows that the maximum temperature varies from 28.63°C to 37.04°C and April is the warmest month. While the minimum temperature varies from 9.84°C to 24.31°C and January is the coldest month in the study area. The monthly average of the maximum and minimum temperature of Dhaka Station is shown in Figure 5.1.

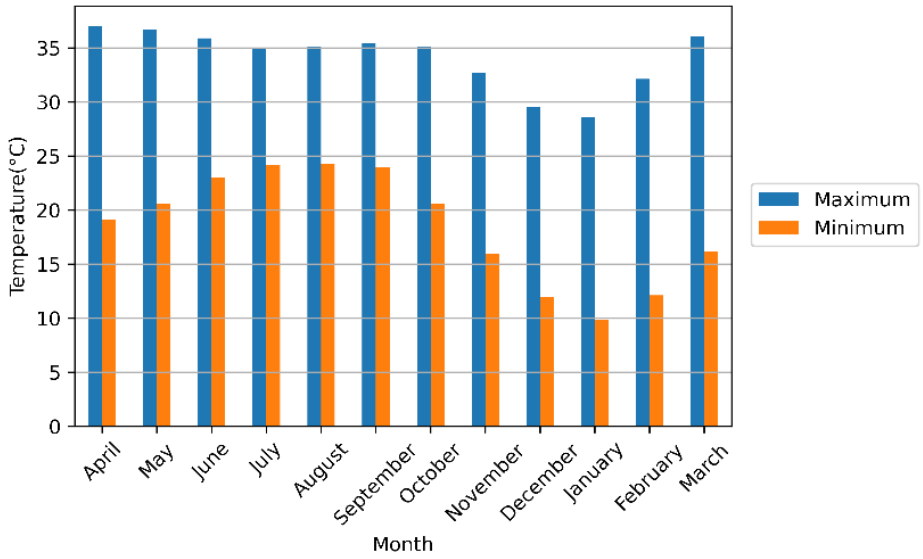


Figure 5.1: Monthly Temperature (°C) at Dhaka BMD Station (1993-2022)

5.1.2 Rainfall

The monthly maximum and average rainfall data for the last 30 years, from 1993 to 2022, was collected, analyzed, and shown in Figure 5.2. The data analysis shows that the monthly average rainfall varies from 165.4 mm to 372.6 mm in monsoon and the area received a maximum of 836.0 mm of rainfall in September 2004. This station's historical maximum annual rainfall was recorded as 2892.0 mm in 2017 the minimum was 599.0 mm in 2022, while the average annual rainfall is 1925.0 mm. The annual rainfall of this period is shown in Figure 5.2.

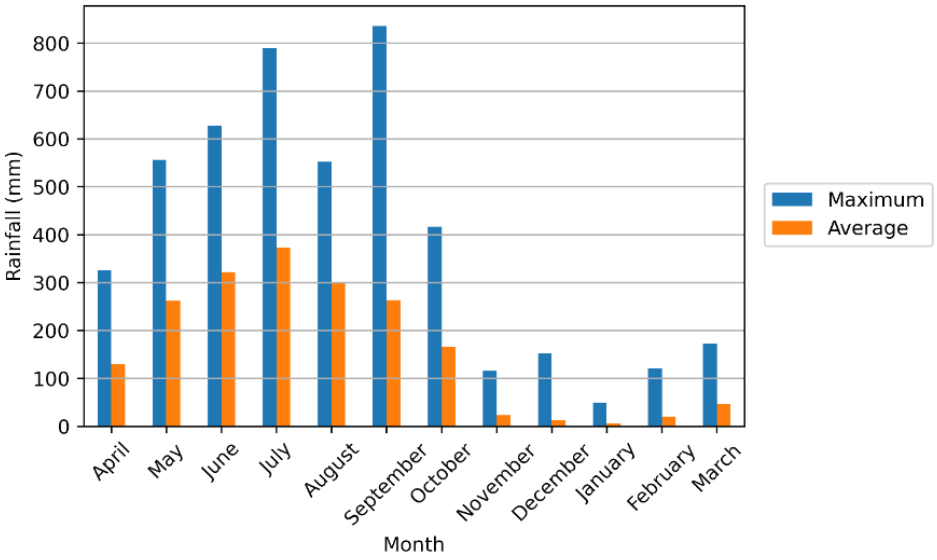


Figure 5.2: Monthly Maximum and Average Rainfall at Dhaka BMD Station (1993-2022)

5.1.3 Relative Humidity

The analysis of the Relative Humidity (RH) data from 1993 to 2022 indicates that the average RH varies seasonally from a minimum of 60.15% in March to a maximum of 82.1% in July. The mean monthly RH data for the last 30 years is shown in Figure 5.3.

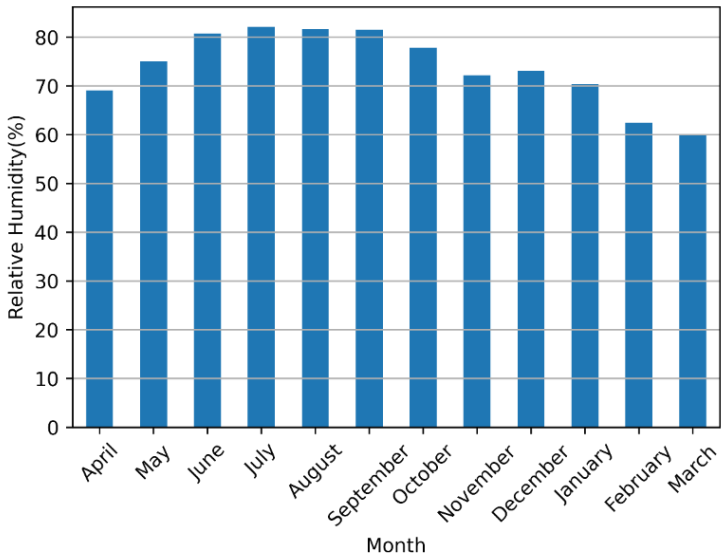


Figure 5.3: Monthly Relative Humidity at Dhaka BMD Station

5.1.4 Evapotranspiration

The maximum and average monthly ETo data collected from the BMD station at Dhaka for the last 30 years (1979-2008) is shown in Figure ETo. It is observed that the evapotranspiration changes with the increase of temperature, and with the change of humidity and wind speed. The monthly average of maximum ETo in the area varies from 2.55 mm/day in December to 6.37 mm/day in April. On the other hand, the average ETo varied from 2.05 mm/day in December to 4.97 mm/day in April.

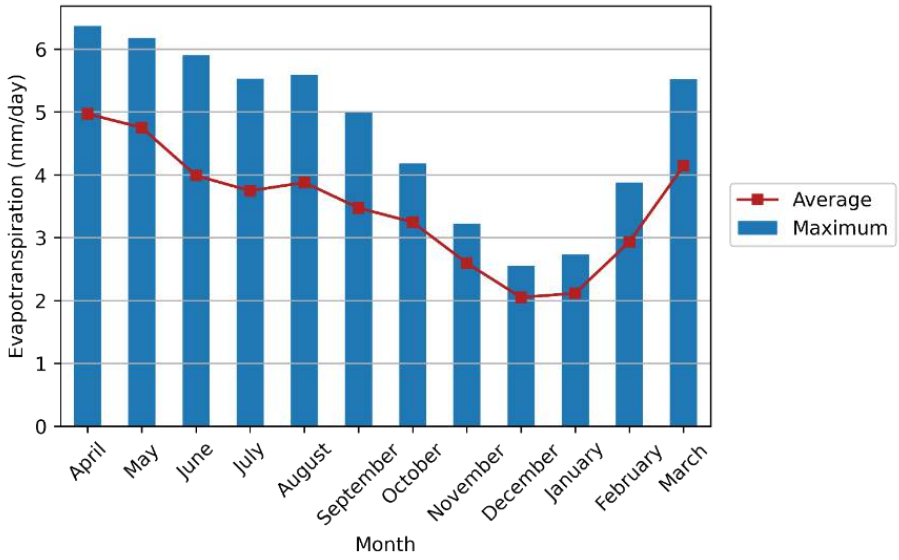


Figure 5.4: Monthly Variation of Evapotranspiration at Dhaka BMD Station

5.1.5 Evaporation

The maximum and average monthly evaporation data collected from the BMD station at Dhaka for the last 11 years (2001-2011) is shown in Figure ET. It is observed that the evaporation changes with increasing temperature. The average maximum evaporation in the area varies from 3.3 mm/day in December to 6.07 mm/day in May. On the other hand, the average average varies from 1.28 mm/day in December to 2.76 mm/day in April.

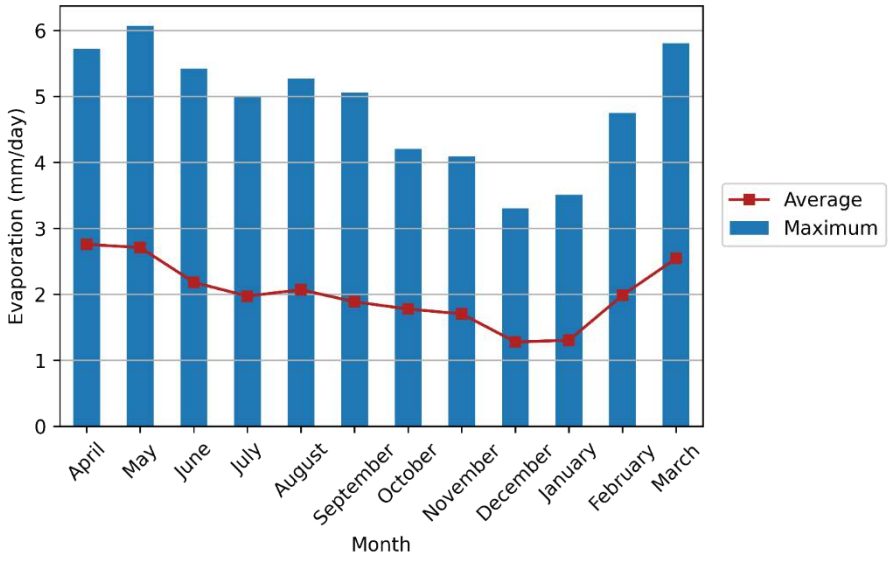


Figure 5.5: Monthly Variation of Evaporation at Dhaka BMD Station

5.1.6 Wind Speed

The data on the maximum wind speed for the last 30 years (1993 to 2022) shows that the monthly maximum wind speed of 129.6 km/hour occurred in June 2022. On the other hand, the average maximum wind speed varies from 9.8 km/hour in December to 22.82 km/hour in May. The monthly maximum and average maximum wind speeds are shown in Figure 5.6.

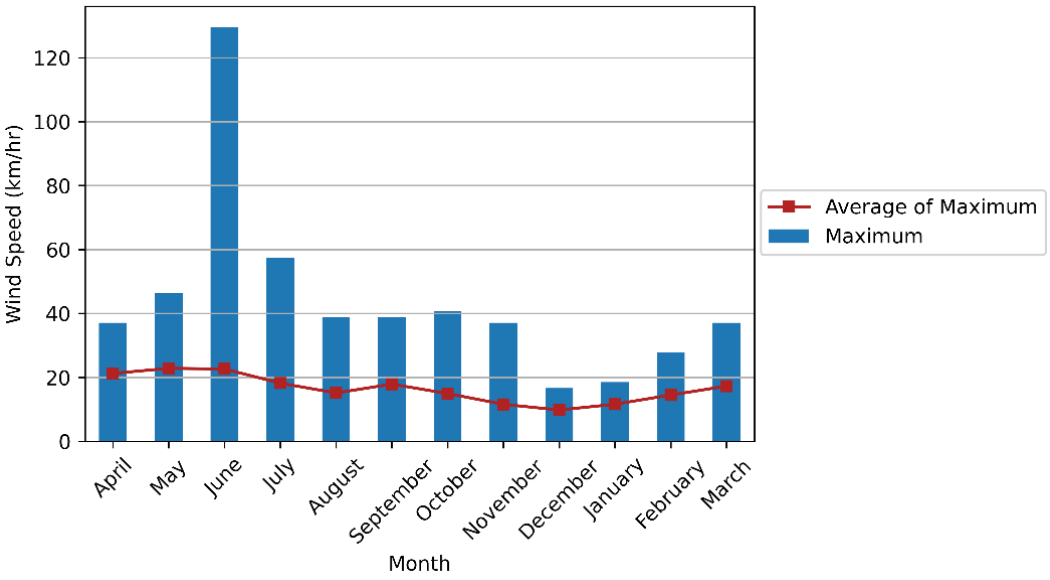


Figure 5.6: Monthly Maximum and Average Wind Speed at Dhaka BMD Station

5.1.7 Sunshine Hour

The data on sunshine hours for the last 30 years (1993-2022) was collected and analyzed. It was revealed from the analysis that the monthly average sunshine hour varies from a minimum of 3.93 hours/day in July to a maximum of 7.62 hours/day in March. The variations in monthly average sunshine hours are shown in Figure 5.7.

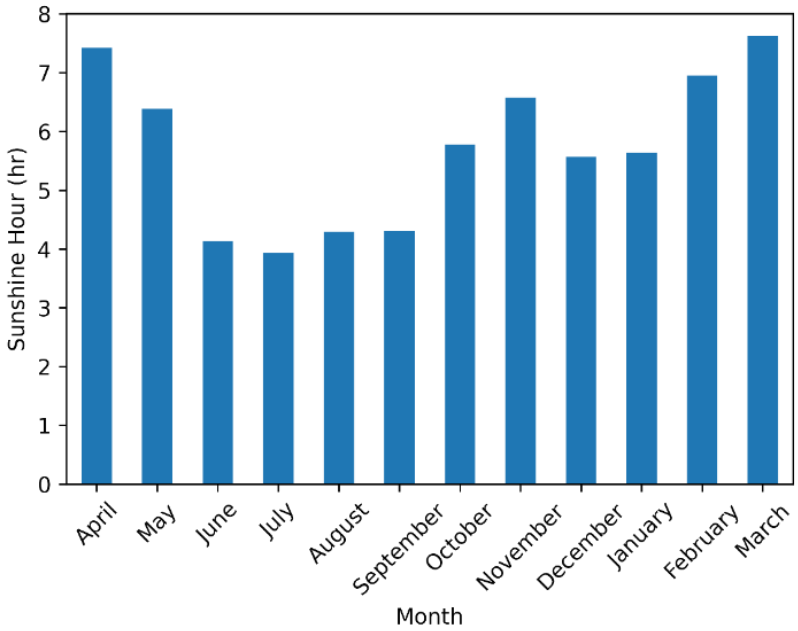


Figure 5.7: Monthly Variation of Sunshine Hours at Dhaka BMD Station

5.2 Disaster and Climate Change

Climate change is one of the major threats to Bangladesh. Studies suggest that due to climate change temperature and rainfall patterns of the country will be changed considerably and the seasonal behaviours will be more erratic. Consequently, there are greater chances of extreme events in the future and the frequency of different water-related disasters like floods, heavy rain-fed drainage issues etc. will increase.

To assess the impacts of future climate change in the study area. The results of the PRECIS regional climate model have been used from a recent CEGIS study (CEGIS, 2014). The results of PRECIS for SRES scenario A1B (medium GHG emission scenario) for Dhaka are presented in tables 5.1 to 5.3.

Table 5.1 shows the possible changes in future maximum temperature for different seasons. On average, there is a rise in temperature in all seasons. The trend in different future periods is gradually increasing in all seasons. The highest temperature is observed from March to May, which is expected to increase by 1.3°, 2.5° and 4.7°C during 2030, 2050 and 2080 respectively.

Table 5.1: Changes in Average Maximum Temperature due to Climate Change

Season	Base (1970-2000)	2030	2050	2080
	Average (°C)	Change (°C)		
Dec. - Feb.	23.5	1.8	3.4	4.9
March-May	36.9	1.3	2.5	4.7
June - Aug.	33.0	0.9	2.4	3.7
Sept. - Nov.	29.6	1.7	3.1	4.3

Source: CEGIS 2014

Table 5.2 shows the possible changes in future minimum temperature for different seasons. The lowest minimum temperature is seen during Dec. – Feb. season. The trend in different future time slices is gradually increasing for all seasons. In future, the minimum temperatures will rise in all seasons as a result, the winter average low temperature is expected to rise by 1.7°, 3.5° and 4.9°C during 2030, 2050 and 2080 respectively.

Table 5.2: Changes in Average Minimum Temperature due to Climate Change

SEASON	BASE (1970-2000)	2030	2050	2080
	Average (°C)	Change (°C)		
Dec. - Feb.	10.1	1.7	3.5	4.9
March-May	24.1	1.3	2.6	4.0
June - Aug.	26.0	1.0	2.0	3.0
Sept. - Nov.	21.1	1.5	2.9	4.0

Source: CEGIS 2014

Table 5.3 presents the possible changes in future seasonal average rainfall for different seasons. In Dhaka, the seasonal total rainfall is highest during monsoon (June-August) followed by post-

monsoon (September-November). Almost half of the annual total rainfall showers during monsoon. Future predictions from PRECIS show an increase of monsoon rainfall by 15% during 2030 and afterwards reduction to 13% and 11% during 2050 and 2080 respectively. So, the highest rainfall is expected soon while in the long term, this will reduce slightly from that of 2030. During the post-monsoon period, a decrease of 7% is seen in model results during 2030 followed by an increase during 2050 and 2080. Due to a substantial increase in monsoon rainfall in the future, the drainage and flooding situation in the study area will be under a more stressful situation. The flooding (from drainage congestion or river flow) probability will be relatively high in the study area unless sufficient preventive measures are taken.

Table 5.3: Changes in Seasonal Average Rainfall due to Climate Change

Season	Base (1970-2000)	2030	2050	2080
	Average (Mm)	Change (%)		
Dec. - Feb.	68.9	-10.2	5.0	14.4
March - May	382.2	11.2	32.3	-6.0
June - Aug.	814.4	14.9	13.1	10.9
Sept. - Nov.	451.8	-7.0	4.3	14.7

Source: CEGIS 2014

5.3 Geology

5.3.1 Tectonic Setting

Bangladesh is a part of the Bengal Basin. The frequent tectonic activities among the Indian, Tibetan (Eurasian) and Burmese (West Burma Block) Plates have made the Bengal Basin dynamic in nature. A major collision of the Indian plate with the South Tibet and Burma plates took place in the Early Miocene, and rapid uplift occurred in the Himalayas and Tibet. At the same time, a major upthrust movement occurred along the Dauki Fault resulting in the separation of the Sylhet Trough from the stable shelf, and the Trough formed an important sediment deposition hub. However, the subsurface geophysical characteristics of Bangladesh have divided the country into nine major tectonic units- the Himalayan Fore Deep, Rangpur Platform, Bogura Shelf, Calcutta-Mymensingh Hinge zone, Faridpur Trough, Sylhet Trough, Barisal Gravity High, Hatiya Trough and Indo-Burman Ranges. Among these tectonic units, the study area is a part of the Faridpur Trough which is filled up by an enormous volume of Tertiary sediments and can broadly be sai, Carboniferous to Recent sediments of about 15 to 20 km pile of deposits. It is an active deltaic Trough with a subsidence rate of 2.2 cm/year or higher. In this area three types of subsidence are recognized which are tectonic subsidence, compaction of peat layers and human-induced subsidence. This area is geologically one of the least explored areas in Bangladesh.

5.3.2 Physiography

In the context of physiography, Bangladesh may be classified into three main physiographic regions - (a) floodplain areas, (b) terraces, and (c) hills. Each of the physiographic units has its distinctive distinguishing characteristics that make each unit identical to others. However, the maximum area of the study area and the whole area of the project area fall in the Modhupur Tract physiographic (Figure 5.9) unit which is mainly a Pleistocene terrace. Both the project and study area are covered by thick sticky clay. The residual part of the Pleistocene Madhupur clay is a

typical geological unit of the project area. Pleistocene terrace land with some abandoned channels is also a typical characteristic of the study area.

5.3.3 Seismicity

Analysis of earthquake hazard is more regional concern than that of local. For example, an earthquake that occurred in Nepal may cause damage to Bangladesh. So, regional earthquake analysis is necessary to predict any earthquake hazard in Bangladesh. According to Bangladesh National Building Code (BNBC), 2020; the whole land area of Bangladesh has been divided into four seismic zones (Figure XZ). The zone coefficients (Z) for the four zones respectively are Z= 0.12 (Zone-I), Z= 0.20 (Zone-II), Z=0.28 (Zone-III) and Z= 0.36 (Zone-IV). The Zone-IV is the most and Zone-I is the least vulnerable to seismic risks. Among these zones, the project and study area are located under earthquake Zone II (Figure 5.10) which is considered as the middle class of earthquake risk in Bangladesh point of view. If any civil structure is designed in the study area taking seismic coefficient (Z=0.20), then according to the relationship between Z values and the Richter Scale; the structure can withstand a maximum earthquake of 07 on the Richter Scale. A summary table of seismic intensity and the historical records of earthquakes in and around Bangladesh that occurred during the last 450 years is presented in Table 5.4 as a ready reference for future planning and designing purposes for this project.

Table 5.4: The regional earthquake history of Bangladesh for the last 450 year

Sl	Year	Source Area	Magnitude (Richter Scale)	Depth (Km)
1	1548	Sylhet	-	-
2	1664	Shillong-Plateau	-	-
3	1762	Chittagong-Arakan	≤8.8	-
4	1858	Sandway, Myanmar	6.5	-
5	1869	Cachar, India	7.5	48
6	1885	Sirajganj, Bangladesh	7	72
7	1897	Assam, India	8.1	60
8	1906	Calcutta, India	5.5	-
9	1912	Mandalay, Myanmar	7.9	25
10	1918	Srimangal, Bangladesh	7.6	14
11	1930	Dhubri, India	7.1	60
12	1934	Bihar, India-Nepal	8.3	33
13	1943	Numaligarh, Assam, India	7.2	13

Sl	Year	Source Area	Magnitude (Richter Scale)	Depth (Km)
14	1938	Mawlaik, Myanmar	7.2	60
15	1950	Assam, Himalaya	8.6	25
16	1950	Chittagong, Bangladesh	6	-
17	1954	Manipur, India	7.4	180
18	1975	Assam, India	6.7	112
19	1981	Sundarbans, Bangladesh	4.9	-
20	1984	Cachar, India	5.7	4
21	1988	Bihar, India-Nepal	6.6	65
22	1988	Phek, Manipur, India	7.3	90
23	1995	Monipur, India	6.4	-
24	1997	Sylhet, Bangladesh	5.6	35
25	1997	Bangladesh-Myanmar	5.3	56
26	1999	Maheshkhali, Bangladesh	4.2	10
27	2003	Rangamati, Bangladesh	5.6	-
28	2011	Sikim, India	6.9	-
29	2015	Gorkha, Nepal	7.8	8.2
30	2016	Imphal, India	6.7	-
31	2016	Baniachang, Sylhet, Bangladesh	4.4	30
32	2023	14 km ESE of Dohar upazila,Dhaka	4.3	10

5.4 Topography

The project and study area are occupied by the southern part of the Madhupur Tract. A remarkable difference in the ground elevation can be observed throughout the study area (Figure 5.11), which is reflected in distinct landforms: high lands, lowlands, floodplain of Balu, abandoned channels, and depressions. From the Digital Elevation Model (DEM), it is found that the ground elevation of the study area varies from 1.1 to 12 mPDW whereas the elevation of the project area varies from 1.1 to 4.4 mPWD.

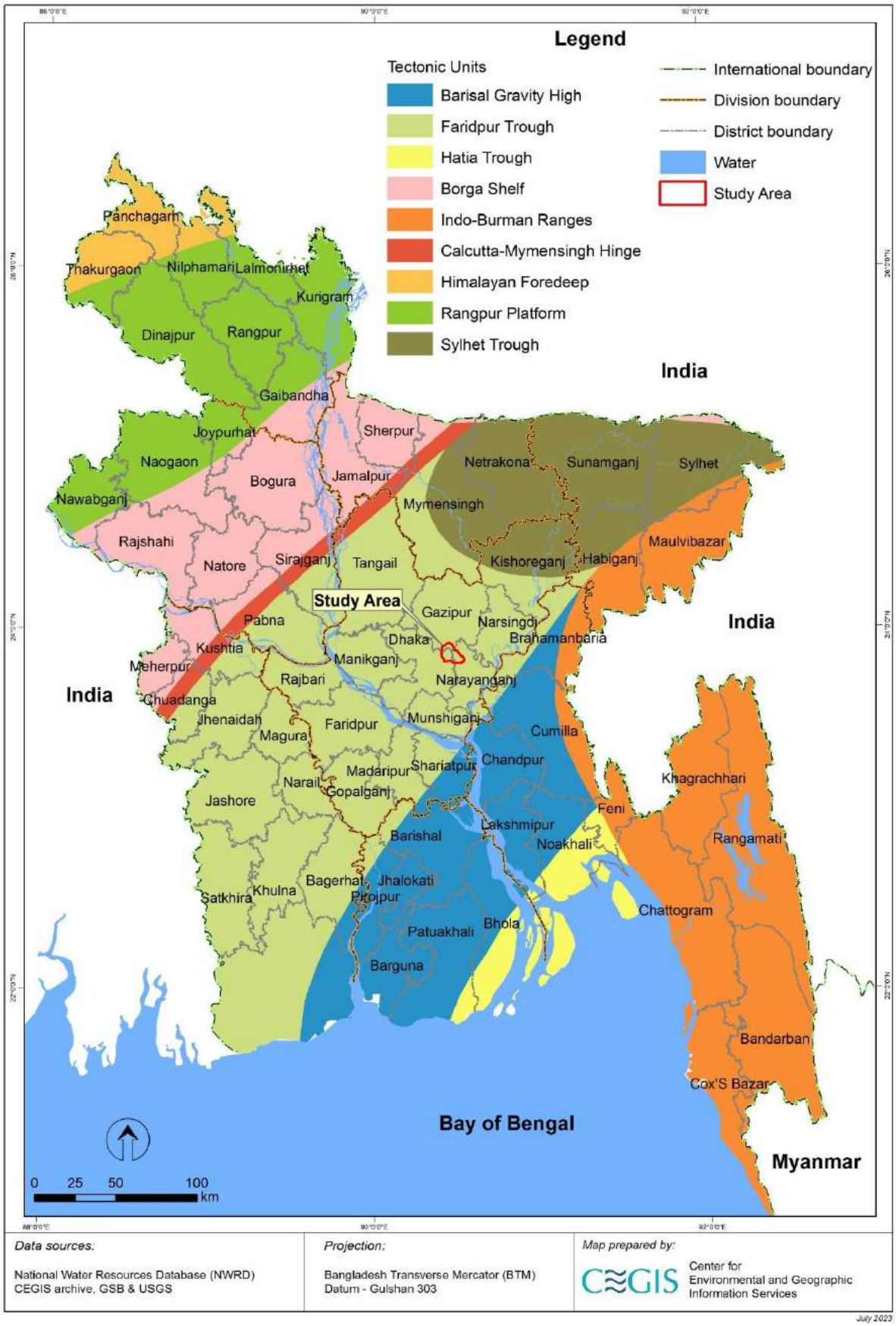


Figure 5.8: Tectonic map of Bangladesh showing the study area

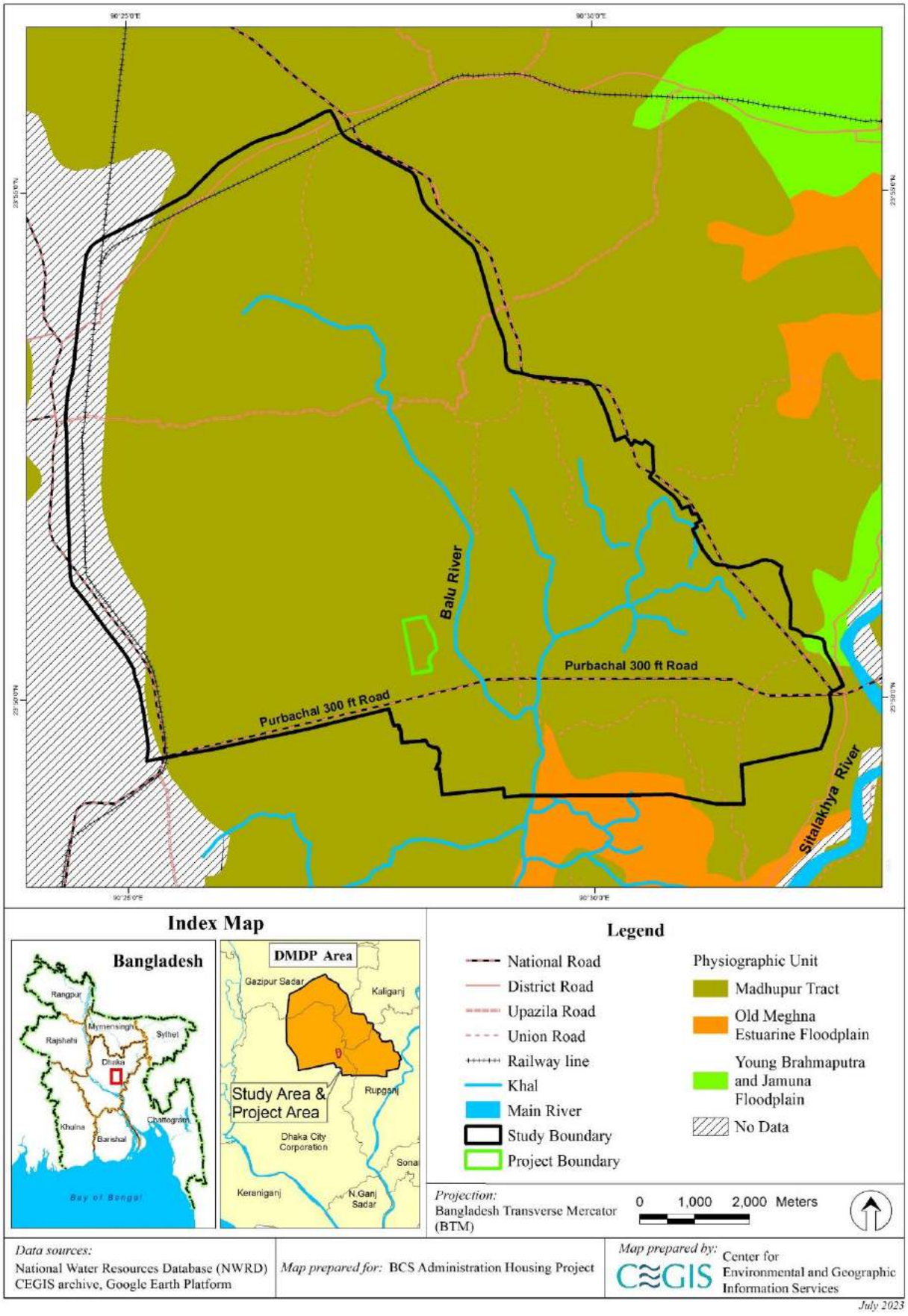


Figure 5.9: Physiographic units of the project and the study area

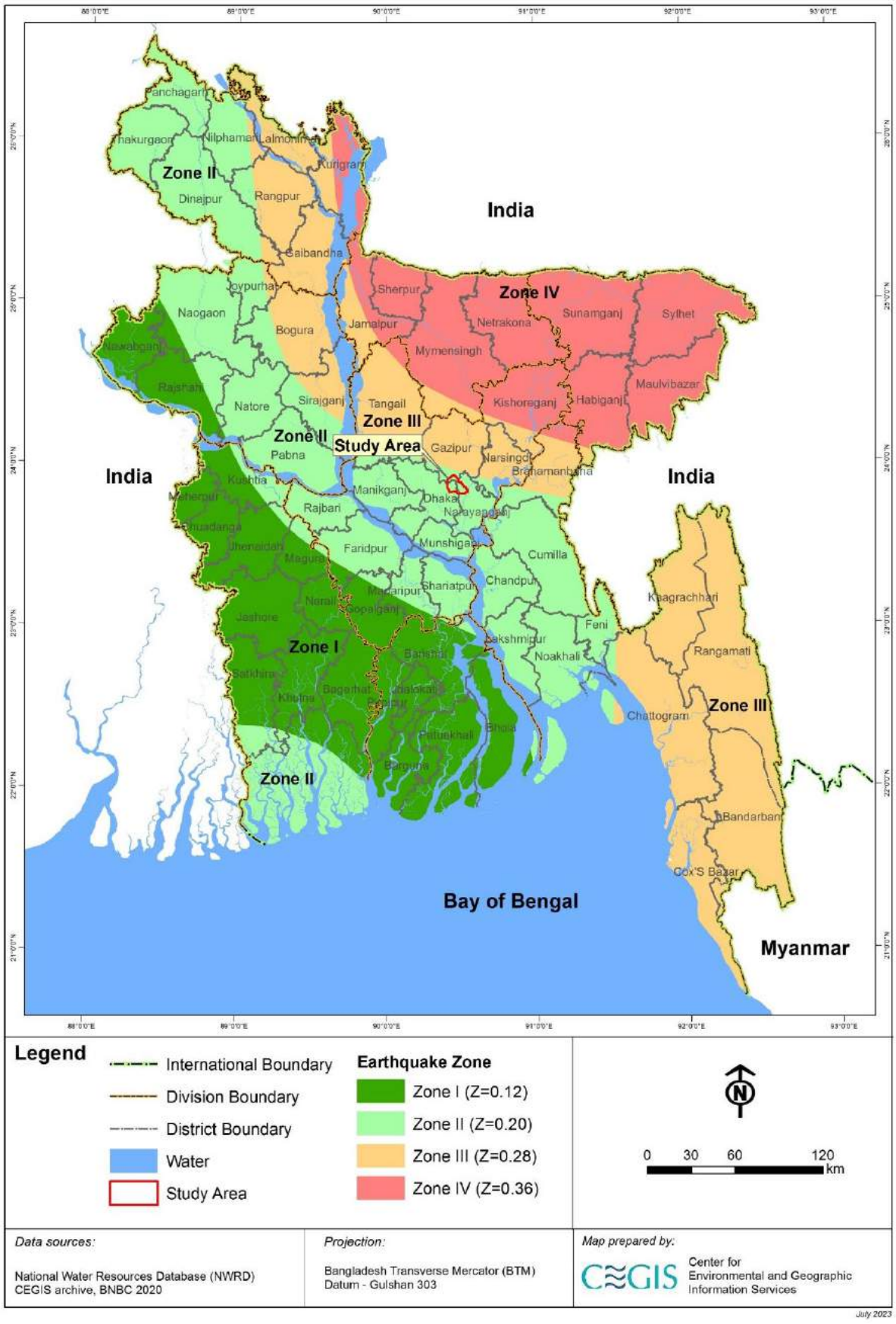


Figure 5.10: Earthquake zoning map of Bangladesh showing the study area

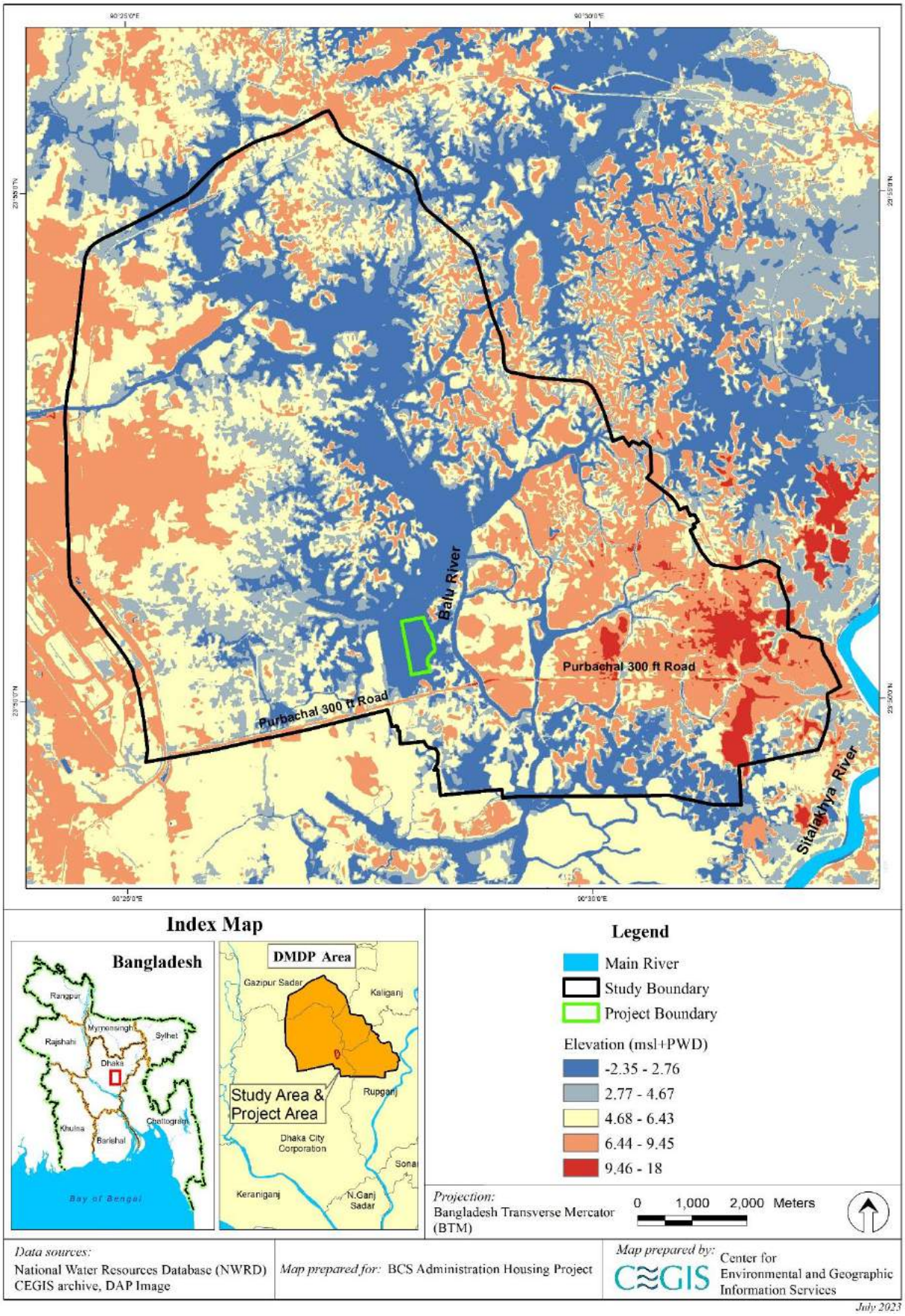


Figure 5.11: Digital Elevation Model (DEM) map of the project and the study area

5.5 Land Use and Soil Characteristics

5.5.1 Agro-ecological Regions

Both the project and study are part of the Madhupur tract (AEZ-28). The majority of the AEZ's soils were developed atop Madhupur clay. The top soils have low to medium levels of organic matter, a low moisture-holding capacity, and low fertility levels. They are primarily very strongly acidic in reactivity but can also be somewhat acidic. The soils mostly fix phosphate and have extremely low to low levels of Phosphorus, Boron, and Potassium as well as low to medium levels of Sulphur.

5.5.2 Land Type and Soil Texture

Before November 2016, the project area was mostly lowland and frequently remained underwater for more than six months. But after the starting of landfilling, the land is now raised to a highland. The project area's soil is primarily clay with a small amount of clay loam. But now, the soil texture is mostly sand and sandy loam due to landfilling. The study area land type is still dominated by lowland and soil texture is clay loam. Except for the edges close to the urban areas and roads where some highlands have been found.

5.5.3 Land Use

In November 2016, a landfill was started in the project area. Before that, only one crop was grown during the Rabi season which was mostly a lowland. The study team observed during the field visit that the landfilling had nearly been finished in the project area, hence no agricultural activity had been identified. Although the main land use of the study area is a built-up area (51% of the total area), followed by agricultural land (25% of the total area) and settlement (18% of the total area). The change of land use with present status is presented in Table 5.5. The land use of the project and study area is presented in Figure 5.12.

Table 5.5: Land use of both Project and Study Area

Land Use	2015	2019	Change of Area (in %)
	Project Area (Area in Ha)		
Built-Up Non-Linear	-	42	100.0
Agricultural Land	36	-	-100.0
Perennial Beels	6	-	-100.0
Total	**42**	**42**	**-**
Land Use	**Study Area (Area in Ha)**		
Built-Up Non-Linear	5,398	5,581	3.4
Rural Settlement	2,073	2,044	-1.4
Brickfield	14	14	-
Agriculture	2,791	2,702	-3.2
Baor	4	0	-100.0
Fresh Water Aquaculture	9	36	283.5
Lake	195	141	-27.4
Perennial Beels	127	85	-32.7
Rivers and Khals	265	273	3.0
Orchards and Other Plantations (Trees)	41	41	0.0
Shrub Dominated Area	26	26	0.0
Total	**10,942**	**10,942**	**-**

Source: SPOT image, 2015 and Landset image, 2019 with CEGIS field observation, 2023.

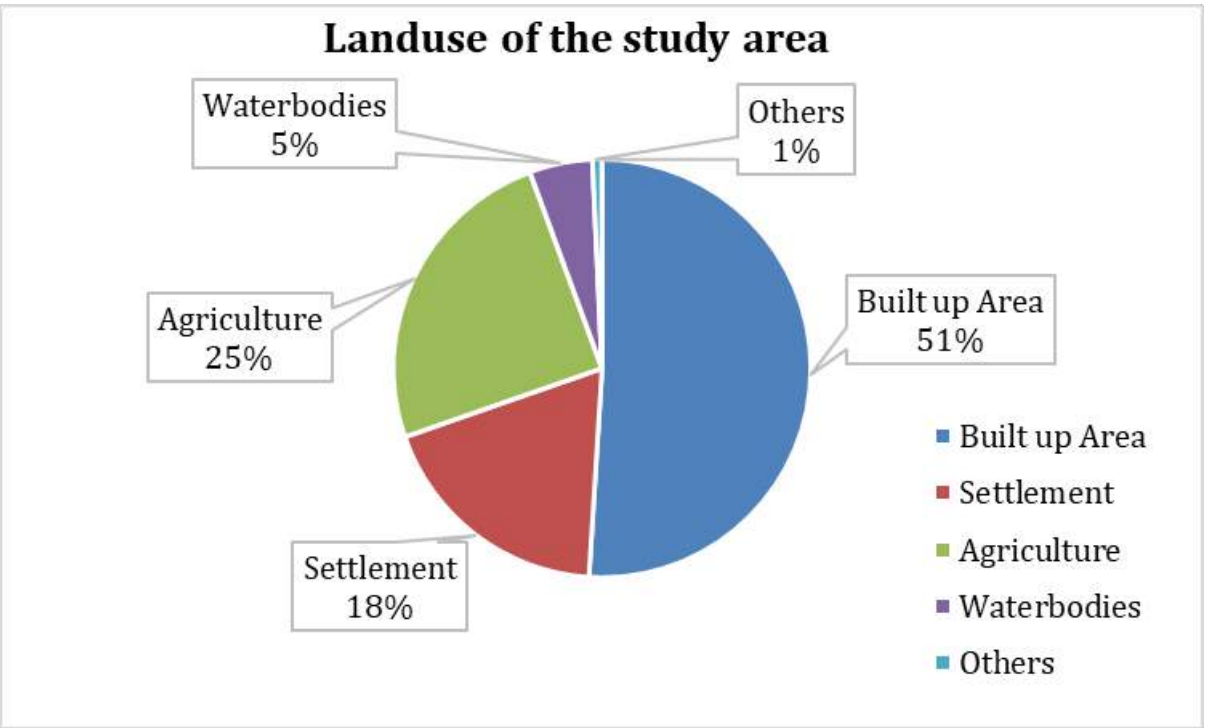


Figure 5.12: Major landuse of the study area

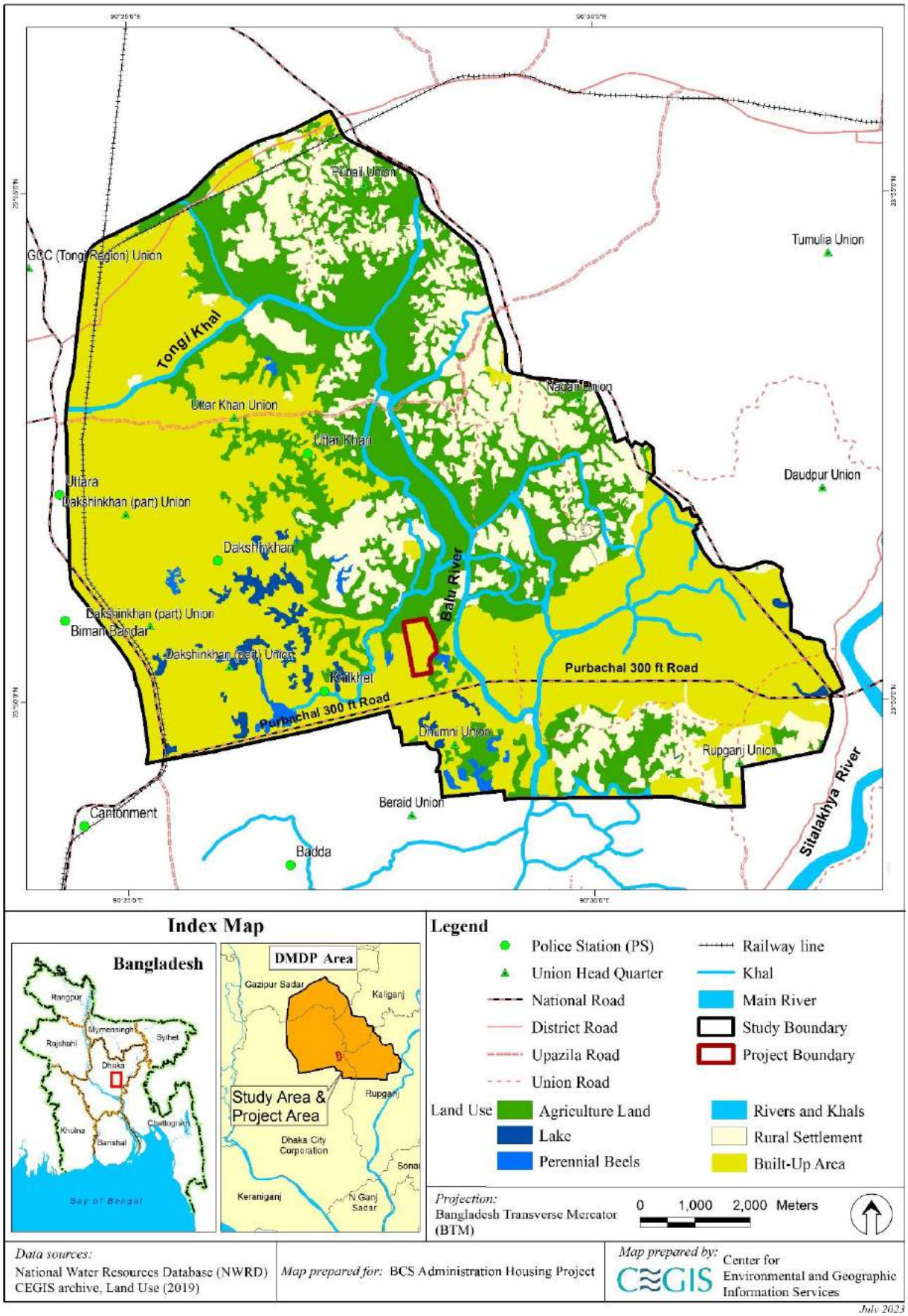


Figure 5.13: Landuse of the project and study area

5.6 Hydrology

5.6.1 Hydrological connectivity

The water resources system of the area is mainly governed by the Balu River. The Balu River is a tributary of the Shitalakshya River and passes through the wetlands of Beel Belai and Dhaka before its confluence with the Shitalakshya at Demra. The Tongi Khal is the upper tributary of the Buriganga, a major river in Bangladesh. The river acts as both a source of flooding from overbank spillage during periods of high discharges and as a restriction to the outflows of drainage water. Balu is a meandering and perennial river with less flow during the month from December to February and a high flow during July to September. The water resources system of the area also comprises with Balu River as well as many other water bodies.

5.6.2 Surface water system

Surface Water Level

To assess the surface water characteristics of the study area, water level data were collected from two tidal gauge stations of BWDB: Tongi (ID: 299) and Pubail ID: 07). The maximum and minimum water level at Tongi gauge station is 7.84 m PWD and 0.69 m PWD respectively. The calculation has been done by analysing the maximum of maximum high WL and a minimum of minimum low WL data. On the other hand, the maximum and minimum water level at Pubail gauge station is 7.32 m PWD and 0.75 m PWD respectively.

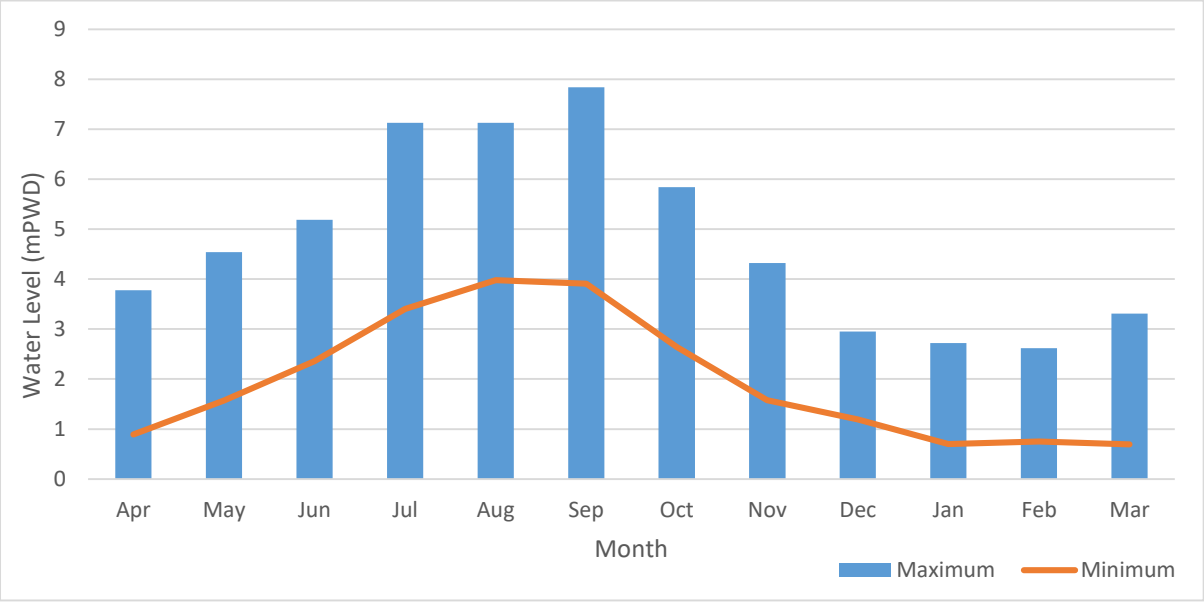


Figure 5.14: Surface water level of Tongi Khal River

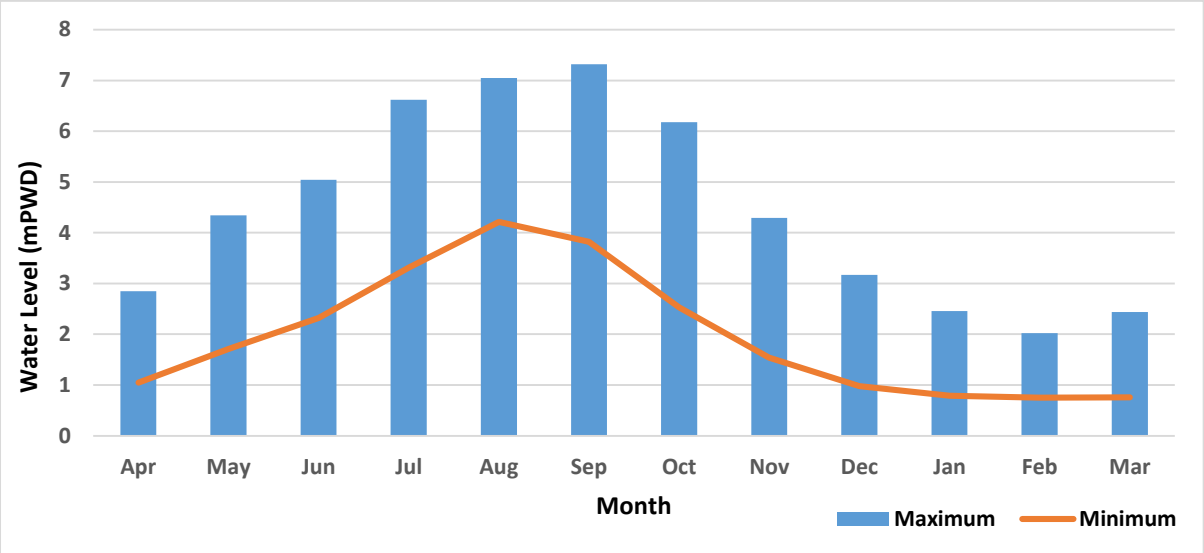


Figure 5.15: Surface water level of Balu River

Discharge

The annual discharge data was collected from Tongi BWDB station (Station ID: 299) where maximum discharge was found as 508 m^3/sec in 1980 and minimum discharge was found as 14.30 m^3/sec in 1979. On the other hand, the average discharge varied between 26.39 m^3/sec to 125.92 m^3/sec.

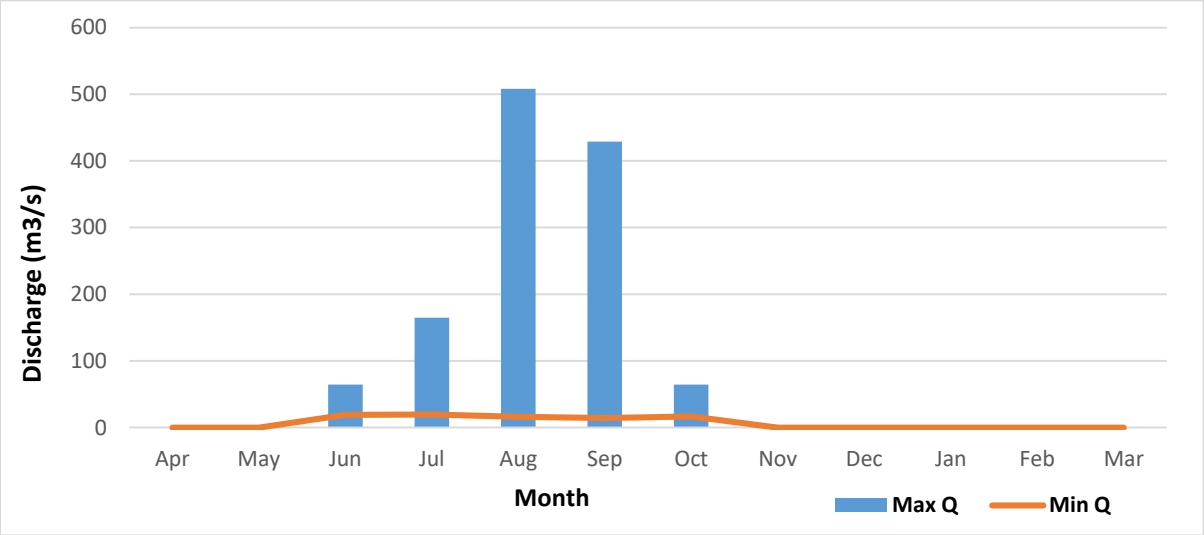


Figure 5.16: Discharge at Tongi Khal River.

5.6.3 Flooding

The housing project is located within the mixed-use zone of the DAP near the Balu River. A major part of the study area was low-lying land which usually gets inundated during monsoon. Mostly, a flood occurs in this low-lying area due to upstream river flow. It was estimated that about 99% of the project area gets inundated during average flooding conditions, whereas 90% area has a flood depth of above 3.6m PWD. This floodplain area acts as flood storage during high flow and ensures smooth passage of flood and secondly, functions as a water retention basin to store the flood peak temporarily and reduce the peak flow.

5.6.4 Drainage System

The drainage system of the Khilkhet Abshahon Prokalpo is mainly comprised of khals, open drains and rivers. Due to the favourable natural landscape, gravity flow is dominant in these areas and a natural drainage system prevails. The Balu River and the Tongi Khal act as the main drainage channels in the area. The major portion of the surface run-off of the region is generated either by rainfall or by the upstream flows during monsoon discharges into the lower reach of the Balu River and consequently contribute to the Shitalakhya River. On the other hand, the remaining portion of the runoff from the area drains through the Tongi Khal to the Meghna River through the Balu-Sitalakhya-Daleswari Rivers.

Local people stated that drainage is not a major problem in this area. During monsoon, only flood plain area is inundated as mentioned in the above section. As most of the project area is comprised of low lands, the storm water from the project area accumulates in these low lands. After that storm water passes though different canals and beels and finally discharges into the Shitalakhya River. The settlements in this area are established by raising the land. There are numerous water bodies and rain water is mostly drained under gravity into the khals or water bodies.

5.6.5 Ground Water Hydrology

Groundwater

The groundwater data of the BWDB observation well around Dhaka (Station DHA017) was collected and analyzed (1983 to 2012) and it is observed that the depth of groundwater level from the ground surface in the dry season goes downward and the maximum depth was found to 12.2 m in April. On the other hand, the water table rises in monsoon and the lowest depth of groundwater level from the ground surface is observed in August due to recharge by rain water and peripheral river water.

Aquifer Condition

Water-level declination is increasing non-linearly due to massive extraction and limiting vertical recharges over the years which severely threaten the sustainability of the aquifer. Due to the construction of buildings, roads and concrete pavements natural water recharge to aquifers cannot keep pace with the water withdrawal, for more than three decades. The average declination of static water level in Dhaka City is 3.06 m per year (Chowdhury, 2018). It has been found that the aquifer system of the area can be divided into four aquifers and four aquitards up to a depth of 400m. The long-term hydrographs for the observation wells within Dhaka City show a sharp decline in water level with little or even no fluctuation which indicates over-exploitation of aquifers (Ahmed et al. 1998). The water table maps (Figure 4.6) of wet and dry seasons show a pointed cone of depression in the central part of the city (Akhter et al. 2017).

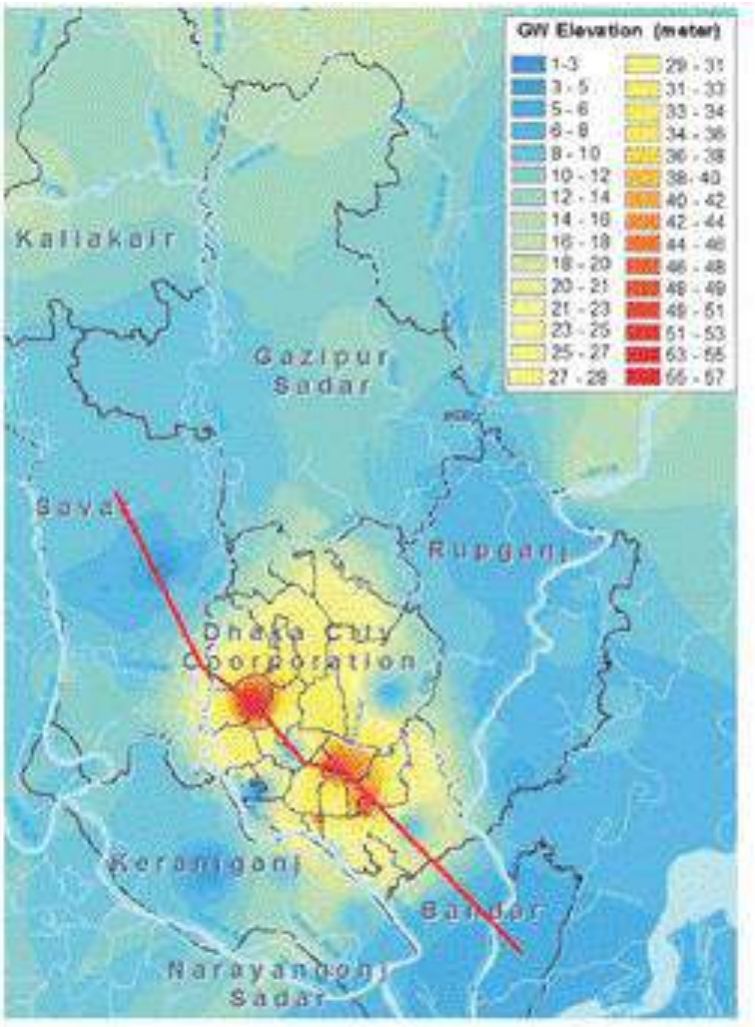


Figure 5.17: Water Table Map

5.7 Biological Environment

The study area and its surroundings comprise different landforms having various vegetation patterns that create different habitats. IUCN, the World Conservation Union, has divided Bangladesh into 25 Bio-ecological Zones (Nishat *et al*, 2002) in the context of physiographic units and biological diversity. Each of the bio-ecological zones represents the overall ecological situation of an area of the country. The study area is under a bio-ecological zone termed as the Brahmaputra–Jamuna floodplain.

5.7.1 The Bio-ecological Zone

The Brahmaputra–Jamuna Floodplain

The Brahmaputra floodplain (situated in greater Mymensingh and Dhaka districts) comprises the active channel of the Brahmaputra River and the adjoining areas of the 'young' floodplain lands formed, since about 1780, when the river shifted to its present course (i.e., the Jamuna river) to the south of Dewanganj in Jamalpur district. It consists of several interconnecting channels, which erode and form new lands on a large scale during each flooding season (Nishat *et al*, 2002).

The Brahmaputra-Jamuna floodplain possesses a unique variety of plants, medicinal herbs, fruit-bearing trees, hundreds of jungle shrubs, creepers and climbers, flowering trees, etc., many of which yield valuable products. Some of the floral species, that are valued as timber producers are The Banyan *(Ficus bengalensis)*, Tamarind *(Tamarindus indica),* Sada koroi *(Albizia procera),*

Simul *(Bombax ceiba)* and Ashwath *(Ficus religiosa).* The prominent fruit-bearing trees of this zone are Mango *(Mangi fera indica),* Jackfruit *(Artocarpus heterophyllus),* and Litchi (Litchi chinensis). Bushes of reeds and canes are also found here. This zone is similarly enriched with orchids. The Rasna *(Vanda roxburghii)* is commonly found in this zone (Khan, 1991).

According to Hunters (1875), leopards are frequently sighted in this zone. A few species of deer, such as the Samber *(Cervus unicolor),* Hog deer (Axis porcinus), Swamp deer *(Cervus duvauceli),* and Barking deer *(Muntiacus muntjak)* were also once found in abundance everywhere in the forests of this zone. Among the bird species, small game birds such as the Common peafowl *(Pavo cristatus),* Red junglefowl *(Gallus gallus),* partridges, and several varieties of pheasants are commonly found. The Bengal florican *(Houbaropsis bengalensis)* and snipes are plentiful in the sandbanks and chars of this zone. On the other hand, the most common poisonous snake is the Banded krait *(Bungarus fasciatus)* in this zone, which could easily be identified by its broad black and yellow bands (Nishat *et al*, 2002).

5.7.2 Ecosystems

The study area occupies both terrestrial as well as aquatic ecosystems. Ecosystems of the area can be divided into three major categories, of these are: i) Terrestrial ecosystem, ii) Urban Ecosystem and iii) Aquatic ecosystem. Each major category is further divided into sub-categories. The ecosystems of the study area are shown in Figure 5.19.

5.7.3 Terrestrial Ecosystems

The major terrestrial ecosystems of the area are: i) Homestead, ii) Crop fields and iii) Roadside vegetation. The system consists of both static (Flora) and dynamic (Fauna) lifelines which are described below:

a. Terrestrial Flora

The terrestrial flora of the area can be categorized as, i) Homestead vegetation, ii) Crop field vegetation, iii) Roadside vegetation. Each category of vegetation has distinct characteristics that separate them from each other.

Homesteads Vegetation

Most of the houses are vegetated by locally cultivated plants and a major portion of the coverage is occupied by wild shrubs and herbs. Commonly planted tree species are Raintree (*Albizia saman*), Mango (*Mangifera indica*), Supari (*Areca catechu*), Coconut (*Cocos nucifera*), Mehogani (*Swietenia mahagoni*), Banana (Musa sp). The homesteads are commonly found near the wetland which favour good growth of wetland trees like Pitali (*Trewia nudiflora*), Baroon (*Crataeva nurvala*), Hizal (*Barringtonia acutangula*) etc. Among the shrubs, Dumur (*Ficus hispida*) is the most common of all species. This type of vegetation has a major contribution to food, fodder, medicine, fuel and other household requirements of the local people.

Crop Field Vegetation

A large portion of crop fields is inundated during the rainy season. The area is mostly used for paddy cultivation. Local inhabitants cultivate *Dhaincha (Sesbania rostrata)* after harvesting the Boro. Details of cultivated crop varieties have been described in the Agricultural section of this report. Among the weeds, *Alternanthera sessilis, Amaranthus spinosus, Cynodon dactylon, Polygonum sp, Oxalis corniculata* etc. are common species.

Roadside vegetation

Roadside vegetation are generally dominated by hard wood tree species (Photo 5.3). These species are Raintree *(Albizia saman)*, Sada Sirish *(Albizia procera)*, Mahogoni *(Swietenia*

mahogany), Akashmoni *(Acacia moniliformis)*, etc. Some plants also grow naturally in-between the planted plants and in the remaining bottom levels on either side of the road which function as barriers of soil weathering. The small-sized herbs are also available and Bhat *(Clerodendron viscossum),* Daton *(Dentella repens), and* Muktajhuri *(Acalypha indica)* are commonly found everywhere in the area.

Figure 5.18: Satellite Image shows different types of ecosystems of the study area

b. Terrestrial Fauna

Terrestrial birds can be divided into two major groups; birds observed in floodplains and wetlands, and birds observed in dryland habitats such as homesteads, open woodland, and scrub grass. The common bird of prey species found in the project area are Brahminy Kite (*Haliastur indus*), Peregrine Falcon, Red-necked Falcon, Black Kite, Black-winged Kite (*Elanus caeruleus*), Crested Serpent Eagle and Common Kestrel. Other common birds found within the study area are Plain Prinia, Zitting Cisticola, House Crow, Black-headed Munia, Red Munia, Scaly-breasted Munia, Indian Silver Bill, Pied Starling, Common Mayna, Black Drongo, Jungle Myna, Cheasnut-tailed Starling, Jungle Crow, Common Tailor Bird, Rock Pigeon, House Sparrow, Spotted Dove, long-tailed Shrike etc. Different types of birds found in the study area are shown in Figure 5.20 to Figure 5.23.

During field visits, it is found that the reptilian population is lower than the amphibians. The turtle and tortoise populations are found extremely lower than others. Their main habitat and habitat niche are being destroyed by the local people because of rapid urbanization and drastic changes in types of land use.

Many lizards and skinks are seen during the field visits and are from four different families. Among the lizards, Brook's House Gecko *(Hemidactylus brookii)*, Common House Gecko *(Hemidactylus frenatus)* and Common Garden Lizard (*Calotes versicolor)* were found most frequently. They prefer places around or within human habitation, homestead forest edges etc. Keeled Grass Skinks are found almost in all the terrestrial habitats within the study area. They are terrestrial and prefer their niche habitat as low-lying vegetation, leaf litter, grassy areas, bushes, riverbanks, under logs, burrows etc. Normally burrow-dweller Bengal Monitor (*Varanus bengalensis)* and Yellow Monitor *(Varanus flavescens)* are found within the study area. These two species are categorized as endangered (EN) in the IUCN Red list category.

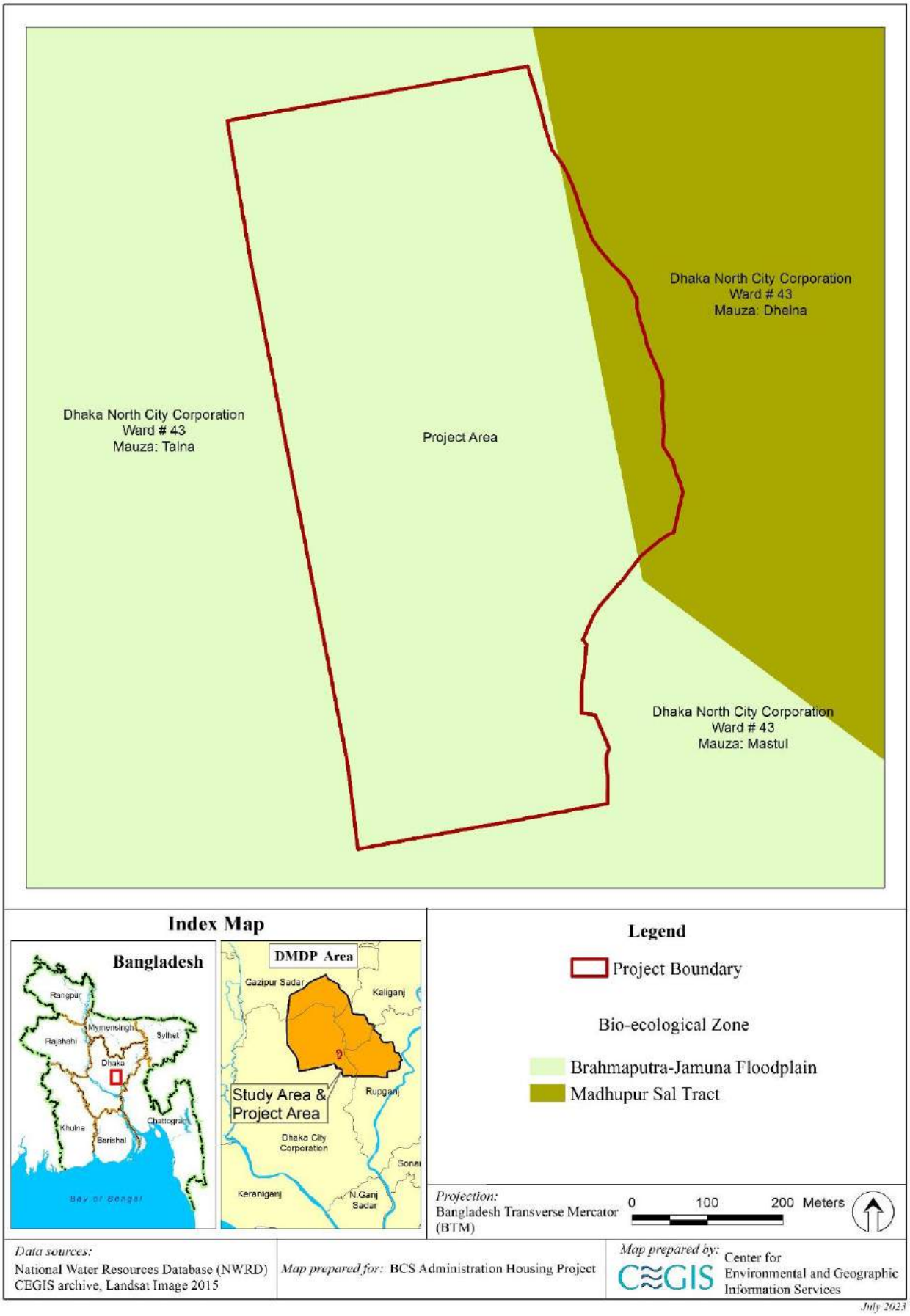


Figure 5.19: Location of housing area in Bangladesh Bioecological Zone

Figure 5.20: Plain Prinia

Figure 5.21:Zitting Cisticola

Figure 5.22:Indian Silver Bill

Figure 5.23:Black Headed Munia

The snake population in the study area is found less in number. Snakes found in the study area are Striped Keelback *(Amphiesma stolatum),* Indian Rat Snake *(Ptyas mucosus)*, and Spectacled Cobra *(Naja naja).*

Significant numbers of two species of cricket frogs are also found there. The niche preferences of these frogs were dump areas such as under refuse, thrash or vegetation, rocks, logs, burrows, leaf litter etc. Common Toad *(Duttaphrynus melanostictus)* is the only toad found within the site. Asian Brown Tree Frog *(Polypedates leucomystax)* is the tree-dwelling frog that belongs to the Rhacophoridae family and is usually found in the homestead forests, roadsides, around human habitation etc.

Common mammals which are found within the area are Mole Rat *(Bandicota bengalensis),* Bandicot Rat *(Bandicota indica),* House Shrew *(Suncus murinus),* Field Mouse (*Mus booduga*), House Mouse (*Mus musculus*), House Rat (*Rattus rattus*), Small Indian Mongoose *(Herpestes autopunctatus),* Golden Jackal *(Canis aureus)* etc. Short-nosed Fruit Bats *(Cynopterus sphinx)* and Asian Indian Pipistrelle (*Pipistrellus coromandra*) are other flying mammals found in this area.

5.7.4 Urban Ecosystem

Urbanization is the key factor for the gradual degradation of the biological or natural environment of any area or place. The existing urban ecosystem covers mainly grasses since no major infrastructures have been developed there.

Urban Flora

The portion of the project area which is already been filled up for development is covered with tall grass such as Chon, Kash and Nol. Some small herbs and shrubs are also found during the field

visits. Other planted trees of urban habitat such as Raintree, Papawa, Narikel etc. are found in the study area. Kanchira (*Commelina benghalensis*), *Bulbostylis barabata*, Chancha (*Cyperus compressus*), Kash (Saccharum *spontanea*), Benna (*Vetiveria zizanioides*), Makra (*Dactyloctenium aegyptium*) are common weed species also found in the study area.

Urban Fauna

The already filled-up area of the project is covered with grassland. Such type of grassland is a very important habitat for grass-dwelling birds. A good number of Plain Prinia, Zitting Cisticola, Black Headed Munia and Indian Silver Bill are found during the field visits. The grass-dwelling birds also make their nest on grassland vegetation. Ground dweller birds like Yellow-legged Buttonquail hide in the grasslands. Other wildlife found within the semi-urban area are grasshoppers, jungle crow, common toads, cricket frogs, small Indian mongoose etc.

5.7.5 Aquatic Ecosystem

The study area and its surroundings support different types of wetlands both perennial and seasonal. The wetlands consist of different aquatic ecosystems. The major ecosystems of the area are:

I. Canals/ Khals ecosystem
II. Beel, Ponds and ditches ecosystem

Aquatic Flora

There is one perennial khal near the project area. The khals are covered with water hyacinths and aquatic plants (Fig 5.25 and 5.25). The diversity and densities of floral species are varied according to wetland types as well as water depths and velocity. Kochuripana *(Eicchornia crassipes)* is the most common free-floating hydrophyte that covers the maximum portion of the ponds and ditches. Topapana *(Pistia strateotes)* is found in most of the ditches as well as the ponds mixed with hyacinth. Shapla *(Nymphaea stellata)* and Chandmala *(Nymphoides sp)* dominate the floodplain vegetation. Sedges are quite common during monsoon in all types of wetlands. Hydrilla, Valesnaria, Helencha *(Enhydra fluctuans), Ludwgjia, Echinocola, Hygrorhyza, Ficus heterophylla* are the main floral composition of aquatic vegetation here.

Aquatic Fauna

The population of aquatic faunal species varies with wetlands characteristics and the surface area of water inside the water bodies. The major portions of the study area are covered with seasonal floodplains. The common and uncommon wetland-dependent bird species found in the study areas are India Pond Heron, Cinnamon Bittern, Little Egret, Great Egret, Pheasant-tailed Jacana, Common Moorhen, Water Cock, Yellow Bittern, Lesser Whistling Duck Cotton Pigmy Goose, Little Cormorant, White-breasted Water Hen and Common Kingfisher, Pied Kingfisher etc.

Among the amphibians, the bull frog, skipper frog, etc. are common all over the year. They are the most successful fauna in adapting to all kinds of wetlands. An abundance of Bullfrogs (*Hoplobactruchus tigerinus*) is generally observed in the rainy season at paddy fields, ditches and other marshy places. Common aquatic snakes including the checkered Keel Back *(Xenocrophis piscator)* and Smooth Water Snake (*Enhydris enhydris*) are also observed in the area. The common turtle species found within the study area are the Indian Roofed Turtle (*Pangshura tectum*) and the Median Roofed Turtle (*Pangshura tentoria*).

Figure 5.24: Khal, Densely covered by water hyacinth

Figure 5.25 Free-floating and marginal vegetation of Khal

5.7.6 Ecosystem Services

The shallow part of the wetlands is used for Dhancha cultivation, and the deeper parts of the wetland play the role of fish habitat, aquatic vegetation, and water birds. The wetland ecosystems are a convenient habitat for water birds and aquatic vegetation. The people living inside and in surrounding areas of the project area catch fish throughout the year and use some wild herbs as vegetables. The existing filled-up area is covered with tall grass (as discussed before) which is supportive for roosting, nesting, and feeding habitat for grass-dwelling birds, small mammals, reptiles, and other insects.

5.7.7 Present Threats on ecosystems

The landfilling process gradually reduces the wetland and creates threats to its ecosystems and relevant aquatic vegetation and wildlife. The aquatic communities losing their habitat and dependent on other species are facing the crisis of food, shelter and living habitat. Land development activities also deteriorate ecosystems' health due to habitat conversion.

5.8 Environmental Quality

5.8.1 Air Quality

The air quality parameters in the study were collected from secondary sources in two locations near the vicinity of the project area. From the measurement results, it is observed that all the measurement values are within the standard which is mainly due to the wet season. The measurement results are presented in Table 5.6.

Table 5.6: Air Quality Status of the Study Area

Location	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	PM_1 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	CO ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	CO_2
Kuril Fly over	22.57	25.05	17.61	18.78	48.29	0.509	20.74	987.71
Talna Central Mosque	28.37	31.94	21.24	9.04	41.7	0.184	19.32	982.28
Bangladesh Standard	**65 (24hr)**	**150 (24hr)**	**200 (8hr)**	**365 (24hr)**	**100 (Annual)**	**10000 (8hr)**	**157**	**-**

Location	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	PM_1 (µg/m³)	SO_2 (µg/m³)	NO_X (µg/m³)	CO (µg/m³)	O_3 (µg/m³)	CO_2
IFC/WB Standard	**75 (24hr)**	**150 (24hr)**	**NF**	**125 (24hr)**	**220(1hr)**	**NF**	**160**	**-**

Source: Field Survey

Note: *This monitoring report was usually accomplished by-Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550)*

$PM_{2.5}$=Fine Particulate Matter, PM_{10}=Respirable Dust Content, SPM=Suspended Particulate Matter, NO_X =Oxides of Nitrogen, SO_2 =Sulphur Di-Oxide, CO =Carbone Mono-Oxide, O_3 =Ozone, NF= Not found.

Weather Condition: The weather was cloudy when the measurements were recorded. Sometimes, it was raining, and the wind direction was from the South-East to the North-West corner.

5.8.2 Water Quality

Water sample results were collected from the study area. The selected parameters are indicative of the quality of the study area as well as pollutants of concern from the project-related activities during the construction and operation phases. The selected parameters for water quality testing include temperature, pH, EC, TDS, DO, and salinity. From the data, it is observed that most of the parameters are within the acceptable limit except the DO of 2 samples. The underlying factor of such a result is that the samples are collected and tested during monsoon when impurities are already diluted by shower.

The local people opined that during the dry season, the surface water quality of the rivers and canals especially Balu River water becomes seriously polluted. At that time the water turned dark and smelt very bad. The values of different water quality parameters are presented in Table 5.7.

Table 5.7: The Water Quality Status of the Study Area

Serial	Latitude	Longitude	Time	Weather	TEMP (°C)	pH	EC (µS/cm)	TDS (mg/l)	DO (mg/l)	SALINITY (ppt)
Gw-01	23°50'14"	90°28'17"	12:00 PM	sunny	27.7	6.86	420	210	2.9	0.1
Gw-02	23°51'03"	90°28'23"	2:00 PM	sunny	33.1	8.06	300	150	5.2	0.1
SW-01	23°50'20"	90°28'23"	12:30 PM	sunny	34.2	7.7	500	250	6.2	0.2
SW-02	23°50'42"	90°28'18"	1:00 PM	sunny	31.9	7.27	240	120	2.5	0
SW-03	23°50'57"	90°28'12"	1:40 PM	sunny	35	7.68	420	210	7.7	0.1
Standard of Water quality for recreation purpose					-	6.5-8.5	-	1000	>=5	-
Standard of Water quality for irrigation purpose					-	6.5-8.5	2250	1000	-	-

Source: Field Survey, 2023

5.8.3 Noise Quality

Noise levels were collected from secondary sources within the study area. All the measurements are taken during day time. Measurement results are given in Table 5.8 which reveals that all the measured levels are above the standard defined by the Noise Pollution (Control) Act (Bangladesh Gazette, 2006). The highest noise is recorded at Kuril flyover point which can be regarded as a commercial area where the standard noise level is 70dBA. Other noise measurement results also show that noise levels inside the study area are also higher than the standard value.

Table 5.8: Noise Level of the Study Area

Sl No	Location	GPS Reading	Measuring Time	Noise Level (dBA)	Sources of Noise	The standard defined by the Noise Pollution (Control) Act (Bangladesh Gazette, 2006)
1	Purbachal Balu Bridge	N23050'12.96" E 90028'38.8"	10:45 am	76.30	Water Vessel, car, micro bus	60 dBA (For mixed areas during day time)
2	In front of Pink City	N23049'59.74" E 90027'37.35"	12:15 am	77.10	Car, microbus, activities related to road carpeting	50 dBA (For mixed zone during day time)
3	Kuril flyover	N23049'39.38" E 90026'2.39"		104.0	Bus, car, microbus, minibus, different types of roadside activity	70 dB (for commercial areas at day time)

Source: Field Survey, 2023

5.9 Socio-economic Environment

5.9.1 Overview

The current section delineates the baseline condition of social and economic resources of the study area. Several socio-economic indicators are analyzed based on the available data regarding the study area. The study area boundary is demarcated based on the extent of the impact of the project and demonstrated through the geographical locations in the Government's administrative units (namely District, City Corporation, Upazila/Thana and Ward/Union).

In doing so, the required data were collected from both primary and secondary sources. The Primary data were gathered by using a variety of data collection techniques, such as Rapid Rural Appraisal (RRA), Key Informant Interview (KII), informal discussions and observations. Moreover, secondary information is supplemented from the community series of the Population and Housing Census 2011, published by the Bangladesh Bureau of Statistics (BBS) in 2012.

5.9.2 Administrative Boundary

The project area regarded as the Direct Impacted Area (DIA) is covered by three mouzas of ward 43 of Dhaka North City Corporation and Khilkhet thana of Dhaka District. I addition the study area covers 30 unions/wards of 7 thanas of Dhaka, Gazipur and Narayanganj Districts and Dhaka North City Corporation, Gazipur City Corporation and Kaliganj Pourasabha of Gazipur, Kanchan and Taraba Pourasabha Narayanganj district. The contributing thanas with their area percentage is presented in Table 5.9.

Table 5.9: Consedered study area of the BCS (admin) Housing Society residential area project

District	City Corporation	Thana	%
Dhaka	Dhaka North City Corporation	Khilkhet	2
		Bhatara	2
		Bimanbandar	22
		Dakkhinkhan	100
		Khilkhet	77
		Uttara Purba	57
		Uttarkhan	100
Gazipur	Kaliganj Pourasabha	Kaliganj	7
	Gazipur City Corporation	Pubail	31
		Tongi Purba	55
Narayanganj	Kanchan Pourasabha, Taraba Pourasabha	Rupganj	13

Source: GIS Analysis, CEGIS'

5.9.3 Demographic Profile

a. Population and household

The demographic profile of the Study area was captured from the Population and Housing Census, 2011, and primary data. According to the Population and Housing Census, 2011 the whole Study area is comprised of 5,17,120 households and the estimated population up to 2022 is 21,71,903 of which 11,99,926 (55.25%) are male and 9,71,976 (44.75%) are female. However, there is no settlement within the project boundary. The following Table 5.10 shows that the average household size for the study area is lower than the national average of 4.50 [BBS, 2012]. The Population distribution for the study area is presented in Table 5.10.

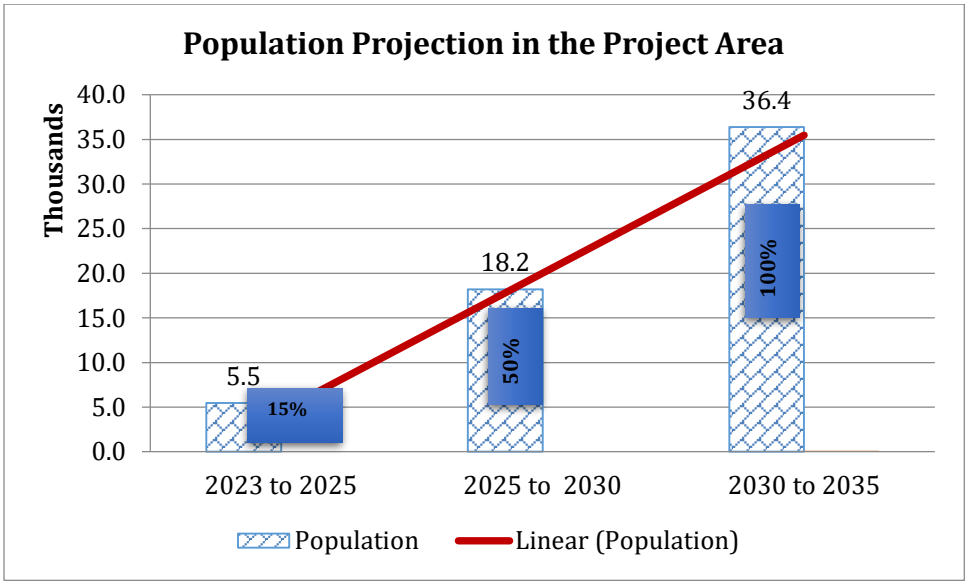
Table 5.10: Distribution of households and population in the study area

Location	Hhs No.	Population			Sex Ratio	Hh Size
		Total	Male	Female		
Study area	517120	2171903	1199926	971976	123	4.2

Source: Population Census, BBS, 2011

b. Projected Population in the Project Area

The proposed project will lead to an increase in population in-migration in the study area through the settlement's establishment, social services/facilities creation, and alternative income generation. Population projection in the project area has been developed considering the probable project-starting year (2023) and completion year (2035).



CEGIS estimation, 2023

Figure 5.26: Projected Population in the Project Area

As per "Private Residential Land Development Policy, 2004" [1], the standard density of population per acre is 350 persons[2]. Therefore, the approximate total population will be 36,400 persons after the completion of the project. The total population is distributed over three 5-year spans considering the advancement of the project. In the first span, plot distribution will begin, and the plot owners will start to construct households therefore, the rate of population increase will be comparatively lower in this span and this rate will be increased in the next two spans. Thus, it is estimated that about 5,460 populations (15%) will be settled in the first span, about 18,200 populations (50%) in the second span and 36,400 populations (100%) in the last span (**Figure 5.26**).

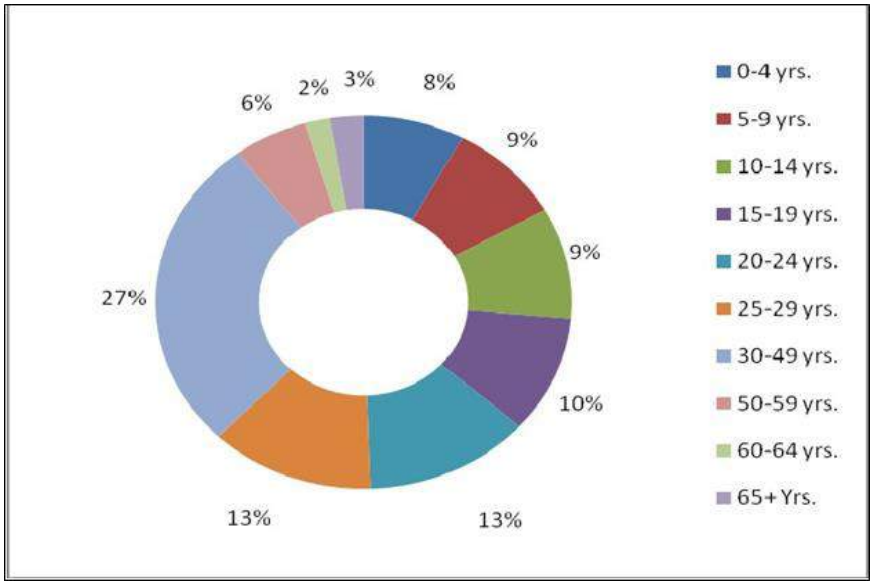
c. Age Composition and dependency ratio

According to BBS 2012, among the total population, the highest number of the population (around 27%) of the study area belongs to the 30 to 49 years age group. Whereas the lowest population is only around 2% in the 60 to 64 years age group (BBS, 2012). Moreover, according to the ILO reference for opting out of potential labour force and dependent population, the analysis of age structure shows that about 31% of the total population of the study area are dependent population. On the other hand, around 69% of the total population (age ranges from 15 to 59 years) of the study area belongs to the active working group (BBS, 2012). Therefore, the

[1] Policy is published as Bangladesh Gadget in March 1, 2004 by the Ministry of Housing and Public Works, Government of Bangladesh.

[2] This standard is described in article 8.2 of Chapter-2

dependency ratio of the study area is 69:31. Age composition of people in the study area is presented in Figure 5.27.



Source: Population Census, BBS, 2011

Figure 5.27: Population percentage by age group in study area

5.9.4 Economy and Employment

a. Occupation and Livelihood

In the study area, a major portion of the people are economically employed. According to BBS, 2011 data, it is found that 55% of the total population is employed, 27% are engaged in household work (mostly women) and about 18% are not engaged in any type of work (it includes children and physically challenged population). Out of the employed population about 65% people engaged in service, the second highest engagement in industrial work (25%) and about 10% are engaged in agricultural activities (BBS, 2012).

Besides, the project area is close to the Balu River and there are khals and perennial beel. During field visits, it is found that several people are involved in fishing activities, especially aquaculture. During the monsoon, the project area becomes inundated, and few people practice aqua culture for business and sell fish in the market. Moreover, few people capture fish from the Balu River and adjacent canals only for family consumption. But, at present the land category of the project area is mainly fallow land. Moreover, now most of the land close to the project areas is taken by different housing development companies. Service and industrial activity covers most of the field of activity due to the developing nature of the study area.

However, the BBS data shows that service is the main occupation in the study area but the source of income of the study area people shows a different picture. According to the field findings, it is observed that house rent (30%) and business (25%) are the prominent income sources in the study area due to the proximity of Dhaka City. Table 5.11 shows the percentage of households with their sources of income.

Table 5.11: Percentage of HHs by income sources in the study area

Sources Of Income	Percentage Of Hhs by Income Sources
Service	15
Land selling	10
House rent	30
Foreign currency	3
Agriculture	4
Business	25
Day Labor	10
Fishing	1
Land broker	2

Source: FGDs. CEGIS, August, 2023.

5.9.5 Education

In the study area, the status of education is satisfactory. Almost 70% of females are literate whereas 77% of males are literate as well as overall literacy rate is 74% (BBS, 2012). The literacy rate is higher compared to the national level (52%). The school attendance rate at the primary and secondary school levels in the study area is satisfactory and consequently, the literacy rate is increasing day by day in the study area. According to the BBS 2012, the boys' and the girls' school attendance rate at primary school is 85% and 83% respectively. Moreover, as the area is developing tremendously, several private schools, colleges and universities are established in the study area which will enhance the educational quality of the study area.

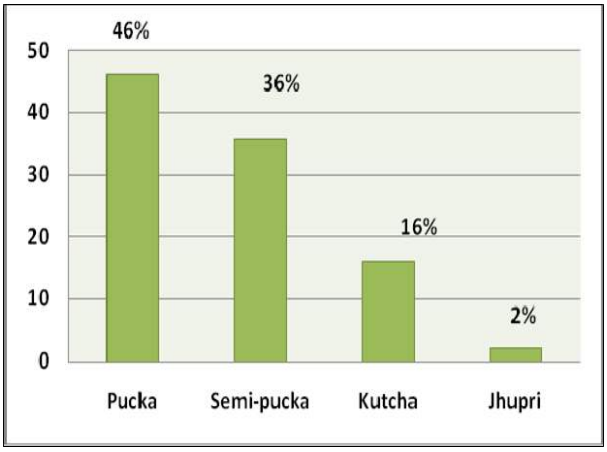
5.9.6 Land Ownership and Price

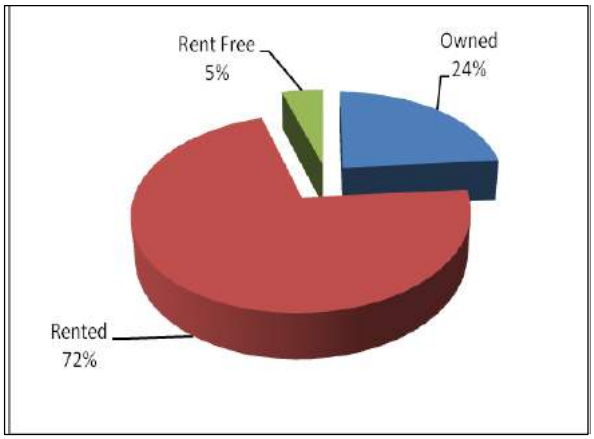
During the field visit, it was found that most of the land within the project area is owned by local people. Local people reported that proximity to the road and variation of the area are the main determinants of land price. Since the project area is very close to Purbachol Housing and the communication system is also very developed, land price in the peripheral area has increased rapidly. In the project area, there is no homestead land, where agricultural lands are dominant with few Perennial Beels. The price of homestead land is comparatively higher than agriculture land.

5.9.7 Quality of Life Indicators

a. Settlement and Housing Conditions

During the field visit, it was observed that there was no settlement in the project area. On the other hand, BBS classified all four types of housing structures i.e., pucca, semi-pucca, kutcha and Jhupri are observed in the study area. It is reported that 46% of HHs are pucca, 36 % of HHs are semi-pucca, and 16% of HHs are kutcha (Figure 5.27). On the other hand, in the study area, it is found that 24% of households live in their own house 72% in rented houses and only 5% live as rent free (Figure 5.28). The people who live in rented houses come from different places in the country for better work opportunities. Overall, the housing condition is satisfactory in the study area.





Source: Population Census, BBS, 2011

Figure 5.28 : Percentages of Households by structures in Study Area

Figure 5.29: Percentage of HHs by housing tenancies

b. Health Services Facilities

As the project area is situated within the Dhaka North City Corporation and most of the study area are also within the city corporation area people get better health services than other part of the country. Dwellers of the study area reported that normally they get available health services facilities in their area and most of them are private clinics which is very costly. Overall health condition of the study area is better.

c. Water Supply and Sanitation

Supply water (Tap water) by DWASA is the main source of drinking water in the study area. Almost 73% of people use supply water for drinking purposes while 25% use Hand Tube-wells (HTWs) as their drinking water source.

On the other hand, in the study area, about 90% of households reported that they have sanitary toilet facilities of which 51% are water-sealed and another 39% with non-water-sealed sanitary facilities. Only 9% of the people have non-sanitary latrines. In the slum area, there are some non-water sealed toilettes.

d. Electricity

According to BBS 2011, in the study area, 97% of households has access to electricity but during the field visit it is found that at present 100% of the households have electricity connection in their homestead.

e. Income and Poverty

Poverty has been measured through a self-assessment process in the study area. This measurement was mainly based on income and food security for the whole year. In this process, the respondents were asked to assess themselves on the overall condition of people living in the project area. Their responses were assembled into three categories such as deficit, balance/breakeven and surplus.

According to the FGDs, local people assessed that on average about 50% of the total population living in the balanced or breakeven category, i.e., their economic activities are subsistence-oriented. They also reported that 41% of people belong to the surplus category. People belonging to the deficit category are 9% only.

5.9.8 Conflict of interest and Law and Order Situation

There is no remarkable social conflict observed between the people in the project area. Overall, the social condition of this area is better. But the due to urbanization and increasing demand for land there have been some land-oriented complexities observed within the study area. However, the overall Law and order situation along with the social security condition of the project area along with the study area is found satisfactory (RRA, 2023).

5.9.9 Gender Concerns

Since the studied area is urbanized in nature, women are enjoying more freedom than in rural areas of Bangladesh. They are enjoying more gender-specific health services and facilities, higher enrolment in educational institutions, and higher engagement in direct income-generating activities than rural areas. Simply, there is no restriction in education, employment, services, and facilities. It was found that women have significant contributions to the income-generating activities for their households.

5.9.10 Common Property Resources

As there is no settlement in the project area, no common resource property is found within the project area. However, the common property resource of the study area comprises different social amenities e.g., mosques, graveyards, temples, cremation grounds, playgrounds and Eidgah etc. These are used frequently by the local people for performing religious, social and cultural rites.

5.10 Agriculture Resources

As previously noted, before the end of 2016, Boro was cultivated in the project area. The farmers had grown local varieties (Amboro, Jagliboro, Lathiail, Pizum) in the majority of the project area (almost 80% of NCA) with some winter vegetables (brinjal, okra, tomato, gourds etc.). But currently, no agricultural activities are prevailed in the project area (Figure 5.29).

Figure 5.30: Existing situation of the project area

However, there are still some agricultural practices present in the study area. Since the area is submerged for more than six months in monsoon, agricultural activity is restricted to the Rabi season. In that area, vegetables were primarily grown (Figure 5.31). Adjacent Tongi Khal and Turag rivers are used for irrigation. In the study area, the major cropping pattern is Fallow-Fallow-Boro followed by Fallow-Fallow-Vegetables. The cropping intensity of the study area is 113%.

Figure 5.31 : Vegetables Gardens in the Study area

Table 5.12: Cropping pattern and intensity of both project and study area

Kharif-I	Kharif-II	Rabi	Project Area		Study Area	
(March-June)	(July-October)	(Nov-February)	Area (ha)	% of NCA	Area (ha)	% of NCA
Vegetables	Fallow	Vegetables	-	-	351	13
Fallow	Fallow	Vegetables	-	-	865	32
Fallow	Fallow	HYV Boro	-	-	1,486	55
Total			-	-	2702	100
Cropping Intensity (%)			**-**		**113**	

Source: CEGIS field observation, 2023.

In the study area, the total cropped area is 3,053 ha of which 1,486 ha (49%) is under rice crops and the rest 1,567 ha (51%) is under non-rice crops. On the other hand, total crop production is 22,967 metric tons of which rice is 4,161 metric tons and non-rice is 18,806 metric tons.

5.11 Fisheries Resources

5.11.1 Habitat Description, Assessment and Fish Production

The study area comprises different types of fish habitats, such as rivers and Khal, Beel, floodplain, aquaculture ponds, seasonal cultured water bodies and lakes. In the study area, there is just one river (Balu River) and one khal (Delna-Tolna Khal). According to the statement of local people, in the dry season, the river can retain 7-8 feet of water, while in the rainy season, 15-20 feet. The

Shitalakshya River is joined by the Delna-Tolna Khal. Shitalakshya River pollution is contaminating the nearby waterbodies in this khal.

Figure 5.32: Fish habitat area near the project site

The estimated total fish habitat is about 3,057 acres with a share of 2,619 acres of capture fish habitat and 437 acres of culture fish habitat in the study area. Here, the aquaculture area is very minimal. A description of the total habitats of the study area is given in the following Table 5.13.

Overall, the estimated total fish production for the study area is 195 MT. Annual fish production of capture fisheries is estimated at 122 MT, and culture fisheries are estimated at 73 MT. The estimated production of the study area is given in the following Table 5.13.

Table 5.13: Fish habitat and production of the study area

Sl. No.	Fishery Category	Habitat Type	Habitat Area (Acres)	Production (Mt)
1	Capture Fishery	Rivers and Khals	675	25
3		Floodplain	1735	42
4		Perennial Beels	210	55
		Capture Total=	**1,060**	**122**
4	Culture Fishery	Aquaculture	89	56
5		Lake	348	17
		Culture Total=	**177**	**73**
		Habitat Total=	**1,237**	**195**

Source: Land use data and Image analysis, CEGIS, 2019

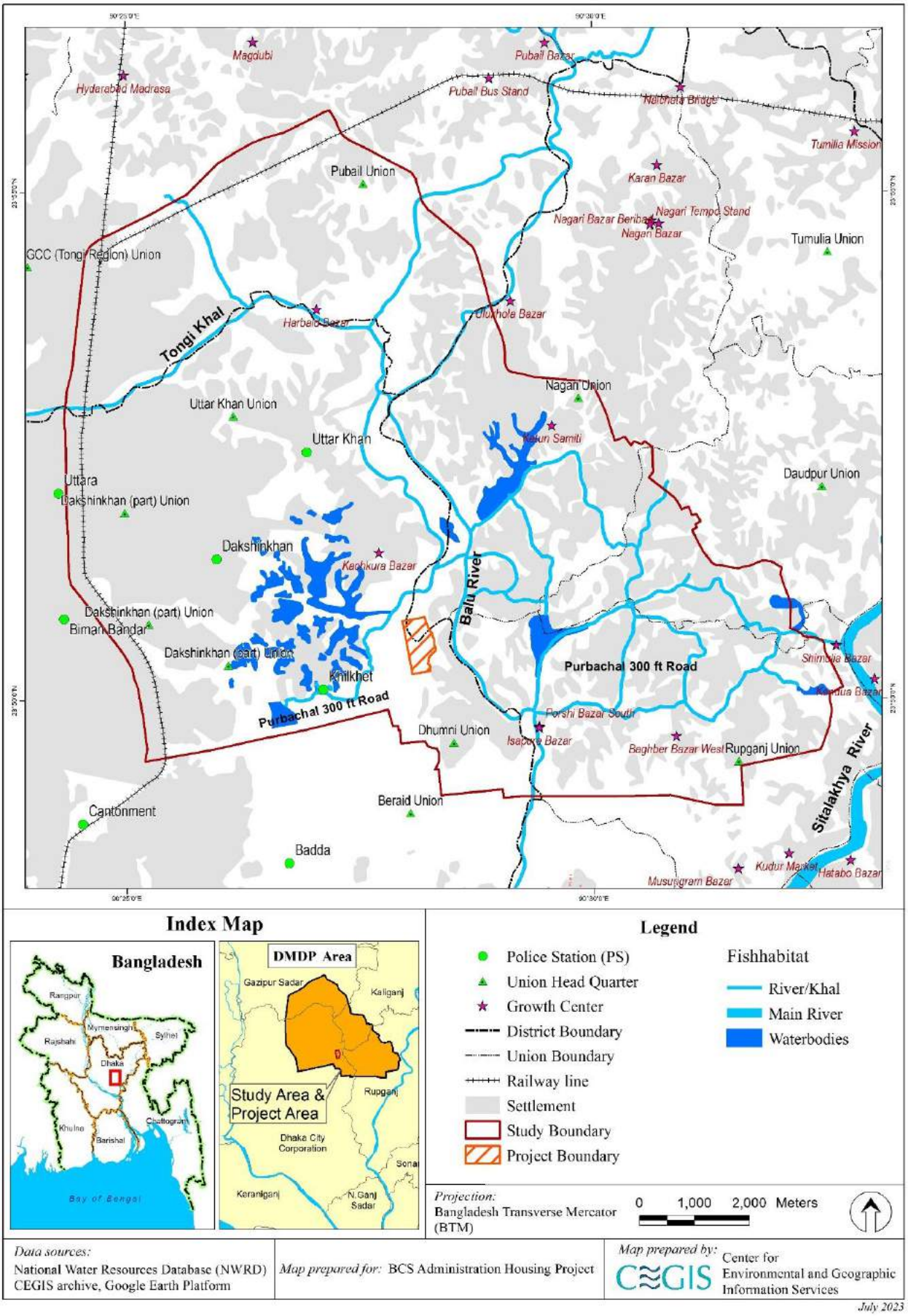


Figure 5.33: Fish habitat in the Study area

5.11.2 Fish Biodiversity and Composition

Fish biodiversity of the study area consists of Guchi (*Striped Spiny Eel*), Bele (*Glossogobius giuris*) Chanda (*Indian glassy fish*), Khalisha (*Stripled Gourami*), Gura Chingri (*Prawn*), Puti (*Spot fin Swamp Barb*), Taki (*Spotted Snakehead*), Shol (*Snakehead Murrel*), Gazar (*bullseye snakehead*) Koi (*Climbing Perch*), Boal (*Fresh Water Shark*), Ayre (*Long whiskered catfish*), Magur (*Walking Catfish*), Shingi (*Stinging Catfish*), Gutum (*Guntea loach*), Baim (*Zig-zag eel*) Bata (*Reba Carp*), Rui (*Rohu*), Catla (*Catla*), Mrigel (*Mrigel*), Carpio (*Common carp*), Silver carp (*Silver carp*), Thai sarputi (*Java Barb*), Grass carp (*Grass carp*) and Nilotica (*Nile Tilapia*), Chapila (*Indian river shad*).

5.11.3 Fish Migration

The Balu River is connected with floodplains, beels and khals in the project area. Whitefish migrate upstream and laterally to the inundated floodplains adjacent to the river channel in the early rainy season to spawn in the nutrient-rich waters. The eggs and larvae of these species are drifting downstream and entering the floodplain with the floodwater. At the end of the rainy season, the adults and young fish migrate to the main river channel to avoid the harsh conditions of the floodplain during the dry season. The movement and migration patterns of the small fish species appear to be more complex. Many small species are known to spawn several times during the monsoon, thus some schooling movements during the mid and even late monsoon could be due to spawning migrations rather than feeding or refuge migration. A list of migratory species, migration period and cause of migration is given in **Table 5.14.**

Table 5.14: Migratory fish species and their migration pattern

Species	Beel to River Migration		River to Beel Migration	
	Period	Migration Pattern	Period	Migration Pattern
Rui, Labeo rohita	Jul - Oct	Foraging	July to Aug	Breeding foraging
Mrigal, Cirrhinus mrigala	Sep to Nov	Refuge/ Foraging	June to Sep.	Breeding/ Feeding
Catla, Catla catla	Sep. to Dec.	Refuge	June to Sep.	Breeding
Common Carp, Cyprinus carpio	July to Nov.	Refuge Foraging	June to sep.	Breeding/ feeding/Nursing/
Boal, Wallgo attu	Aug. to Dec.	Refuge Foraging	June to Aug.	Breeding
Ayre Sperta aor	Aug-Nov	Refuge/ Foraging	Jun. to Jul.	Nursing/Feeding
Tengra, Mystus tengara	Jul. - Sep.	Refuge/ Foraging	Jun to Oct.	Feeding/Breeding

Species	Beel to River Migration		River to Beel Migration	
	Period	**Migration Pattern**	**Period**	**Migration Pattern**
Gulsa tengra, Mystus cavasius	Sep.- Nov	Refuge/ Foraging	May to Jul.	Breeding/Nursing/Feeding
Chanda, Chanda sp.	Jun. - Oct.	Foraging	Jun. – Oct.	Feeding/Foraging
Puti, Puntius sp.	Jun.- Nov	Foraging	Jun. – Oct.	Feeding/Breeding/Foraging
Magur, Clarias batrachus	May - Jul	Breeding/ Nursing	Aug– Nov	Refuge/ Foraging/Feeding
Shing, Heteropneustes fossilis	May - Jul.	Breeding/Nursing	Aug– Nov	Refuge/ Foraging/Feeding
Koi, Anabas testudineus	May - Jul	Breeding/ Nursing	Aug– Nov	Refuge/ Foraging/ Feeding
Kholisa, Colisa fasciatus	Jun. – Oct.	Breeding/ Nursing	Jul. – Oct.	Refuge/ Foraging/ Feeding

Source: CEGIS field visit, 2023 and Sultan et., al, 2020

6. Public Consultation

6.1 Introduction

Public consultation is a mandatory part of the Environmental Impact Assessment (EIA) study for any development project according to the EIA Guidelines of the DoE. It is a part of the EIA process aimed at involving the stakeholders in the project development and implementation process. A formal meeting comprising of local people who are likely to be impacted is conducted in the close vicinity of the project location. During the consultation meeting, the proposed project infrastructures and their associated impacts are discussed following a comprehensive checklist. Therefore, the participants disclosed their opinions spontaneously and considered this attempt as a neutral platform to share their experiences to ensure the proposed housing project is socially acceptable and environment-friendly.

6.2 Approach and Methodology

6.2.1 Approach

The participatory approach is followed for identifying the participants as well as conducting public consultation meetings. Initially, the study team consulted with the project proponent to understand the project situation and the potential stakeholders. Therefore, the key stakeholders including occupational groups were identified through consultation with local people and representatives of the local government institute (LGI). However, the meeting ensured a common and equal platform for the participants so that they could express their opinions in an enabling environment. The consultants unfold the issues and in turn, the participants gave feedback to the given issues and in some cases, two-way discussions were held in the meeting. The overall consultation process is shown in Figure 6.1.

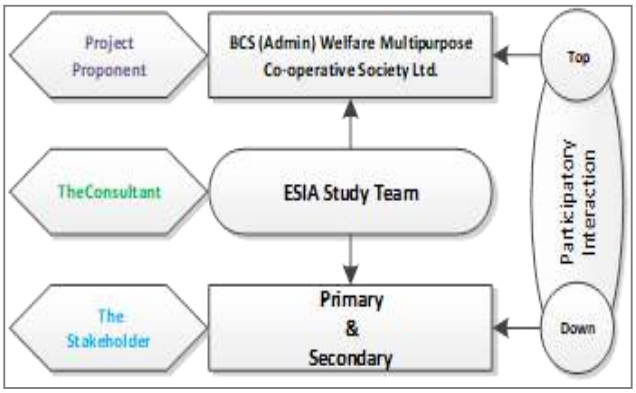


Figure 6.1: Public Consultation Approach

6.2.2 Methodology

c. Identification of Stakeholders

Stakeholders include those who affect or are being affected by policies, decisions, or actions within a particular system. Stakeholders can be groups of people, organizations, institutions, and sometimes-even individuals. Stakeholders can be divided into primary and secondary stakeholder categories.

Primary Stakeholders: Primary stakeholders are people who would be directly benefited or impacted by the proposed housing project. In this context, the people who have/had land within the project boundary are considered the primary stakeholders.

Secondary Stakeholders: This category of stakeholders pertains to those who may not be directly affected or benefitted but have interests that could contribute to the study, play a role in implementation at some stage, or affect decision-making on project aspects.

The local elites, representatives of Local Government Institutions (LGIs), people who are living in close vicinity, occupational groups, government departments and line agencies of this project are under this category.

Time, Date and Venue Selection

Venue, date and time of meetings are selected through consultation with the local people and, the project proponent. A venue has been selected considering the closeness to the proposed project; and easy accessibility to the venue; The Date and time were also finalized considering the availability of the participants to ensure maximum participation.

d. Enlisting and Invitation

A comprehensive list of potential stakeholders was prepared through consultation. This list was intended to cover all the interest groups, representatives of LGI, occupational groups and socially acceptable and knowledgeable people. A formal invitation was sent to them and also communicated over the telephone to ensure their participation in the meeting for the public interest.

e. Tools and Techniques

Checklist: A comprehensive checklist covering all possible issues to be addressed was prepared through consultation among the multidisciplinary study team. This checklist was used in the meeting to unveil peoples' perceptions and opinions along with suggestions.

Attendance list: An inventory of the participants was maintained in an attendance sheet containing name, age, occupation, address and contact cell phone number. In addition, photos were taken for this consultation.

f. Consultation Process

A four members study team conducted the consultation meeting. During the consultation session, the following process was followed with sequences (figure 6.2).

Greetings: At the outset, the team spelt greetings to all participants. The team further welcomed the participants for attending and stated the entire design of the meeting.

Chairperson fixation: For conducting an effective and fruitful meeting, the head of the LGIs was selected as chairperson of the consultation meeting.

Introduction: The team members introduced themselves to the participants and gave detail description of the CEGIS as well as of the proposed project, spelled out the objectives and anticipated outcome of the meeting.

Respect to the participants: The study team showed respect to all participants carefully. They respected not only the individuals but also their values, cultural practices, and social structures.

Power Point Presentation: A power point presentation was prepared based on the project background, objective and project activities that will be performed by the project proponent. The future plan of the project also shared with the stakeholders so that they can know about the project and share their opinion in this regard.

Encouragement for participation: Generally, all participants cannot participate equally. In fact, a substantial number of participants tended to remain silent in any meeting. However, the study team encouraged all to participate willingly through explaining the ethics of the study.

Note taking: Discussed issues and opinions were written in notebook continuously and carefully. All issues were given equal importance.

Recapitulation and closing the session: At the end, the study team recapitulated the session and responded to all the quarries raised. Finally, the facilitator closed the session thanking the participants.

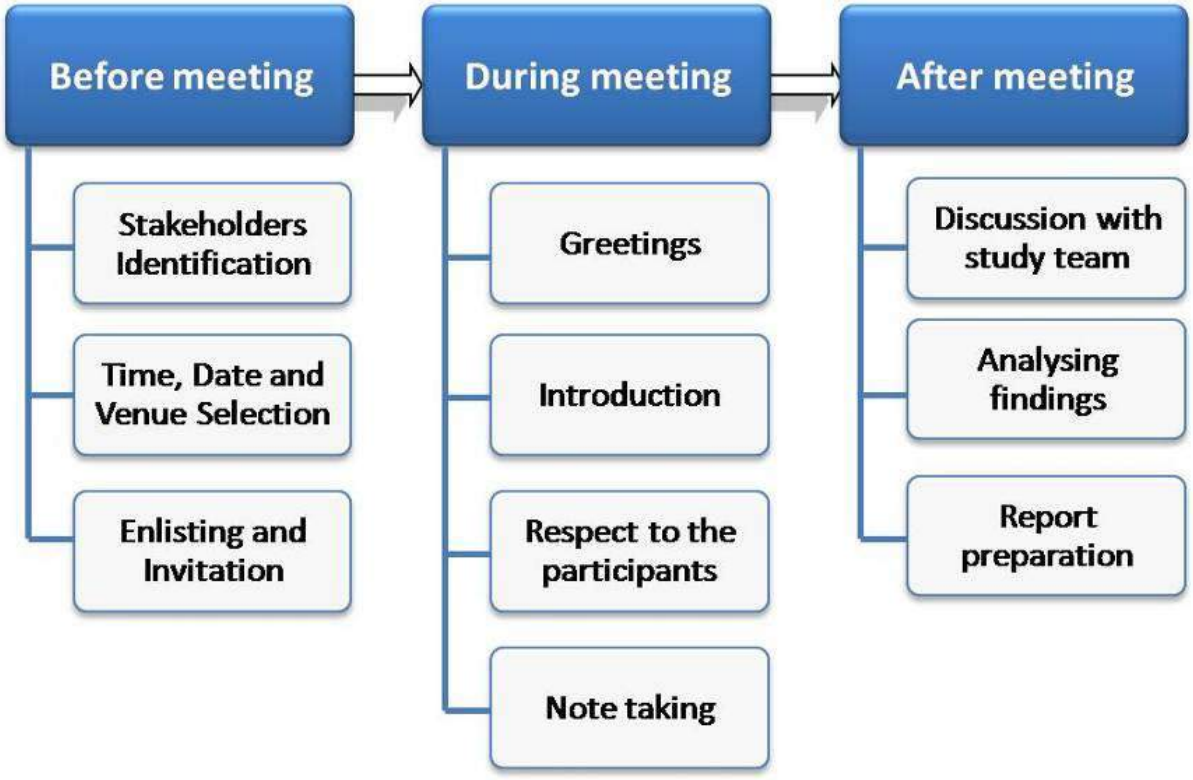


Figure 6.2: Public Consultation Process

6.3 Consultation Meeting

6.3.1 Venue, Date and Time of Consultation Meeting

The consultation meeting was arranged in the Project Site from 10:30 a.m. to 12:30 p.m. on 29 July 2023.

6.3.2 Participants

A total 53 numbers of participants comprising land owners, several occupational groups, representatives of local government, and local elite persons were present in the meeting. The detail Participant list is attached in Appendix 1. However, the type of stakeholders and their number are presented in the following table in Table 6.1.

Table 6.1: Participants Details of the Consultation Meetings

Type of Stakeholder		No. of Participants
Primary Stakeholder	Land Owner	21
	Occupational groups	12
Secondary Stakeholder	Local government institute	2
	Service Holder	3
	Businessman	7
	Local Elite	3
	Khilkhet Abason Prokolpo Authority	5

Source: PCM, Ward 43, Dhaka North City Corporation

6.4 Feedback from the Stakeholders

6.4.1 Knowledge about the Project

Participants informed that they were well acquainted with the *Khilkhet Abashon Prokolpo* from the beginning. The project proponent frequently consulted with them and informed them about the project and the process as to how it would be implemented.

6.4.2 Attitude towards the Project

The participants showed a very positive attitude towards the "*Khilkhet Abason Prokolpo*" project. They expressed that this project has benefited them. If it is implemented properly the benefits will certainly be enhanced. The participants were also informed that the project authority committed to establishing new social facilities like schools, colleges, mosques, playgrounds, and better services i.e., health care facilities, road network, post office, police station etc. and as such they opined that, the commitment should be carried out by the project authority and community people get chance to use the facilities.

6.4.3 Potential Positive Impacts and Enhancement Measures

The participants unveiled several benefits that are likely to precede for implementation of the proposed project. A few of them discussed in the meeting are presented below.

6.4.4 Communication Network

Positive Impact: As per the project plan, the project will necessarily create new road networks for the residents of the project area. This road will connect the adjacent area especially the northeastern part of the project area which has no road connectivity at present. All inhabitants of the area can communicate through this approach road. Therefore, people will be facilitated by a new, developed and widened road in place of a narrow, muddy, and fragile one.

Enhancement Measure: The participants opined that accessibility of the people beyond the project area to these road networks is to be ensured by the project authority. Nevertheless, since this project area will be demarcated and bounded by concrete walls, it will appear as a barricade to the local people. It is suggested that both sides of the roads should be covered with tree plantation.

6.4.5 Land Utilization

Positive Impact: The lands, prior to this project remained fallow since it was a very low-lying area. Only Boro (HYV) paddy was cultivated for short periods. The project will necessarily develop lands and prepare for housing/residential areas. Moreover, other govt. and non-govt. agencies will be interested in developing a planned housing project after the implementation of the project. This will increase the demand for land in the project area which will fasten the development of the area. Therefore, the demand for land will be highly increased and extensively utilized and provide more cash to the owners.

Enhancement Measure: The project proponent should give support to the local landowners for developing their lands.

6.4.6 Land Price

Positive Impact: The project proponent purchased the land at a price that is nearly double that of the market price. However, currently, the land price has been hiked to more than 120 times

higher. This increased price eventually brings tax for the government as well as cash for the land owners.

Enhancement Measure: If the adjacent area is to be connected with the road networks of the project, the land price will further increase and will be more than the current market price.

6.4.7 Services and Facilities

Positive Impact: People stated that although the area is within Dhaka City, there is still a substantial scarcity of health and education service providers in this area. For this reason, people cannot avail of health services and facilities properly. However, the project proponent will establish standardized hospitals and educational institutions which will have a positive impact on the local people in future.

Enhancement Measure: People urged that service providers should serve at a cheaper rate. Otherwise, poor people cannot avail of the services. They stated that these facilities should be initiated immediately.

6.4.8 Employment

Positive Impact: The participants stated that the project will bring employment opportunities for several occupational groups. For instance, the labour involved in earthworks might be engaged in land preparation and development; construction labourers will be engaged in building constructions. On the other hand, local relevant businesses will be stimulated and in turn, will emerge as employment hubs for the local people.

Enhancement Measure: They demanded that local people should be given priority in engaging them in all related activities of the project.

6.4.9 Potential negative impacts and mitigation measures

The participants unfolded several negative impacts which are likely to be preceded by the proposed project. These are pointed out in the following sections:

6.4.10 Drainage Congestion

Negative Impact: There are several canals within the study areas through which rain water of the entire area gets drained away. These canals have connectivity to the Balu River. If the canals are disturbed and/or closed/silted-up by the project activities then, the entire area will be flooded and in turn, drainage congestion will take place.

Mitigation Measure: Instead of filling up the canals, the canals should be maintained following a sustainable plan so that they can carry rainwater to protect the area from drainage congestion. Since they are connected to the river, it must be ensured that wastes will not pass through these networks.

6.4.11 Population Redistribution

Negative Impact: Since the project is intended to provide human habitation, a considerable number of people will be concentrated in this area. Based on this housing area, certain unplanned settlements may be developed surrounding the project area i.e., within the study area.

Mitigation Measure: This suburb should be developed following a realistic plan and the approved DAP should be followed in every stage.

6.4.12 Social Relation

Negative Impact: It is usual that when modern facilities are initiated within a given area, traditional social bondages are weakened.

Mitigation Measure: Several community clubs and associations should be formed so that they can serve the community interest and can work for the community.

6.4.13 Traffic Congestion

Negative Impact: Obviously, the proposed development will increase traffic but, there is a chance of huge traffic congestion in future.

Mitigation Measure: A traffic/road plan should be made considering this matter and a strong traffic system should be developed to make this area congestion-free.

6.5 Peoples Concluding Remarks

Despite having some negative impacts, the people of the area still consider those insignificant as compared to the potential benefits. Therefore, they urged immediate implementation of the project. They also stated that they will support and help the project authority to implement the project and they believe that the implementation of the project will certainly curb the existing problems.

Figure 6.3: Presenting the Project Activities by CEGIS Professional

Figure 6.4: The Participants from Local Government

Figure 6.5: The participant from Khilkhet Abason Prokolpo

7. Important Environmental Components

Important environmental components, likely to be impacted by the project interventions, along with the rational of their selection, are discussed in the following section. The list of all the IECs is presented in table 7.1 below.

Table 7.1: List of IEC for EIA Study

Physical Environment	Biological Environment	Environmental Quality	Socio-Economic Condition
• Flooding • Drainage Congestion • Ground Water Depletion	• Wetland Ecosystem • Ecosystem Habitat (quality and type) • Fish habitat (quantity and quality) • Lateral fish migration • Breeding and grazing grounds • Fish species diversity and richness • Fish production • Crop production loss	• Air quality • Water quality • Noise quality	• Population migration • Employment opportunities • Land price • Investment Opportunity • Land ownership

7.1 Physical Environment

7.1.1 Flooding

The study area as well as the project area is identified as Mixed Used Zone (Predominantly residential) in the Detail Area Plan 2016-2035 (DAP) report prepared by RAJUK. During monsoon, the entire area goes under water and drains out when the monsoon is over. Therefore, flooding has been selected as an IEC.

7.1.2 Drainage Congestion

Though the study area has been identified as a flood flow zone by DAP, the area is going to be filled up for land development. As a result, drainage congestion problems during the post-construction period may occur at different locations. Thus, drainage congestion has been considered an IEC.

7.1.3 Ground Water Depletion

Presently, the study area is characterized as low land for which ground water could be recharged easily both through open land as well as through existing water courses. But when the land is developed, this process could be hampered. Thus, ground water depletion has been selected as an IEC.

7.2 Biological Environment

7.2.1 Wetland Ecosystem

Wetland is a dynamic form of aquatic ecosystems. Most of the project area was covered with seasonal or perennial wetlands like floodplains, ponds, beel, ditches and canals. These wetlands are the habitat for many aquatic vegetation (Kachuripana, Topapana, Nakha etc.) as well as

aquatic wildlife including waterfowl (Jacana, whistling ducks etc.) and fishes. Due to land development, most of the wetlands are apprehended to be filled up by sandy soil. As a result, seasonal variation of floodplain biodiversity may be interrupted which will ultimately reduce wetland habitats. Thus, the wetland ecosystem has been considered an IEC.

7.2.2 Ecosystem Habitat (Quality and Type)

The existing natural habitat is expected to be converted into a permanent terrestrial landform due to land development. All these habitats have luxurious growth of wild herbs and shrubs, which depend on the natural fluctuation of water. In addition, the existing developed area that contains dense tall grasses and supports various grass birds is expected to be reduced when different infrastructures are constructed. Hence, habitat has been considered as an IEC for this study.

7.2.3 Fish Habitat (Quantity and Quality)

Land development activities and subsequent housing are likely to affect the adjoining fish habitats in terms of quantity and quality. In this context, fish habitat (quantity and quality) has been considered as an IEC.

7.2.4 Lateral Fish Migration

Along with land development, other works such as road development, drainage network, etc. may change the lateral migration pattern of the study area. Thus, fish migration has been considered an IEC.

7.2.5 Breeding and Grazing Grounds

Different seasonal and perennial fish breeding and grazing grounds of the area are likely to be impacted by the development activities. Therefore, 'breeding and grazing grounds' have been considered as an IEC.

7.2.6 Fish Species Diversity and Richness

Collective impacts on fish habitat quantity and quality and lateral fish migration with breeding and grazing grounds of the area will affect the species diversity and richness of fish. Therefore, 'fish species diversity and richness' has been considered as an IEC.

7.2.7 Fish Production

Combined effects of the above-mentioned component might affect the fish productivity of the remaining habitats and ultimately the fish production of the areas. Thus, fish production has been considered an IEC.

7.2.8 Crop Production Loss

Since the entire project area will be developed for residential purposes, the crop production in the project area may have no existence. Along with this, the crop production of the surrounding agriculture land may be affected due to the disposal of wastes and construction debris during the construction phase. In future when the residential development is completed, it can be assumed that the agriculture land surrounding the project area will be filled for further development. Eventually, the crop production may gradually be reduced and will be nil at one stage. Therefore, crop production has been considered an IEC.

7.3 Environmental Quality

7.3.1 Noise Quality

The maximum noise level of the study area has already exceeded the standard as per Environmental Conservation rules. It is assumed that the proposed project from its pre-construction to the operation phase will further increase the noise level through construction equipment, vehicles, construction work and other human interventions. It may eventually cause inconvenience and certain health impacts related to hearing impairment and other problems for the workers and the people of the study area. Therefore, noise quality has been considered as an IEC for this study.

7.3.2 Water Quality

The baseline condition of the water in the study area is not suitable for direct use. When the development works start, the water quality will further deteriorate due to surface runoff from the project site, waste spills and sewage discharge from the pre-construction to the operation phase. Hence, water quality is considered as an IEC.

7.3.3 Air Quality

The baseline condition of the air quality is within Bangladesh standards. However, there is a possibility that the air quality could be impacted by the project intervention like dust generation from construction activities, fugitive emissions from various construction equipment and increased vehicular movement. Therefore, air quality has been considered as an IEC.

7.4 Socio-Economic Environment

7.4.1 Population Migration

It is predicted that due to rapid urbanization of the area, people will migrate within this study area as well as within the project area. As such, population migration is considered as an IEC.

7.4.2 Employment Opportunities

In the proposed project, a huge number of civil works i.e., land development, roads and canal development and residential house construction will be done in future. These activities will create new employment opportunities for the people during and after the project development compared to previous conditions. In addition, such development may influence other commercial and industrial development in proximity, which will also open scopes for employment opportunities for people. So, an employment opportunity has been selected as an IEC.

7.4.3 Land Ownership

Land ownership patterns will be changed since most landowners may sell their land to the developer as well as to the private land buyer. It will gradually reduce the portion of personal land as well as ownership. For this, the landownership is considered as an IEC.

7.4.4 Land Price

It is expected that the peripheral areas will be rapidly urbanized due to the implementation of the project and the current land price will increase gradually which will be beneficial for the land owners. This is why land price is considered as an IEC.

7.4.5 Investment Facilities

A good number of people may like to invest/buy plots within the project area and consequently invest in the surrounding area for markets, commercial shops, and other infrastructures. Thus, a large investment opportunity may be created in this area. Which investment facility is considered an IEC of this study.

8. Impact Assessment

The environmental impacts that may take place during various project phases, along with the appropriate mitigation measures to be taken to avoid, offset, and reduce the negative impacts, enhancement measures for positive impacts and suggest compensation for the impacts that can never be mitigated are identified in this chapter. The proposed activities under the Housing project may cause potential environmental impacts during the pre-construction, construction, and operation (post-construction) stages which have been identified and pointed out in Chapter 4.

8.1 Impact Screening

As a part of the environmental impact assessment process, a screening matrix was used, focusing on the potential environmental impacts during the design, construction, and operation phases. The matrix examined the interaction of project activities with IECs selected for various components of the environment. The impacts were broadly classified as physical, biological, and social, each of these are again divided into different aspects depending on their categories. The potential impacts thus predicted were characterized as follows:

- Highly negative (adverse) impact;
- Moderately negative impact;
- Insignificant impact;
- Highly positive (beneficial) impact;
- Moderately positive impact.

The matrix is provided in Table 8.1. Appropriate mitigation measures are recommended as part of this EIA. The potentially negative impacts identified through this process are discussed in the subsequent sections.

Table 8.1: Environmental Screening Matrix (without application of mitigation measures)

Project Phases And Activities	Physical Environment			Biological Environment								Socio-Economic Condition					Environmental Quality		
	Flooding	Drainage Congestion	Ground Water Depletion	Crop Production	Wetland Ecosystem	Ecosystem Habitat (Quality and Type	Fish Habitat (Quantity And Quality	Lateral Fish Migration	Breeding and Grazing Grounds	Fish Species Diversity and Richness	Fish Production	Population Migration	Employment Opportunities	Land Price	Investment Opportunity	Land Ownership	Air Quality	Water Quality	Noise Quality
Pre-construction Phase																			
Preparing the project layout	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Purchasing land	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MN	NI	NI	NI
Obtaining clearance from DC office;	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Stakeholder consultation;	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Bill board in the project site for public disclosure	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Construction Phase																			
Procurement of labor;	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Clearing some of the vegetation from the project site.	NI	NI	NI	I	I	MN	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Filling up of small water bodies	NI	MN	NI	NI	MN	MN	MN	MN	MN	MN	MN	NI	MP	NI	NI	NI	NI	NI	NI

Project Phases And Activities	Physical Environment			Biological Environment								Socio-Economic Condition					Environmental Quality		
	Flooding	Drainage Congestion	Ground Water Depletion	Crop Production	Wetland Ecosystem	Ecosystem Habitat (Quality and Type	Fish Habitat (Quantity And Quality	Lateral Fish Migration	Breeding and Grazing Grounds	Fish Species Diversity and Richness	Fish Production	Population Migration	Employment Opportunities	Land Price	Investment Opportunity	Land Ownership	Air Quality	Water Quality	Noise Quality
Land Development through sand filling;	I	MN	I	MN	HN	HN	MN	I	I	I	MN	I	MP	NI	NI	NI	MN	MN	MN
Land Leveling using dumper;	NI	I	I	I	I	I	I	I	I	I	I	I	MP	NI	NI	NI	MN	I	MN
Procurement and management of construction materials;	NI	I	I	I	MN	I	I	I	I	I	I	I	MP	NI	NI	NI	MN	MN	MN
Construction of roads;	NI	MN	I	I	I	MN	MN	I	I	MN	MN	NI	MP	NI	NI	NI	MN	MN	MN
Installation of water supply systems; gas line systems; electricity systems; storm water drainage systems; solid waste management system;	NI	I	MN	NI	MN	MN	MN	MN	MN	MN	MN	I	MP	I	I	I	I	MN	I
Removal of the temporary structures (e.g shelter and toilet for construction engineer, labors)	NI	I	I	NI	I	I	I	I	I	I	I	I	MP	I	I	I	I	I	I
Collection and disposal of wastes (liquid and solid)	NI	MN	I	NI	MN	MN	I	I	I	I	I	I	MP	I	I	I	I	MN	I

Project Phases And Activities	Physical Environment			Biological Environment								Socio-Economic Condition					Environmental Quality		
	Flooding	Drainage Congestion	Ground Water Depletion	Crop Production	Wetland Ecosystem	Ecosystem Habitat (Quality and Type	Fish Habitat (Quantity And Quality	Lateral Fish Migration	Breeding and Grazing Grounds	Fish Species Diversity and Richness	Fish Production	Population Migration	Employment Opportunities	Land Price	Investment Opportunity	Land Ownership	Air Quality	Water Quality	Noise Quality
generated during the construction period																			
Post-construction Phase																			
Operation and maintenance of infrastructure (road, gas, electricity etc.) of the project, treatment plant and surface drainage channels	MP	MP	I	NI	I	I	I	I	I	I	I	I	NI	NI		NI	MP	MP	MP

Note: Highly negative (adverse) impact (HN); Moderately negative impact (MN); Insignificant impact (I); Highly positive (beneficial) impact (HP); Moderately positive impact (MP) and (NI) No impact

8.2 Pre-construction Phase

Table 8.2: Impact Assessment Matrix during Pre-construction Phase

IESC	Location	Baseline Condition	Impact	Impact (+/-)/ Magnitude
Activities: Land purchase				
Land ownership	Study area	Most of the landholders (65%) have less than or equal to 49 decimals of land.	Land (within the project area) will be bought by BCS Housing Society as such the land owners will lose their ownership. But they have got their land value	1

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.3 Construction Phase

Table 8.3: Impact Assessment Matrix during Construction Phase

IESC	Location	Baseline Condition	Impacts	Magnitude of Impact*
Activities: Land development through sand filling				
Drainage congestion	Near Khal	Presently, no drainage congestion exists, water drains out properly after monsoon. Erosion of top soil in the housing area flows to the existing khals near the project area which will deteriorate the condition of siltation.	Land fill works may temporarily obstruct drainage channels and cause drainage congestion.	-3
Crop production	Project area	90% of the project area (95 acres) was single cropped agricultural land.	95 acres of single cropped land would be converted into residential which would result in loss of crop production from this land	-3
Wetland Ecosystem Habitat	Project area	• Habitat is in good condition with clear seasonal variation and diversity of both terrestrial and aquatic flora and fauna. • Major portions of existing habitat are mainly seasonal floodplain in wet season which is used as paddy field in dry season. • The existing land development area is covered with tall grass like *Chhon, Kash* and	• Permanent damage or loss of wetland habitat • All existing natural vegetation will be damaged • Deteriorate ecosystem health condition	-5

IESC	Location	Baseline Condition	Impacts	Magnitude of Impact*
		Nol and some small herb, shrub. Such type of grass lands is very important habitat for grass dwelling birds. A good number of Plain Prinia, Zitting Cisticola, Black Headed Munia and Indian Silver bill are observed during the field visit. The natural habitat also supports different types of herb, shrub and wildlife species.		
Fish habitat quantity and quality	Project area	• Due to accumulation of pollutants and sedimentation, the river bed is elevating gradually; • Dumping of solid and hazardous wastes into the drainage Khals causing water pollution; • Floodplain and other habitats are in declining trend due to land development for different purposes; • Fish habitats are reducing and becoming less suitable for fish habitation.	• Fish habitats of the project area would be moved out due to leakage of watery sand on the Khals may narrow down the habitat. • Water quality may be degraded by the indiscriminate disposal of wastes into the water bodies.	-5
Lateral fish migration		The fishes mainly perform lateral migration from river to Khals and Khals to river along with floodplain to floodplain for a number of purposes like feeding, nursing, breeding, etc.	Fish migration would be permanently stopped in some floodplains with temporary obstruction in other habitats.	-3
Breeding and grazing ground		Floodplain and deep areas of the Khals act as fish breeding and grazing grounds.	Permanent loss of breeding and grazing grounds within the project area and increased fishing pressure in other areas would disturb the specialized grounds.	-3

IESC	Location	Baseline Condition	Impacts	Magnitude of Impact*
Fish production		Annual fish production derived from different habitats of the study area is about 195 tons.	Floodplain and culture fish production would be declined, thus fish production within the project area would decline.	-3
Activities: • Land development through sand filling; • Leveling of land using dumper; • Construction of roads and different structures on roads; • Installation of water supply system; electricity systems; storm water drainage systems; • Collection and disposal of wastes (liquid and solid) generated during construction period				
Noise	Project and study area	The maximum noise level of the area exceeds the standard noise level of Bangladesh (MoEF 2006)	• Noise generation from barge and sand pumping, construction equipment and vehicles will cause noise pollution. • Noise generation would be intermittent and decrease with increasing distance. • The personnel operating the machineries and the people stationed close to the machineries may get exposed to high levels of noise which may result in loss of hearing.	-3
Air quality		Air quality is within the permissible limits as per Bangladesh Standard	• Ambient air quality may be deteriorated due to dust generation during land leveling, SPM generation due to handling of construction materials and emission from on-site vehicular movement and construction equipment. • Cause health risk to workers and surrounding people such as cough, nausea, throat irritation etc.	-3
Water quality	Tongi Khal	Water quality is not suitable for drinking purpose or any other direct use	• Water quality may deteriorate more as turbidity will further increase due to the barge movement and disposal of construction debris, fuel/oil spills. • Solid waste and sewage disposal to water will	-4

IESC	Location	Baseline Condition	Impacts	Magnitude of Impact*
			affect the overall quality of the water and increase different type of water borne disease	
Activity: Installation of water supply system				
Ground water	Entire study area	GW table in the study area is declining	Ground water-based water supply system through installation of deep tube wells in the project might have effect on the ground water table which would limit the pond water availability period.	-2
Activities: • Land development through sand filling; • Leveling of land using dumper; • Construction of roads and different structures on roads; • Installation of water supply systems; gas line systems; electricity systems; storm water drainage systems; • Collection and disposal of wastes (liquid and solid) generated during the construction period				
Employment opportunities	Study and project area	A total of 63% of the population are employed within the study area of which 15% are engaged in service, 3% abroad and 4% in agricultural activities. Here 10% people are mainly day laborers.	Several laborers will be needed for land and other development activities of the project area such as, earthwork, preparation of materials, road construction, installation of utility services and other construction works, which eventually will generate employment for the labor.	+4
Population migration		Almost 50% of people migrate here from different parts of the country. Mainly male labors come here for better working opportunities.	A good number of laborers may migrate to the study area for better working opportunities especially the construction activities of the project area.	+5

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.4 Post-construction Phase

8.4.1 Flooding

Future-Without-Project

The project area was relatively low (but now the land development works is finished by the housing authority), with an average elevation of 0.95 m above Mean Sea Level (MSL). 100% of the project area has already been filled up, up to an elevation of 7.5 m above MSL. Approximately 1.9 million cubic meter of water was retained on the land in monsoon, whereas the flood volume in the project area during extreme event is 2.7 million cubic meters.

Future-with-Project

The project intervention includes land filling works in the entire project area (appx.104 acres). Land is to be filled up to an elevation of 7.5 m above MSL if the project is implemented. This proposed elevation is higher than the observed average monsoon flood levels in both Balu and Shitolakhhya rivers. This infers that due to implementation of the project, the entire project area would be free from regular monsoon flooding. After filling of the land throughout the project area, about 0.22 m^3 of water would be stored instead of 1.9 million cubic meter of water in monsoon.

Impacts

Around 91 acres (88% of the project area) of lands would be free from regular monsoon flooding. This would bring in other associated benefits i.e., anthropogenic developments, urban growth etc. within the area. But additional 1.9 million cubic meter of water will have to be accumulated inside the project area in monsoon. Otherwise, this water would create immense problem in the study area during monsoon.

Table 8.4: Impact Matrix for Flooding (Post-Construction Phase)

IESC	Baseline	FWOP	FWIP	Impact/ Magnitude
Flooding	91 acres (88% of project area) of the project area is flooded up to a depth of 0.95 meters. Approximately 1.9 million cubic meters of water could be stored on the land of project area during monsoon.	The situation will remain the same (91 acres flooded area). Water will be stored in the project area in monsoon.	• 1.5 cm. increase of flood level; • Reduction of Flood Retention Capacity (1.9 million cubic meter) • Reduction of ground water recharge area 75 acres	-3

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.4.2 Drainage Congestion

Future-Without-Project

Due to the existing lower elevation in most of the portion of the project area, a significant amount of surface runoff occurs as overland flow following any major rainfall events. Furthermore, the existing khals drain out substantial volume of water as and when required. As such, there will be no drainage congestion in the project area. This situation is expected to remain unchanged if the land filling works within the project are not implemented (Table 8.5).

Future-with-Project

If the land filling works beside the proposed drainage channel/lake will be destroyed, then a significant portion of overland flow will be disrupted. This would create immense water logging problems inside the housing area. This may result in drainage congestion problems along the khals.

Impacts

Almost 850-meter length of khals may be subjected to drainage congestion problems following heavy rainfall. This may adversely affect the existing water resources functions and its uses.

Table 8.5: Impact Matrix for Drainage Congestion (Post Construction Phase)

IESC	Baseline	FWOP	FWIP	Impact (+/)/ Magnitude
Drainage congestion	There is no drainage congestion in the project area	Situation will remain same (no drainage congestion)	Almost along 850-meter length of khals may be subjected to drainage congestion	-4

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.4.3 Groundwater Depletion

Future-Without-Project

The depth of Ground Water Table (GWT) in the project area is usually 7m below the ground surface during dry season. From the analysis made on the annual variation of GWT in the project area, it is observed that the annual average GWT declines at a rate of 0.3 to 0.4 meters per year. The existing GWT may continue to decline at its usual rate if the project is not implemented. In 20 years of time, GWT may drop by additional 7 meters from surface (Table 8.6).

Future-with-Project

Implementation of housing projects would cause alteration of the existing land use situation. Ground water recharge through subsurface infiltration would be reduced to a great extent. Furthermore, extraction of ground water for regular domestic use would increase tremendously. Groundwater layer would decline at an increased rate in future. Considering the development of 50% housing area, standard rate of domestic water use, and reduced rate of ground water recharge; in future the GWT may decline at a faster rate which would be around 0.6 meters per year. This infers that within next 20 years, the GWT may further decline and may drop down to a depth of 14 m from the ground surface.

Impacts

Rate of subsurface infiltration would decrease, and groundwater abstraction would increase. Around 36~40% reduction of groundwater availability may take place in dry season. This may create concerns over groundwater security in future.

Table 8.6: Impact Matrix for Ground Water Depletion (Post-Construction Phase)

IESC	Baseline	FWOP	FWIP	Impact (+/)/ Magnitude 1-10
Groundwater Depletion	GWT is below 7m from the ground surface during dry season, which is declining at a rate of 0.3 to 0.4 m/yr	GWT may decline at similar annual rate, and may further drop by a depth of 7 m in the next 20 years	GWT may decline at a rate of 0.6 m/yr, and in future the GWT may drop down to 14 m below surface in the next 20 years	-3

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.4.4 Crop Production

Future-Without-Project

If the project is not implemented, the crop production will remain same as baseline.

Future-with-Project

Residential development will encourage people to use the agricultural land for other development works. Therefore, crop production may reduce drastically.

Impact

Crop production will decline as most agricultural land will be utilized for urban housing.

Table 8.7: Impact Assessment Matrix for Crop Production (Post-Construction Phase)

IEC	BASELINE	FWOP	FWIP	IMPACT/ MAGNITUDE
Crop production	Crop production of the study area is 23000 tons and loss are 800 tons	Crop production without project situation will remain same or may further decrease.	Crop production will be reduced due to use of existing agriculture land for other development activities or replication of the existing residential development projects	-1

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.4.5 Air, Noise and Water Quality

Future-Without-Project

As per baseline condition, the maximum noise levels of the study as well as project area are above the ECR, 1997 standard. The air quality is good, and the water quality is not suitable for direct consumption. Without the project, the quality of all these three parameters would remain same if there is no further urban development in the study area (Table 8.8).

Future-With-Project

Future with project scenario will further worsen the noise level and water quality during construction and post construction phase. In addition, air quality will also be affected, but the extent cannot be estimated unless the project is in full operation. However, during construction phase air, noise and water quality will temporarily be affected severely. The extent of degradation during post-construction phase needs quality testing when the project is in full operation.

Impacts

The project would enhance the noise levels and degrade air and water quality which will be inconvenient for the people and cause risk of different types of diseases specially the water borne diseases.

Table 8.8: Impact Assessment Matrix for Environmental Quality (Post-Construction Phase)

IEC	Baseline	FWOP	FWIP	Magnitude
Noise pollution	Maximum Noise levels both inside the project area and project influence area are above the Sound quality standard 2006.	The noise levels in the study area will increase in future without project also if normal urbanization pattern would continue.	Noise levels in future with project condition would increase in the project area as well as the study area for the increase of vehicular movement, generator operation and other equipment which generate different pollutants	-3
Air and dust pollution	Air quality is within the Air pollution rules, 2022.	The air and dust pollution in the study area would also increase, if normal urbanization pattern would continue.	Similar to the noise pollution situation, more pollutants such as oxides of carbon, S and N, total suspended particulates, would be generated after development of the project which will affect the air quality. In addition, due to the residential development, other construction works for beautification/ amenities/ other infrastructure development may be initiated which will affect the air quality and create dust pollution	-3
Water pollution	Water quality is not in good condition during dry season in the river and nearest waterbodies	If the project is not implemented, water pollution during dry season would continue is deterioration due to increasing unplanned urbanization patterns.	The project would contribute to increase the surface water pollution from wash out of urban wastes and sewerage disposal (if the treatment plant does not function properly).	-3

8.4.6 Ecosystem Habitat

Future-without-Project

If the area is not converted to urban residential area, there will be no change in ecosystem of the project as well as the study area, whereas the total project area is land filled by sand.

Future-With-Project

Major losses of aquatic habitat have already been made during land filling period. However, the remaining aquatic habitats near the project site would be further deteriorated for contamination of urban wastage as well as interruption of drainage facilities and connectivity with surrounding water bodies. On the terrestrial part/developed land will follow succession with long tall grasses and very few herbs' species within 1-2 years. Consequently, some grass loving birds and insects (grass birds, grasshoppers, butterflies, and skinks) will start to dwell there. Population and diversity of this flora and fauna will depend on the time up to which the land will remain unused. The grassy vegetation will completely disappear when civil infrastructures will be constructed.

Impacts

Deterioration of the wetland habitat quality after land development, succession of tall grasses on developed land and further diminishing of these grasses with construction of urban infrastructures.

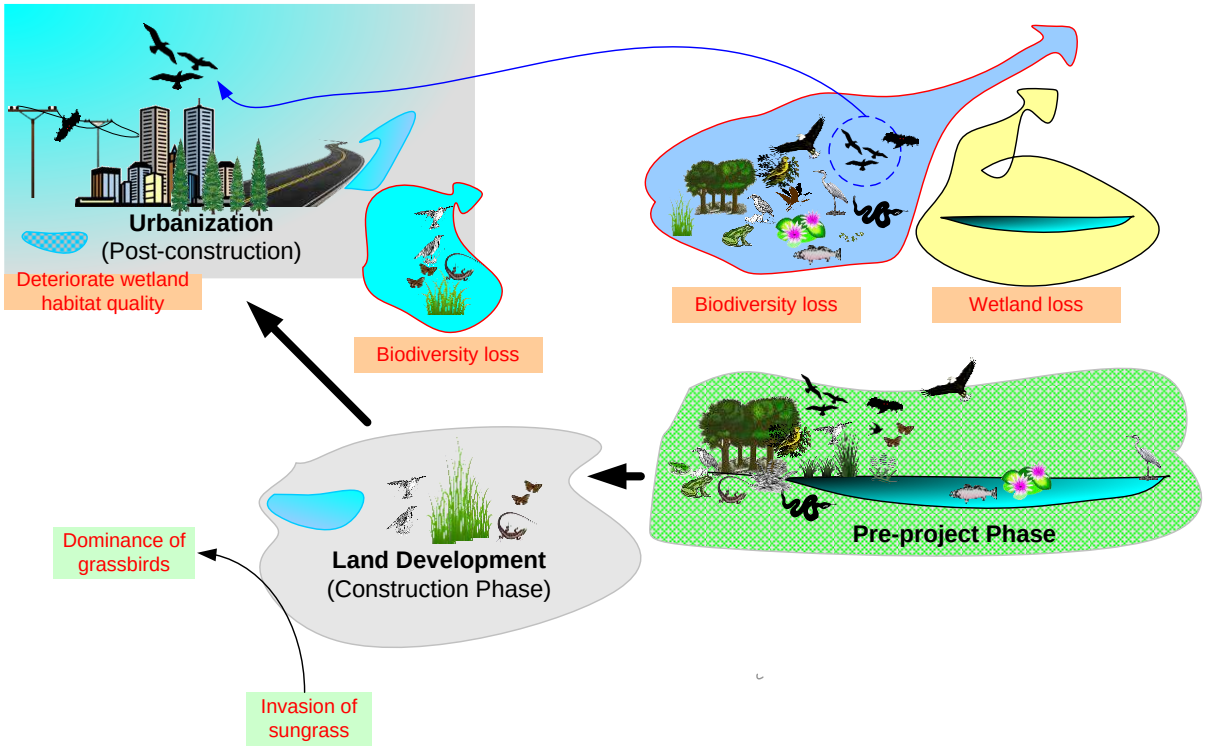


Figure 8.1: Impact Scenario on Ecological Resources for Land Development

Table 8.9: Impact Matrix for Ecological Resources (Post-Construction Phase)

IESC	Location	Baseline	FWOP	FWIP	Impact (+/-)/ Magnitude
Wetland Ecosystem	Project area	Wetland (both seasonal floodplain and small ditches/ponds) have already been filled up and converted as grassland during land development phase. However, rest of the wetlands (i.e.: khals) are moderate in quality having less floral and faunal diversity	There will be no change wetland in ecosystems inside the project area if there would be no additional urban expansion in the surrounding land.	Deterioration of surrounding wetland ecosystems due to degraded water quality from contamination by urban wastage.	-3
Ecosystem habitat	Project area	In this phase, habitat of the filled-up area will be mainly terrestrial form where grasses will be dominant and grass birds and small reptiles and insects like lizards and skink is expected to exist there.	The grassland area will be increased and dependent wildlife species (i.e.; Grass birds) population will be increased.	Conversion of habitat from grasslands to urban ecosystem due to infrastructural development will reduce grassland habitat and create disturbance to the grassland birds and other wildlife.	-3

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.4.7 Fish Habitat

Future-Without-Project

Fish habitat quality, in the study area is degrading over the years. Based on the land development trend it is anticipated that in future without project condition, floodplain and culture fish habitat area would be reduced more. It is estimated that about 550 ha of fish habitat of the study area and 90 acres of fish habitat of the project area would be transformed into other types of land uses permanently.

Future-With-Project

Land development activities would exert negative impact on fish habitat in terms of quality and quantity for both project and study areas. Moreover, urbanization trend shows that land

development activities would continue in this area. Besides, Khilkhet Housing project has a plan for beautification of the existing major khals within the project area, though other water bodies would be transformed into other types of land uses. It is estimated that about 90 acres of fish habitat of study area will be reduced by this project. Water bodies like floodplain, ditch, semi-closed water body and cultured pond will be permanently lost from the project area. The estimated loss of water bodies of the study area may be transformed into different land uses like housing, commercial center development etc. having potentials of generating pollutants. Moreover, fishing pressure would be increased on the remaining habitats. Breeding and feeding grounds would be lost immensely and thus sharing of feeding grounds may cause natural mortality. Therefore, habitat quality would further be degraded.

Impact

Net loss of fish habitat for implementation of the project will be 550 acres from the study area and 90 acres in the project area.

In summary, breeding and grazing grounds for the aforementioned fishes would be alarmingly reduced. Conservation of existing Khal in natural form may have positive impact on fish breeding and grazing grounds.

Species diversity and richness would be declined highly, and the remaining habitats might have high species dominance which means only limited species will dominate species composition.

In summary, lateral fish migration in the project area will be lost and this will be highly hampered in the study area.

8.4.8 Fish Production

Future-Without-Project

Based on above mentioned assumptions, the estimated annual loss of fish production of the study area habitats would be 27 tons while the estimated annual loss of fish production of the project area would be 7 tons.

Future With Project

Based on the above-mentioned assumptions, about 27 tons of fish production of study area and 7 tons of fish production of project area will be reduced annually from base condition. Floodplain and culture fish production would be lost from the project area.

Impact

The net annual loss of fish production will be 27 tons from the study area and 7 tons in the project area.

Table 8.10: Impact Matrix for Fisheries Resources (Post-Construction Phase)

IEC	Location	Baseline condition	FWOP	FWIP	Impacts	Magnitude of impact*
Fish production	Study area	Production in study area: 195 tons	Production in FWOP in study area would be: 27 tons	Production in FWIP in study area would be: 34 ton.	**Study area**: Estimated net loss to fish production would be 34 tons.	-4 (for study area)

** Low impact (1); Medium impact (2-3); High impact (4-5)*

8.4.9 Socio-economic Condition

Future without project

Population migration, employment opportunities, land price and investment opportunities will be increased even if the project will not have implemented since the study area is gradually pushing towards urban development.

Future with project

It is obvious that with project scenario, people will be interested to invest here for better living condition away from urban hustle. In addition, based on such development different employment opportunities will be created or gradually people will migrate here.

Impact

A certain group of people will migrate to this area either for residing or for better employment opportunities.

Table 8.11: Impact Assessment Matrix for Socio Economic Environment (Post-Construction Phase)

IESC	Baseline	FWOP	FWIP	Impact/ Magnitude
Population Migration	In the project area the number of total populations is 3500. Total 285 plots are proposed in the project area and per acre 350 people will reside within this area in near future.	The area is close to Dhaka city. Apart from the proposed project, there are other housing projects under development. Therefore, there is a chance for people to migrate for a calm and quite environment for living and other opportunities.	After implementing the project, a certain group of people will migrate to this area either for residing or better employment opportunities.	+5
Employment opportunities	As per BBS, 55% of total population is	There are possibilities of increasing employment	People already residing in the study area will interact with	+5

IESC	Baseline	FWOP	FWIP	Impact/ Magnitude
	employed, 27% are engaged in household work (mostly women) and about 18% are not engaged in any type of work	opportunities due to existence of other development projects in the study area.	the new comers and may be encouraged for decent jobs or for any other entrepreneurship. In addition, smallholder farmers will get in their midst a ready market for their farm products due to the increase of non-farming residents.	
Land price	The previous land price per decimal was 5 lacs for homestead land and 3 lac for agriculture land. The current sale value of per decimal land is 15 lac taka for homestead land and 10 lac taka for agriculture land.	Land price will be increased	Land price may increase rapidly since the area will get gradual urban flavor. It is obvious that land price is influenced by the surrounding development. Once the project is in operation, other infrastructure and development will take place which will eventually hike the land price.	+5

** Low impact (1); Medium impact (2-3); High impact (4-5)*

9. Environmental Management Plan

The Environmental Management Plan (EMP) aims to ensure the compliance of all activities undertaken during implementation and the operation of proposed project with the environmental safeguard requirements of GoB. The plan consists of mitigation measures, and monitoring plan to be undertaken during implementation and operation phases to eliminate adverse environmental impacts, off-set or reduce them to acceptable levels.

EMP measures during pre-construction, construction and operation phases are presented in tables 9.1, 9.2 and 9.3 respectively.

9.1 Pre-construction Phase

Table 9. 1: Environmental Management Plan for Pre-Construction Phase

Impact	Mitigation Measure	Enhancement/ Contingency/ Compensation	Residual Impact	EMP Cost (Lakh Tk)	Responsible Agency
People will lose their land ownership	BCS Housing Society should buy the land at the current market price without any hassle.	A plot may be given (if possible) in addition to land price to those whose land are to be bought by BCS Housing Society.	0	-	BCS Housing Society

9.2 Construction Phase

Table 9. 2: Environmental Management Plan for Construction Phase

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
Physical environment					
Drainage Congestion: Land filling works may cause drainage congestion. Moreover, soil may go into the existing khals inside the project area and siltation might occur.	• Re-excavation might be needed for quick drainage (as stated in the Drainage Modelling report) to the existing khal as per CS mauza inside the project area which should be executed properly. • Proper care should be taken during land filling so that no soil could flow or dumped into the khals and the width of the khals proposed should be properly maintained.	• For earthwork by manual labor in excavation of channels Tk. 122/cum is needed.	-1	• For earthwork by manual labor in excavation of channels Tk. 122/cum is needed.	BCS Housing Society
Environmental Quality					
Noise quality	• All vehicles, equipment and machinery to be used should comply	-	-2	-	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
Noise generation from barge and sand pumping, from the construction equipment and vehicles. • Noise generation would be intermittent and decreasing with increasing distance. • The personnel operating the machines and the people stationed close to the machines may get exposed to high levels of noise.	with the relevant ECR norms and other rules. • Use enclosure for all diesel generator sets. • Source control through proper maintenance of all equipment. • Workers operating equipment generating noise of ≥85 dB continuously for 8 hours or more should use ear muffs (OSHA) • All vehicles used on site for this purpose should carry currently valid fitness certificates issued by the BRTA				
Air quality • **Ambient air quality** may deteriorate due to dust generation during land leveling, SPM generation due to handling of construction materials and emission from onsite vehicular movement and construction equipment. • Cause health risk to workers and surrounding people such as cough, nausea, throat irritation etc. • Vehicular movement and other equipment generating emissions will cause air pollution which cause different health constraints	• Materials should be covered with clean tarpaulin in good condition. • Water should be sprinkled as and where necessary. • Carry out regular maintenance of equipment and vehicles. • Use of masks should be made compulsory for the workers. • Generators should be regularly inspected to ensure that they are operating efficiently, and emission standards are maintained. • Define vehicle movement to control dust emission.	-	-2	-	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
Water quality • **Water quality** may be deteriorated as turbidity will be further increased due to the barge movement carrying sand for land filling; • Disposal of construction debris, fuel/oil spills, solid waste and sewage to water will affect the overall quality of the water. • People using surface water for any domestic purpose may be affected by water borne diseases.	• Stockpiles of all construction material should be at least 100 m away from the nearby water bodies. • Strictly avoid cleaning/ washing of any construction vehicle/equipment in any water body. • Provide septic tanks for treating sewage from toilets. • Strictly avoid any type of waste disposal to the water bodies. • Collection of plastics/polythene in separate bins for disposal.	-	-2	-	BCS Housing Society
Biological Environment					
Wetland Habitat • Permanent loss of wetlands habitat. • Loss connectivity of khals which are existing in project area, deteriorate surrounding aquatic ecosystem health. • Diminish/reduce all small faunal communities including micro-organisms	• Keep water bodies (10% of area) within the project area as per Bangladesh National Building Code. • Existing canals alignment must be separated from all kinds of land filling and conserve their connectivity with major water bodies/rivers adjacent to the project. • Khals inside the project area should be re-excavated and used as water reservoirs.	-	-4	-	BCS Housing Society
Fish habitats of the project area would be moved out. Leakage of watery sand on the Khals may narrow down	• Sand filling should be completed by making chamber/or by fencing.	-	-1	-	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
the habitat. Water quality may be affected due to indiscriminate disposal of wastes into the water bodies.	• River should be kept pollution free by abstaining from dumping solid and liquid wastes of different kinds. • Awareness building to the local inhabitants in abstaining from dumping solid and liquid wastes in the water bodies.				
Fish migration would be closed permanently in some floodplains while partially obstructed in other habitats temporarily.	Associated facilities for urbanization like roads and drainage facilities should be provided with fish friendly structures like fish friendly culverts, outlets etc.	-	-2	-	RAJUK, BCS Housing Society
Permanent loss of **breeding and grazing ground** within the project area while increase fishing pressure in other areas would disturb the specialized grounds.	At least khals within the project area should be conserved for facilitating breeding and grazing of fishes. Some water retention areas should also be created in natural form in compliance with DAP for creating similar facilities for fishes.	-	-1	-	RAJUK, BCS Housing Society with the suggestion of DoF
Floodplain fish production would be declined, thus fish production within the project area would decline.	No additional measure needed. Implementation of above measures would facilitate fish production.	-	-1	-	-

Low impact (1); Medium impact (2-3); High impact (4-5)

9.3 Operation Phase

Table 9.3: Environmental Management Plan for Operation Phase

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
Physical Environment					
Flooding: Around 95 acres (100%) of lands would be free from regular monsoon flooding. But additional 1.9 million m^3 of water would be accumulated outside of the project area in monsoon.	• The existing khals and rivers within the study area would be re excavated as suggested in the Drainage Modeling Report. • Roof top rainwater in the project area would be accommodated with the building considering water reservoir. This water would be used as flushing, car wash and irrigation in roof top garden. • **LID Rain Park:** Build detention basin and constructed wetland to manage storm water. Including the specific facilities of Detention Lawn, Constructed Wetland, Rain Garden, Bio	Not required	-1	• For earthwork by manual labor in excavation of channels Tk. 122.00/cum is needed.	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	retention, Dry Swale and Pervious Pavement. • **LID Dry Pond Park:** Create a sunken dry pond park to fulfill functions such as recreational activities and detention. Including the specific facilities of Dry Pond, Constructed Wetland, Rain Garden, Dry Swale and Pervious Pavement. • **LID Public Space:** Build various LID facilities in major public & commercial areas to enhance rainwater infiltration. Including the specific facilities of Vegetated Roof, Bio retention, Rain Garden, Detention Lawn, Pervious Pavement and Rainwater Tank (Figure 9.1).				

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency

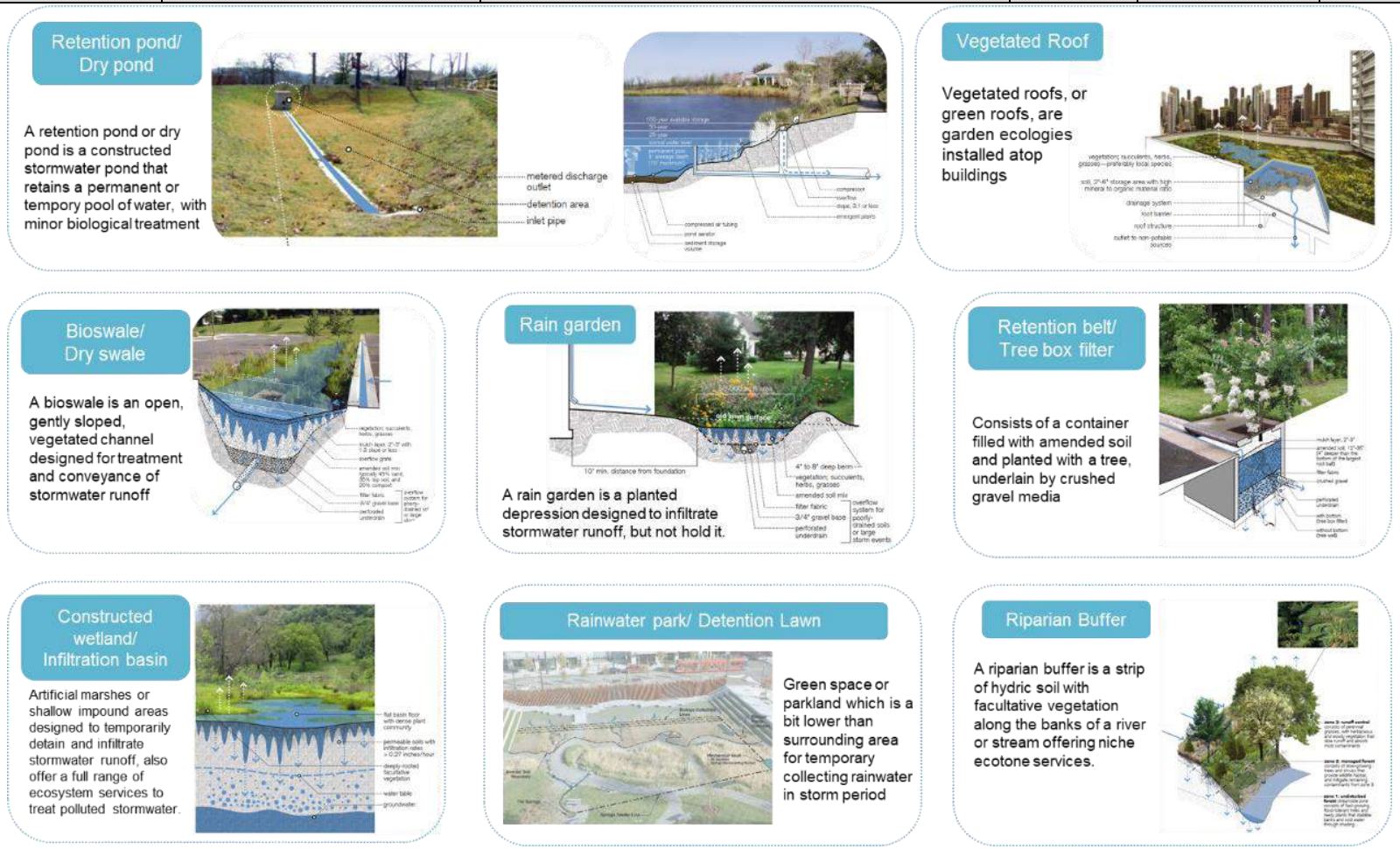


Figure 9.1 : Description of LID facilities

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
Groundwater Depletion	• Rainwater Harvesting (RWH) infrastructure should be adapted at domestic level to reduce the underground water use for domestic purpose; two possible ways may be used, one is individual collection and distribution of rainwater after some preliminary treatment and can be used only for washing, flushing etc. Other one is the cumulative collection and distribution after necessary treatment; • For the entire residential area, one central RWH system may be introduced, by constructing artificial ponds for water retention and ground water recharge; • Porous basement facilities may be kept in parks or amusement	Not required	-1	-	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	spaces so that significant groundwater recharge can take place. • Use of surface water may be encouraged for domestic uses (when the khals have sufficient water as in monsoon). This may be possible through construction of surface water treatment plants within the project area.				

- The construction of Sponge City makes the urban underlying surface recover its "natural sponge" function through LID facilities

Figure 9.2: Low Impact Development Mode

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency

Figure 9.3: Spring Park Development Concept

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
Environmental Quality					
Noise quality • The increased vehicular movement and use of different equipment generating sound will create inconvenience to people and certain health impacts related to hearing impairment and other problems	• Greenbelts and plantations or artificial mounds (Figure 9.4) may be built to reduce noise levels. • Strong leafy trees (Figure 9.5) should be planted to act as noise baffles and shrubs or creepers to provide additional protection between tree trunks. • The vehicles should strictly maintain sound level as per ECR 2006 inside the project area. • Carry out regular maintenance of plant, equipment and vehicles. • Periodic monitoring of noise levels should be carried out. Values if exceed the standard limits, suitable mitigation measures should be taken.	-	-2	-	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency

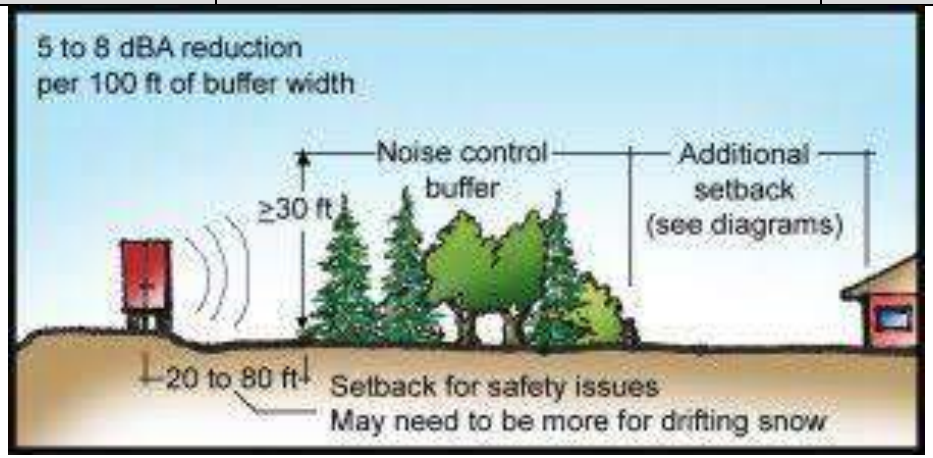


Figure 9.4: Natural acoustic barriers

Figure 9.5: Noise Blocking Plants

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
Air Quality • Ambient air quality may deteriorate due to dust generation during land levelling, SPM generation due to handling of construction of buildings and emission from onsite vehicular movement and construction equipment. • Cause health risks to workers and surrounding people such as cough, nausea, throat irritation etc. • Vehicular movement and other equipment generating emissions will cause air pollution which causes different health constraints	• All vehicles, equipment and machinery used should comply with the relevant ECR norms and other rules; • All vehicles used on site for construction purposes should have currently valid fitness certificates always issued by the BRTA; • Generators should be regularly inspected to ensure that they are operating efficiently, and emission standards are met; • Periodical monitoring of air pollutants and if values exceed the standard limits, proper measures should be taken; • Use less energy in individual buildings/apartments. Generating electricity and other sources of energy creates air pollution. By	-	-2	-	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	reducing energy use, you can help improve air quality, curb greenhouse gas emissions, encourage energy independence and save money; • Encourage your child's school to reduce exposure to school bus emissions. To keep exhaust levels down, schools should not allow school buses to idle outside of their buildings. • Walk, bike or carpool. Combine trips. Use buses, or other alternatives to driving your car.				
Water Quality • Water quality may be deteriorated; turbidity will be increased due to the barge movement during carrying sand for land filling. • Disposal of construction debris, fuel/oil spills, solid	• Strictly prohibit disposal of any type of waste disposal to nearby water bodies. • Proper treatment of existing surface water prior to use for drinking or any other direct use. • Suitable STP (Appendix 3) with tertiary treatment should be established and		-2		BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
waste and sewage disposal to water will affect the overall quality of the water. • People who use surface water for any domestic purpose may be affected by water borne diseases.	treated wastewater may be used as potable and non-potable water. • There should be separate waste treatment options for medical waste since a clinic has been proposed in the project area				
Biological Environment					
Ecological Resources					
Wetland Habitat: Deteriorate surrounding wetland ecosystems due to degradation of water quality for contamination of urban wastage	• To demark wetland area and keep connectivity with surrounding water bodies/rivers. • Enforce existing laws to prohibit waste disposal in all wetlands to retain good water quality	N/A	-4	-	DoE, Project Authority and Local Administration
Ecosystem Habitat: Convert habitat from grasslands to urban ecosystems due to	• Some grassland habitats and other important habitat areas should be conserved or retained for wildlife conservation.	Implement plantation with local plant species along the roadsides, unpaved areas and on the rooftop.	-3	-	BCS Housing Society and House owners

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
infrastructural development. Reduce grassland habitat and disturbance of grassland birds and other wildlives in developed land.	• **LID Rain Park:** Build detention basin and constructed wetland to manage storm water. Including the specific facilities of Detention Lawn, Constructed Wetland, Rain Garden, Bio retention, Dry Swale and Pervious Pavement. • **LID Dry Pond Park:** Create a sunken dry pond park to fulfil functions such as recreational activities and detention. Including the specific facilities of Dry Pond, Constructed Wetland, Rain Garden, Dry Swale and Pervious Pavement. **LID Public Space:** Build various LID facilities in major public & commercial area to enhance rainwater infiltration. Including the specific facilities of Vegetated Roof, Bio				

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	retention, Rain Garden, Detention Lawn, Pervious Pavement and Rainwater Tank (Figure 9.1).				

River sediment dredging

Using a dredger to excavate and clean the current contaminated sediment. After being fully stirred by a mixer, they can be used for embankment reinforcement, land filling and green planting.

Figure 9.6: Image of River Sediment Dredging

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency

Riparian buffer zone construction

Through the transformation of the environmental of the riverbank, a multi-layer vegetation zone composed of woodland and shrub grassland is built to buffer and protect the pollution into the river.

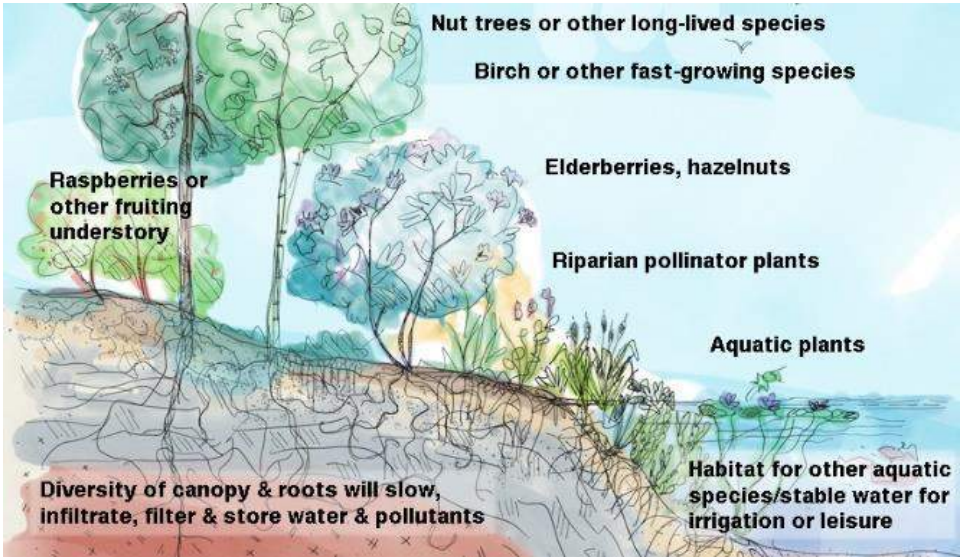


Figure 9.7: Image of Riparian Buffer Zone

- **Recirculating Constructed Wetland**

Through terrain optimization, planting aquatic plants in the shallow water area in the lakeside, adding filling material with strong pollutant adsorption capacity as necessary, to build lakeside recirculating constructed wetlands and purify lake pollution. Building pumping facilities in the wetland to strengthen the flow exchange capacity.

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency

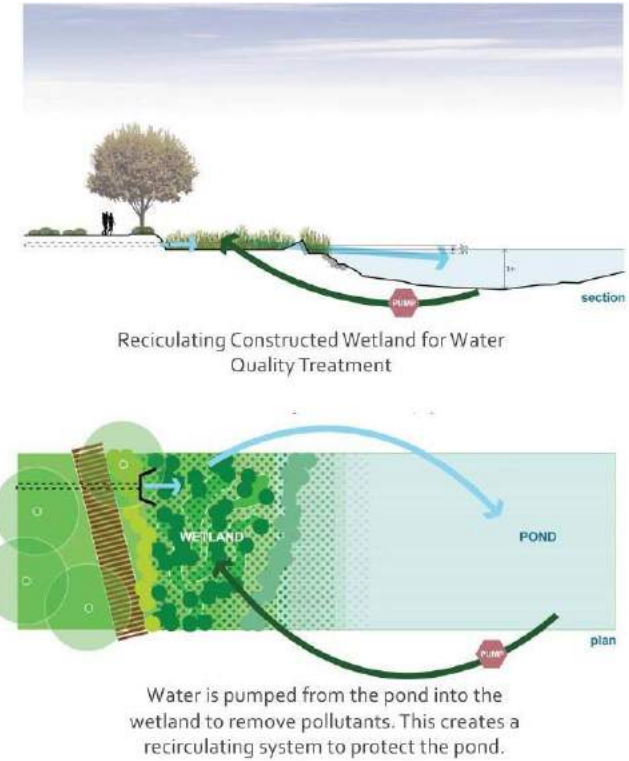



Figure 9.8: Image of Recirculating Constructed Weland					
Fisheries Resources					
Fish migration in the study area would be hampered	Connectivity should be restored between the river and khals through re-	-	-1	1.00	BIWTA or BWDB

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	excavation to keep fish migration functional. • A drainage network should be provided with fish-friendly outlets in the study area.				
Shrinkage of fish breeding and grazing grounds with deteriorated quality.	For facilitating breeding and grazing of the resident fishes a suitable reach of the Balu River should be declared as a fish sanctuary/ protected area/floating island marked with a sign board and red flag in consultation with DoF and BIWTA,	The proponent should compensate for the loss of the capture fisheries by purchasing a similar type of land at least an area of 2 (two) acres within or outside the project area for conserving fisheries -	-1	63.00	BIWTA and DoF

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency

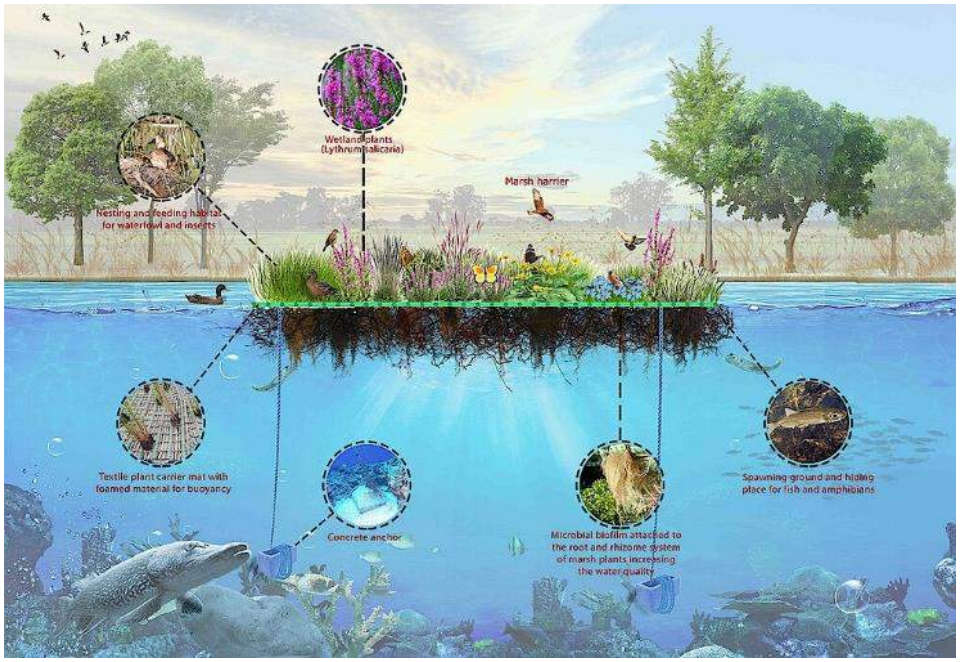



Figure 9.9: Typical example of a Floating island in the Khal and Balu river					
Socio-economic Environment					
Population Migration	More than 36500 people will be migrated in the project area and many people will be migrated around the project area	Civic facilities and utilities should be planned as per future needs in the study area	+5	-	BCS Housing Society

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	for service and other purposes.				
Employment Opportunities	A huge working opportunity will be created for all income-generating sectors after the development of the project	Priority should be given to engage the local people as far as possible.	+5	-	
Land Price	Land prices would increase rapidly since the area would get gradual urban flavour.	Ensure the land price follows the market price	+5	-	
Investment facilities	The investment opportunities will increase significantly in two ways. Firstly, people will invest in the housing sector. Secondly, they would also like to invest in commercial and industrial purposes within or close to the study area.	Ensure safe and secured investment	+5	-	
Waste Management	Generated solid waste will be transported to Secondary Transfer Stations (STS) from individual plots. The location of STSs has been proposed in the plot of the			-	

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	Integrated Waste Management Facility. The area of this site is about 4.19 khata. There will be four (04) compartments in this integrated waste management facility (IWMF); among which three compartments (03) will be used for the residential zone and one comportment (01) will be used for the hospital and commercial zone. Sufficient numbers of dustbins shall be placed along the road network and in public places (i.e., parks, playgrounds, etc.). A waste sorting facility will be constructed to process waste and recover material from commercial and household waste, including metals, glass, paper, textiles, and plastics, as well as domestic food waste, roads and building construction waste and electronic waste. Mechanical sorting technologies will be used to ensure effective and safe material recovery from industrial and household waste. The facility will screen, sort, shred, separate and store industrial and household solid waste to be recycled. The waste from this housing project includes waste from residential, administrative buildings, kitchens, green space, roads, utilities, etc. which will be at first segregated into biodegradable and non-biodegradable waste and will be put in separate bins. In front of every installation, two bins will be placed. Waste collectors (designated by the housing authority) will collect the waste from the bins and put it in a covered van/pick-up to avoid any spill-off. **Biodegradable waste/organic waste** will be directly sent to the compost plant which is proposed to be within the R/A. The compost can be used for manure gardening and any production purpose within the R/A. It is a way to cut down on the volume of waste materials at landfills or incinerators. Compost contains valuable nutrients that could replace and/or supplement the use of commercial fertilizers by homeowners. Further, the **non-biodegradable waste** should be segregated into recyclable and rejected waste. Recyclable waste should be sent to licensed traders for				

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	recycling and rejected waste should be disposed of in the landfill site that will be located outside the R/A. **Bio-Medical Waste Management** Biomedical waste will be generated from the onsite health care facilities within R/A. The wastes will be collected, sorted, and incinerated by the appropriate agencies, and monitored regularly by the housing authority. This agency will dispose of the inert (waste which is neither chemically nor biologically reactive and does not pose any threat to the environment and society) into the landfill site. Incineration includes complex machines that were designed to dispose of these materials effectively and responsibly in a manner that would prevent any spread of disease and reduce the amount of hazardous waste. **Solid Waste from Commercial Zone** In the commercial zone, each commercial unit should have three bins; • Biodegradable, • Non-biodegradable • Hazardous waste. The waste collector will collect waste and dispose of it accordingly. The hazardous waste will be collected by the appropriate agency and will be incinerated like bio medical waste. **E-Waste Management** There are authorized vendors for recycling e-waste in Bangladesh and they collect the e-waste. Department of Environment (DoE) with other relevant stakeholders will regulate the collection, recycling, refurbishing and				

Impact	Mitigation Measure	Enhancement/Contingency/Compensation	Residual Impact	EMP Cost (Lakh Taka)	Responsible Agency
	disposal of e-waste. Within R/A following points should be adopted by the commercial unit and others. • Leave e-waste in separate collection bins. • There can be a sorting point/site within R/A controlled by the approved collector, which should have an impermeable surface with the provision of spillage collection facilities. • Have signs to deposit e-waste to the respective container or area, prevent mixing of e-waste with other waste or allow contamination with hazardous material.				

** Low impact (1); Medium impact (2-3); High impact (4-5)*

9.4 Environmental Management Plan for operation Phase: Urban Environment

9.4.1 Occupational Health Safety for the Labourers

- A comprehensive Health and Safety Plan should be developed aimed in preventing accidents, injuries, and work-related diseases.
- First aid must be provided, and proper engagement procedures should be in place to access appropriate emergency facilities;
- Health screening of employees prior to labourers working on site and living in temporary accommodation facilities.
- All employees need to carry out induction health and safety training prior to the commencement of work.
- The construction contractor(s) should not hire people under the age of 18 on permanent contracts and should include short training activities for youth to the extent possible;
- Provide health insurance to the employees for the duration of their contracts;

9.4.2 Urban Civic Facilities

The baseline condition on civic facilities' (Chapter 5) only focused on the study area. Here a projection has been made to give an idea about the demand for urban civic facilities in terms of water demand, electricity demand, and waste generation. This projection is essential while planning and implementing different utility facilities within the project area. The total number of households in the housing area will be 2,826. Therefore, the projected total water demand for these households will be approx. 8 million litres per day (*Assuming 220 litres per person*), electricity demand 25 MW per day and gas demand will be 4000 cubic feet/ per hour. In addition, solid waste to be generated will be 1800kg/day (Assuming DCC Standard: 0.5 kg per person per day). Therefore, Khilkhet Housing Society should consider these demands while planning the development of utility facilities within the project area.

9.4.3 Transport and Traffic Facilities

According to TIA study, 300-feet highway is currently carrying traffic (1471 PCU/hr) within its capacity. The V/C ratio is found as 0.56 which indicates that there is no/ low congestion. After this residential area development, this volume will be 3138 PCU/hr (private cars will be the highest which will be 948 PCU/Hr) and the V/C ratio will be 1.5 which indicates severe congestion. The probability of a crash will be high in this congested traffic due to close following distances and unexpected stops and starts of other vehicles. Congestion will increase average emission rates when speeds are low. The emission includes pollutants such as lead, various types of particulate matter, oxides of nitrogen, and carbon which will pose different health risks. The following measures have been proposed to reduce/ minimize traffic impacts,

- All vehicles should comply with the relevant ECR 1997 standards and other rules.
- Personnel operating/ working close to the vehicles generating noise of ≥85 dB continuously for 8 hours or more should use ear muffs.
- Provision of proper maintenance works on traffic signs, lane marking, pedestrian crossing and instructions to guide people.
- Provision of parking facilities should follow the Dhaka Mega City Building Construction Rules, 2008.
- Greenbelts and plantations may be used to reduce noise levels.

- Every educational institution should have their own school and staff bus in the vicinity of the study area.

9.5 Environmental Monitoring Plan

9.5.1 Pre-construction Phase

In this phase, all land development plan along with drainage facilities of surface water should have to be approved by the concerned authority before implementation of the work.

9.5.2 Construction Phase

	Khilkhet Abson Prokolpo **BCS Housing Society** **Dhaka North City Corporation, Dhaka**	

EMP IMPLEMENTATION

Book No. _____ Monitoring Report No._____

Date:_____ Time:_____

Contract:_____

Contractor:_____

Work Sites (s):_____

A	DAILY EHS CHECKLIST	Yes	No	Score Yes=+5 No=-5	A	DAILY EHS CHECKLIST	Yes	No	Score Yes=+5 No=-5
1	Correct Disposal of excavation earthwork				12	Dispensary working, Doctor present			
2	Correct Disposal of Liquid Waste				13	Spoil earth dumping system			
3	Vehicles With No Smoke or Noise				14	Presence of Child Labour			
4	Vehicles Within Speed Limit				15	Labour camp location & management in order			
5	No Pollution from construction site				16	Drinking water and sanitation facilities for labour			

A	DAILY EHS CHECKLIST	Yes	No	Score Yes=+5 No=-5	A	DAILY EHS CHECKLIST	Yes	No	Score Yes=+5 No=-5
6	No Oil/Diesel Spills on Land/water				17	Disrupt road communication			
7	No Social Issue Created				18	No Burning of wood in camp			
8	Any Threat Caused to a residential area				19	Women wage			
9	Safety dress, helmet and field boots used				20				
10	Health precautions taken				21				
11	Keeping a first Aid Box in every labour shed				22				

B. EXPLANATION (of any of the above points) **Total Scores = _____%**

C. NON COMPLIANCE:

Non Compliance # **Period Description**	**Class**
	1. Minor: Under One Month (Contractor alerted)
	2. Moderate: Over One Month but under Two Months (Contractor warned)
	3. Major: About Two Months (Contractor's local bill withheld by RE* till compliance)
	4. Critical: Over Three Months (Contractor's overall bill withheld by RE and PM* till compliance)

D. CIRCULATION

1) DG, DoE 2) **President, Khilkhet Housing Project** 3) **Chief Engineer**, RAJUK

4) **Chief Engineer**, North City Corporation; 4) Resident Engineer**, Khilkhet Housing Project**,

Field EHS* Monitor of Consultant

(Full Name & Signature)

Field EHS Expert of Contractor

(Full Name & Signature)

*EHS- Environment Health & Safety

*****RE – Resident Engineer

***ES – Environmental Supervisor of Consultants.**

9.5.3 Post-construction Phase

g. Water Resources

Table 9.4: Monitoring Plan for Water Resources

Indicator	Method	Location	Frequency	Monitoring Cost (Lakh Tk./ Year)*	Responsible Agency
Water level of khal within the project area	To check the availability of water	Housing project Khal	Monsoon season and dry season (up to 5 years after the completion of the project)	0.50	BCS Housing Society and Welfare Society of Khilkhet Housing area
Flooding pattern	To check the water level each year	Entire khals of the study area	Monsoon season (up to 5 years after the completion of the project)	2.50	BCS Housing Society and Welfare Society of Khilkhet Housing area
Drainage congestion	• Before the rainy season, the entire drainage network system both inside and outside of the housing project should be cleaned from urban wastage, debris, solid waste etc. (off-site monitoring) • During monsoon, the water draining	• Intersection points of road network and manholes. • Upstream of Balu River and drainage outlets of the project area	Pre-monsoon and monsoon season (up to 5 years after the completion of the project)	2.00	BCS Housing Society and Welfare Society of Khilkhet Housing area

Indicator	Method	Location	Frequency	Monitoring Cost (Lakh Tk./ Year)*	Responsible Agency
	out pattern should be checked along with if any problems arise to drain out rainwater				
			Total	**5.00**	

h. Biological Environment

Table 9.5: Environmental Monitoring Plan for Ecological Resources

Indicator	Method	Location	Frequency	Monitoring Cost (Lakh Tk./ Year)*	Responsible Agency
Wetland area	Direct observation	Entire project and study area	Quarterly in a Year (3 Months After 3 Months)	5.00	DoE and BCS Housing Society
Vegetation Coverage					
Wildlife species composition	Direct observation			2.00	
			Total	**7.00**	

Table 9.6: Environmental Monitoring Plan for Fisheries Resources

Indicator	Method	Location	Frequency	Yearly Monitoring Cost (Lakh Tk.) *	Responsible Agency
Fish habitat status	Habitat observation	Balu river	Twice per year. (Will continue for 5 years after completion of the project)	4.00	A Consortium of BCS Housing Society, RAJUK and DoF by engaging Consultant
Fish migration	Catch monitoring, RRA and FGD	Balu River	Two months fortnightly e.g., May and June, per year. (Will continue 5 years after completion of project activities).	1.50	A Consortium of BCS Housing Society, RAJUK and DoF by engaging Consultant
		Inside the housing Khal			
			Total	**5.50**	

The total monitoring cost for fisheries resources is BDT 6.50 Lakhs only.

9.5.4 Environmental Quality

Table 9.7: Monitoring Plan for Air, Noise and Water Quality

Indicator	Method	Location	Frequency	Yearly Monitoring Cost (Lakh Tk) *	Responsible Agency
Noise	Use Noise meter	The project area, and 300 feet road	Weekly	1	BCS Housing Society
Air	The method used for measuring the base condition of air	300 feet road	Twice in a year	4	BCS Housing Society (BCS Housing Society may appoint any to any firm measuring air quality)
Water quality	Different analytical methods as used for measuring the base condition of water	Balu river	Monthly	2	DoE
			Total	**7**	

Total monitoring cost: BDT 24.50 lakh per year

10. Conclusion and Recommendation

10.1 Conclusion

This EIA report is a legal requirement and obligation for this project since the project area is in the general flood plain as per DAP where any type of urban residential development essentially requires prior permission from RAJUK as per DAP 2016 to 2035. The information and data presented in this EIA report are based upon field surveys and public consultation meetings and specific data obtained and gathered from relevant organizations/institutions in the study area in line with the Environmental guidelines and other legislation of Bangladesh.

On critical review of the potential environmental impacts, specific mitigation and monitoring measures have been proposed. The findings revealed that major IECs adversely affected during the implementation of the project are drainage congestion, groundwater depletion, environmental quality, fish habitat and production, and wetland habitat. The anticipated adverse effects should be controlled and minimized through the adoption of suggested mitigation measures and implementation of the Environmental Management Plan (EMP) during the construction, operation, and maintenance phases of the project.

10.2 Recommendations

The major EMP measures suggested and recommended for proper implementation of the proposed project without any environmental hazards to the proposed location are provided:

- Re-excavation of existing khals inside the study area for quick drainage and fish migration.
- Associated facilities for urbanization like roads and drainage facilities should be provided with fish-friendly structures like fish-friendly culverts, outlets etc. in the study area.
- Rainwater Harvesting (RWH) facilities would be kept in the individual households of the project to reduce the underground water use for domestic purposes.
- Greenbelts and plantations or LID concepts mentioned in the EMP measures would be implemented to reduce noise levels and drainage problems during heavy rainfall. All the plantations in the project area will be followed considering the local floral species.
- Use of mask by workers where the noise level is ≥85 dB continuously for 8 hours or more. Other compliances under rules and laws are to be followed stringently.
- Balu River should be declared as a fish sanctuary/protected area marked with a signboard and red flag in consultation with DoF and BIWTA.
- Awareness building program on natural resources enactment, re-enforcement of fisheries laws and regulations, etc.
- Demarcation of wetland area and maintaining connectivity with the surrounding water bodies and rivers in the study area.
- Existing canal alignment must be free from all kinds of landfilling and their connectivity with surrounding major water bodies and rivers should be conserved. The riparian buffer zone would be maintained by both banks of the Balu River.
- Local labourers should get priority during construction works.
- Compliance with all the national rules/ acts/ standards.

While undertaking any project, it is important to prioritize environmentally-friendly practices. This can be achieved by properly operating and maintaining infrastructure, implementing mitigation measures, and regularly monitoring environmental quality parameters. The extent of environmental damage caused by the project depends on how well the authority fulfils its environmental responsibilities, enforces compliance, and implements the monitoring program. It is essential to understand that no development project can entirely avoid any adverse environmental impact. However, by minimizing negative impacts through proper management and appropriate control measures, as proposed and recommended for this project, the positive impacts can be maximized. Achieving this goal will require careful consideration and financial investment.

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Appendix 1: List of Participants in the Public Consultation Meeting

Participant List

Stakeholder Consultation Meeting

Environmental and Social Impact Assessment (ESIA) Of Khilkhet Abason Prokolpo

Location: Date:

Sl No.	Name	Occupation/Designation	Mobile no.	Signature
01	Md. Abul Fazal Mir	Joint Secretary, MoHPA	01712-156373	[signature]
02	Md. Shibli Sadique	ADC (R)	01616121111	[signature]
03	Md. Kidkat Hossain	SrE.D (Parliament)	01733892409	[signature]
04	Kazi Kamrull Hasan	Principal Specialist, CEGIS	01720054692	[signature]
05	M.A. Muhaimin Al Zohan	AD, BIAM Foundation	01733 990436	[signature]
06	Md. Tyfur Rahman	AD, BIAM found.	01734464886	[signature]
07	Md. Atiqur Rahman	Associate specialist, CEGIS	01717888569	[signature]
08	Md. Ashin Mawla	Associate Specialist CEGIS	01716198860	[signature]
09	Abdul Hakim Farhad	Research Associate CEGIS	01840675675	[signature]

Center for Environmental and Geographic Information Services (CEGIS)
(A Public Trust Under Ministry of Water Resources)

Sl No.	Name	Occupation/Designation	Mobile no.	Signature
10	[illegible]	কমিশনার	01819-217909	[illegible]
11	[illegible]		01611-798011	[illegible]
12	[illegible]		01816-368610	[illegible]
13	[illegible]		01922-791928	[illegible]
14	[illegible]			[illegible]
15	[illegible]			[illegible]
16	[illegible]		01922-558376	[illegible]
17	[illegible]		01935-128626	MOYNUL DEWAN
18	[illegible]			[illegible]
19	[illegible]		01759-219762	[illegible]
20	[illegible]		01824439313	[illegible]

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৭	রেজাউল করিম		01916-510979	
২২	মোঃ রমজান মিয়া			মোঃ রমজান
২৩	মোঃ সাজিদ হোসেন			
২৪	[illegible]			
২৫	সাজিদ			
২৬	সজিব		০৭৪০৩৬৩৪৫৯৪	
২৭	মহিবুল			
২৮	রমজান		01829974501	
২৯	সুধাংশু বিশ্বাস		0	
৩০	আসলাম		01866434846	
৩১	সাজিদ			

Sl No.	Name	Occupation/Designation	Mobile no.	Signature
32	[illegible]			[illegible]
33	[illegible]		01926186957	[illegible]
34	[illegible]			[illegible]
35	[illegible]		01969273981	[illegible]
36	[illegible]		01966191592	[illegible]
37	[illegible]		01947253743	[illegible]
38	[illegible]			[illegible]
39	[illegible]		01913006279	[illegible]
40	[illegible]			[illegible]
41	[illegible]		01568321217	Akash
42	[illegible]		01405680304	[illegible]

Sl No.	Name	Occupation/Designation	Mobile no.	Signature
43	মো: রিপন মিয়া		01978068877	Ripon
44	মো: তুহিন হোসেন		01540183667	তুহিন
45	মো: ফয়সাল		01721216295	Faisal
46	জোবায়েদ রহমান		~~01968983~~ 0196 5983621	জিসান
47	আমিনুল ইসলাম		01816108330	[illegible]
48	মো: আলিম উদ্দিন		01914-381295	আলিম
49	আনোয়ার হোসেন		01927119049	Anwar
50	মো: রুহুল আমিন		~~01812~~ 01812-332742	[illegible]
51	মো: ইকবাল হোসেন		01922385797	ইকবাল
52	রাকিবুল ইসলাম		01825561882	Rakibul
53	S M Jahidul Islam	AO BCS Admin Housing	01723-428282	[illegible]

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Appendix 2: Plantation Plan

Plantation Plan for Land Development Project

Plants are important biotic components of an ecosystem for maintaining the ecological balance of an area. Urbanization is a process which causes huge damage to natural vegetation and wetland degradation. A good plantation plan can recover the loss of vegetation damage to some extent and provide services to keep the ecosystem balanced.

In an urban area, there is a scope to implement plantation along the roads and avenue sides, lakes and park sides, and unpaved areas of buildings sides. In addition, there is a good prospect of rooftop plantations which may arrest vegetation damage due to infrastructural development.

Plantation plans for land development and urbanization projects should give importance to consider the following major issues:

- Land suitability of planted tree species
- The extent and height of the canopy of the selected plant species
- Aesthetic and economic value
- Preference of local wildlife for their habitat suitability
- Capability of dust and sound arrest

In this endeavour, this plantation plan has been prepared considering the species composition of natural vegetation that existed before land development. Providence of food and shelter for local wildlife, the extent of canopy area and canopy density have also been considered. In addition, the ornamental/ aesthetic value of a plant species has been given importance.

For this project, the authority can implement the following major types of plantations with the mentioned selected plant species to maintain green cover as well as the ecological viability of the land-developed area.

Avenue Plantation: This type of plantation should be implemented along the primary roadsides and their dividers. Tall timber tree species like Chambol, Rendi koroi, Sada Koroi, Mehogani etc can be planted along the footpath if there is no overhead electric line. On the roadside where overhead electric lines exist, medium-height and densely canopy trees can be planted. Road dividers can be planted with ornamental shrubs and small bushy plants. This type of plant will contribute to increasing scenic beauty and arrest dust and sound from vehicular movement. Table A.1 provides a list of suggested plant species for the avenue plantation.

Table A1: Preferable Major Plant Species for Avenue (Primary Road) Plantation

Scientific Name	Local Name	Plant Type	Importance
Plantation alignment: Roadside without overhead electric line			
Albizia richardiana	Chambol/Raj Koroi	Tall timber tree	Single trunk, canopy expansion is far above the ground, dense leaf provides good shade, enough flexibility during the storm, small compound leaf do not create litter on road, support raptors bird habitat
Albizia Saman	Rendi Koroi	Tall timber tree	Expansion of canopy is a high, single trunk, good wood value, mortality is low, support raptors and various local bird habitat
Albizia procera	Shada Koroi	Tall timber tree	Single trunk, good wood value

Scientific Name	Local Name	Plant Type	Importance
Swietenia mahogany	Mahogany	Medium-height timber tree	High wood and medicinal value, fast-growing, canopy area is limited, able to protect windstorms
Plantation alignment: Roadside with overhead electric line			
Alstonia macrophyla	Chatim	Medium height tree	Dense and limited canopy, bird-friendly, fast-growing
Delonix regia	Krishnochura	Medium-height ornamental tree	Dense shade and wide canopy, scenic beauty of flowering season, medium height
Azadirachta indica	Neem	Medium-height timber and medicinal tree	Medicinal, fruits as the fodder of birds, dust receptors and air purifiers, and small leaves do not create litter on the road
Plumeria alba	Kath Golap	Medium-height flowering tree	Scenic beauty for its flower, broad leaves provide wide shade, limited canopy height
Peltophorum inerme	Kanakchura	Medium-height timber and flowering tree	Scenic beauty for its flower, small compound leaf that does not create litter on the road, dense shade
Plantation alignment: On the Road divider and islands			
Polyalthia longifolia var pendula	Weeping Debdaru	Small height tree	Small basal area, single trunk, cone shape canopy needs small area, dense long leaf act as sound and dust barrier
Murraya paniculata	Kaminy	Medium-height Flowering shrub	Limited canopy width and height, aesthetic value for its flower
Cestrum nocturnum	Hasnahena	Low-height flowering shrub	Limited canopy width and height, aesthetic value for its flower
Nyctanthus arbor-tristis	Shewly	Medium-height Flowering shrub	Limited canopy width and height, aesthetic value for its flower
Bougainvillea glabra	Baganbilash	Low-height ornamental shrub	Scenic beauty for its coloured leaves, provides a habitat for small birds and reptiles
Dypsis lutescens	Erica palm	Low height monocot	Small basal area, scenic beauty as small palm
Areca catechu	Supari	Medium height monocot	Small basal area, fruit as fodder by flying mammals
Mimusops elengi	Bakul	Low-height flower and timber tree	Limited canopy width and height, aesthetic value for its flower, dense shade, dust receptor
Lagerstroemia speciosa	Jarul	Low height flower tree	Scenic beauty for its colored flower, limited canopy width and height

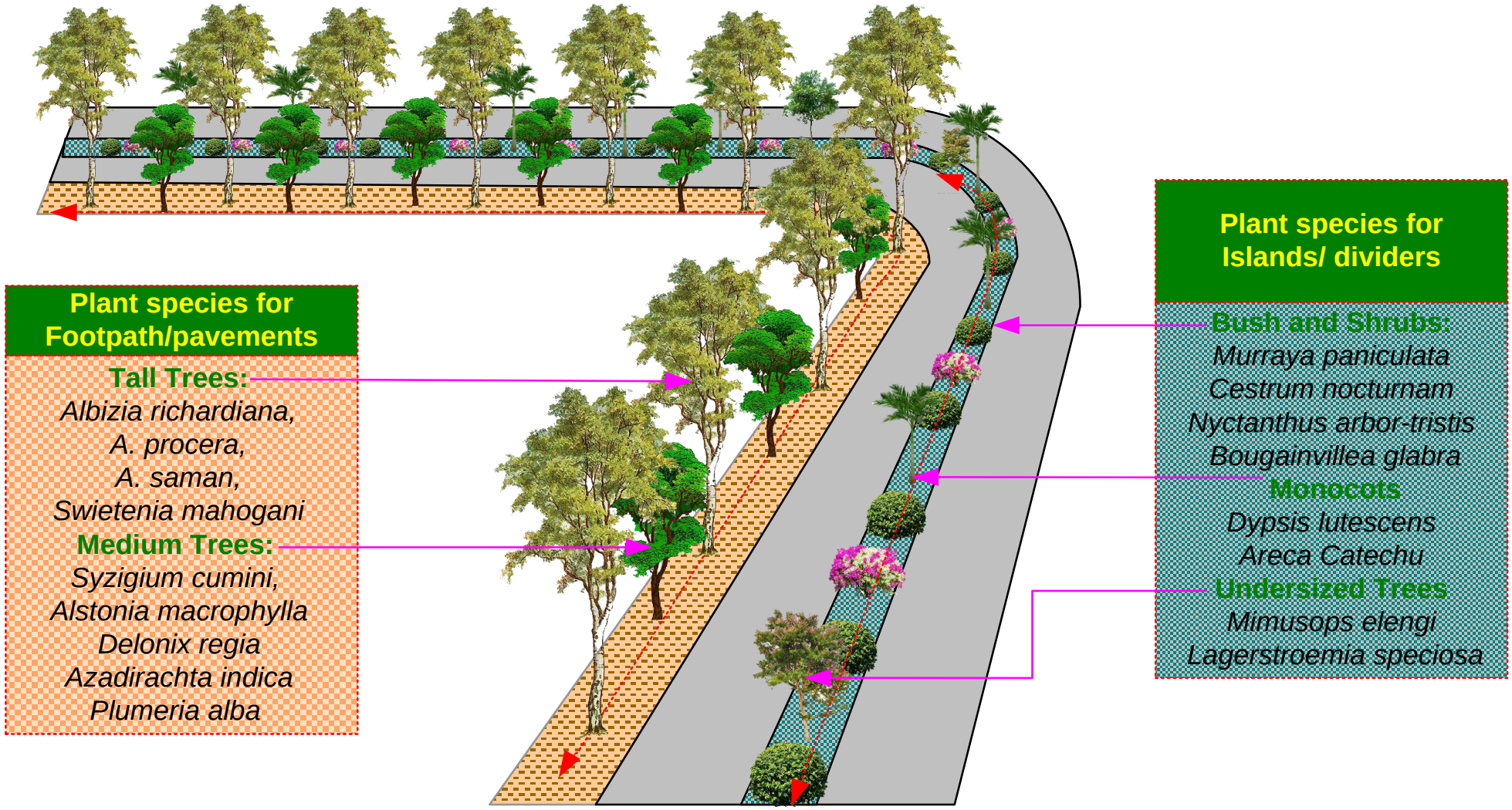

Figure: Avenue Plantation

Residential roadside Plantation: Usually residential roadsides (secondary roadsides) are occupied by small unpaved areas where medium-height timber and fruit-yielding trees are suggested for plantation. Suggested plant species and their importance are listed in Table A.2 below.

Table A.2: Preferable Major **Plant Species for Residential Roadside Plantation**

Scientific Name	Local Name	Plant Type	Importance
Azadirachta indica	Neem	Medium-height timber and medicinal tree	Medicinal, fruits as fodder for birds, dust receptors and air purifiers, small leaves do not create litter on the road
Delonix regia	Krishnachura	Medium-height ornamental tree	Dense shade and wide canopy, scenic beauty of flowering season, medium height
Mesua ferrea	Nageswar	Medium-height timber tree	Dense leaves and limited canopy, good wood value, provide habitat for sparrow, myna etc.
Areca catechu	Supari	Medium height monocot	Small basal area, fruit as fodder by flying mammals
Swietenia mahogany	Mahogany	Medium-height timber tree	High wood and medicinal value, fast-growing, canopy area is limited, able to protect windstorms
Polyalthia longifolia	Debdaru	Medium-height timber tree	Single trunk, limited canopy, fruits as fodder for bird
Peltophorum inerme	Kanakchura	Medium-height timber tree	Dense shade and wide canopy, scenic beauty of flowering season, medium height
Terminalia catapa	Kathbadam	Medium-height shade tree	Broadleaf, wide canopy, fruit as fodder for squirrels, bats and birds

Residential building side Plantation: Local fruit-yielding plants have been given preference to plant at the residential building side to meet fruit demand, give the building shade from sunlight as well as provide habitat and feed for local wildlife. Both trees and shrubs with two species of monocot can be planted. There is a scope of plantation by seasonal and perennial ornamental and flowering plants in front of buildings. Selected plant species are mentioned in the following table.

Table A.3: Preferable Major Plant **Species for Residential Building Side Plantation**

Scientific Name	Local Name	Plant Type	Importance
Cocos nucifera	Narikel	Tall fruit-yielding monocot	Small basal area, year-round fruit, canopy height above ground
Mangifera indica	Aam	Medium-height fruit yielding tree	Delicious fruit, medium timber value, fruit as food for all types of wildlife
Psidium guajava	Peyara	Low height fruit yielding tree	Delicious fruit, small canopy width, early productive
Musa sp	Kola	Low height monocot	Delicious fruit, short-time production, small basal area

Scientific Name	Local Name	Plant Type	Importance
Carica papaya	Pepey	Low height fruit yielding plant	Minimum basal area, single trunk, short time production, multiple use of fruit, bird feeds
Anona squamosa	Ata	Low height fruit yielding tree	Delicious fruit, small canopy
Citrus maxima	Jamboora	Medium-height fruit-yielding tree	Delicious fruit, medium canopy
Syzygium cumini	Jaam	Medium-height timber and fruit-yielding tree	Delicious fruit, good wood value, fruit as feeds for birds and other animals
Artocarpus heterophyllus	Kanthal	Medium-height timber and fruit-yielding tree	High wood value, canopy height is limited, dense broad leaf, seasonal fruit, provide shelter for birds and squirrels
Dillenia pentagyna	Chalta	Medium-height timber fruit-yielding tree	Broadleaf, wide low-height canopy
Plumeria rutia	Kath Golap	Medium-height flowering tree	Scenic beauty for its flower, broad leaves provide wide shade, limited canopy height
Zizyphus sp	Kul/Boroi	Low height fruit yielding tree	Delicious fruit, fruit as feeds for birds and other animals
Litchi chinensis	Lichu	Low height fruit yielding tree	Delicious fruit, fruit as feeds for birds and other animals
Phylanthus emblica	Amlaki	Low height fruit yielding tree	Medicinal Fruit
Averrhoa carambola	Kamranga	Low height fruit yielding tree	Delicious fruit, food for birds and bats
Nerium odorata	Korobi	Flowering shrub	Scenic beauty for its seasonal flower, small low-height canopy

***Rooftop plantation*:** Rooftop plantation can contribute to increasing vegetation coverage of the urban area which is permanently damaged due to infrastructure development. Plant species with small roots and low height should be selected for this plantation that can grow in plant tubs. Both aesthetic and fruit-yielding values are considered for these purposes. The following plant species can be selected for building rooftop plantations.

Table A.4: Major Selected **Plant Species for Rooftop Plantation**

Scientific Name	Local Name	Plant Type	Importance
Citrus medica	Pati lebu	Fruit yielding shrub	Limited shade, daily use of fruit, short-time production
Zizyphus sp	Kul/Boroi	Low height fruit yielding tree	Delicious fruit, fruit as feeds for birds and other animals
Psidium guajava	Peyara	Low height fruit yielding tree	Delicious fruit, small canopy width, early productive
Corium variagatum	Patabahar	Small shrub	Colourful leaf round the year

Scientific Name	Local Name	Plant Type	Importance
Bougainvillae sp	Baganbilash	Low-height ornamental shrub	Scenic beauty for its coloured leaves, provides a habitat for small birds and reptiles
Dypsis lutescens	Erica Palm	Low height monocot	Small basal area, scenic beauty as small palm

Besides these different types of seasonal vegetables can be cultivated on roof tops and balconies of the buildings.

Canal side/lakeside Plantation: Flood-tolerant tree species like Jarul, Hijol, borun, koroach etc. are suggested for the canal side near water. On the other hand, the walkway and other unpaved areas of lakeside which are far from water, can be planted with ornamental and shade trees. These types of plant species will increase the aesthetic beauty of the lakeside and protect canal bank erosion. Shapla and Singara can be planted in Shallow areas of the canal to facilitate fish and aquatic avifaunal habitats. Some major suggested plant species for canal-side plantation are mentioned in the following table.

Table A.5: Suggested **Plant Species for Canal Side Plantation**

Scientific Name	Local Name	Plant Type	Importance
Plantation Alignment: Canal bank Near Water			
Lagerstroemia speciosa	Jarul	Low-height flower tree	Scenic beauty for its coloured flower, limited canopy width and height
Pongamia Pinnata	Koroach	Medium-height evergreen tree	Flood tolerant, evergreen leaf, beautiful seasonal flower, vegetative propagation, wildlife-friendly, wave protector
Trewia nudiflora	Pitali	Medium-height evergreen tree	Flood tolerant, broad leaf, bird-friendly
Crataeva nurvala	Baroon/Banya	Medium-height evergreen tree	Flood tolerant, beautiful seasonal flower, bird-friendly
Barringtonia acquitangula	Hizol	Low-height evergreen tree	Flood tolerant, beautiful seasonal flower, fish and bird friendly
Trema orientalis	Charcoal Gach	Medium-height evergreen tree	Flood tolerant, fruit as bird feeds for year-round
Anthocephalus sp	Kadom	Medium-height evergreen tree	Flood tolerant, beautiful seasonal flower, broad leaf
Ficus hispida	Dumur	Small shrub	Flood tolerant, fruit as feeds for small birds, nesting habitat for tailor bird
Plantation Alignment: Canal bank far from Water/walkway/unpaved area of canal side			

Scientific Name	Local Name	Plant Type	Importance
Phoenix sylvestris	Khejur	Medium height monocot	Small basal area, single canopy above ground, fruits as feeds for birds and shrews
Delonix regia	Krishnachura	Medium-height ornamental tree	Dense shade and wide canopy, scenic beauty of flowering season, medium height
Butea monosperma	Palash	Medium-height ornamental tree	Scenic beauty for its seasonal coloured flower, broad leaf, bird-friendly
Mesua ferrea	Nageswar	Medium-height timber tree	Dense leaf and limited canopy, good wood value, provide habitat for sparrow, myna etc
Alstonia scholaris	Chatim	Medium height tree	Dense and limited canopy, bird-friendly, fast-growing
Mimusops elengi	Bakul	Low-height flower and timber tree	Limited canopy width and height, aesthetic value for its flower, dense shade, dust receptor
Syzigium cumini	Jaam	Medium-height timber and fruit-yielding tree	Delicious fruit, good wood value, fruit as feeds for birds and other animals
Cassia fistula	Sonalu	Medium-height ornamental tree	Scenic beauty for its yellow flower

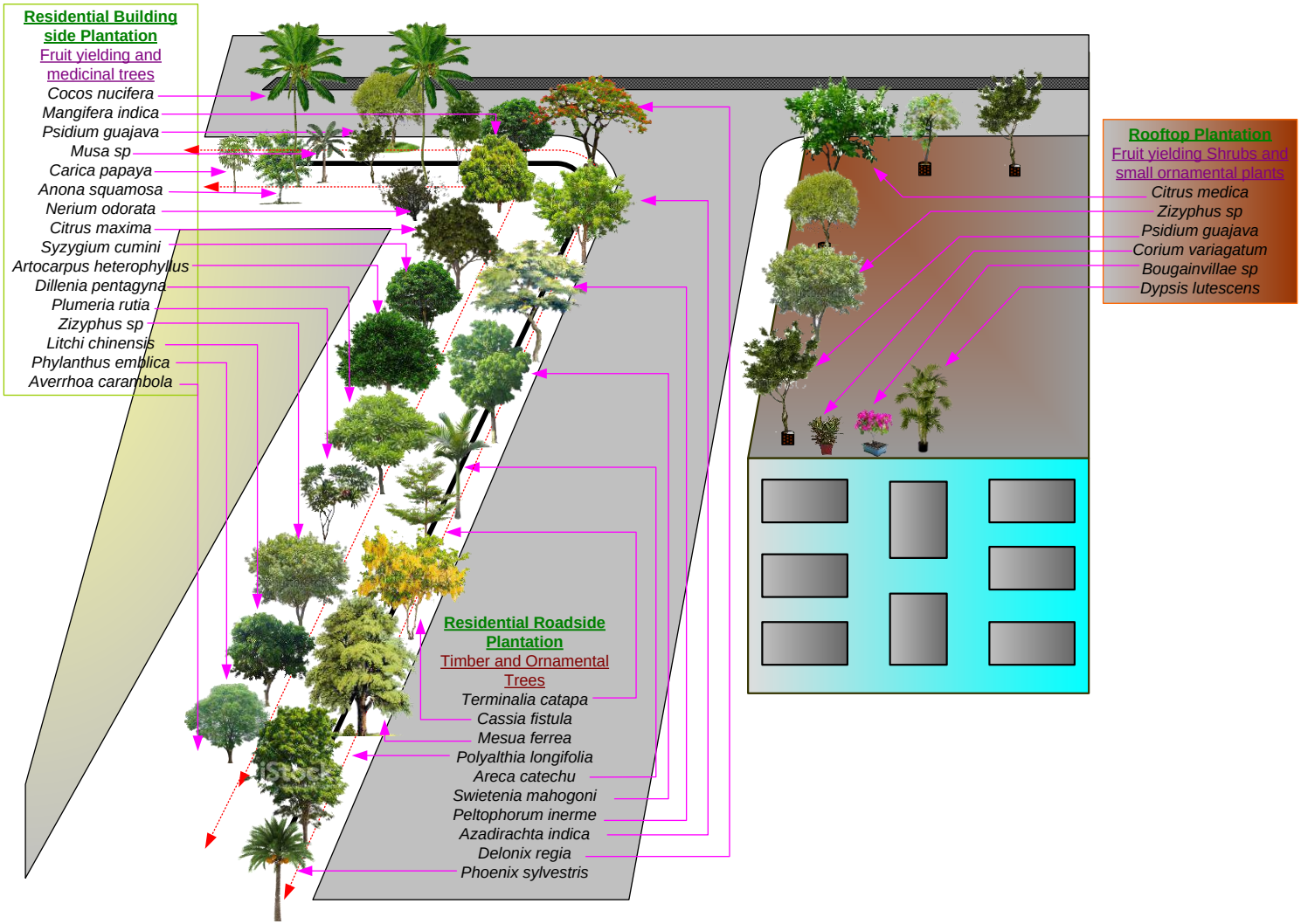

Figure: Residential Building, Roadsides and Rooftop Plantation

Parkside Plantation: Ornamentals and shade trees are mainly suggested for the Parkside plantation. Both aesthetic and ecological importance are given preference to select the plant species in this regard. Some of the major selected species are listed in the following table.

Table A.6: Preferable Plant Species for Park Side Plantation

Scientific Name	**Local Name**	**Plant Type**	**Importance**
Ficus benghalensis	Bot	Large shade tree	Wide shade, fruit as feeds for numerous birds
Roystinia regia	Palm	Tall Monocot	Small basal area, scenic beauty
Cocos nucifera	Narikel	Tall fruit yielding monocot	Small basal area, year round fruit, canopy height above ground
Borassus flabellifer	Tal	Tall fruit yielding monocot	Broad leaf, long shade, bird habitat
Salmalia malabarica	Shimul	Tall tree	Scenic beauty for its seasonal colored flower
Terminalia catappa	Kathbadam	Medium height shade tree	Broad leaf, wide canopy, fruit as fodder for squirrel, bats and birds
Meloccana bambusoides	Muli Bansh	Bushy monocot	Bushy, habitat for small birds
Dypsis lutescens	Erica palm	Low height monocot	Small basal area, scenic beauty as small palm
Azadirachta indica	Neem	Medium height timber and medicinal tree	Medicinal, fruits as fodder of birds, dust receptor and air purifier, small leaf do not create litter on road
Butea monosperma	Palash	Medium height ornamental tree	Scenic beauty for its seasonal colored flower, broad leaf, bird friendly
Mimusops elengi	Bakul	Low height flower and timber tree	Limited canopy width and height, aesthetic value for its flower, dense shade, dust receptor
Delonix regia	Krishnochura	Medium height ornamental tree	Dense shade and wide canopy, scenic beauty of flowering season, medium height

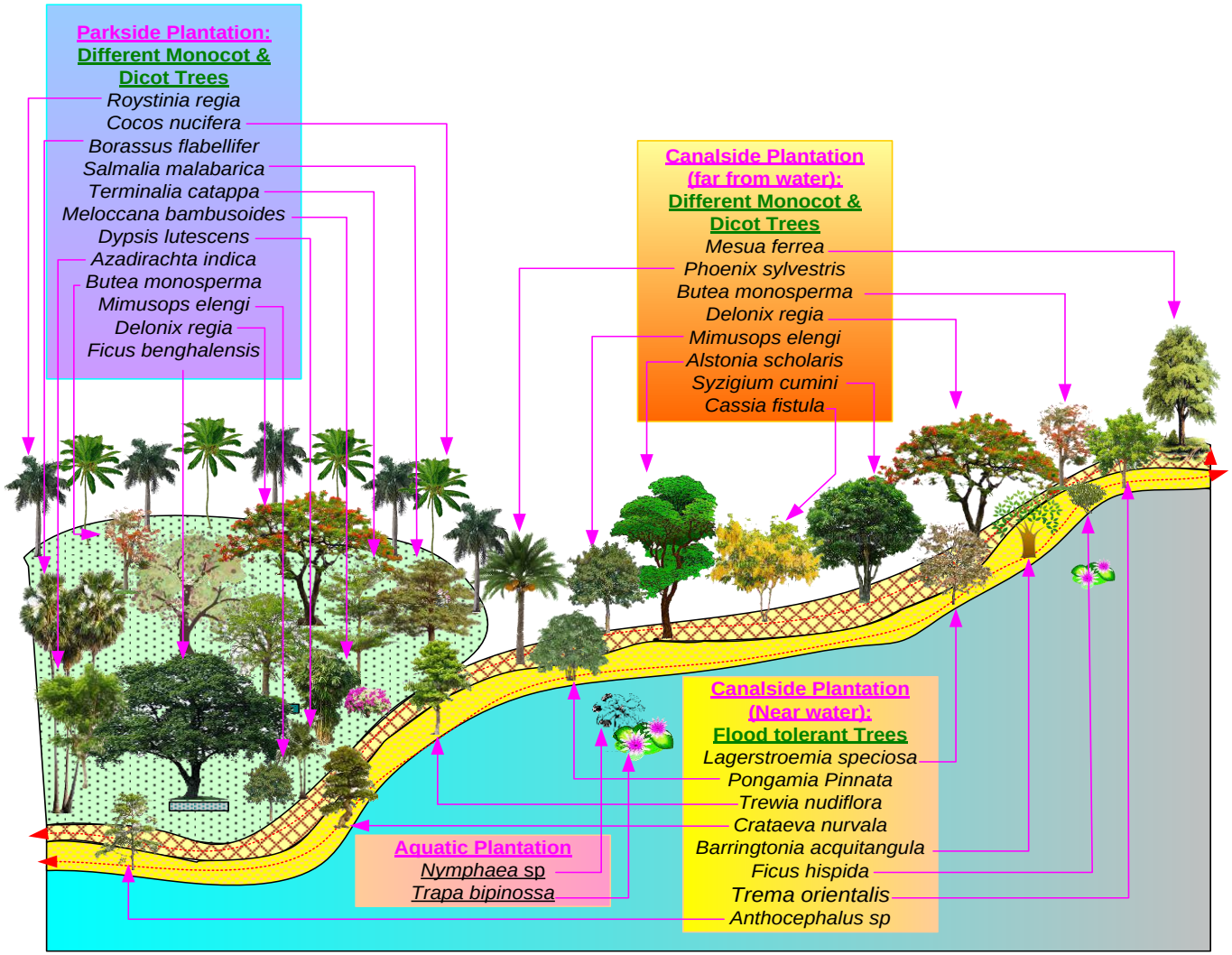

Figure: Lakeshore and Parkside Plantation

Appendix 3: Sewerage Treatment Plant

1. Sources of Sewerage Wastewater

The development of new residential areas becomes a necessity to accommodate growing urban populations. Approximately 36,000 people will live in the proposed housing area in the future. The amount of wastewater generated from the communities will be around 11.71 MLD. Approximately 1.12 TPD of sludge will be generated from the above-mentioned wastewater produced in the housing area. The amount of sludge will vary depending on which specific treatment technology will be used to treat the sewerage wastewater, as different treatment methods can result in different amounts of sludge production.

While planning for housing and infrastructure is crucial, it is equally important to consider the management of wastewater generated by these communities for a better environment. Understanding the sources of wastewater for a proposed housing area is a fundamental step in designing an effective sewage and treatment system.

Wastewater, often referred to as sewage, originates from various sources within a residential area. It encompasses a diverse mix of liquid and solid waste, including human waste, household grey water, and more. Here, we explore the primary sources of wastewater that will be generated from the proposed residential area. The sources of wastewater from the proposed project area are given below briefly.

i. **Residential Areas**:

Households: Domestic wastewater from homes, including water from toilets, sinks, showers, bathtubs, washing machines, and dishwashers.

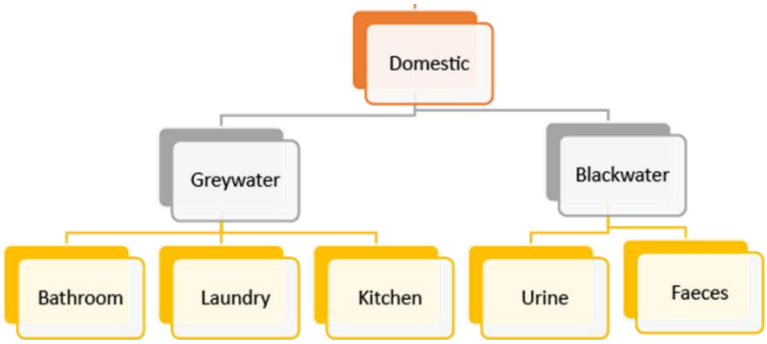

Figure 1: Sources of Domestic Wastewater

Hospitals and Healthcare Facilities: Medical facilities produce medical wastewater containing contaminants from patient care, laboratories, and other sources.

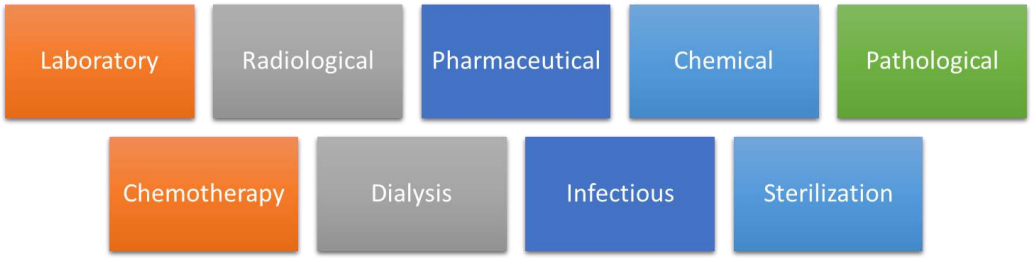

Figure 2: Sources of Medical Wastewater

Schools and Educational Institutions: The specific types and volumes of wastewater generated in schools and educational institutions can vary widely depending on the institution's size, activities, and facilities.

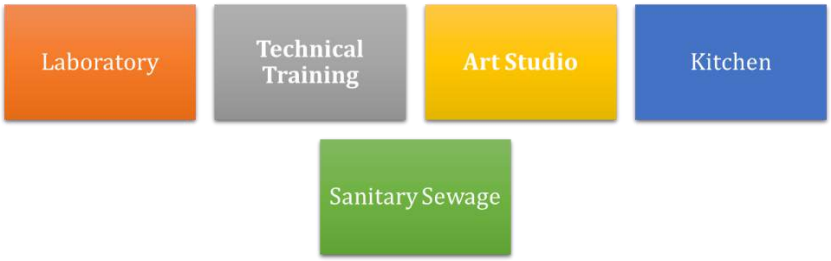

Figure 3: Sources of Educational Institutions Wastewater

ii. **Commercial and Business Areas**:

- **Restaurants and Cafes**: Commercial kitchens and food service establishments produce wastewater with organic matter and grease.
- **Shopping Centers**: Wastewater from restrooms, janitorial activities, and any food courts or dining areas.
- **Office Buildings**: Wastewater generated from restrooms and kitchenettes.
- **Kitchen Market**: Vegetables, Fish, and slaughterhouse produce wastewater.

2. Method of Sewerage Treatment

There are various methods and technologies used in sewage treatment to remove contaminants and pollutants from wastewater. Each type has its characteristics and suitability depending on specific requirements and environmental considerations. Types of sewage treatment are given below.

- Activated Sludge Plant
- Trickling Filter Plant
- Rotating Biological Contactor (RBC) Plant
- Extended Aeration Plant
- Sequential Batch Reactor (SBR) Plant
- Constructed Wetland Treatment Plant
- Membrane Bioreactor (MBR) Plant
- Chemical Treatment Plant
- Septic Systems

Determining which sewage treatment plant is better for the environment depends on various factors, including specific circumstances, local regulations, and environmental goals. Each type of sewage treatment plant has its advantages and disadvantages in terms of environmental impact. **Above mentioned treatment plant, Biological Treatment Plants (e.g., Activated Sludge) are suitable for the proposed housing area considering regulation and environmental goals**.

Biological Treatment Process

Biological treatment processes for sewage water are designed to use microorganisms to break down organic contaminants and reduce the concentration of nutrients like nitrogen and phosphorus. These processes rely on the natural abilities of bacteria, fungi, and other microorganisms to digest and convert pollutants into less harmful forms. There are many biological treatment processes used in wastewater treatment, among them activated sludge process is very popular around the world. The activated sludge process for wastewater treatment of the proposed housing area is given below briefly.

Activated sludge process for wastewater treatment.

The activated sludge process is a biological wastewater treatment process that uses microorganisms to break down organic matter in wastewater. It will be a good option for sewerage treatment of the proposed housing area. The process will consist of two main steps:

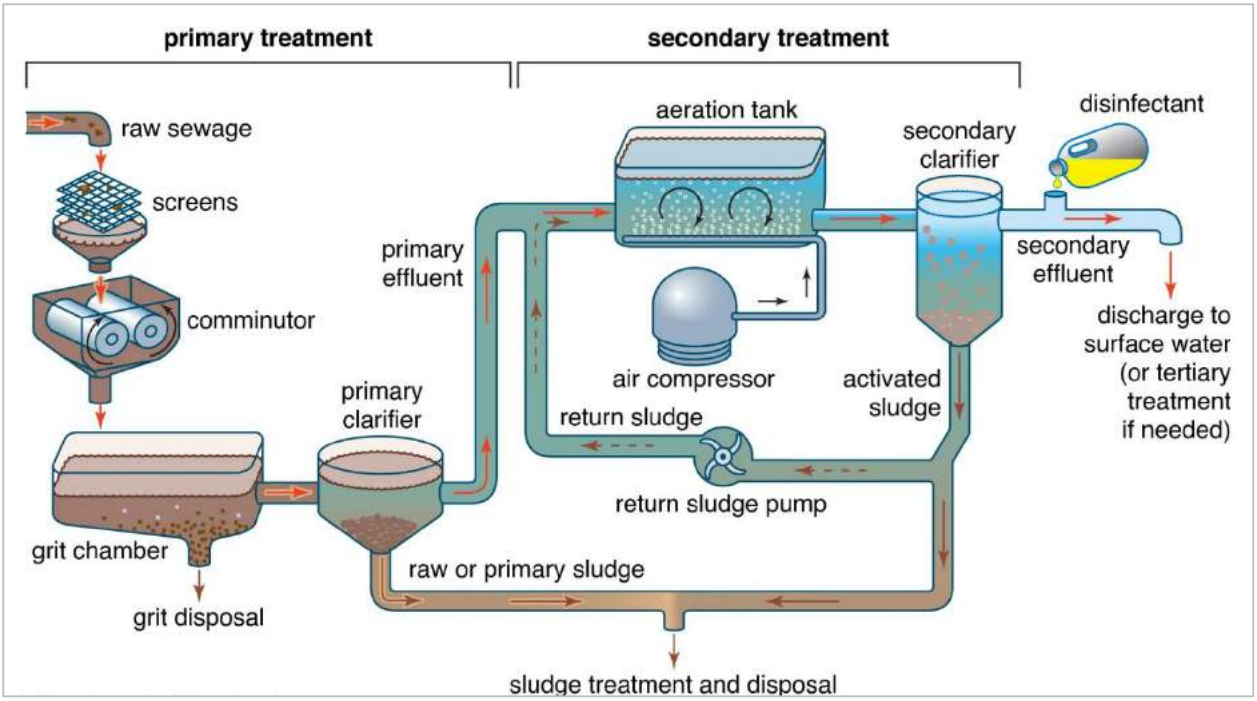

Figure 4 : Wastewater Treatment Process of Proposed Housing Area

Primary Treatment: Primary treatment will eliminate substances that can either float on the surface or easily settle out due to gravity. This stage involves physical procedures such as screening, comminution, grit removal, and sedimentation.

Secondary Treatment: Secondary treatment will remove the soluble organic substances that remain after primary treatment, as well as further reduction of suspended solids. This is typically achieved through biological processes, where microorganisms consume the organic impurities as a source of nourishment, transforming them into carbon dioxide, water, and energy for their own sustenance and replication. After secondary treatment the water will be treated by chlorine (.0.2 m/L) before discharge into nearest river maintaining the DoE guidelines, which is given below.

Table x: Sewage emission levels

SL	Parameter	Unit	Standard
1	Temp	°C	30
2	Ph	mg/L	6-9

SL	Parameter	Unit	Standard
3	BOD5 at 20° C	mg/L	30
4	COD	mg/L	125
5	SS	mg/L	100
6	Oil & Grase	mg/L	10
7	NO3	mg/L	50
8	PO4	mg/L	15
9	Total Coliform	CFU/100 m.L	1000

Source: DoE, 2023

Sludge treatment

The sludge byproduct of treated wastewater treatment process is important to ensure that sludge is properly managed and disposed of in a way that protects public health and the environment. The amount of sludge will be generated around 1.3 TPD from the housing area. The overview of the sludge treatment process in a wastewater treatment plant for the proposed housing area is given below.

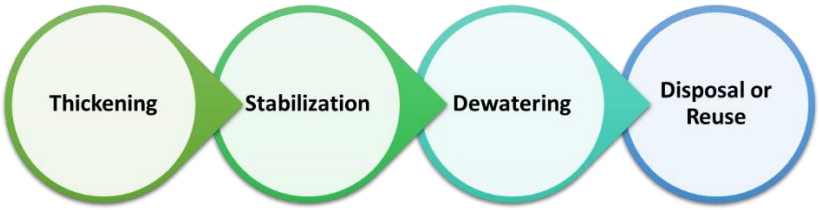

Figure 5: Sludge Treatment Process for Proposed Housing Area

Thickening: The first step in sludge treatment is often thickening. This involves concentrating the sludge by removing excess water to reduce its volume. Gravity thickeners or mechanical devices like centrifuges or belt presses are commonly used for this purpose. The method of sludge thickening is given below.

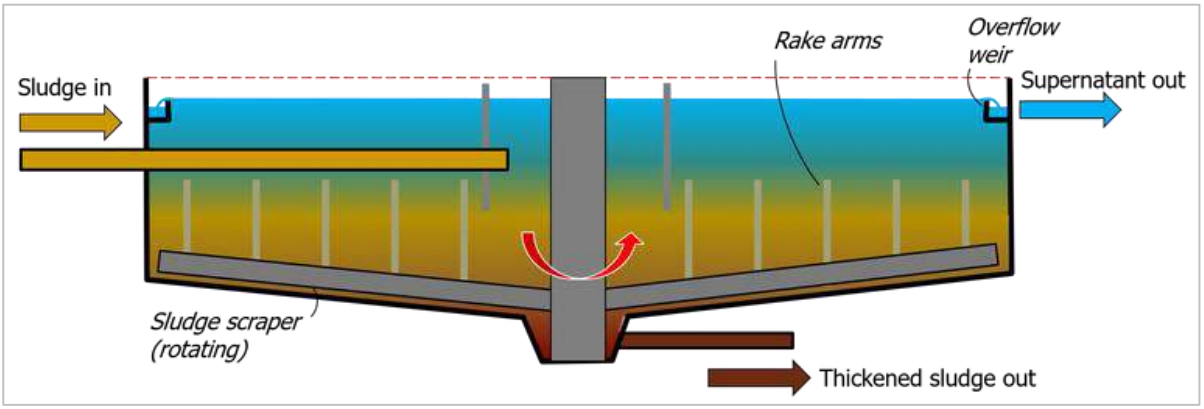

Figure 6: Sludge Thickening Method

Stabilization: Stabilization processes aim to reduce the biological activity of sludge to minimize odor and pathogens. Common methods include anaerobic digestion, aerobic digestion, and lime stabilization. Anaerobic digestion breaks down organic matter in the sludge in the absence of oxygen, producing biogas (methane and carbon dioxide) as a by-product. The biogas can be used

as an energy source. Aerobic digestion uses oxygen to decompose organic materials but typically does not produce biogas.

Anaerobic Digestion

The heart of the anaerobic sludge treatment process is the digestion phase. The sludge is introduced into a closed, oxygen-free digester tank, which creates an anaerobic environment. In this environment, various groups of microorganisms work together to break down the organic matter.

- **Hydrolysis**: Complex organic matter is broken down into simpler compounds like sugars, amino acids, and fatty acids. This is the first stage of digestion.
- **Acidogenesis**: Acid-forming bacteria further break down these simpler compounds into volatile fatty acids.
- **Acetogenesis**: Acetic acid, along with hydrogen and carbon dioxide, is produced from volatile fatty acids.
- **Methanogenesis**: Methanogenic archaea convert acetic acid, hydrogen, and carbon dioxide into methane (CH4) and carbon dioxide (CO2). This methane is the primary component of biogas.

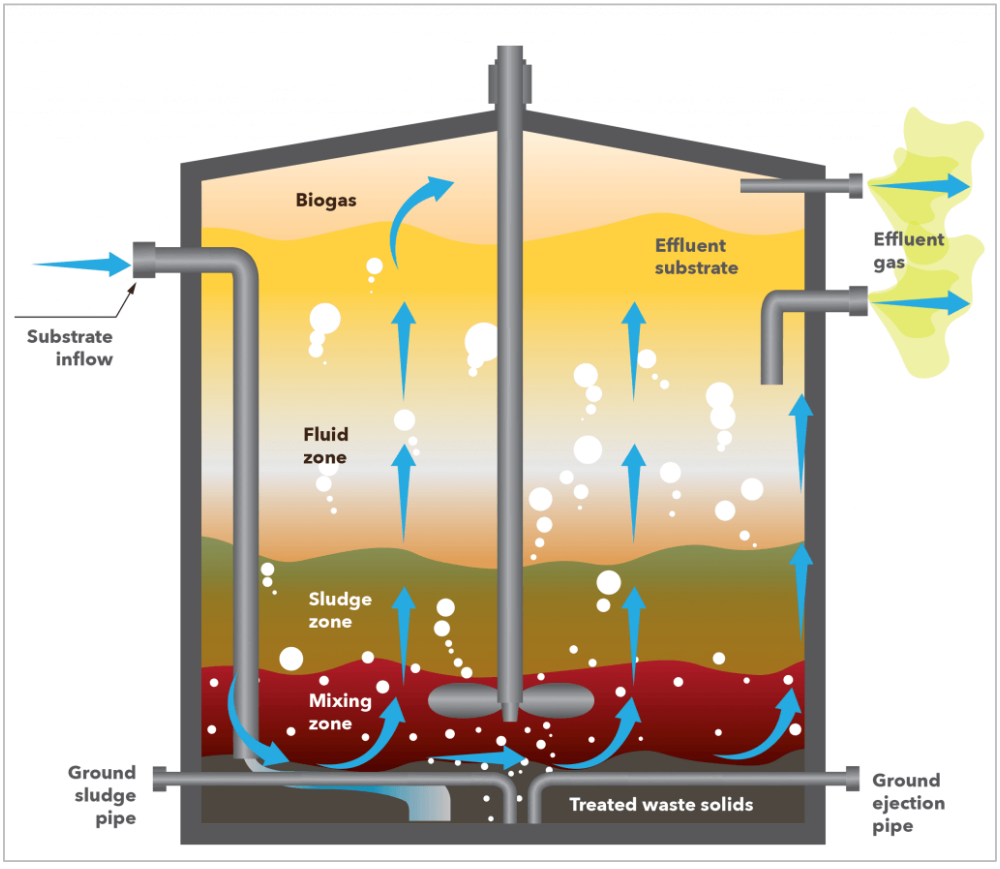

Figure 7: Anaerobic Digestion Process

Dewatering: After thickening and stabilization, the sludge will be dewatered further to reduce its moisture content and volume. Mechanical dewatering (using belt presses or centrifuges) method, which is given below will be used.

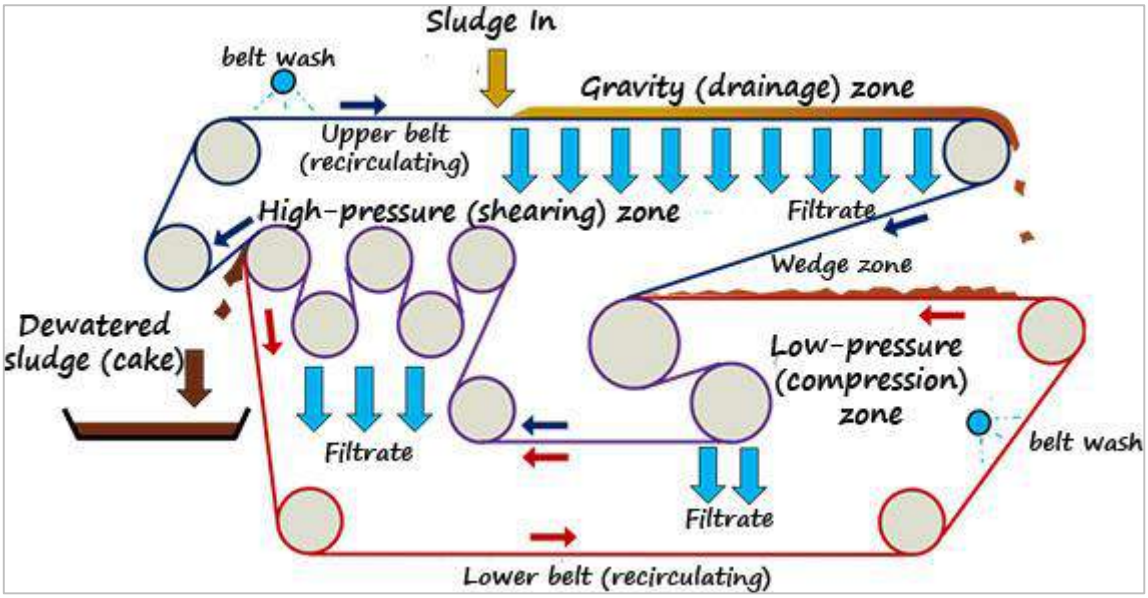

Figure 8: Mechanical Dewatering Method

Disposal or Reuse: The final stage of sludge treatment will be involved beneficial reuse. The sludge cake will be used for biogas production. After production of biogas, the stabilized digestate will be used as a nutrient-rich fertilizer in agriculture. Before used as fertilizer, additional treatment will be done to reduce pathogens to acceptable levels.

Appendix 4: Approved ToR

শেখ হাসিনার বাংলাদেশ
পরিচ্ছন্ন পরিবেশ

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Sher-e-Bangla Nagar, Dhaka-1207
www.doe.gov.bd

Memo No: 22.02.0000.091.71.119.23.90 Date: 26 July 2023

Subject: Approval of Terms of Reference for Environmental Impact Assessment (EIA) for Khilkhet Abason Prokolpo at Khilkhet, Dhaka.

Ref: Your Application on 12.06.2023

With reference to your letter received on 12.06.2023 for the subject mentioned above, the Department of Environment hereby gives approval of Terms of Reference for Environmental Impact Assessment (EIA) for Khilkhet Abason Prokolpo at Khilkhet, Dhaka subject to fulfilling the following terms and conditions:

I. The project authority shall submit a comprehensive Environmental Impact Assessment (EIA) considering the overall activity of the said project in accordance with the ToR submitted to the Department of Environment (DoE). The EIA study shall be conducted as per the provision laid down in the Environmental Conservation Rules, 2023.

II. The EIA report shall be prepared in accordance with the guidelines provided in the schedule-11 and Rules-15 & 16 of the ECR, 2023.

III. Hence the Department of Environment issues additional ToR to include in the Environmental Mitigation, Management and Monitoring Plan as follows:

1. The STP design, calculation shall be prepared in accordance with the guideline provided in the schedule-12 of the Rule-33 of ECR, 2023.
2. EMP should include 3R concept for solid waste management.

IV. Without approval of EIA report by the Department of Environment, the project authority shall not undertake land and infrastructure development of the project and open L/C in favor of importable machineries.

V. Without obtaining Environmental Clearance, the project authority shall not start operation of the project.

VI. The Project Authority shall submit the EIA report to the Department of Environment, Dhaka.

26.07.2023

(Masud Iqbal Md. Shameem)
Director (Environment Clearance)
Phone: 02-222218342

Mr. Mohammad Salahuddin
President
BCS (Administration) Welfare
Multipurpose Co-operative Society Limited
BIAM Foundation Bhaban,63 New Eskaton , Dhaka-100

Copy Forwarded to:

1. Director, Department of Environment, Dhaka Metro Office, Dhaka.
2. Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Appendix 5: No Objection Certificates

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
জেলা প্রশাসকের কার্যালয়, ঢাকা
(রাজস্ব শাখা)
www.dhaka.gov.bd

স্মারক সংখ্যা- ০৫.৪১.২৬০০.০১২.১৬.০৪.২৩- ১১৫৮/১(২১) তারিখ : বৈশাখ ১৪৩০ / ১৭ এপ্রিল ২০২৩

বিষয় : ঢাকা জেলা তলনা, বাওথার, ডুমনী, মস্তুল, ঢেলনা ও বরুয়া মৌজাস্থিত বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড এর বেসরকারী আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা, ২০০৪ (সংশোধিত ২০১২ ও ২০১৫) এর আওতায় প্রকল্প বাস্তবায়ন করার নিমিত্ত কমবেশী ১০৩.৪০৬৩ একর জমির মালিকানা যাচাই প্রসঙ্গে।

সূত্র : ১। রাজধানী উন্নয়ন কর্তৃপক্ষের স্মারক নং-২৫.৩৯.০০০০.০৩১.১৪.০০৭.২২-৪০৮, তারিখ-৩০/০৩/২০২৩ খ্রি.।
২। সহকারী কমিশনার (ভূমি) গুলশান রাজস্ব সার্কেল, ঢাকা এর স্মারক নং-৩৯৯, তারিখ-১৬/০৪/২০২৩ খ্রি.।

উপর্যুক্ত বিষয় ও সূত্রোক্ত স্মারকের প্রেক্ষিতে জানানো যাচ্ছে যে, বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড এর বেসরকারী আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা, ২০০৪ (সংশোধিত ২০১২ ও ২০১৫) এর আওতায় প্রকল্প বাস্তবায়ন করার নিমিত্ত তলনা, বাওথার, ডুমনী, মস্তুল, ঢেলনা ও বরুয়া মৌজাস্থিত ক্রয়কৃত ও আম-মোক্তারকৃত কমবেশী ১০৩.৪০৬৩ একর জমির হালনাগাদ খাজনা রশিদ, দলিল, নামজারীপর্চাসহ মালিকানা যাচাইঅন্তে খাসজমি, পরিত্যক্ত সম্পত্তি, অর্পিত সম্পত্তি বা অন্য কোন সরকারি স্বার্থ সংশ্লিষ্ট জমি রয়েছে কিনা তা উল্লেখ করে সিএস, আরএস এবং এমএস দাগসূচী অনুযায়ী জমির বিবরণসহ জমির মালিকানা সঠিকতার বিষয়ে মতামত প্রদানের জন্য অনুরোধ করেন। তৎপ্রেক্ষিতে সহকারী কমিশনার (ভূমি) গুলশান রাজস্ব সার্কেল, ঢাকাকে মালিকানা যাচাই করে প্রতিবেদন দাখিল করতে বলা হলে তিনি প্রতিবেদন দাখিল করেছেন (কপি সংযুক্ত)।

দাখিলকৃত প্রতিবেদন পর্যালোচনায় দেখা যায়, বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিঃ এর অনুমোদিত লে-আউটের ভিতরে তলনা মৌজার ২৫.৭০২৯৩ একর, বাওথার মৌজার ১১.০৩২৬ একর ডুমনি মৌজার ২৩.৮২২৫ একর, মস্তুল মৌজার ১৩.৪৩৬৫ একর, ঢেলনা মৌজার ৬.০১৬৪ একর সাফ-কবলা দলিলমূলে এবং তলনা মৌজার ০.৬১৬৬ একর, বাওথার মৌজার ১.১৭৮২ একর, ডুমনি মৌজার ৬.০৭২৫ একর, মস্তুল মৌজার ১৪.৭৬৯৬ একর, ঢেলনা মৌজার ০.৪৪০০ একর জমি আম-মোক্তার দলিলমূলে সর্বমোট সাফ-কবলা ও আম-মোক্তার দলিলমূলে ৮০.০১০৯৩+২৩.০৭৬৯ = ১০৩.০৮৭৮৩ একর জমির মালিকানা এবং সরকারী স্বার্থ যাচাই করা হয়। যাচাইঅন্তে দেখা যায়, উক্ত জমির মালিকানা সঠিক আছে এবং সরকারী কোন স্বার্থ জড়িত নেই মর্মে উল্লেখ করেছেন।

এমতাবস্থায়, বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড এর সহকারী কমিশনার (ভূমি) গুলশান রাজস্ব সার্কেল, ঢাকা এর জমির মালিকানার সঠিকতার বিষয়ে প্রতিবেদন পরবর্তী প্রয়োজনীয় ব্যবস্থা গ্রহণের জন্য মহোদয়ের বরাবর এসাথে প্রেরণ করা হলো।

সংযুক্তি : বর্ণনামতে.....৪১৮......ফর্দ।

১৭/৪/২০২৩

মোহাম্মদ মমিনুর রহমান
জেলা প্রশাসক
ঢাকা।
ফোন- ৯৫৫৬৬২৮
e-mail : dcdhaka@mopa.gov.bd

চেয়ারম্যান
রাজধানী উন্নয়ন কর্তৃপক্ষ
রাজউক ভবন, ঢাকা।

অনুলিপি:
১। সভাপতি, বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড, বিয়াম ফাউন্ডেশন, ৬৩ নিউ ইস্কাটন, ঢাকা।

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ঢাকা উত্তর সিটি কর্পোরেশন
Dhaka North City Corporation

শেখ হাসিনার মূলনীতি
গ্রাম শহরের উন্নতি

স্মারক নং-৪৬.১০.০০০০.০২০.০০.১০০২.২২-৫৭৬

তারিখ ঃ ২৬ আশ্বিন, ১৪২৯ বাং
০৬ অক্টোবর, ২০২২ খ্রিঃ

বিষয়ঃ ছাড়প্রত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক অনাপত্তি পত্র প্রদান প্রসংঙ্গে।

১। আবেদনকারীর নামঃ সভাপতি, বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড।

২। পিতা/স্বামী/স্ত্রীর নামঃ প্রযোজ্য নহে।

৩। আবেদনকারীর ঠিকানাঃ বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড, বিয়াম ফাউন্ডেশন ভবন, ৬৩ নিউ ইস্কাটন, ঢাকা-১০০০।

৪। প্রকল্পের তফসিলঃ

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	শ্রেণি	মোট জমির পরিমাণ
ঢাকা	গুলশান	মস্তুল	৯১৭, ১৩৮৫, ১৫০৩, ৯১৬, ৯৮৩, ১২২৯, ১২২৮, ১৪৩২, ১৪৮১	২, ৩, ৪, ৫, ১৬, ১৭, ১৮, ৭, ৮, ৯, ১২, ১৩, ১৪, ১৫, ১৯, ২০, ২১, ২২, ২৩, ২৪, ২০১, ২০২, ২০৩, ২০৪, ২০৫, ২৫, ২৬, ৩৫, ৩৬, ৩৭, ৩৮, ২৭, ২৮, ২৯, ৩০, ৩২, ৪০, ৪১, ২১৪, ২১৫, ৪৩, ৩৯, ৪২, ২১২, ২১৩, ১০, ১১, ২০৯, ২১০, ২১৬, ২১৭, ২১৮, ৩৫১, ৩৫২, ৩৫৩, ৩৫৫, ৩৫৬, ৩৫৭, ৩৫৮, ৩৫৯, ৩৬০, ৩৫৪, ৩৬৩, ৩৬৪, ৩৬৫, ৩৬৬, ৩৬৭, ৩৭১, ৩৬৮,৩৬৯, ৩৭০, ৩৭২, ৩৭৫, ৫০৩, ৫০৪, ৫০৫, ৫০২, ৫১৫, ৫১৬, ৬, ২০৬, ২১১, ২০৭, ২০৮, ৩৭৩, ৩৭৪, ৩৬২, ৩৭৬, ৩৭৭, ৩৭৮,		৩১৫ বিঘা (প্রায়)
		ডুমনী	৬৯৪৭, ১৯৪৯, ৪৮২০, ৪৮০৮, ৪৮০৯, ৪৮১৬, ৪৮১৯, ৪৮০৭, ৪৮১৮, ৪৮১০, ৪৮৩১, ৪৮১৭, ৪৮১২, ৪৮২৮, ৪৮২৩, ৪৮১৩, ৪৮২৯, ৪৮১১, ৪৮২২, ৪৮২১, ৪৮২৪, ৪৮১৫, ৪৮১৪, ৪৯১০, ৪৯০৮, ৪৯০৯, ৪৯৮৩, ৪৯৮৪, ৪৯৮৫, ৫২৩৩, ৫২৩২, ৬৪২৭, ৬৪২৬, ৬৪২৪, ৬৪২৩, ৬৪২৫, ৬৯৪৩, ৬৬৩৮, ৬৬৩৭, ৬৬৪২, ৬৯৪৬, ৬৯৪৪, ১০৫৪২, ৬৯৪৪, ৬৯৪৩, ৬৯৪৫, ৮৩৯৩, ৮৩৯৫,	১, ২, ৩, ৯, ১০, ১১, ১২, ১৩, ১৪, ১৫, ১৬, ৪, ৫, ৬, ৭, ৮, ১৭, ১৮, ২২, ২৩, ২৪, ২৫, ২৬, ২৭, ২৮, ৩২, ৩৮, ২০৪, ২০৬, ২০৭, ২০৮, ২০৯, ২১০, ১৯, ২০, ২১, ২০১, ২০২, ২০৩, ২১১, ২১২, ২১৩, ২১৪, ২১৫, ২১৬, ২১৭, ২১৮,২২০,২২১, ২২২, ২২৩, ২২৪, ২২৫, ২২৬, ২৩০, ২৩১, ২৩২, ২২৭, ২২৮, ২২৯, ২১৯, ৪২১, ৪২২, ৪২৩, ৪২৩, ৪২৪, ৪২৫, ৪০৪, ৪০৫, ৩৪, ৪০৪, ৪০৫, ৪১৮, ৪১৯, ৪২০, ৩৩, ৩৪, ২৯, ৩০, ৩৫, ৩৬, ৩৭, ৩১, ৪০৩, ৪০৪, ৪০৭, ৪২৬, ৪২৭, ৪২৮, ৪২৯, ৪৩০, ৪৩২, ৪৩৩, ৪৩৪, ৪৩৫, ৪৬৮, ৪৬৯, ৪৭০, ৪৭১, ৪৭২, ৪৭৩, ৮৫০, ১২০১, ১২০২, ১২০৩, ১২০৪, ১২০৫, ১২০৬, ১২০৭, ১২২৪, ১২২৫,		

পৃষ্ঠা-২

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	শ্রেণি	মোট জমির পরিমাণ
ঢাকা	গুলশান	ডুমনী	৮৩৯২, ৮৩৯৪, ১০২৮৭, ৯২৯২, ৯৬৪১, ৯২৯২	১২২৬, ১২২৭, ১২২৩, ১২২৯,		
		ঢেলনা	২৭৮, ২৩০, ২৩২, ২৩৩, ২২৯, ২৩১, ২৩৪, ২৩৫, ২৫৯, ২৫৬, ২৬০, ২৫৮, ২৫৭, ২৬৬, ২৭৬, ২৭৭, ২৮৯, ২৮৭, ২৮৮, ৩৫৯, ৩৬০, ৩৬১, ৪৬৪, ৩৫৮, ৩৬২, ৪৪২, ৪৮৬, ৪৮৬	৪০১, ৪০২, ৪০৩, ৪০৪, ৪০৫, ৪০৬, ৪০৭, ৪০৮, ৪০৯, ৪১০, ৪১১, ৪২৫, ৪২৬, ৪২৭, ৪২৮, ৪২৯, ৪৩০, ৪৩২, ৪৩৩, ৪৩৪, ৪৩১, ৪১২, ৪১৩, ৪১৪, ৪১৫, ৪১৬, ৪১৭, ৪১৮, ৪১৯, ৪২০, ৪২১, ৪২২, ৪২৩, ৪২৪, ৪৩৬, ৪৩৭, ৪৩৫, ৪৩৮, ৫১৪, ৫১৫		
		তলনা	১১১২, ১১৮৫, ১১৮৬, ১১৯৯, ১২৩৮, ১২৩৯, ১২৪৮, ১২৫৬, ১২৩৬, ১২৫৫, ১২৪৪, ১২৫০, ১২৪৫, ১২৫১, ১২৫২, ১২৫৪, ১২৫৩, ১২৪০, ১২৪৯, ১২৪১, ১২৪৬, ১২৪৭, ১২৬৯, ১২৬৮, ১২৬৭, ১২৭০, ১২৭৯, ১২৮১, ১২৮০, ১২৩৭, ১৩২০, ১৩১২, ১৩১৪, ১৩১৯, ১৩১৫, ১৩১০, ১৩১১, ১৩১৭, ১৩১৮, ১৩১৩, ১৩১৬, ১৩০৯, ১৩০৮, ১৩০৫, ১৩০৬, ১৩০৭, ১৩৮১, ১৩৮২, ১৩৮৫, ১৩৮৬, ১৩৮৩, ১৩৮৭, ১৩৮৮, ১৩৮৯, ১৩৮০, ১৩৬৮, ১৩৭৮, ১৩৮৪, ১৩৬৯, ১৩৭৬, ১৩৭১, ১৩৭২, ১৩৭৪, ১৪৭৭, ১৩৭৯, ১৩৬৭, ১৩৭৩, ১৩৭০, ১৩৭৫, ১৪১০, ১৪১১, ১৪১৩, ১৪১৮, ১৪১৯, ১৪১৫, ১৪২০, ১৪১৬, ১৪১৭, ১৪৭২, ১৪৬৭, ১৪৭৫, ১৪৬৫, ১৪৫৮, ১৪৬৬, ১৪৬৪, ১৪৭৩, ১৪৫৯,	৩২১৩, ৩২১৪, ৩২১৮, ৩২১৯, ৩২২৬, ৩২৩০, ৩২৩১, ৩২৩২, ৩২২৭, ৩২২৮, ৩২২৯, ৩৫১০, ৩৫১১, ৩৫০৮, ৩৫০৯, ৩২২১, ৩২২২, ৩২২৩, ৩২২৪, ৩২২৫, ৩৫০১, ৩৫০৫, ৩৫০২, ৩৫০৩, ৩৫০৪, ৩৫০৬, ৩৫০৭, ৩৫১৮, ৩৫১৯, ৩৫২৩, ৩২৫৭, ৩২৫৮, ৩২৫৯, ৩২৬০, ৩৫১২, ৩৫১৩, ৩২৩৪, ৩২৩৫, ৩২৩৬, ৩২৩৭, ৩২৩৮, ৩২৩৯, ৩২৫১, ৩২৫২, ৩২৫৩, ৩২৫৪, ৩২৫৫, ৩২৫৬, ৩২৬১, ৩২৬২, ৩২৬৩, ৩২৬৪, ২৩৬৫, ৩২৬৬, ৩২৬৭, ৩৬০১, ৩৬০২, ৩৬০৩, ৩৬০৪, ৩৬০৬, ৩৬০৭, ৩৬০৮, ৩৬০৫, ৩৬০৯, ৩৬১০, ৩৬১১, ৩৬১২, ৩৬১৩, ৩৬১৪, ৩৬১৫, ৩৬১৬, ৩৬১৭, ৩৬১৮, ৩৫১৫, ৩৫১৬, ৩৫১৭, ৩৫২০, ৩৫২১, ৩৫২৪, ৩৫২৫, ৩৫২৬, ৩৫২৭, ৩৫২৮, ৩৫২৯, ৩৫৩০, ৩৫৩১, ৩৫৩৯, ৩৫৪০, ৩৫৪১, ৩৫৪২, ৩৫৪৩, ৩৫৪৪, ৩৫৪৫, ৩৫৫৪, ৩৫৫৫, ৩৫৩২, ৩৫৩৩, ৩৫৩৪, ৩৫৩৫, ৩৫৩৬, ৩৫৩৭, ৩৫৩৮, ৩৫৪৬, ৩৫৪৭, ৩৫৪৮, ৩৫৪৯, ৩৫৫০, ৩৫৫১, ৩৫৫২, ৩৫৫৩, ৩৫৫৬, ৩৬১৯, ৩৬২০, ৩৬২১, ৩৬২৫, ৩৬২৬, ৩৬২৭, ৩৬২৮, ৩৬২৯, ৩৬২২, ৩৬২৩, ৩৬২৪, ৩৬২৯, ৩২৪২, ৩২৪০, ৩২৪১, ৩২৫০, ৩২৪৯, ৩২৪৭, ৩২৪৮, ৩২০৪, ৩২১২, ৩২১৫, ৩২১৭, ৩২২০, ৩২১১, ৩২১৬, ৩৬০৭, ৩৬৬৮, ৩৬৩০, ৩৬৩৩, ৩৬৩২, ৩৬৩১, ৩২৩৩, ৩২৮৫		

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	শ্রেণি	মোট জমির পরিমাণ
ঢাকা	গুলশান	তলনা	১৪৬০, ১৪৬৩, ১৪৬১, ১৪৭৭, ১৪৬৯, ১৪৬২, ১৪৫৭, ১৪৭৪, ১৪৬৮, ১৪৭১, ১৪৭০, ১৫১৬, ১৫১৮, ১৫০০, ১৫২৬, ১৫১৭, ১৫১৫, ১৪৯৫, ১৫২৯, ১৫০৬, ১৫০১, ১৫০৯, ১৫০৭, ১৫০২, ১৫২০, ১৫০৪, ১৪৯৯, ১৪৯৭, ১৪৯৬, ১৫০৫, ১৫২১, ১৫০৩, ১৫১২, ১৫১৪, ১৫২৮, ১৫২৩, ১৫২৪, ১৫১০, ১৫১৯, ১৫০৮, ১৫১৩, ১৫১৮, ১৪৯৮, ১৫১১, ১৫২৫, ১৭৩৩, ১৭৩১, ১৭৩২, ১৭৩৪, ১৩৫৮, ১৯৪৯, ২০১৫, ১৭২৯, ১৭৩০, ১৯৪৯, ২০১৫, ১৩৫৮, ১৭২৮			
		বরুয়া	৭৩৭৫, ১০৩৩, ৭৭৭৩	২৩১৭, ২৩১৮, ২৩১৯, ২৩২০		
	উত্তরা	বাওথার	১৬৭৯, ১৩৩৩, ১৩১৯, ১৩৮২, ১৪৮৯, ১৪৮১, ১৫৭৩, ১৫৭২, ১৬৬৭, ১৬৭৩, ১৭০৯, ১৭০৭, ২১৪৫, ২০৩৮, ২২৩৭	২৯১০, ২৯১৩, ২৯১৪, ২৯১৫, ২৯১৬, ২৯১৭, ২৯১৮, ২৯০৬, ২৯০৭, ২৯০৮, ২৯০৯, ২৯১৯, ২৯২০, ২৯০৩, ২৯০৪, ২৯০৫, ২৯২১, ২৯১১, ২৭২৪, ২৭২৩, ২৭২৬, ২৭২৭, ২৭২৫, ২৭৭২, ২৭৭৩, ২৭৭০, ২৭৭১, ২৭৬৯, ২৭৭৫, ২৭৬৮		

৫। প্রকল্পের নামঃ খিলক্ষেত আবাসন প্রকল্প।

উপরোক্ত তথ্যাদির আলোকে বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেডের আওতাধীন খিলক্ষেত আবাসন প্রকল্পটির ৩১৫ বিঘা (প্রায়) ভূমিতে নিম্নবর্ণিত শর্তসাপেক্ষে অনাপত্তি পত্র প্রদান করা হলো।

শর্তাবলীঃ

(ক) প্রকল্প পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরণ করতে হবে।

(খ) পরিবেশে অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহণ করতে হবে।

(গ) কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।

(ঘ) উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দুর্ঘটনার সময় জরুরী নির্গমন ব্যবস্থা থাকতে হবে।

(ঙ) বায়ু ও শব্দ দূষণ করা যাবে না।

(চ) প্রকল্প সৃষ্ট তরল বর্জ্য ডিএনসিসি'র নিধারিত স্থানে অপসারণ করতে হবে।

(ছ) রেকর্ডীয় রাস্তা ও খাল (যদি থাকে) এর অ্যালাইনমেন্ট সঠিক রেখে প্রকল্প বাস্তবায়ন করতে হবে।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথাপোযুক্ত কর্তৃপক্ষ কর্তৃক প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

১১/১০.২০২২

ড. মোহাম্মদ মাহে আলম
(উপসচিব)
প্রধান সম্পত্তি কমকর্তা (অঃদাঃ)
ঢাকা উত্তর সিটি কর্পোরেশন।
ফোন নং-০২২২২২৮৪১১৬
ফ্যাক্স নং-০২২২২২৯৫৮৮০
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অনুলিপিঃ সদয় অবগতি ও কাযার্থে (জ্যেষ্ঠতার ক্রমানুসারে নয়)।

১। সচিব, ঢাকা উত্তর সিটি কর্পোরেশন।
২। মেয়র মহোদয়ের সদয় অবগতির জন্য তাঁর একান্ত সচিব, ঢাকা উত্তর সিটি কর্পোরেশন।
৩। প্রধান নগর পরিকল্পনাবিদ, ঢাকা উত্তর সিটি কর্পোরেশন।
৪। অফিস কপি।

রাজধানী উন্নয়ন কর্তৃপক্ষ
রাজউক ভবন, ঢাকা-১০০০।

স্মারক নং- ২৫.৩১.০০০০.০৩১.১৪.০০৭.২০২২ - ২৯২ তারিখঃ ২৭/১২/২২

বিষয়ঃ বেসরকারী আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা, ২০০৪ (সংশোধিত ২০১২ ও ২০১৫) এর আওতায় উদ্যোক্তা প্রতিষ্ঠান বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড এর প্রস্তাবিত "খিলক্ষেত আবাসন" প্রকল্পের মধুল, ডুমনী, বাওথার, বরুয়া, তলনা এবং ঢেলনা মৌজার কতিপয় মৌজাদাগসমূহের কমবেশী ১০৪.২৮৬০ একর বা ৩১৫ বিঘা ভূমির উপর পরামর্শকরণ প্রসঙ্গে।

সূত্রঃ স্মারক নং বিবিধ/বিপ্রকবসস-০১/২০২২-৯৮; তাং- ২৮/১১/২০২২ ইং।

উপর্যুক্ত বিষয় ও সূত্রের পরিপ্রেক্ষিতে নির্দেশক্রমে জানানো যাচ্ছে যে, কর্তৃপক্ষের গঠিত ০৪ (চার) সদস্য বিশিষ্ট পরামর্শকরণ কমিটির পরামর্শ মোতাবেক ঢাকা জেলার খিলক্ষেত থানাধীন মধুল, ডুমনী, বাওথার, বরুয়া, তলনা এবং ঢেলনা মৌজাস্থিত কতিপয় মৌজাদাগসমূহের কমবেশী ১০৪.২৮৬০ একর বা ৩১৫ বিঘা ভূমির উপর বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড এর প্রস্তাবিত "খিলক্ষেত আবাসন" প্রকল্পের পরামর্শকরণের ক্ষেত্রে বেসরকারি আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা, ২০০৪ (সংশোধিত ২০১২ ও ২০১৫) এর আলোকে নিম্নোক্ত পরামর্শসমূহ প্রদান করা হলো।

পরামর্শসমূহঃ

সার্বিক পর্যালোচনায় বেসরকারি আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা ২০০৪ (সংশোধিত ২০১২ ও ২০১৫) এর এর বিধি ১১ এর আলোকে বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড এর প্রস্তাবিত "খিলক্ষেত আবাসন" প্রকল্প এর বিষয়ে নিম্ন-বর্ণিত পরামর্শসমূহ প্রদান করা হলোঃ

১. মহাপরিকল্পনায় বর্ণিত নির্দেশনা যথাযথভাবে প্রতিপালনপূর্বক প্রস্তাবিত আবাসিক এলাকার যাবতীয় উন্নয়ন কর্মকান্ড বাস্তবায়ন করতে হবে।

২. প্রাকৃতিক জলাধার সংরক্ষণ আইন-২০০০ (২০০০ সনের ৩৬ নং আইন) এর বিধি বিধান সমূহ প্রতিপালন করতে হবে।

৩. প্রকল্প এলাকায় রাজউক কর্তৃক প্রণীত বিশদ অঞ্চল পরিকল্পনা (২০২২-২০৩৫) ডিটেইলড এরিয়া প্ল্যানে নির্দেশিত ভূমি ব্যবহার রাস্তা, খাল, ওভারলে জোন, জনঘনত্বসহ সকল প্রস্তাবনার আলোকে কার্যক্রম গ্রহণ করতে হবে।

৪. বেসরকারী আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা, ২০০৪ (সংশোধিত ২০১২ ও ২০১৫) এর ১৪(২) অনুযায়ী বিভিন্ন সেবা প্রদানকারী সংস্থা থেকে ছাড়পত্র গ্রহণ করতে হবে এবং ছাড়পত্রে উল্লেখিত শর্তসমূহ লে- আউট প্ল্যানে অন্তর্ভুক্ত করতে হবে।

৫. প্রকল্পের অভ্যন্তরে বিশদ অঞ্চল পরিকল্পনা (২০২২-২০৩৫) এ চিহ্নিত প্রধান সড়কসমূহ Urban Life Line হিসেবে উন্নয়ন করতে হবে।

৬. প্রকল্পের সীমানা নির্ধারনের জন্য নির্দিষ্ট দূরত্ব পর পর BM Pillar স্থাপন করতে হবে এবং কোঅর্ডিনেট মান (Coordinate Value) রাজউক বরাবর দাখিল করতে হবে।

৭. প্রকল্পের লে আউট অনুমোদনের পরে খাল, পার্ক, খেলার মাঠ, স্কুল, কলেজ, মসজিদসহ বিভিন্ন নাগরিক সেবা সংশ্লিষ্ট প্লটসমূহ চিহ্নিত করে সাইনবোর্ড স্থাপন করতে হবে।

৮. প্রকল্প এলাকার বর্জ্য ব্যবস্থাপনার জন্য কমপক্ষে একটি Sewerage Treatment Plant (STP) ও কমপক্ষে দুইটি Secondary Transfer Station (STS) সংস্থান করতে হবে।

৯. প্রকল্প এলাকার শতভাগ জমির নিরঙ্কুশ ও নিষ্কন্টক মালিকানা অর্জন করতে হবে এবং জমির মালিকানার স্বপক্ষে জেলা প্রশাসক, এর নিকট হতে দায়মুক্তি সনদপত্র (Non-encumbrance certificate) গ্রহণ করতে হবে।

১০। ভূতাত্ত্বিক জরীপ অধিদপ্তর কর্তৃক প্রণীত Infrastructure Suitability Map অনুযায়ী প্রকল্পভুক্ত এলাকার Subsoil Condition 'Poor' ও 'Very Poor' হিসেবে চিহ্নিত হওয়ায় প্রকল্প এলাকার যে কোন অবকাঠামো নির্মাণের ক্ষেত্রে BNBC কোড অনুযায়ী পর্যাপ্ত নিরাপত্তা ব্যবস্থা ও প্রকৌশলগত বিষয়াদি নিশ্চিত করতে হবে।

১১. প্রকল্পের অভ্যন্তরে যদি কোন সরকারী (খাস) জমি, অর্পিত সম্পত্তিভুক্ত বা অন্য কোন জমি থাকে তবে তা সরকারের অনুমোদন ছাড়া ব্যবহারে নেয়া যাবে না অথবা বরাদ্দ বা বিক্রি করা যাবে না। খাস জমি, অর্পিত সম্পত্তি এবং খালের শ্রেণী পরিবর্তন কোন অবস্থাতেই গ্রহণযোগ্য হবে না।

১২. বিভিন্ন নাগরিক সুবিধাদি (পার্ক, খেলার মাঠ, কবরস্থান, ধর্মীয় সেবা, ইউটিলিটি প্লট ইত্যাদি) লে আউট প্ল্যানে ক্রয়কৃত জমিতে সংস্থান করতে হবে।

চলমান পাতা-২

১৩. রাজউক কর্তৃক প্রকল্প অনুমোদিত হওয়ার পর প্রকল্পের উন্নয়ন কার্যক্রম গ্রহণ করা যাবে। এক্ষেত্রে প্রস্তাবিত প্রকল্পের প্রধান সড়কের প্রশস্ততা ন্যূনতম ৮০ ফুট, মাধ্যমিক সড়কের প্রশস্ততা ন্যূনতম ৬০ ফুট, তৃতীয় স্তরের সড়কের প্রশস্ততা ন্যূনতম ৪০ ফুট এবং সংযোগ সড়কের প্রশস্ততা ন্যূনতম ২৫ ফুট রাখতে হবে। সকল সড়ক নেটওয়ার্ক উদ্যোক্তার নিজ খরচে স্বীকৃত উন্নয়ন বিধি, কোড এবং স্টান্ডার্ড স্পেসিফিকেশন অনুসারে নির্মাণ করতে হবে।

১৪. প্রকল্প এলাকার মৌজা ম্যাপের উপর আধুনিক পদ্ধতিতে জরীপ (GPS Based Survey) করে Existing Topographical Survey Map প্রস্তুত করতে হবে। যাবতীয় নকশা রাজউক নিবন্ধিত উপদেষ্টা প্রতিষ্ঠান, নগর পরিকল্পনাবিদ, স্থপতি, প্রকৌশলী ও সংশ্লিষ্ট পেশাজীবীর মাধ্যমে প্রণয়ন করতে হবে। উক্ত জরীপ মোতাবেক প্রকল্পের লে আউট প্ল্যান চূড়ান্ত করতে হবে।

১৫. প্রকল্পভুক্ত মোট জমির ন্যূনতম ৩০(ত্রিশ) ভাগ জমি বিধি মোতাবেক নাগরিক সুবিধাদি ও বিভিন্ন ইউটিলিটি সার্ভিসের জন্য সংরক্ষণ করতে হবে। উক্ত ইউটিলিটি সার্ভিসের জায়গাসমূহ সংশ্লিষ্ট সরকারি সেবা প্রদানকারী সংস্থাকে বিধি মোতাবেক হস্তান্তর করতে হবে।

১৬. প্রকল্প এলাকার বিভিন্ন নাগরিক সুযোগ-সুবিধা বেসরকারি আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা ২০০৪ (সংশোধিত ২০১২ ও ২০১৫) এর Space Standards (তফসিল-৩) মোতাবেক নিশ্চিত করতে হবে।

১৭. প্রকল্প এলাকার ভূমির উচ্চতা বন্যার পানি প্রবাহ সীমার উপরে (Highest Flood Level) রাখতে হবে অথবা প্রকল্প এলাকার ভূমি সুষ্ঠু পানি ব্যবস্থাপনার মাধ্যমে বন্যামুক্ত রাখার জন্য Hydrological study প্রতিবেদন দাখিল করতে হবে।

১৮. প্রকল্প এলাকার পার্শ্ববর্তী কোন এলাকার যাতে কোন ধরনের জলাবদ্ধতা সৃষ্টি বা পরিবেশের ভারসাম্য নষ্ট না হয় তা নিশ্চিত করতে হবে।

১৯. প্রকল্প এলাকায় প্লট বা জমি সংক্রান্ত বিষয়ে রিয়েল এস্টেট উন্নয়ন ও ব্যবস্থাপনা আইন ২০১০ এবং অন্যান্য প্রযোজ্য বিধি/ আইন অনুযায়ী ক্রেতার স্বার্থ রক্ষা করতে হবে।

২০. প্রকল্পের অভ্যন্তরে Traffic Circulation বিবেচনায় রেখে কর্তৃপক্ষের নিকট প্রকল্পের Traffic Impact Assessment প্রতিবেদন দাখিল করতে হবে।

২১. প্রকল্প উদ্যোক্তাকে বেসরকারি আবাসিক প্রকল্পের ভূমি উন্নয়ন বিধিমালা ২০০৪ (সংশোধিত ২০১২ও ২০১৫) এর বিধি ৬ এর উপবিধি ১ দফা (ত) অনুযায়ী কর্তৃপক্ষের নিকট নিয়মিত প্রকল্পের পরিবেশগত সমীক্ষা প্রতিবেদন দাখিল করতে হবে।

২২. Neighborhood planning-এর দৃষ্টিকোণ থেকে প্রতিটি ব্লকে/নেইবারহুডে একটি করে নার্সারী স্কুল এবং খেলার মাঠ প্রদান করতে হবে। মাননীয় প্রধানমন্ত্রী কর্তৃক ২৯/০৩/২০১৬খ্রিঃ তারিখের একনেক সভায় প্রদত্ত অনুশাসন অনুযায়ী বৃষ্টির পানি সংরক্ষণের জন্য প্রকল্পের অভ্যন্তরে জলাধার রাখতে হবে এবং Solid Waste Management System রাখতে হবে।

২৩. প্রকল্প অনুমোদনের পূর্বে প্রস্তাবিত প্রকল্প এলাকার কোন প্লট বা জমি বিক্রয় করা যাবে না। এছাড়া, বিক্রয় বা বরাদ্দ প্রদানের জন্য কোন প্রকার বিজ্ঞাপন প্রকাশ বা প্রচারকার্য পরিচালনা করা যাবে না

২৪. রাজউক প্রণীত বিশদ অঞ্চল পরিকল্পনা (২০২২-২০৩৫) অনুযায়ী প্রস্তাবিত প্রকল্প এলাকা General Flood Plane এর অন্তর্ভুক্ত হওয়ায় প্রকল্প এলাকার কমবেশি ১০.৫০% জমি পুকুর, দীঘি, লেক, বড় জলাশয়, পার্ক, খেলার মাঠ, স্কুলের মাঠ প্রভৃতিতে জলাধার এলাকা হিসেবে সংরক্ষণ করতে হবে। উল্লেখ্য, প্রকল্পের অভ্যন্তরে বিদ্যমান প্রাকৃতিক জলাধার উক্ত জলধারণ এলাকার অন্তর্ভুক্ত হবে না।

এমতাবস্থায়, উপরোক্ত পরামর্শসমূহ প্রতিপালনের শর্তে আগামী ০১ (এক) বছরের মধ্যে লে-আউট প্ল্যান অনুমোদনের পরবর্তী কার্যক্রম গ্রহণের জন্য বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেডকে নির্দেশক্রমে অনুরোধ করা হলো। উল্লেখ্য যে, এই পরামর্শকরণ প্রকল্পের কোন প্রাক-অনুমোদন বা সম্মতি প্রদান বুঝায় না।

(মোঃ আশরাফুল ইসলাম)
নগর পরিকল্পনাবিদ - ১
নগর পরিকল্পনা ও বাস্তবায়ন শাখা
রাজউক, ঢাকা।
ফোনঃ +৮৮০২-৯৫৬৬৭৫৫

তারিখঃ

সভাপতি
বিসিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড
বিয়াম ফাউন্ডেশন ভবন, ৬৩ নিউ ইস্কাটন
ঢাকা-১০০০।

স্মারক নং- ২৫.৩৯.০০০০.০৩১.১৪.০০৭.২০২২
সদয় অবগতির জন্য অনুলিপি প্রেরণ করা হলঃ

০১। সদস্য (পরিকল্পনা), রাজউক, ঢাকা।
০২। লিয়াজোঁ অফিসার, রাজউক, ঢাকা (চেয়ারম্যান (সচিব) মহোদয়ের সদয় অবগতির জন্য)।

নগর পরিকল্পনাবিদ - ১
নগর পরিকল্পনা ও বাস্তবায়ন শাখা
রাজউক, ঢাকা।

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
ফায়ার সার্ভিস ও সিভিল ডিফেন্স অধিদপ্তর
কাজী আলাউদ্দিন রোড, ঢাকা।
www.fireservice.gov.bd

মুজিব বর্ষের প্রতিশ্রুতি
সেবা, ত্যাগ ও অগ্রগতি

স্মারক নং-৫৮.০৩.০০০০.০০৭.৩৪.১২৫.১৭- ২০২৪৭ তারিখঃ ২৯/০৫ ১৪২৯ বঙ্গাব্দ / ০৪/১০/২০২২ খ্রিঃ

বিষয়ঃ বিসিএস (প্রসাশন), কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড, খিলক্ষেত, কুড়িল-পূর্বাচল (৩০০ ফুট) রাস্তা হতে আনুমানিক ১৫০০ ফুট উত্তরে, মন্ডুল, ডুমনী, তলনা, ঢেলনা, বরুয়া ও বাওথার মৌজাস্থ আবাসন প্রকল্পের অনাপত্তি ছাড়পত্র প্রদান প্রসংগে।

সূত্রঃ তাঁর স্মারক- বিবিধ/বিপ্রকবসস-০১/২০২২, তারিখ- ১৫/০৯/২০২২ খ্রিঃ।

উপর্যুক্ত বিষয় ও সূত্রের আলোকে জানানো যাচ্ছে যে, বিসিএস (প্রসাশন) কল্যাণ বহুমুখী সমবায় সমিতি লিমিটেড, খিলক্ষেত, কুড়িল-পূর্বাচল (৩০০ ফুট) রাস্তা হতে আনুমানিক ১৫০০ ফুট উত্তরে, মন্ডুল, ডুমনী, তলনা, ঢেলনা, বরুয়া ও বাওথার মৌজাস্থ আবাসন প্রকল্পের ৩১৫ বিঘা ভূমিতে বিভিন্ন শ্রেণীর ভবন নির্মাণের জন্য নির্ধারিত জমিতে নিম্নবর্ণিত শর্তসমূহ বাস্তবায়ন স্বাপেক্ষে আবিষ্ট হয়ে আবাসন প্রকল্পটির অনুমোদন প্রদান করা হল।

পালনীয় শর্তাবলীঃ

১। আগামী ৩০ কার্যদিবসের মধ্যে আবাসন প্রকল্পের ফায়ার সেফটি প্ল্যান অত্র অধিদপ্তর হতে অনুমোদন গ্রহণ করতে হবে।

২। প্রকল্পের প্রতিটি বহুতল ভবনের ছাড়পত্র পৃথকভাবে গ্রহণ করতে হবে। ভবন নির্মাণের ক্ষেত্রে প্রচলিত বিধিবিধান এবং বিদ্যমান বাংলাদেশ ন্যাশনাল বিল্ডিং কোড (বিএনবিসি) অনুসরণ করতে হবে।

৩। একটি প্রাকৃতিক জলাধার সংরক্ষণ করতে হবে।

৪। এই ছাড়পত্র জমির মালিকানা স্বত্ব বা অন্য কোন সংশ্লিষ্ট বিভাগের অনাপত্তি নির্ধারণ করবে না।

উপরে বর্ণিত ব্যবস্থা ছাড়া পরবর্তীতে আরও কোন প্রকার অগ্নিনিরাপত্তা ব্যবস্থা বাস্তবায়নের প্রয়োজন হলে তা বাস্তবায়ন নিশ্চিত করতে হবে এবং সরকারি আবাসন নীতিমালার পরিবর্তন হলে ছাড়পত্রের শর্তাবলীও পরিবর্তন হবে।

০৪/১০/২২

লেঃ কর্ণেল জিল্লুর রহমান, পিএসসি
পরিচালক (অপাঃ ও মেইনঃ)

জনাব মোঃ তোফাজ্জল হোসেন মিয়া
সভাপতি
বিবিএস (প্রশাসন) কল্যাণ বহুমুখী সমবায় সমিতি
বিয়াম ফাউন্ডেশন ভবন, ৬৩ নিউ ইস্কাটন, ঢাকা-১০০০।

বিতরণ সদয় জ্ঞাতার্থে ও কার্যার্থেঃ

১। সচিব, সুরক্ষা সেবা বিভাগ, স্বরাষ্ট্র মন্ত্রণাল, ঢাকা। (মহোদয়ের সদয় অবগতির জন্য)
২। উপ পরিচালক, ফায়ার সার্ভিস ও সিভিল ডিফেন্স ঢাকা বিভাগ, ঢাকা।
৩। সহকারী পরিচালক, ফায়ার সার্ভিস ও সিভিল ডিফেন্স, ঢাকা।
৪। সিনিয়র স্টাফ অফিসার, ফায়ার সার্ভিস ও সিভিল ডিফেন্স অধিদপ্তর, ঢাকা (মহাপরিচালক মহোদয়ের সদয় অবগতির জন্য)।
৫। উপ সহকারী পরিচালক, ফায়ার সার্ভিস ও সিভিল ডিফেন্স, ঢাকা-৩।
৬। স্টেশন অফিসার, ফায়ার সার্ভিস ও সিভিল ডিফেন্স স্টেশন, পূর্বাচল, নারায়নগঞ্জ।
৭। জনাব ---------- ওয়্যারহাউজ ইন্সপেক্টর, সহকারী পরিচালকের দপ্তর, ফায়ার সার্ভিস ও সিভিল ডিফেন্স ঢাকা।

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