Initial Environmental Examination

January 2013

BAN: Urban Public and Environmental Health Sector Development Program: Chittagong Secondary Transfer Stations

Prepared by the Local Government Division, Ministry of Local Government, Rural Development and Cooperatives, Government of the People's Republic of Bangladesh for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 15 January 2013)

Currency unit	–	Taka (Tk)
Tk.1.00	=	$0.01255
$1.00	=	Tk. 79.620

ABBREVIATIONS

ADB	–	Asian Development Bank
BBS	–	Bangladesh Bureau of Statistics
BCC	–	Behavior Change Communication
BOD	–	Biochemical Oxygen Demand
CC	–	City Corporations
CCC	–	Chittagong City Corporation
CCPIU	-	City Corporations Program Implementation Units
COD	–	Chemical Oxygen Demand
DES	–	Domestic Environmental Specialist
DLS	-	Department of Livestock Services
DO	–	Dissolved Oxygen
DoE	–	Department of Environment
DSC	–	Design, Supervision, and Construction Consultant
DSCC	–	Dhaka South City Corporation
DWASA	–	Dhaka Water Supply and Sewerage Authority
EA	–	executing agency
ECC	–	Environmental Clearance Certificate
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EU	–	European Unions
HDPE	–	High Density Poly-Ethylene
IEE	–	Initial Environmental Examination
IES	–	International Environmental Specialist
IMA	–	Independent Monitoring Agency
LGD	–	Local Government Division
LGRDC	–	Ministry of Local Government, Rural Development and Cooperatives
NGO	–	nongovernmental organization
OM	–	Operations Manual
O&M	–	operation and maintenance
PPTA	–	Project Preparation Technical Assistance
RCC	–	Reinforced Cement Concrete
RF	–	Resettlement Framework
RP	–	Resettlement Plan
SCMO	–	Safeguards and Community Mobilization Officer
SIEE	–	Summary Initial Environmental Examinations
SO	–	Safety Officer
STS	–	Secondary Transfer Stations
ToR	–	Terms of Reference
UPEHSDP	–	Urban Public and Environmental Health Sector Development Program
UPEHU	–	Urban Public and Environmental Health Unit
WMD	-	Waste Management Department

WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
m	–	Meter
Mm	–	millimeter
km/h	–	kilometer per hour

NOTE

In this report, "$" refers to US dollars.

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

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I. INTRODUCTION

A. Purpose of the Report

1. With nearly 30% of the country's total population (around 140 million) currently living in urban areas along with a predicted to rise to 50% in the next 25 years and still a higher rate of urbanization than the previous ones, Bangladesh is beset with a situation of continued deterioration in the overall and general state of urban public and environmental health. Such a situation has its root in the existing services overwhelmed by continued influx of ever-increasing number of people in the urban areas and growth of slums and squatter settlements currently accommodating over 35% of the urban population. Disease prevention and health promotion in urban areas encompass a range of issues including water and sanitation, waste management, food safety, healthcare, awareness-raising, etc. These are all the responsibility of the city corporations and municipalities under the authority of the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (LGRDC). Most of these services are under-provided, particularly to the poor.

2. The Bangladesh Urban Public and Environmental Health Sector Development Program (UPEHSDP) aims to establish a sustainable approach to public and environmental health at national level to guide and support city corporations and municipalities in improving the quality of life and economic status of urban residents, especially the poor. This will be achieved by a range of measures, including: (i) creating an Urban Public and Environmental Health Unit (UPEHU) under LGD with a mandate to improve public health; (ii) improving staff and financial resources to enable city corporations and municipalities fulfill their responsibilities in public and environmental health; (iii) improving management of solid waste and hospital waste through municipality-managed public-private partnerships and other mechanisms; and (iv) improving food safety by providing food testing laboratories, food inspection services and sanitary slaughterhouses.

3. The program is being supported by ADB through: (i) a program loan to implement policy measures in institutional strengthening, financial reform, public/ environmental health strategies, governance and service delivery; and (ii) a sector loan, funding investments in municipal and hospital waste management, food safety, and pro-poor integrated services (water supply, sanitation, nutrition/ food security, and health of the urban poor). LGD of the MOLGRDC has been the Executing Agency (EA), whereas the six city corporations (Dhaka, Chittagong, Sylhet, Barisal, Khulna and Rajshahi) have been the implementing agencies. The Program is being implemented over a period of seven years (2010-2016) in the main urban areas of the country.

4. UPEHSDP has been classified by ADB as environmental assessment category B (some negative impacts but less significant than category A). The impacts of activities under the program loan, therefore, need to be reviewed by an Environmental Assessment of the Policy Matrix. The sector loan will be implemented via a series of subprojects, providing infrastructure and other improvements in a particular sector (waste management, food safety, etc). Four sample subprojects were developed by a Project Preparation Technical Assistance (PPTA) study and the environmental impacts of these were assessed by Initial Environmental Examinations (IEE) (or Environmental Reviews for Category C subprojects). Studies were conducted according to ADB Environment Policy (2002) and Environmental Assessment Guidelines (2003). Current IEE had been in line with the Environmental Assessment and Review Framework (EARF) developed for the purpose in 2009 and assessment of environmental

impacts previously conducted on the above four sample subprojects developed through the PPTA study.

5. This Initial Environmental Examination (IEE) has been undertaken to (i) assess the extent and magnitude of impacts that the proposed Chittagong Secondary Transfer Stations subproject in Chittagong City Corporation area have on the overall environment within and around the subproject site; (ii) propose mitigation measures in respect of adverse impacts, enhancement of beneficial impacts; and (iii) formulate an Environment Management Plan (EMP).

B. Extent of IEE Study

6. Bangladeshi law and ADB policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

1. ADB Policy

7. ADB's Environment Policy requires that environmental issues are taken into account in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in Operations Manual (OM) 20: Environmental Considerations in ADB Operations (2003). This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, financial intermediation loans and private sector investment operations.

8. The nature of the assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following categories:

(i) **Category A.** Projects that could have significant environmental impacts. An Environmental Impact Assessment (EIA) is required.

(ii) **Category B.** Projects that could have some adverse environmental impacts, but of less significance than those for category A. An Initial Environmental Examination (IEE) is required to determine whether significant impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
A Category B project may be classified as B-sensitive if it involves environmentally sensitive activities. Such projects require IEE, but have the same requirements for disclosure and Environmental Management Plans as Category A.

(iii) **Category C.** Projects those are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

9. For Category B projects the Draft IEE reports, Summary IEE (SIEE) and any other reports prepared to comply with ADB procedure (in this case the EA of the Policy Matrix) are reviewed by ADB's Regional Department Sector Division and Social and Environmental Safeguards Division. They are also reviewed in-country by the Executing Agency, and additional comments may be sought from project affected people and other stakeholders. All comments

are incorporated in preparing final documents, which are reviewed by the Executing Agency and the national environmental protection agency (in this case the Department of Environment, DoE). The EA then officially submits the reports to ADB for consideration by the Board of Directors.

2. National Law

10. **Environmental Assessment, Protection, and Pollution Control.** The main provisions for environmental protection and pollution control in Bangladesh are contained in the Environmental Conservation Act (ECA) of 1995 and the Environmental Conservation Rules (ECR) of 1997. These legislations also provide the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed. Projects are classified as green, orange or red depending on their location and environmental impacts. Secondary Transfer Stations are not included explicitly in the categorization of projects provided in Schedule 1 of the law; however, "Waste incinerator" is listed under Red Category. But the STS are definitely not having such potential for creating environmental pollution as the waste incinerators. So these may be considered to fall under Category Orange – B.

11. Rule 7 states that the proponent of such projects must obtain a Location Clearance Certificate and an Environmental Clearance Certificate (ECC) from the Department of Environment (DoE). For Orange-B category projects this requires submission to the relevant DoE Divisional Officer of the following:

(i) Completed Application for Environmental Clearance Certificate, and the appropriate fee, shown in Schedule 13 of the Rules;
(ii) Report on the feasibility of the project;
(iii) Report on the IEE for the project, and its Process Flow Diagram, Layout Plan;
(iv) Report on the Environmental Management Plan;
(v) No objection certificate from the local authority;
(vi) Emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution; and
(vii) Outline of the relocation and rehabilitation plan (where applicable).

12. As part of the Environmental Clearance Certificate application, a detailed Environmental Impact Assessment and environmental management plans satisfactory to the Department of Environment must be prepared. During the process of preparing the 2009 Environmental Planning Document, DoE was consulted and it was indicated that ADB IEE, SIEE, Resettlement Framework and other reports prepared during project preparation would be acceptable to DoE as fulfilling many of their national EIA requirements. However, they will review IEEs upon further submission by LGD. All projects are to submit any further materials, if any, as per requirement of DoE toward obtaining the Environmental Clearance Certificate.

13. The Chittagong Secondary Transfer Stations subproject is considered to have some potential for environmental impacts therefore must conduct an IEE and prepare EMPs acceptable to DoE as part of the ECC application. Under the ECR DoE has 30 days to respond from the receipt of the ECC application for an Orange-B category project.

14. **Other Policies, Plans, and Strategies.** In addition to ECA and ECR, there are a numbers of other policies, plans and strategies which are applicable to the subproject. These are National 3R (Reduce, reuse, recycle) Strategy for Waste Management 2010, The Local Government (City Corporation) Act 2009, and Medical waste management rules 2008.

15. The National Building Code 2006 and National Labor Act 2006 have defined certain measures to ensure proper safety and work environment as well as the compensation measures to the laborers. By national law, in order to be compensated, Contractors must follow these safety provisions and compensation arrangements. The implementing agency must ensure that the appropriate occupational health and safety provisions have been included in the bidding documents and are being implemented by Contractor. As per the Safe Drinking Water Supply and Sanitation Policy 1998, provision for arsenic free drinking water and adequate sanitation will have to be ensured. The water quality needs to be monitored to ensure that the supplied water is safe for drinking.

16. The summary of environmental regulations and mandatory requirements for the proposed subproject is shown in **Table 1**.

Table 1: Summary of Environmental Regulations and Mandatory requirements for the Chittagong STS Subproject

Acts/ Guidelines	Purpose	Applicability to the Subproject
Environmental Conservation Act, 1995 and Environmental Conservation Rules, 1997	- main provisions for environmental protection and pollution control in Bangladesh - provides the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed - projects are classified as green, orange or red depending on their location and environmental impacts	- STSs are not included explicitly in the categorization of projects provided in Schedule 1 of the law; however, "Waste incinerator" is listed under Red Category. But the STS are definitely not having such potential for creating environmental pollution as the waste incinerators. So these may be considered to fall under Category Orange – B. - Rule 7 states a Location Clearance Certificate and an Environmental Clearance Certificate (ECC) must be obtained from the Department of Environment (DoE). - Recommends standards for disposal of different types of waste.
National 3R (Reduce, reuse, recycle) Strategy for Waste Management, 2010	- The national 3R Goal for waste management is to achieve complete elimination of waste disposal on open dumps, rivers, flood plains by 2015 through mandatory segregation of waste at source as well as to create a market for recycled products and provide incentives for recycling of waste. - The main objective of the 3R Strategy is to delineate ways and means of achieving national 3R goals through providing a uniform guideline for all stakeholders.	- Source segregation is mandatory and gave directives to municipalities to pursue organic waste-recycling projects through composting, refuse derived fuel, and biogas via Public Private Partnerships (PPPs). - It makes clear that medium to large-scale organic waste-recycling projects will be implemented and managed by the private sector. Moreover, the strategy makes recommendations concerning issues such as tipping fees and access to municipal land for recycling projects.
Local Government (City Corporation) Act, 2009	This Act was incorporated under Bangladesh Gazette on 15 October 2009. The act contains four sub-clauses regarding waste collection and management, which have been depicted as follows: – City Corporation will take all necessary steps to collect and dispose waste from all the roads, toilets, drains, structures and areas	Construction of STS is necessary infrastructure to fulfill the responsibility of the City Corporations for collection, transportation and disposal of municipal solid wastes. Municipal solid waste will be collected in these STSs for onward transportation to the landfill site of the City Corporation outside the city.

Acts/ Guidelines	Purpose	Applicability to the Subproject
	under its jurisdiction – The occupiers of all the structures and spaces within the jurisdiction of the City Corporation will be responsible for removing waste from their possession under the control and supervision of the Corporation. – Corporation will make arrangement for waste collection containers or other type of bins at different places of the city, and wherever such containers or bins are placed, the Corporation will ask the occupiers of the neighboring houses, structures and spaces to dump their wastes into these containers or bins through issuance of a general notice. – All the wastes removed or collected by or under direction of the staff of the Corporation as well as the wastes stored in the containers or bins established by the Corporation will be treated as the property of the City Corporation.	
Medical waste management rules 2008	The main objective is to control overall management including collection, treatment and disposal of medical waste in Bangladesh.	STSs will not be used for collection of medical waste; these hazardous wastes will be collected, transported and disposed of separately by special arrangement.

C. Scope of the Study

17. This is the IEE for the Chittagong Secondary Transfer Stations subproject. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. This IEE report will clarify the situation to the Department of Environment and fulfill the requirement for obtaining Location Clearance Certificate and an Environmental Clearance Certificate (ECC) from DOE. This report will identify the potential environmental impacts due to implementation of the subproject and will suggest appropriate mitigation measures.

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

18. This is a subproject in the field of solid waste management, and as explained above it has been classified by ADB as Category B because it is not expected to have major negative environmental impacts. Under ADB procedures such developments require an IEE to identify and mitigate the impacts, and to determine whether further study or a more detailed EIA may be required.

19. Improvements in solid waste management facilities are needed in Chittagong and in other urban areas in Bangladesh because present services are inadequate. The main problems are that:

(i) Although house-to-house waste collection by NGOs or CBOs is available in most urban areas, slum dwellers still mainly dispose of garbage on open spaces;
(ii) Secondary waste collection has not expanded in line with the primary collection service because of inadequate cost recovery and insufficient public or private investment;
(iii) The interface between private sector primary collection and municipality-run secondary collection systems is also inefficient mainly because of a lack of mechanization.

20. UPEHSDP will address these issues by providing new mechanized Secondary Transfer Stations (STS) in Chittagong, which may then be replicated in other urban centers through further subprojects.

B. Location, Size and Implementation Schedule

21. The Chittagong STS subproject consists of 12 Secondary Transfer Stations (STSs) on small plots of Government land beside roads in different parts of the city; Photographs of the proposed site are attached as Annex 2.

22. Locations of all the subprojects are shown in the following map (Fig 1). Since all these subprojects are located on government owned land CCC does not need to acquire any land for the purpose. Locations of these STS sites are described in the following paragraphs. It may be mentioned here that as per requirement of the EARF selection criteria #14 for waste management, none of these 12 STSs described under Paragraphs 23 to 34 below are located within 30 meters of residences, schools, and churches. This will be again ensured during actual handing over of the layout plan and site to the contractor before the starting of construction activities.

23. STS site 1: This STS is located in W-20 in the Sirajuddoula Road subarea in Chandonpura Mouza and the BS Dag # is 1306.

24. STS site 2: This STS site is located in W-32 in the Nazir Ahmed Choudhury Road, PS Kotowali, Mouza Andarkilla and BS Dag # 2625.

25. STS site 3: This STS site is located in Namuna Bazar Khoar, Ward #30, Mouza Motherbari and RS Dag # 1069/1317, 1068/1314, 681.

26. STS site 4: This STS is located in W-17 on Rahattarpool Mirza Khal, PS Panchlaish, Mouza Bakolia, BS Dag #2348 (A .

27. STS site 5: This STS site is located in W-4 in Chandgaon FIDC, PS and Mouza Chandgaon, BS Dag #9022(A .

28. STS site 6: This STS site is located in W-6 near Police Box of Bohoddarhat Chaktai Khal, Mouza Shulokbahar, PS – Panchlaish, BS Dag #664 (A .

29. STS site 7: This STS site is located in W-2 in the west of Oxygen Moore, in front of Mirzapur Tea on Bayezid Bostami Road, PS Panchlaish, Mouza Jalalabad, BS Dag #1705, 1696 (A .

30. STS site 8: This site is located in W-24 in K-Block, Halishahar, Port connecting road, PS Double mooring, Mouza Agrabad, BS Dag #6305(A .

31. STS site 9: This site is located in W-37 in Port connecting road opposite of port market, part of PC Road.

32. STS site 10: This site is located in the Mohazonghata Road, land of old airport road, Mouza Uttar Patenga. W-39 in front of Kalimondir, South Halishahar.

33. STS site 11: This site is located in W-29 in DT Road Bi-lane in front of Nishkriti over the canal, PS Double mooring, Mouza – Saraipara, BS Dag #1517. West Motherbari but on the east side of the road.

34. STS site 12: This site is located in W-28 in front of Agrabad Commerce College in the north- west corner of the institution; brick storage area and temporary solid waste dumping site.

35. Preliminary design of Chittagong STS subproject has begun in the middle of 2012 and has been completed by the end of the year. As this subproject will be implemented on the basis of turnkey contract, the detailed design will be done by the contractor, and the IEE/ EMP will be updated at the time of detailed design and will be revised by the Design and Supervision Consultants (DSC) team. Construction of the civil works and procurement of equipment would take around 8 months. So the operation of the STSs should therefore begin in late 2013 or early 2014.

C. Description of the Project

36. The following preliminary design criteria formed the basis for selection of Secondary Transfer Stations and secondary collection/ haulage services:

(i) Development on a site 15 meters by 10 meters (150 m^2);
(ii) Enclosed hall building with three roller shutter access points from the road;
(iii) Containers placed in pits equipped allowing primary collection rickshaws to empty collected waste by gravity into the containers;
(iv) Two pit or one pit system depending on population to be served and available land area;
(v) Transfer of wastes directly into large capacity transfer containers through use of an electric hoist mounted onto two ceiling I-beams;
(vi) Weighing the containers in the pits, thus allowing for maximum loads in each container without under-or-overloading.
(vii) Loading of containers directly onto transfer vehicles that have only a light weight tipping frame body, thus maximizing permitted waste loads.
(viii) Storage of full containers at any one time within the transfer station, allowing for daytime collection and night time transfer where there are traffic congestion problems.
(ix) Covering of full containers during storage/ transport to limit the potential for littering and release of odors.

(x) High pressure water on site in order to keep the small transfer station clean and hygienic. At one time each day, the STS should be completely empty, allowing for a full wash down.

(xi) Adaptation of available container and vehicle types to suit the purposes of waste transfer efficiency (e.g. use of a standard 4 x 2 (single rear axle, four wheels, two-wheel drive) truck fitted with a skeleton tipping frame so that a 16 tonne Gross Vehicle Weight (GVW) truck can carry an 8 tonne payload without any overloading. Container capacity 26 m.

(xii) Alternatively, for longer haul distances, use of a 6 x 4 (double rear axle) trucks of 28,000 kg GVW and a payload of up to 18 tonnes. Container capacity can be up to 36 m.

(xiii) Containers designed to resist 'anaerobic crevice corrosion', which is the main corrosion problem of vehicle bodies and manufactured from CorTen steel to further resist corrosion.

(xiv) Where the STS is located in an area with high-rise buildings, the space above the STS can be used for residential or office purposes as long as operational/ management controls are sufficiently in place to limit noise, littering and odor.

37. Implementation of small transfer stations is anticipated to lead to a 50% reduction in operating cost of secondary collection services per tonne. This will free up significant resources to expand the coverage and quality of secondary collection services, as well as to pay for the operating and maintenance costs of the integrated waste treatment and disposal facility.

38. Electrical, mechanical machineries and equipment are also included in the subproject to operate the STS to modern sanitary standards.

39. Figures 2 to 25 provide preliminary site layout plans including the North and East Coordinates as well as the tentative plans of the 12 STSs.

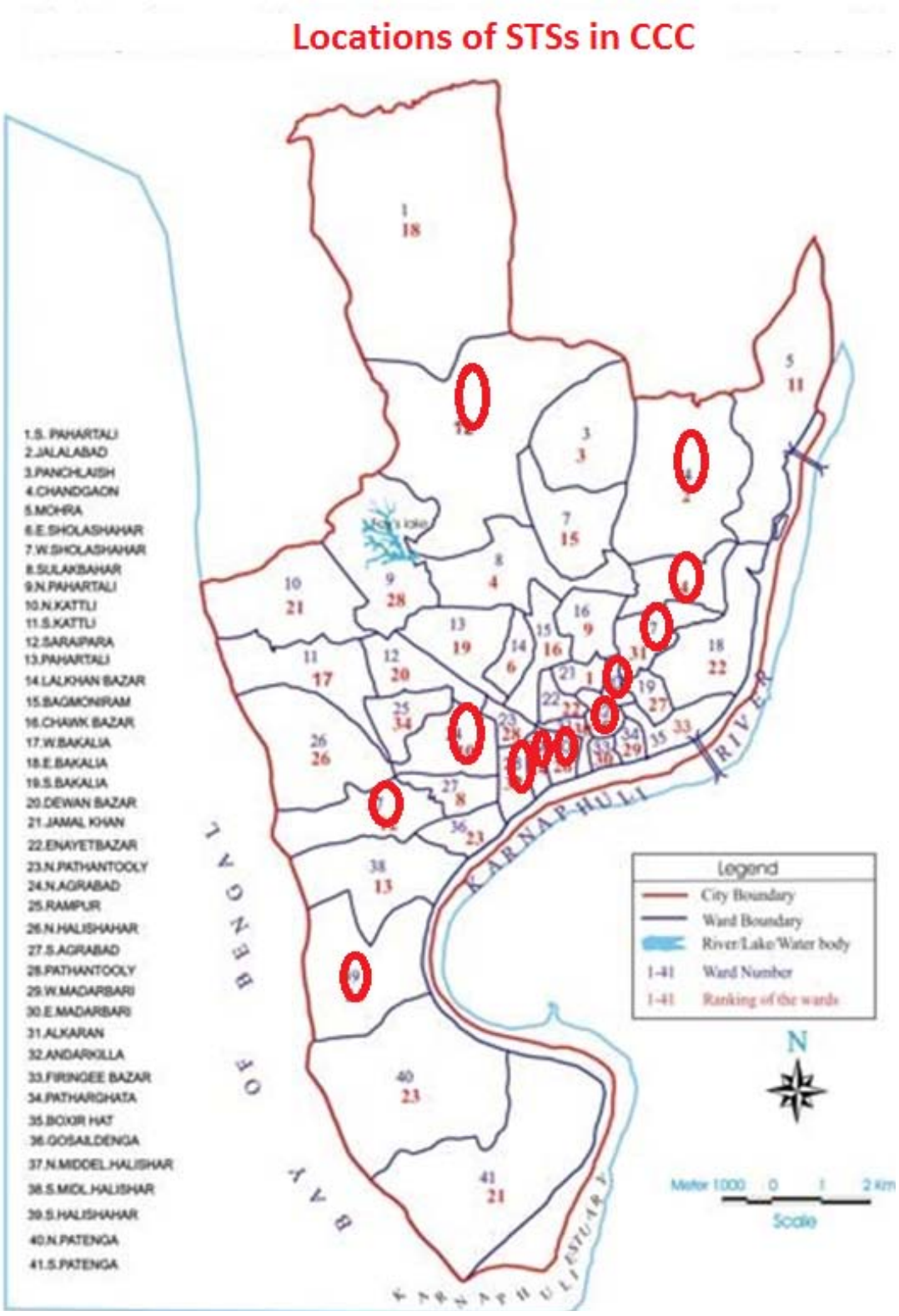


Figure1: Location Plan for 12 STSs in different Wards of Chittagong CC

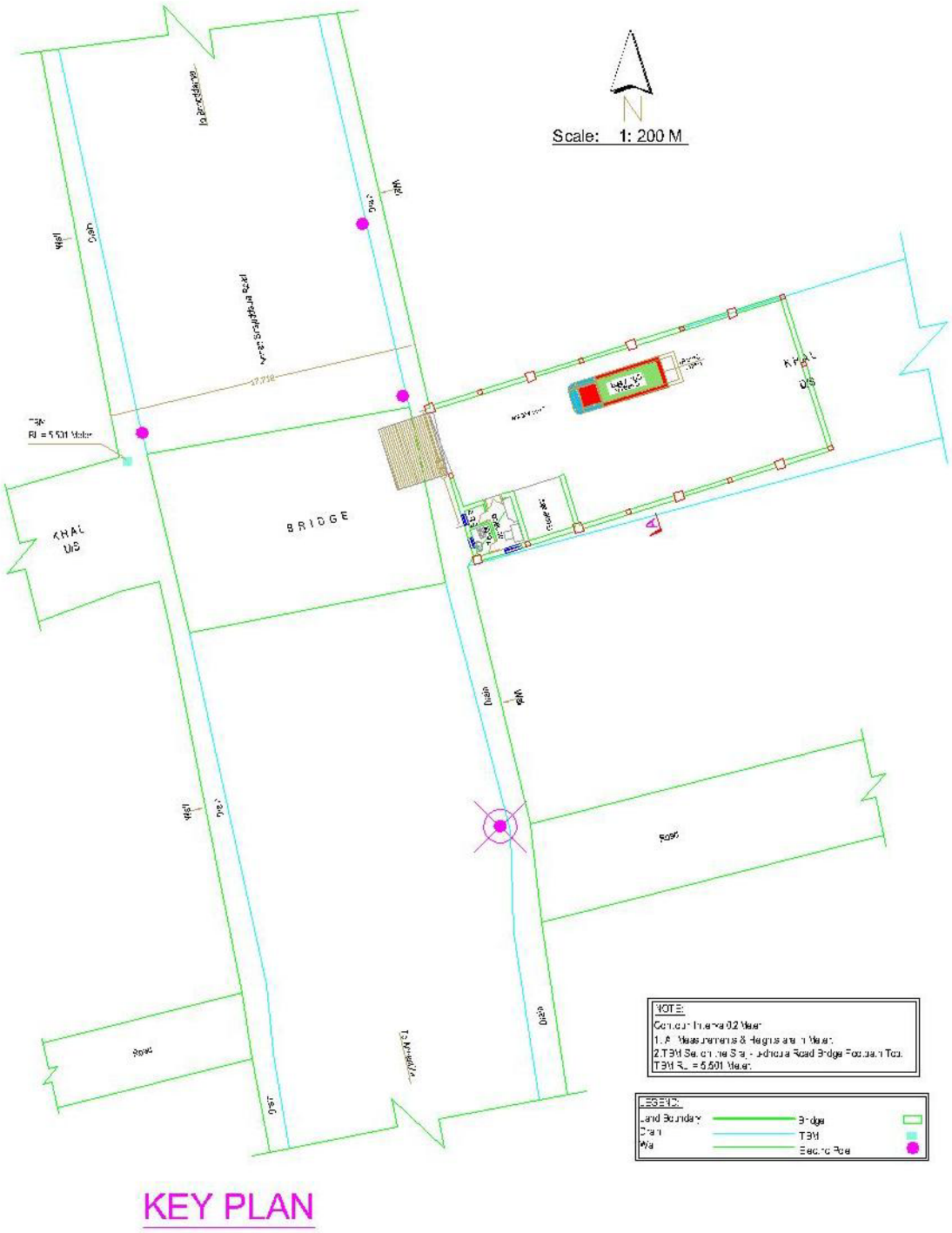


Figure 2: STS – 1 Sirajuddoula Road Layout Plan (22°20'40"N, 91°50'16"E)

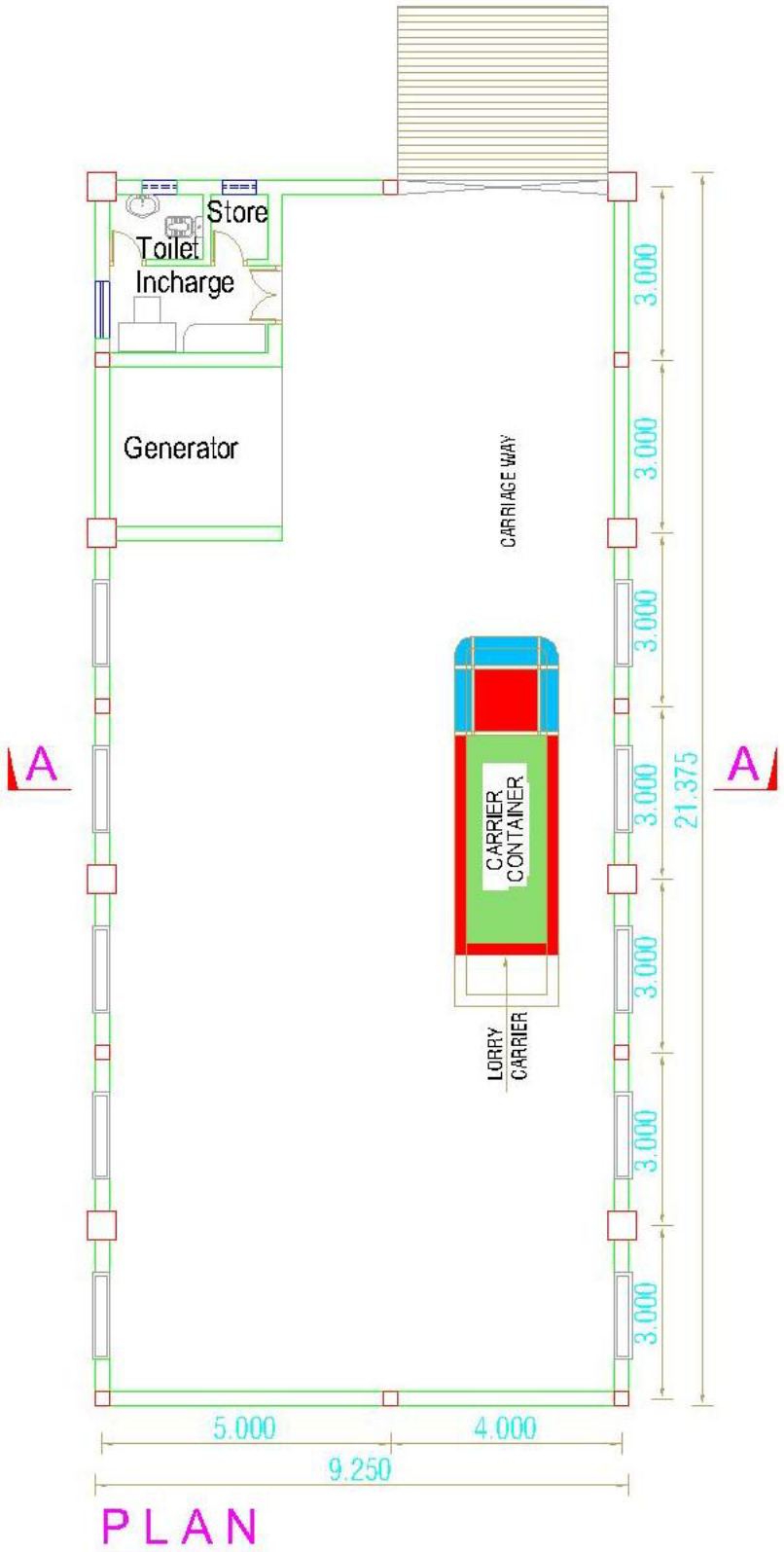


Figure 3: STS – 1 Sirajuddoula Road Preliminary Plan

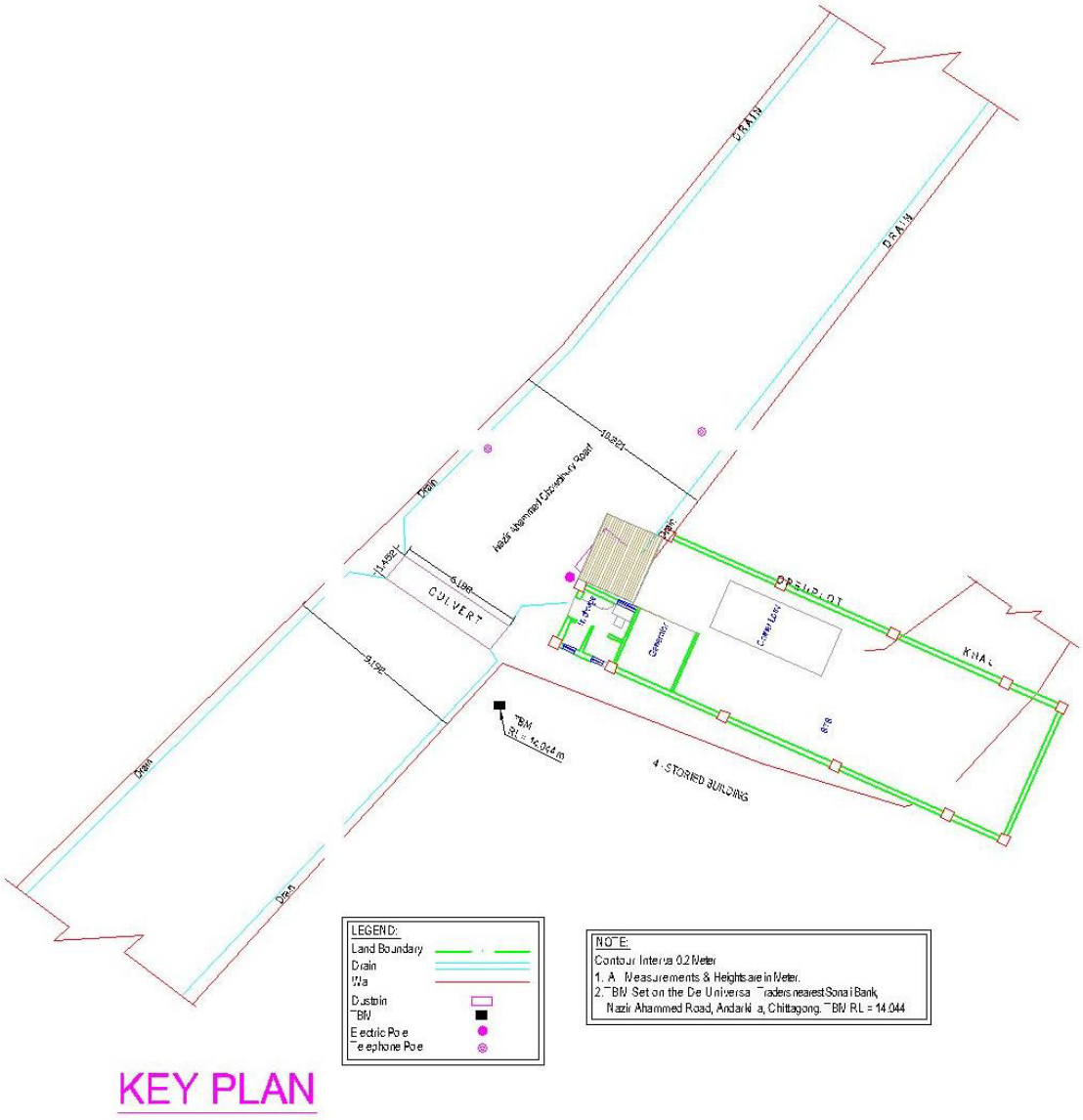


Figure 4: STS – 2 Nazir Ahmed Road Andarkilla Layout Plan (22°20'25"N, 91°50'8"E)

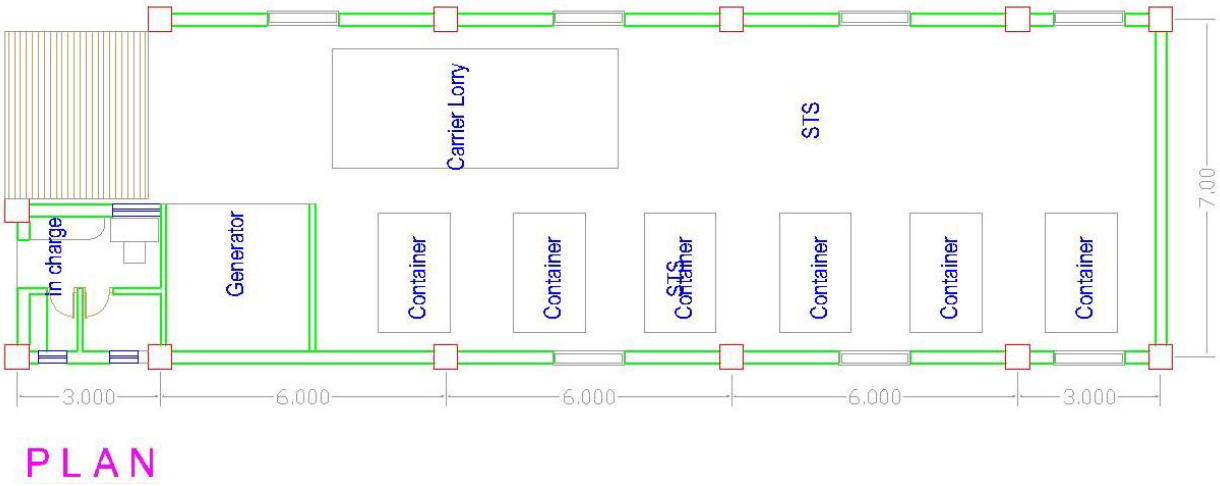


Figure 5: STS – 2 Nazir Ahmed Road Andarkilla Preliminary Plan

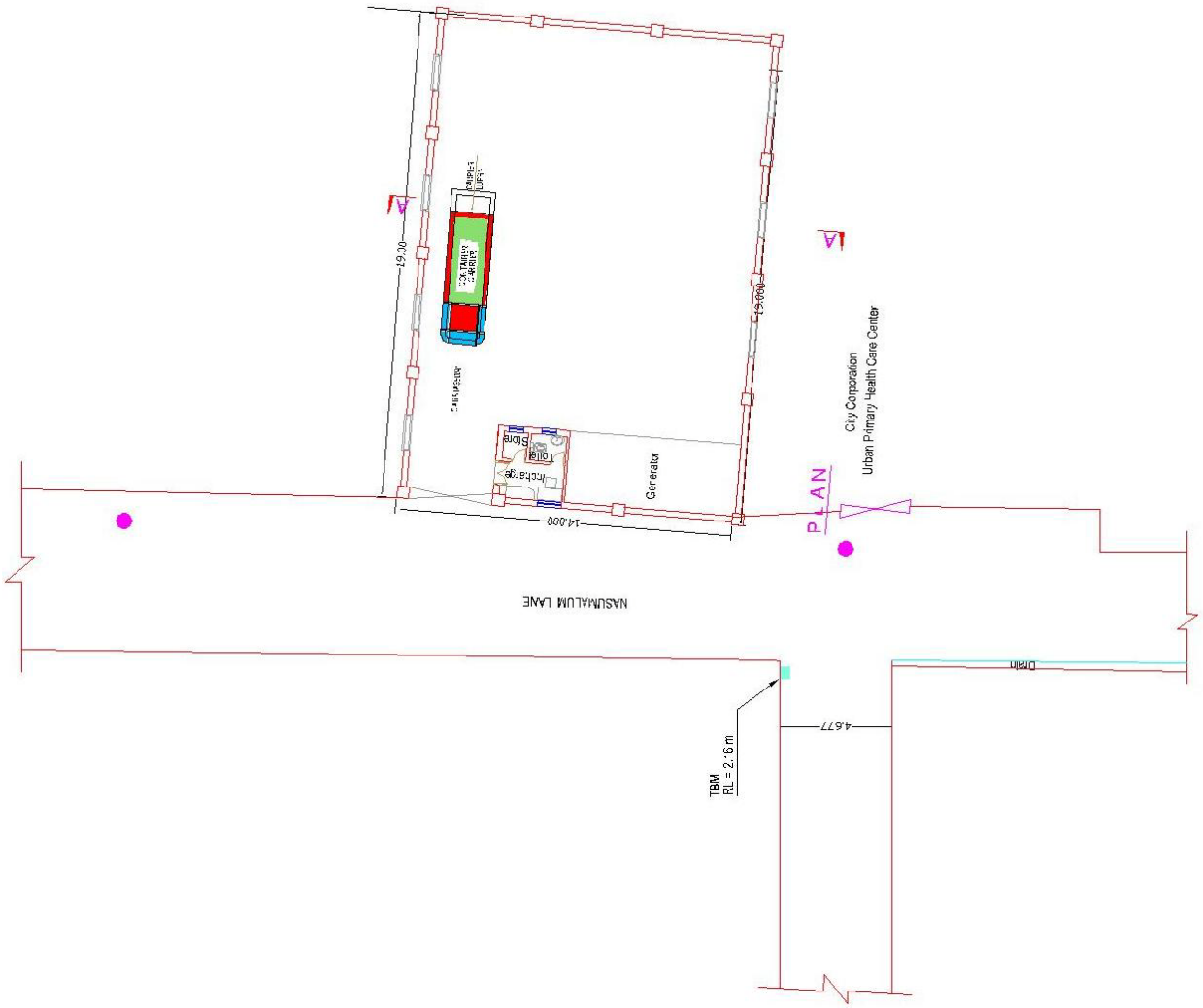


Figure 6: STS – 3 East Motherbari Namuna Bazar Khoar W-30 Layout Plan (22°19'32"N, 91°49'36"E)

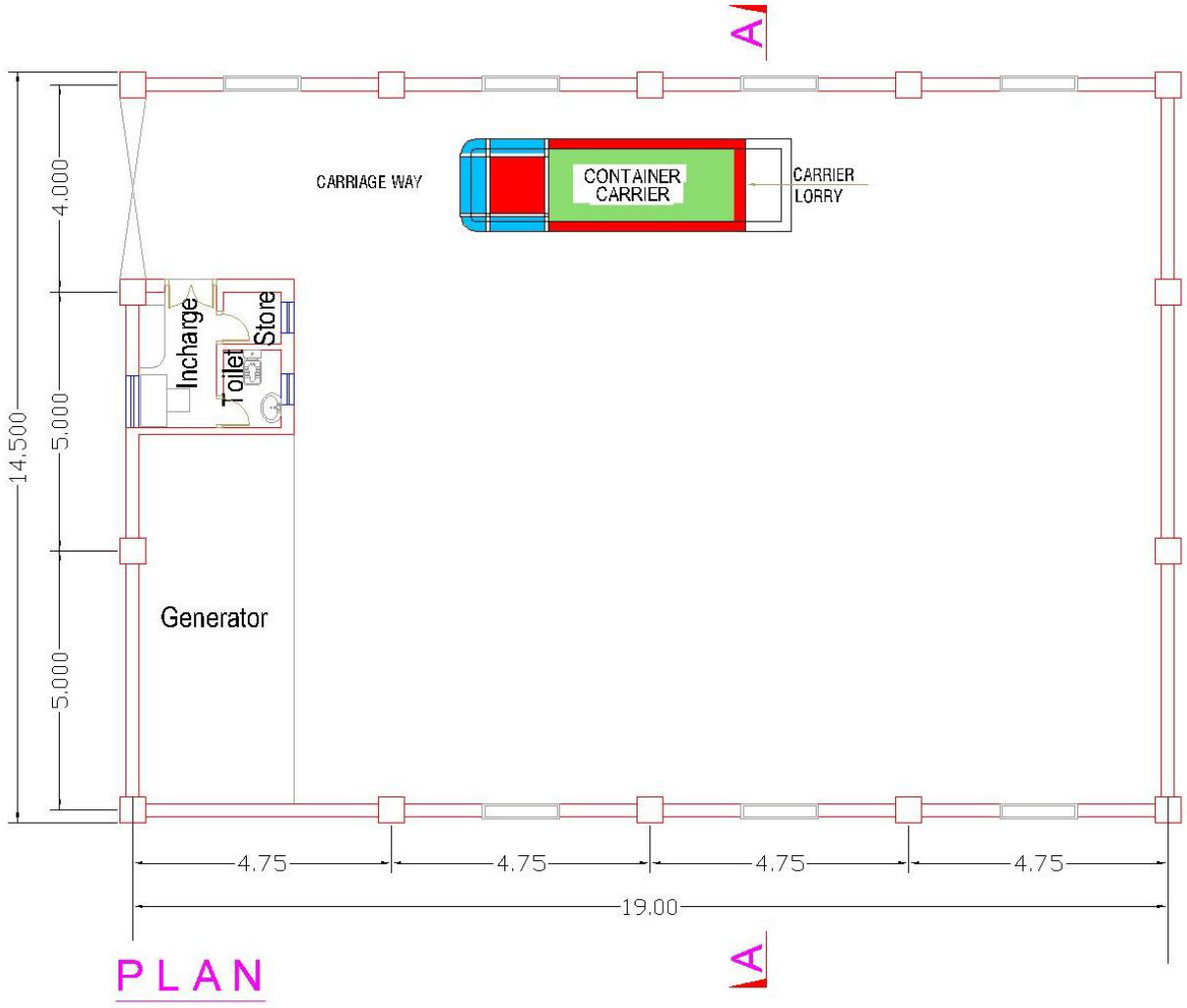


Figure 7: STS – 3 East Motherbari Namuna Bazar Khoar W-30 Preliminary Plan

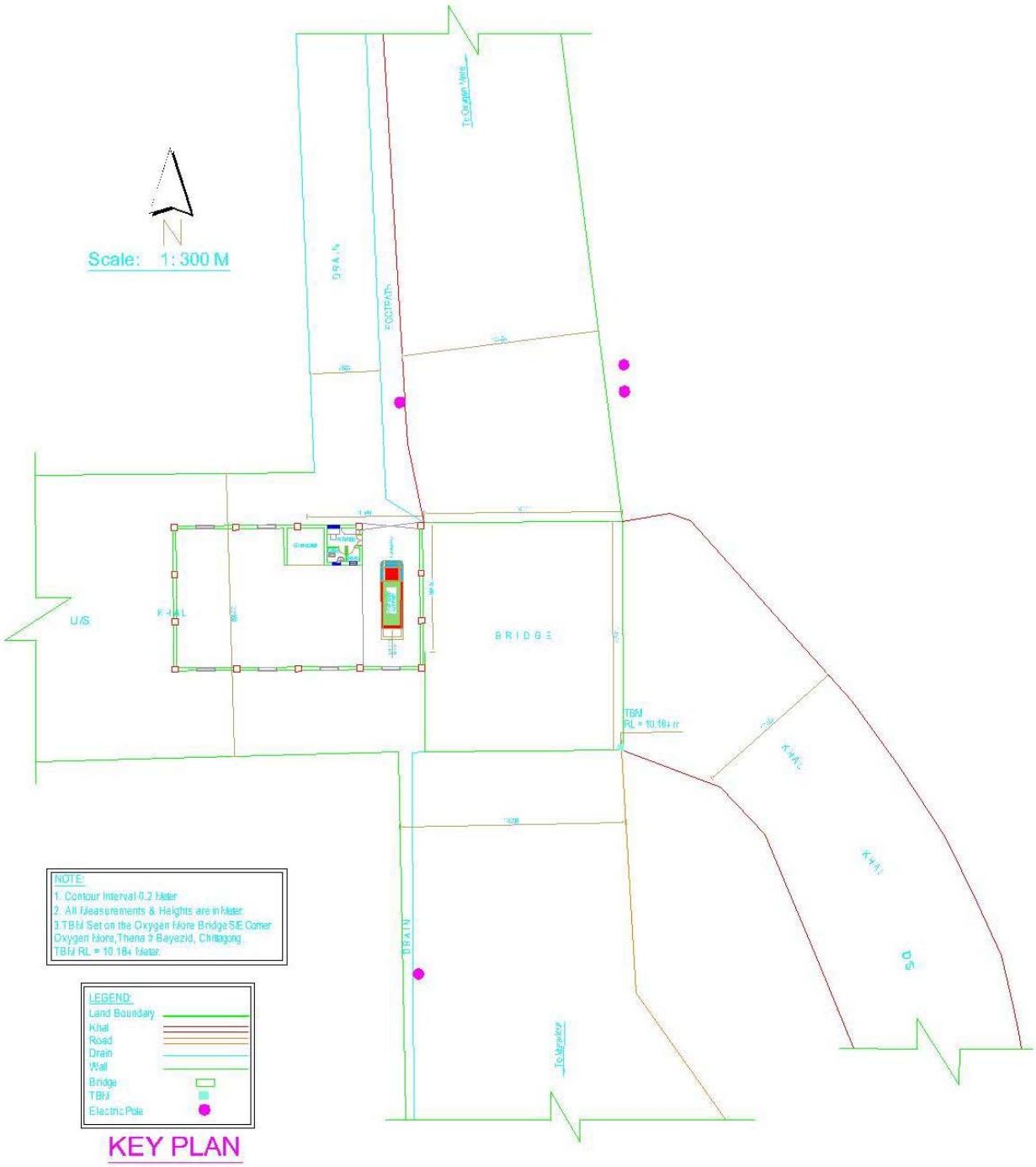


Figure 8: STS – 4 Rahattarpool Mirza Khal Layout Plan(22°21'33"N, 91°51'5"E)

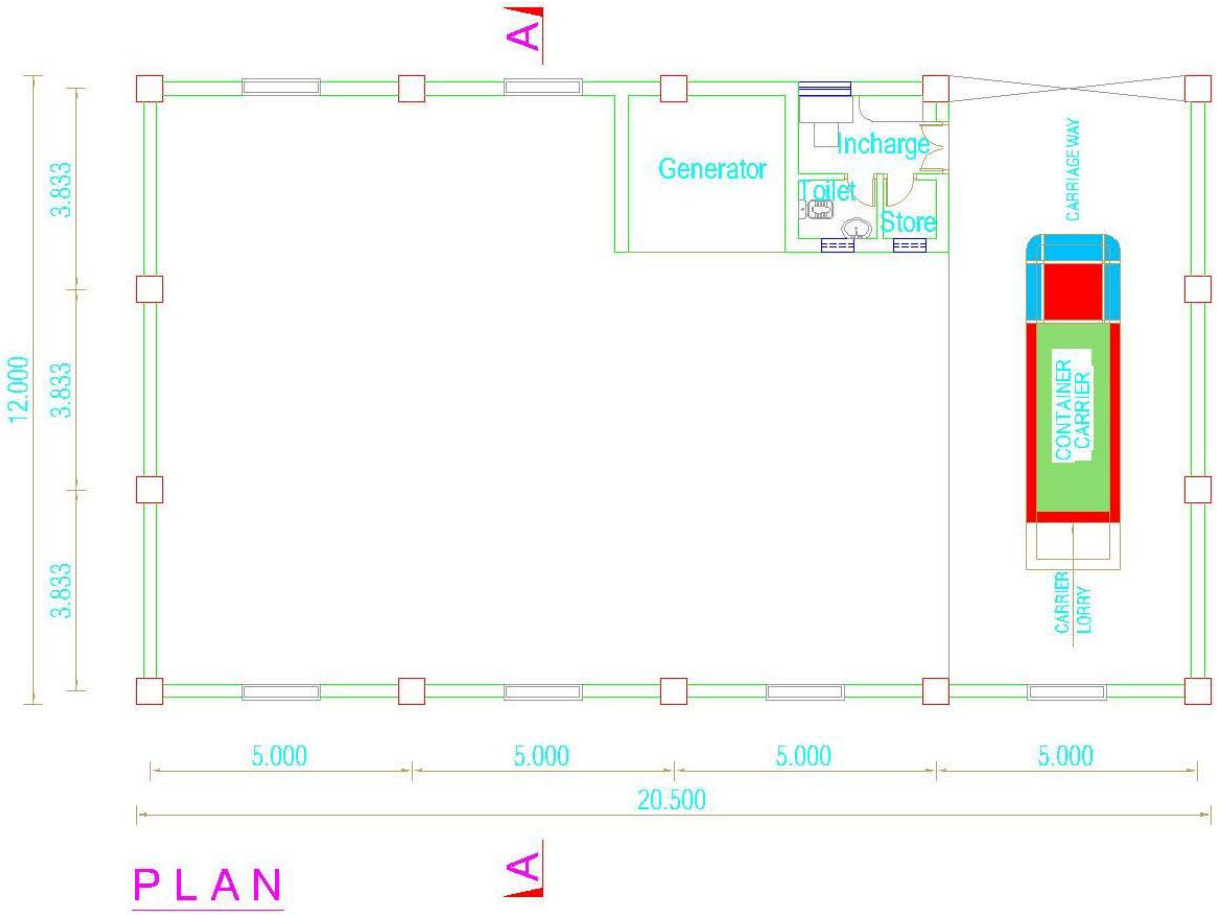


Figure 9: STS – 4 Rahattarpool Mirza Khal Preliminary Plan

Figure 10: STS – 5 Chandgaon FIDC Layout Plan (22°23'16"N, 91°51'56"E)

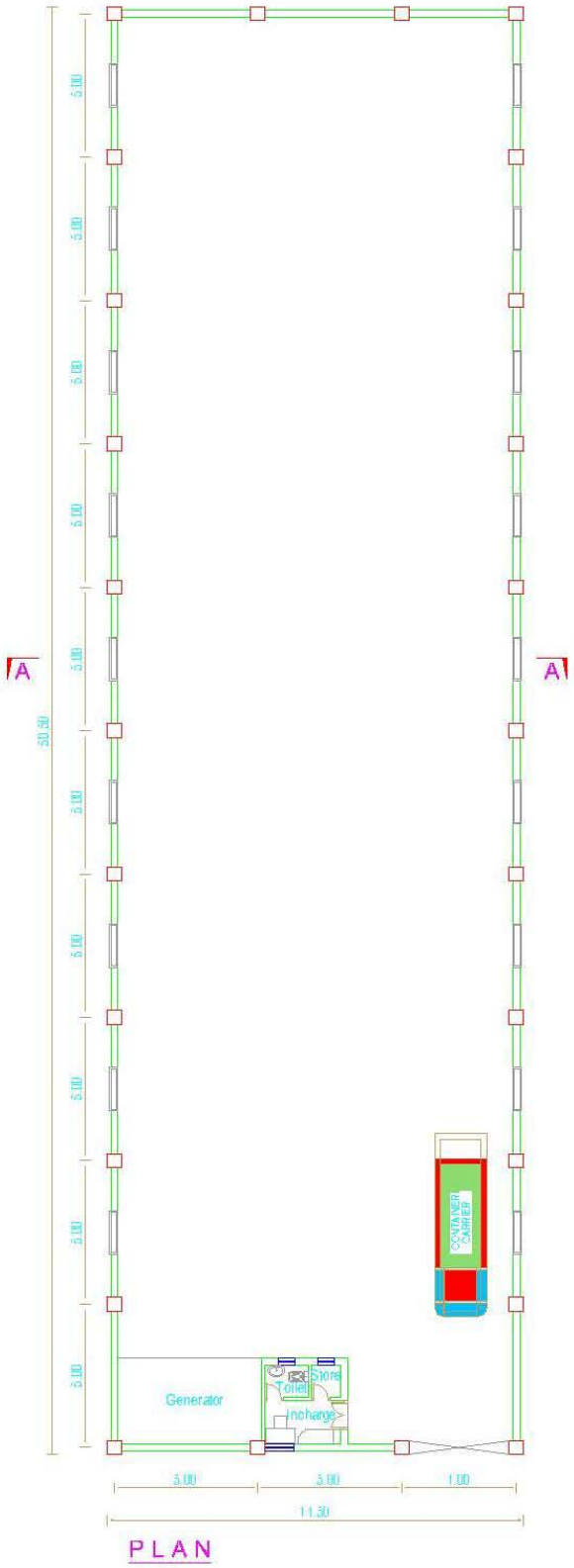


Figure 11: STS – 5 Chandgaon FIDC Preliminary Plan

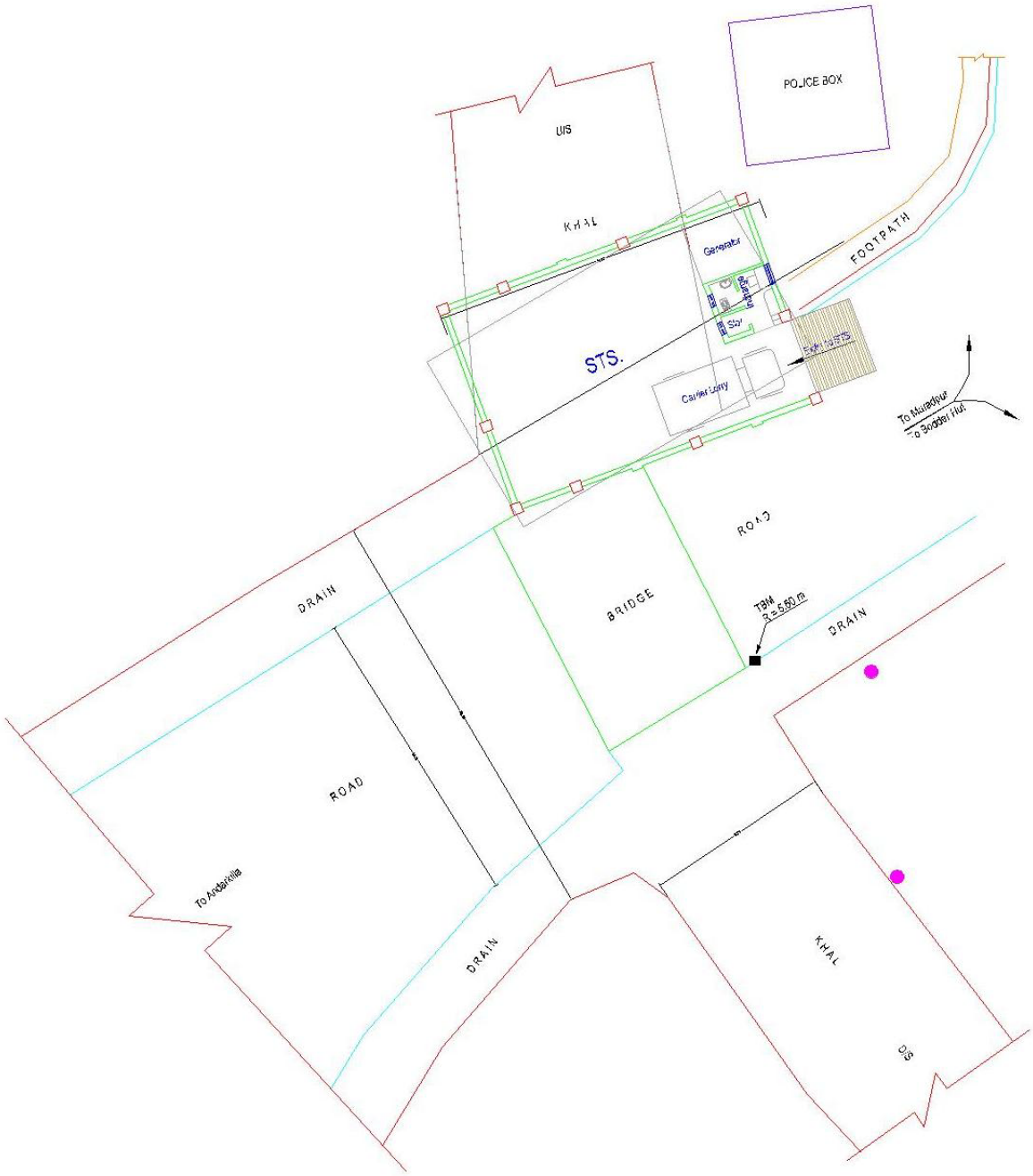


Figure12: STS – 6 Police Box Bohoddarhat Layout Plan (22°22'3"N, 91°50'35"E)

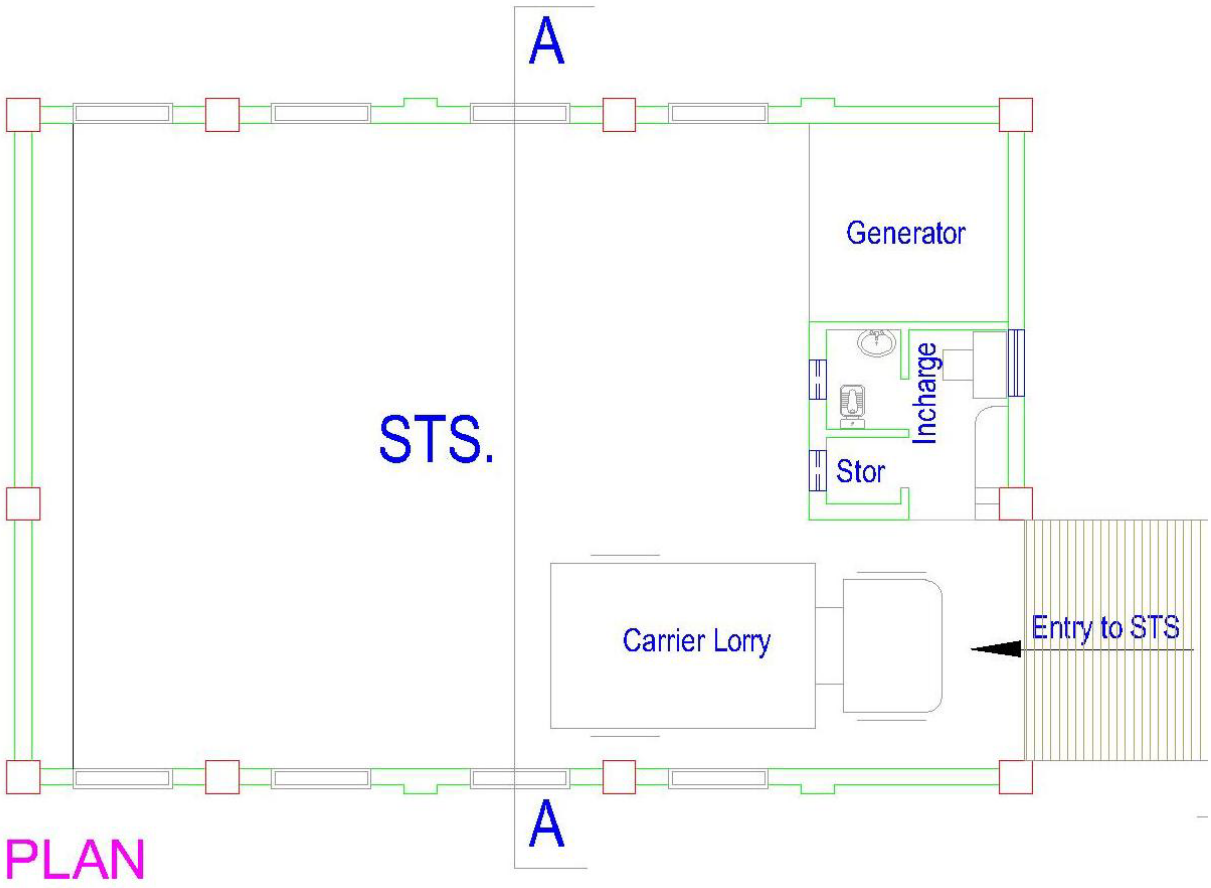


Figure 13: STS – 6 Police Box Bohoddarhat Preliminary Plan

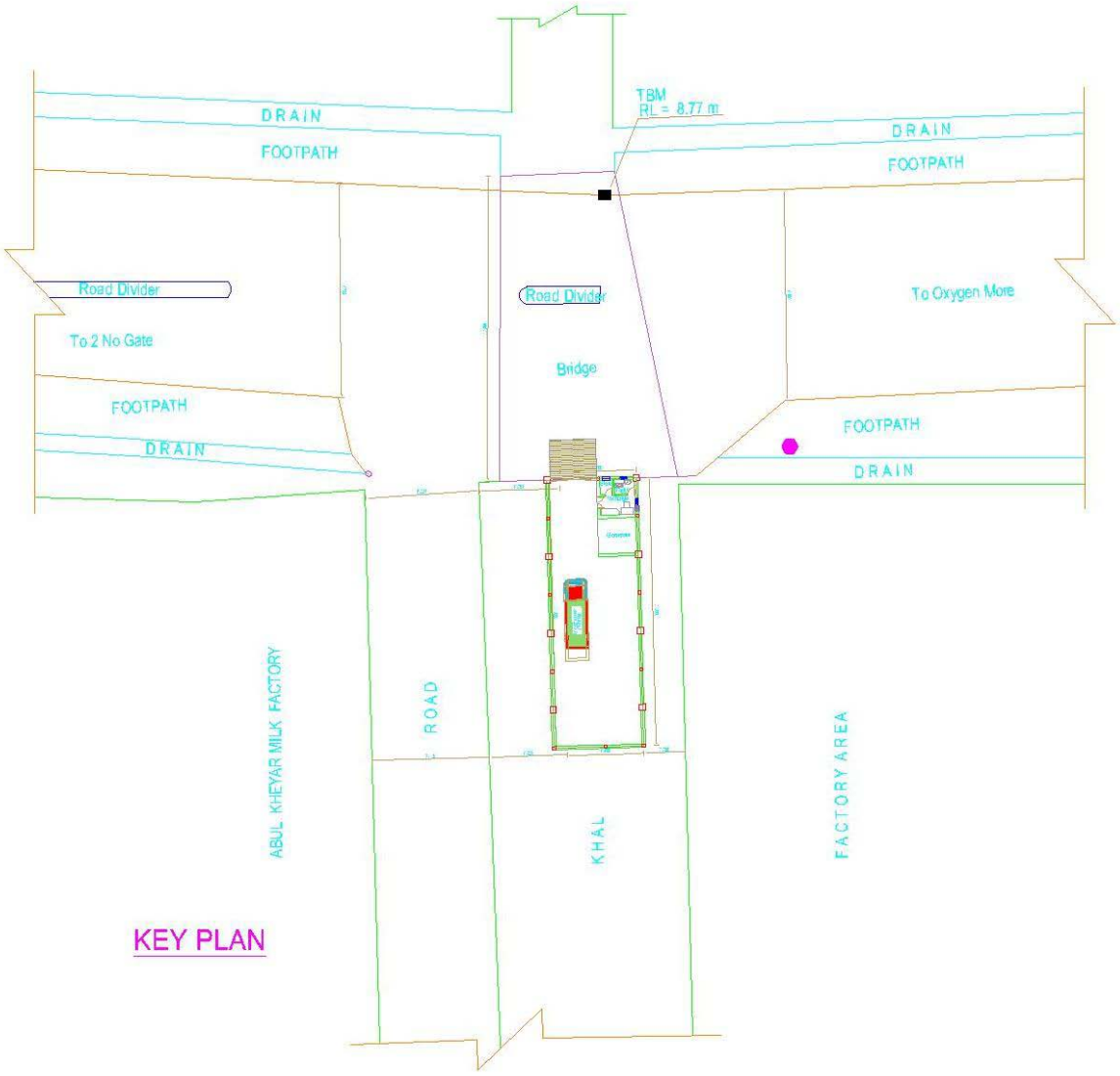


Figure14: STS – 7 Bayezid Bostami Layout Plan (22°23'35"N, 91°49'4"E)

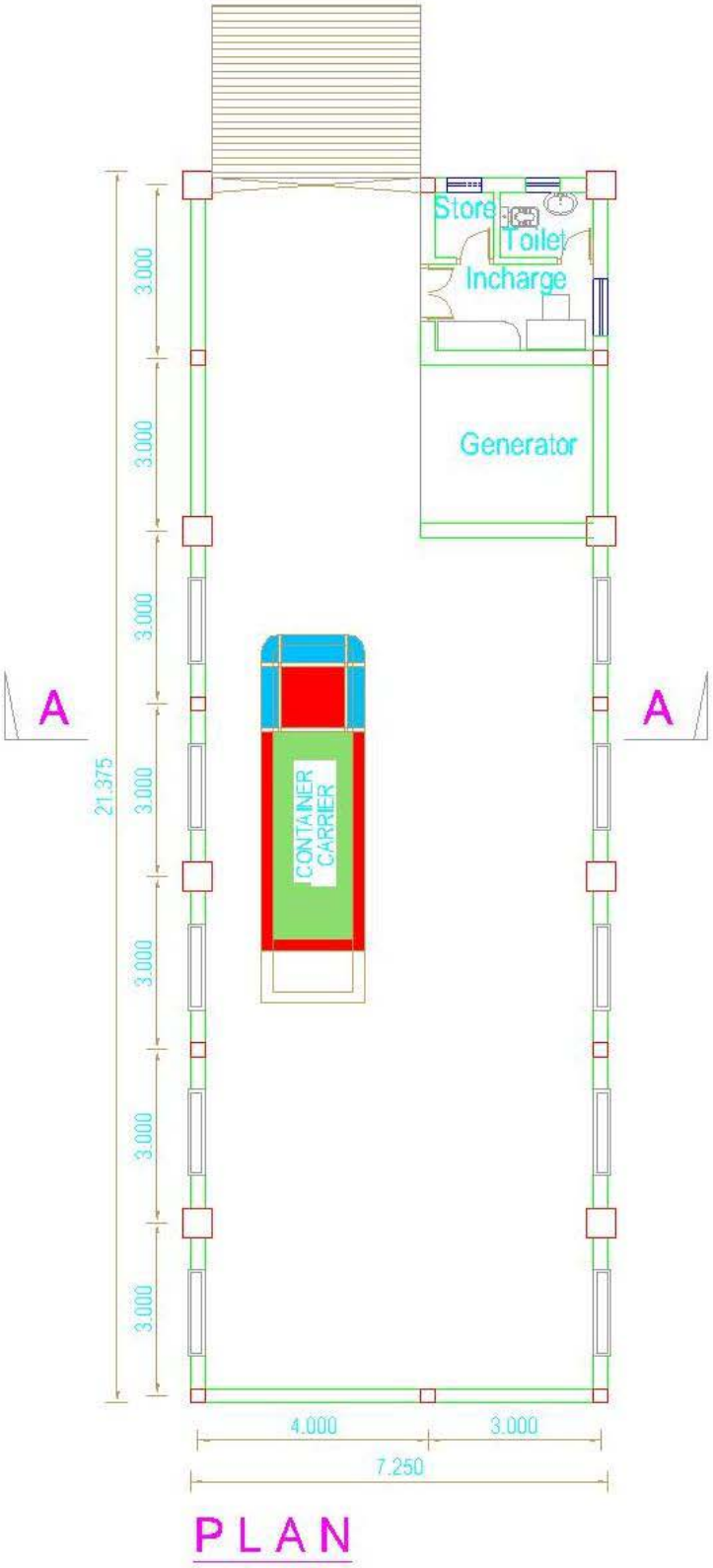


Figure 15: STS – 7 Bayezid Bostami Preliminary Plan

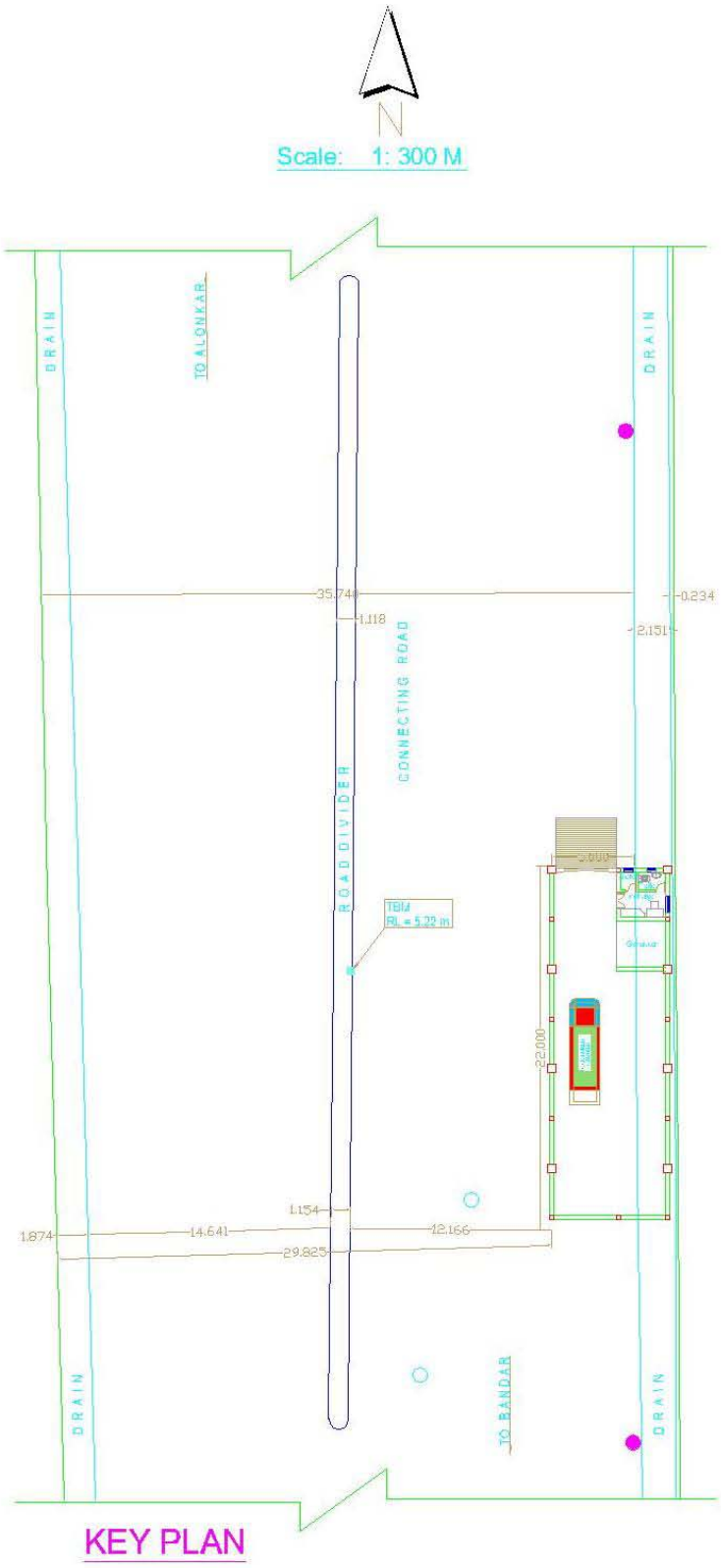


Figure16: STS – 8 K-Block DT Road Layout Plan (22°20'35"N, 91°48'11"E)

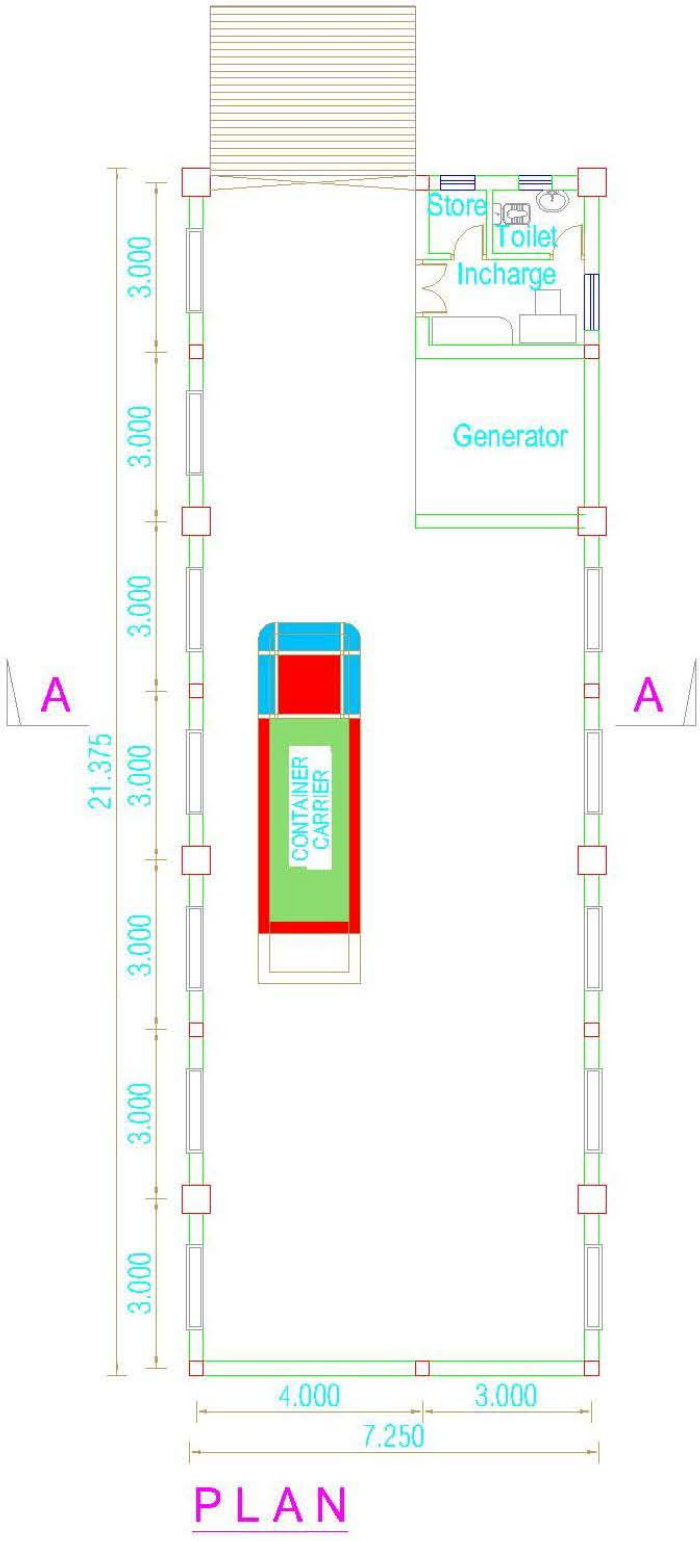


Figure 17: STS – 8 K-Block DT Road Preliminary Plan

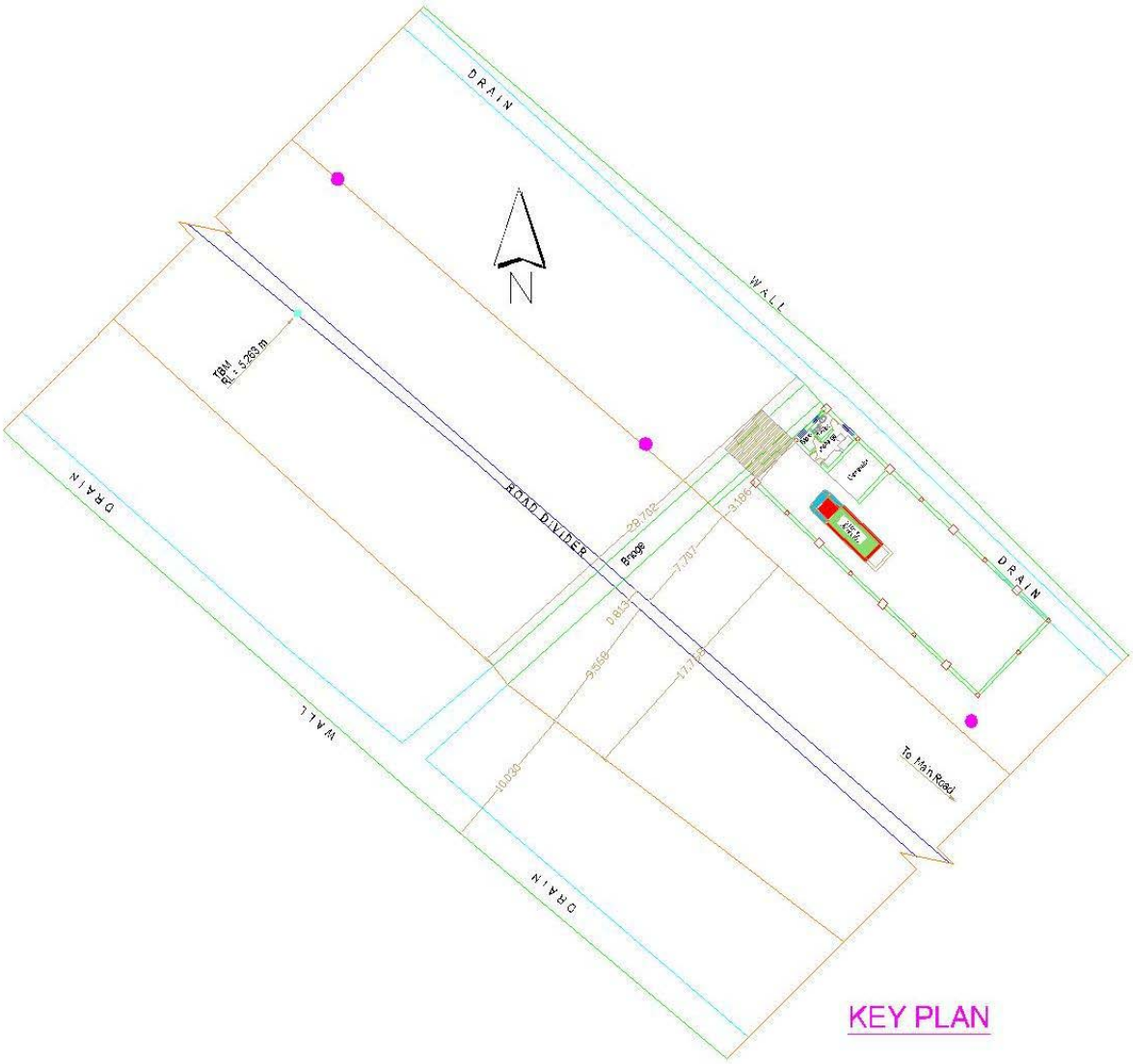


Figure18: STS – 9 Port Connecting Road Layout Plan (22°20'5"N, 91°47'20"E)

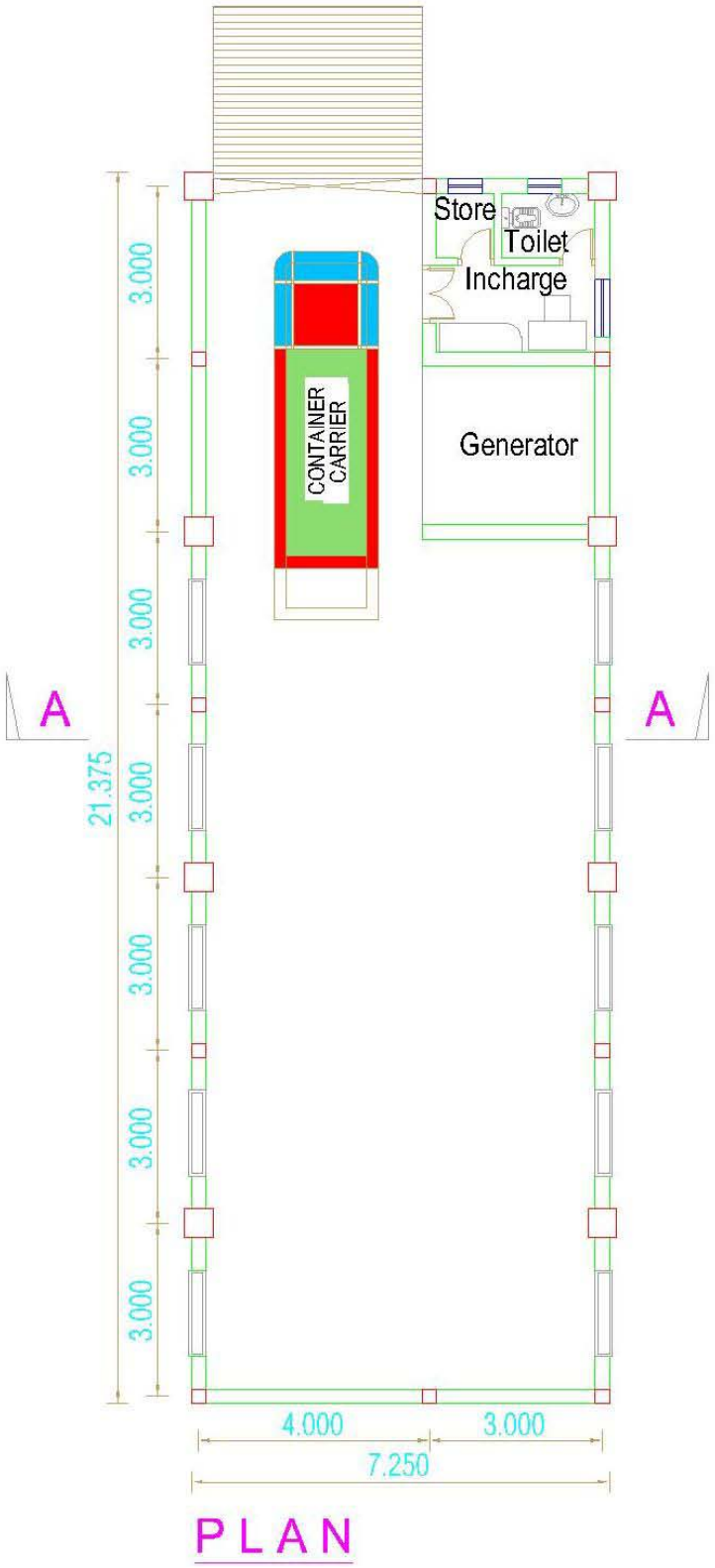


Figure 19: STS – 9 Port Connecting Road Preliminary Plan

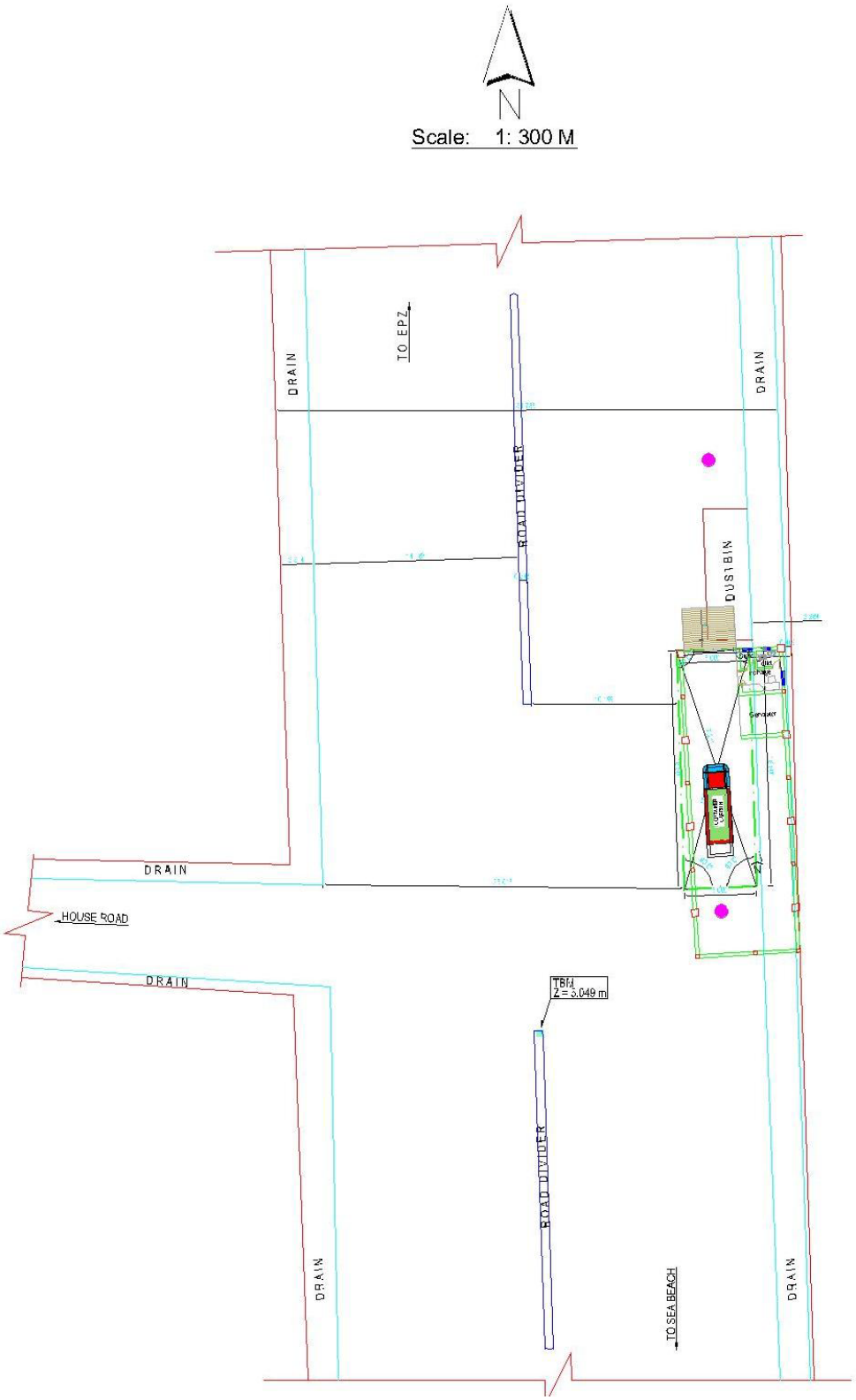


Figure 20: STS – 10 Mohazonghata Road Layout Plan (22°19'23"N, 91°47'40"E)

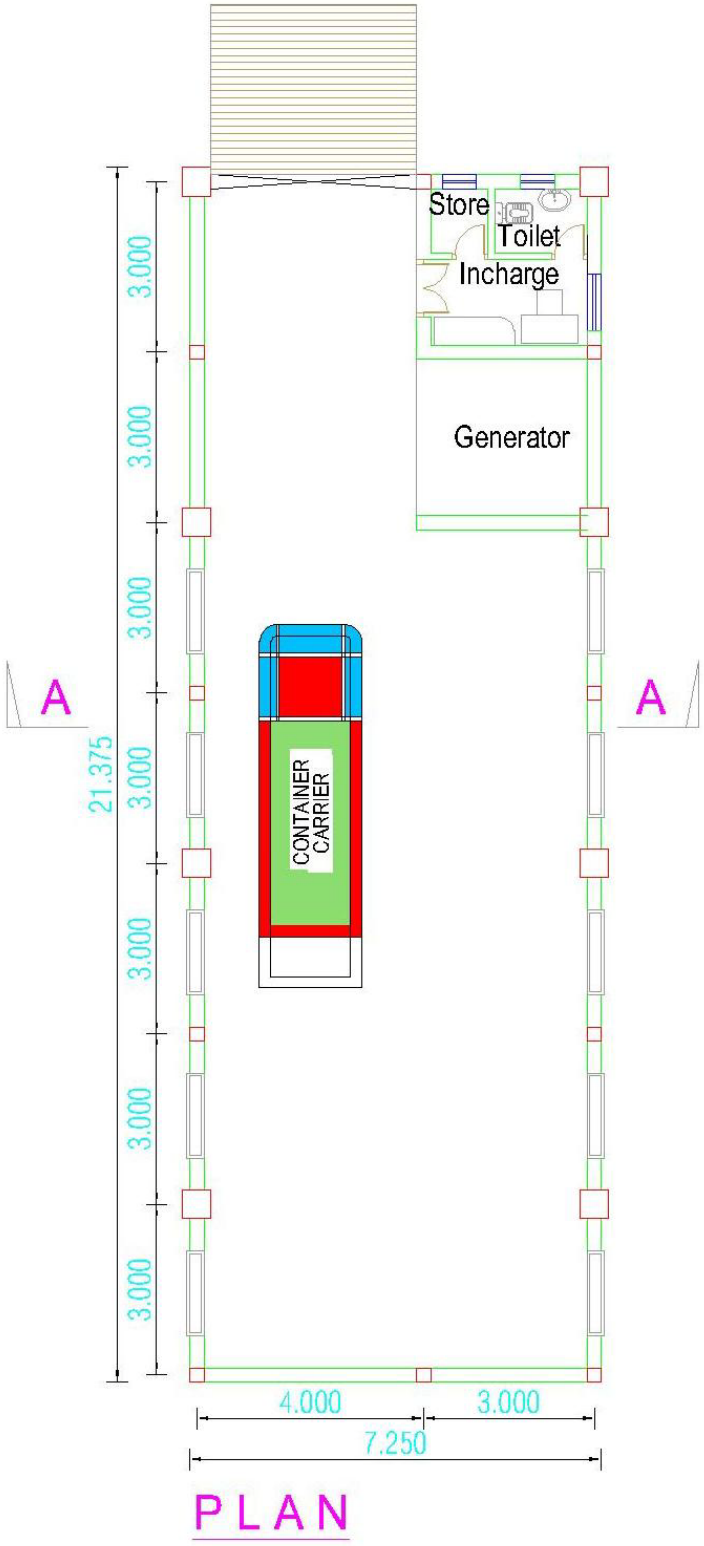


Figure 21: STS – 10 Mohazonghata Road Preliminary Plan

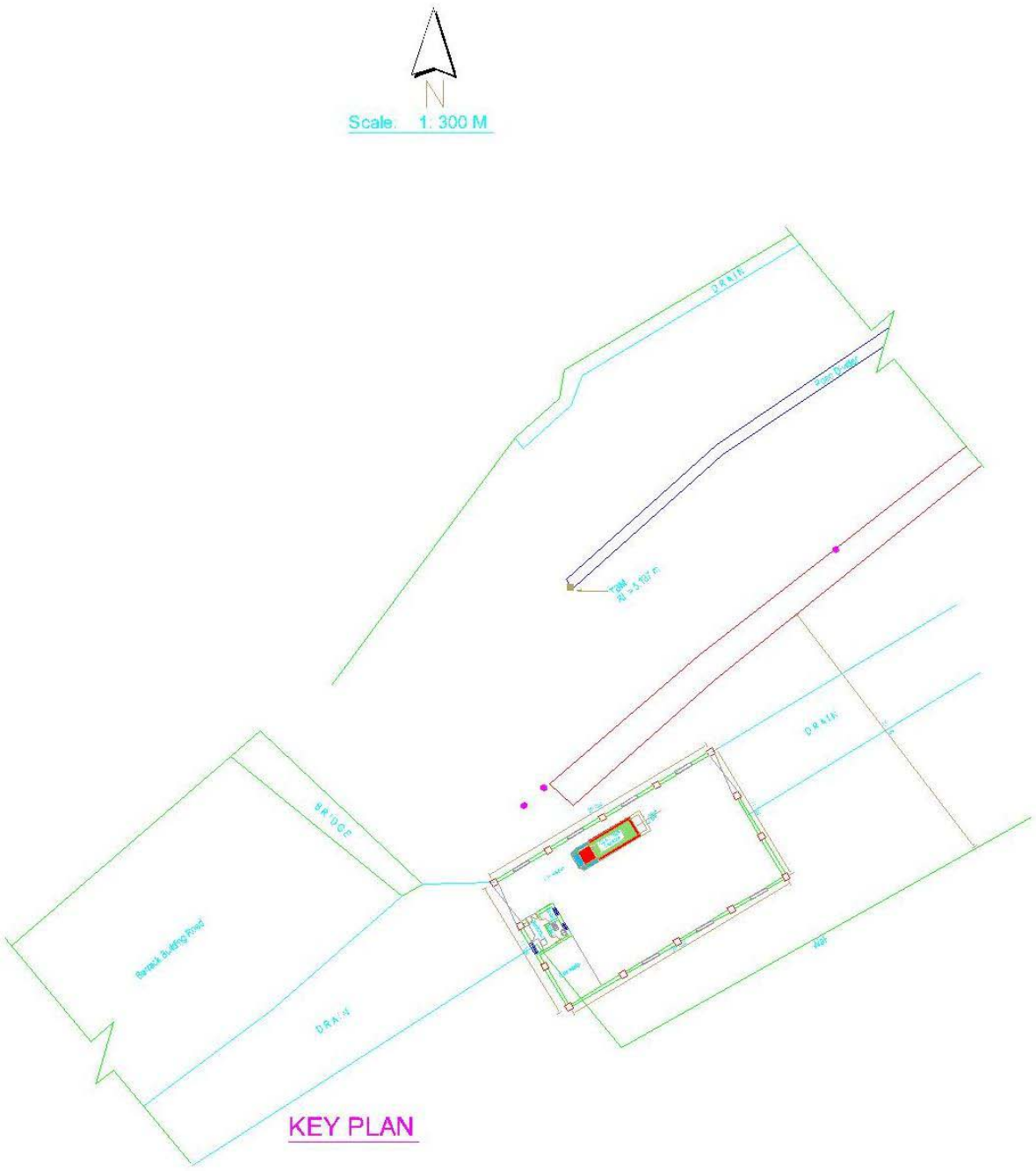


Figure 22: STS – 11 DT Road Nishkriti Layout Plan (22°16'24"N, 91°47'13"E)

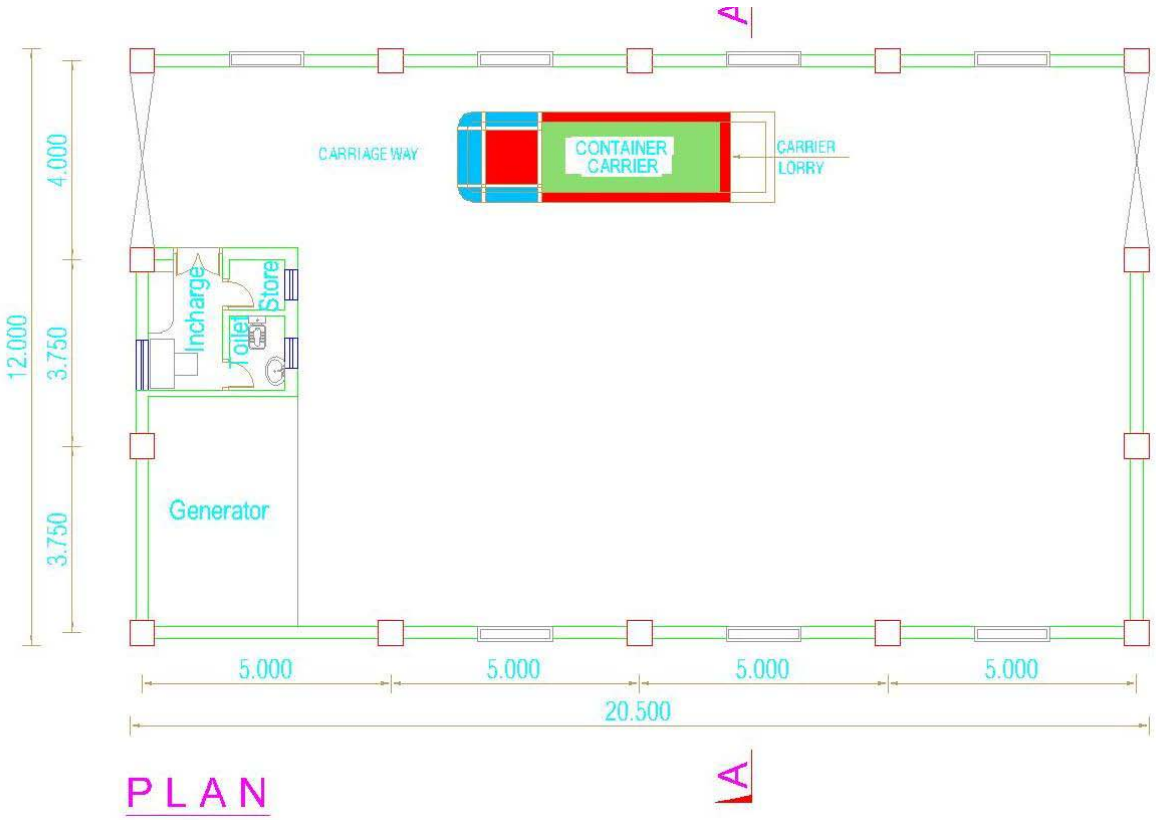


Figure 23: STS – 11 DT Road Nishkriti Preliminary Plan

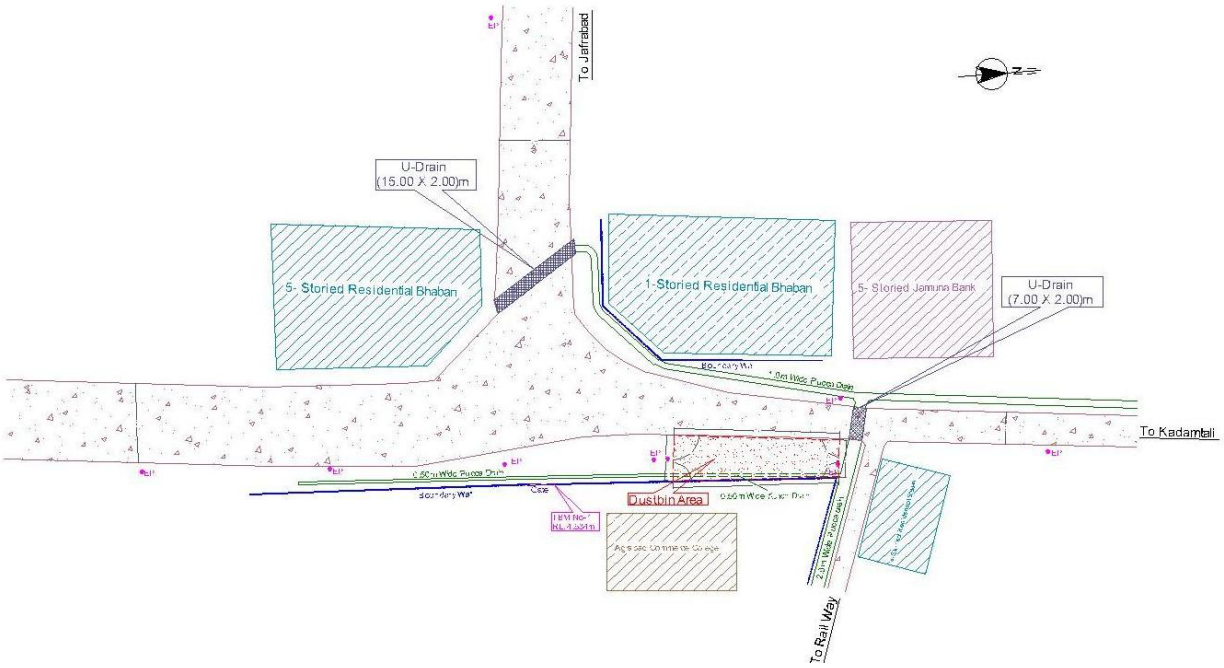


Figure 24: STS – 12 Agrabad Commerce College Layout Plan (22°19'36"N, 91°49'1"E)

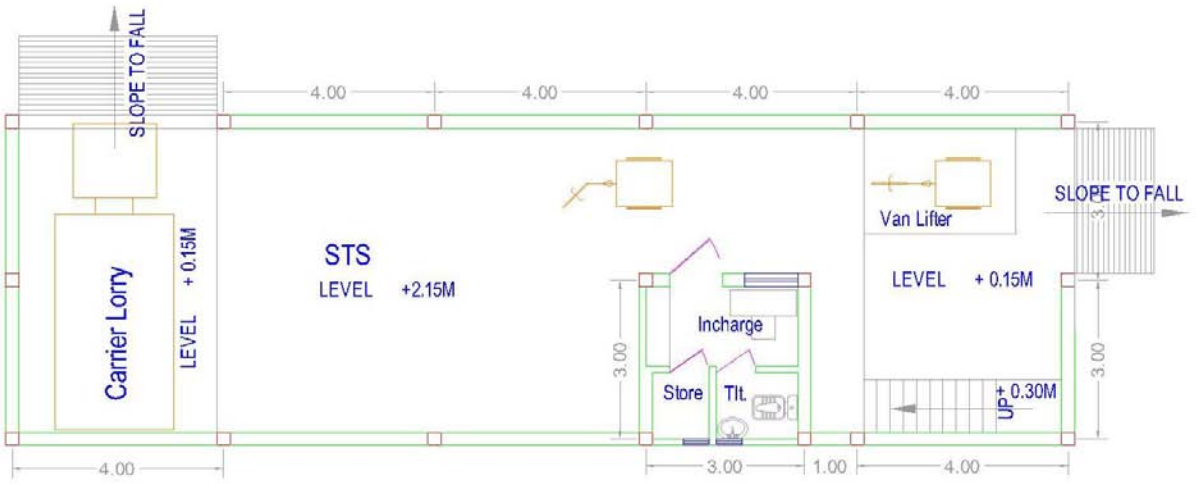


Figure 25: STS – 12 Agrabad Commerce College Preliminary Plan

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Topography and Soils

40. The part of Bangladesh to which the port city of Chittagong belongs is dominated by the rivers Karnafuli and Halda, which drain large quantities of water from the Chittagong Hill Tracts area into the Bay of Bengal. The other rivers in the Chittagong division are Rainkhiang, Thega, Kasalong, Ichamati, Bakkhali, Myani, Chingri, Sangu, Matamuhuri, Naf, Feni, etc. The predominant soil type in the Chittagong coastal plain is the acid sulphate soils. These soils contain sulphidic material, which turns extremely acidic if exposed to air. The other type is grey piedmont soils, which occur extensively on the northern and eastern Piedmont Plains and locally on the Chittagong coastal plain.

41. Figure 26 representing the bio-ecological regions of Bangladesh shows the coastal plains (8a) where the city of Chittagong belongs. This region of Bangladesh comprises the most productive ecosystems of the world.

2. Climate

42. The weather of Chittagong is characterized by tropical monsoon climate. The dry and cool season is from November to March; pre-monsoon season is from April to May which is very hot. The sunny and the monsoon season is from June to October, which is warm, cloudy and wet. On average, the temperatures are always high. A lot of rain (rainy season) falls in the months of April, May, June, July, August September and October. It has dry periods in January and December. On average, the warmest month is April and the coolest month is January. On the other hand, the wettest month is July and the driest is the January. Around 70-80% of the annual rain falls during the months from April to October. The rain is often accompanied by

strong winds, sometimes exceeding 100 km/h. The highest rainfall during the last ten years (2002 to 2011) recorded was 4340 mm in the year 2007 and lowest of 2331 mm in 2005. The highest maximum annual average temperature of 39.5ºC in 2009 and the lowest is 35.4ºC in 2011. On the other hand, the highest minimum annual average is 12.5ºC in 2008 and the lowest of 9.5ºC in 2011.

43. Wind data from the Bangladesh Meteorological Department Climate Division suggests that wind directions vary month-to-month in Chittagong, though predominantly in the NW, S, and NE directions.

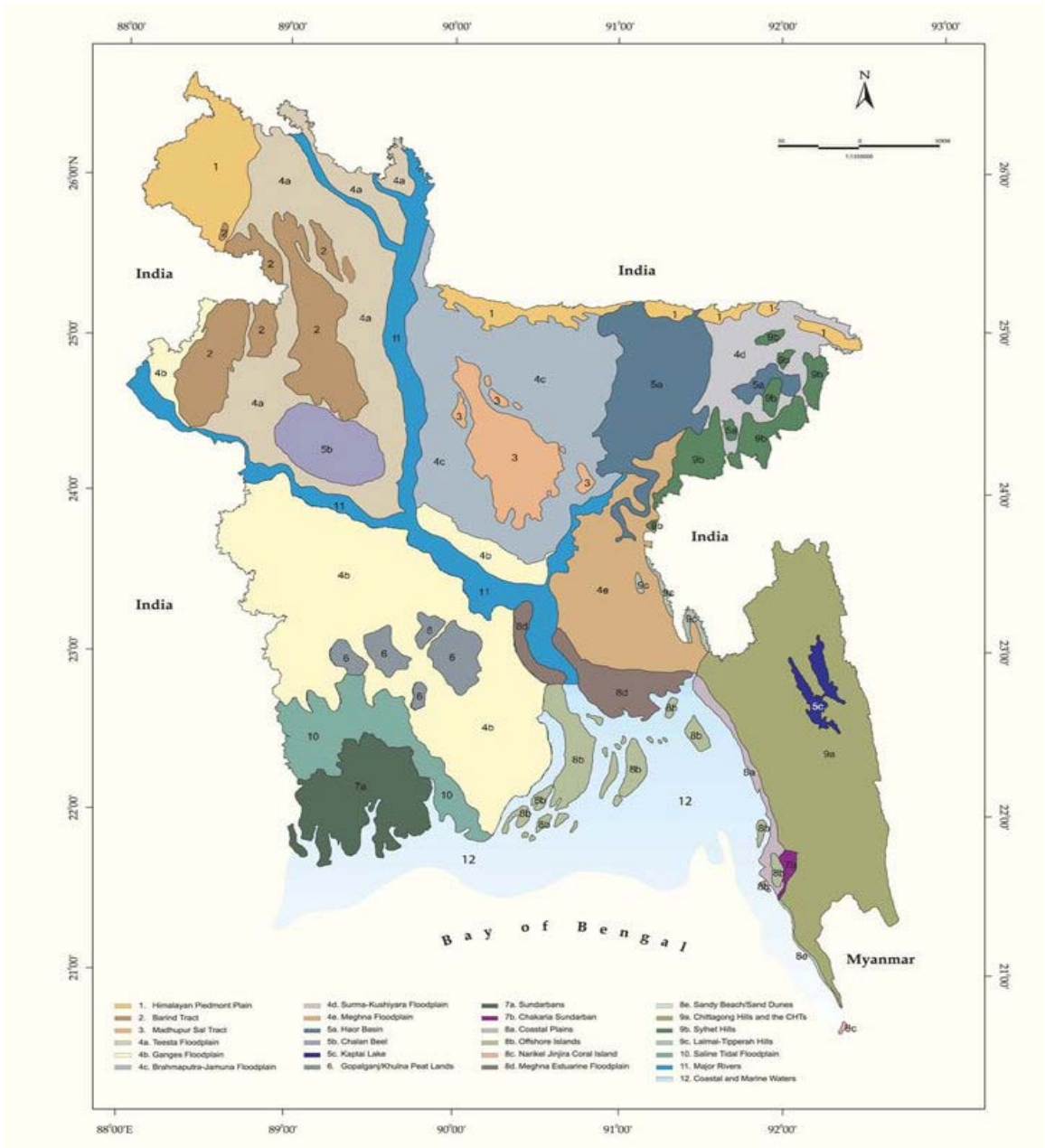


Figure 26: Bio-ecological map of Bangladesh

Source: Internet.

44. Although weather patterns are broadly similar throughout the country, differences in topography, winds and other factors produce some quite marked local variations. This is particularly evident in the annual rainfall of around 3,128 mm (in 2011) in Chittagong. Relative humidity, average dry bulb temperature, maximum and minimum temperatures and rainfall patterns are represented as under based on the raw data obtained from the Bangladesh Meteorological Department (Figures 27, 28, 29, 30 and 31)[1].

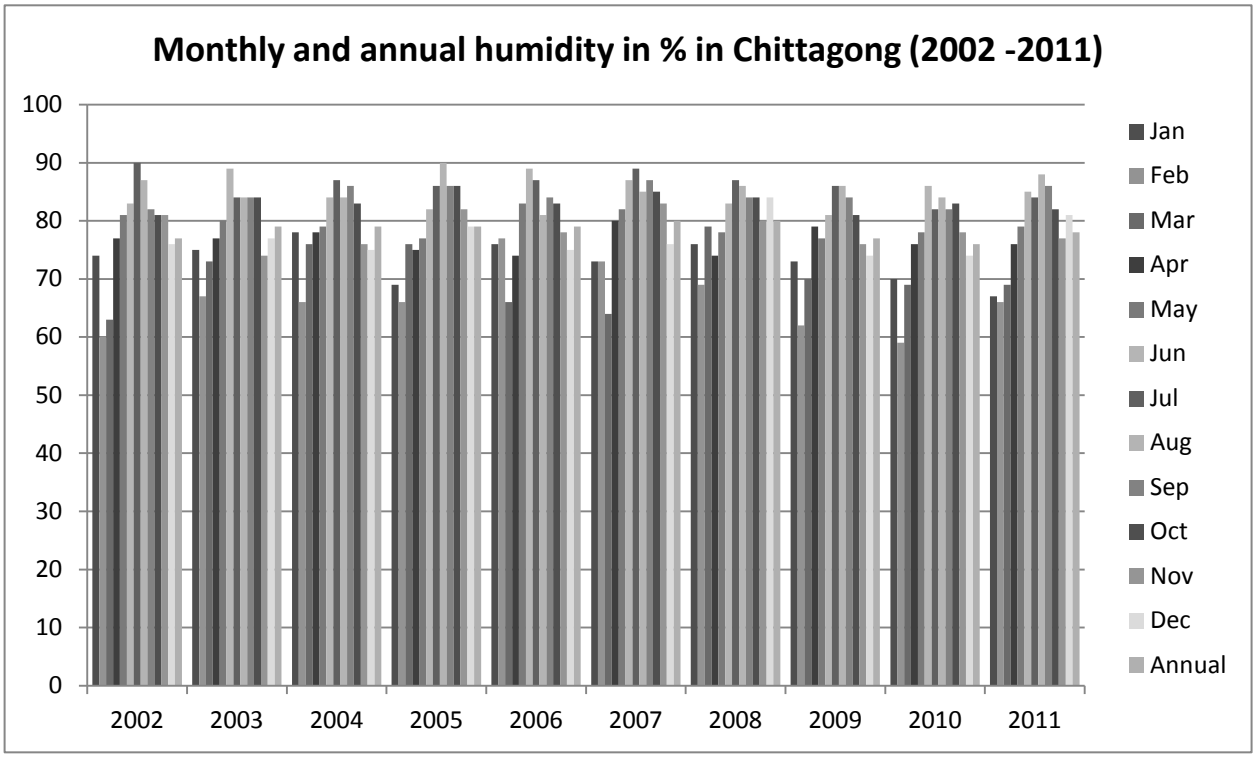


Figure 27: Monthly and annual humidity (%) in Chittagong (2002-2011)

[1] Source of raw data (Fig. 8,9,10, 11 and 12): Bangladesh Meteorological Department, July, 2012.

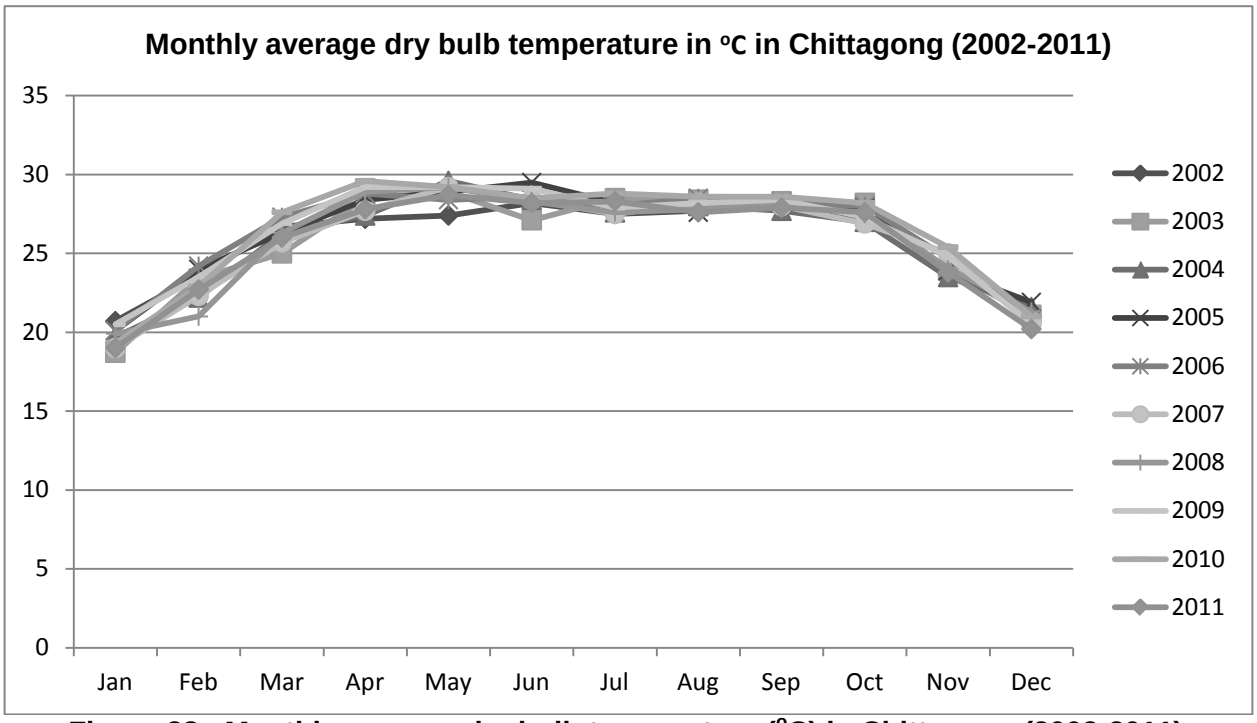


Figure 28: Monthly average dry bulb temperature (°C) in Chittagong (2002-2011)

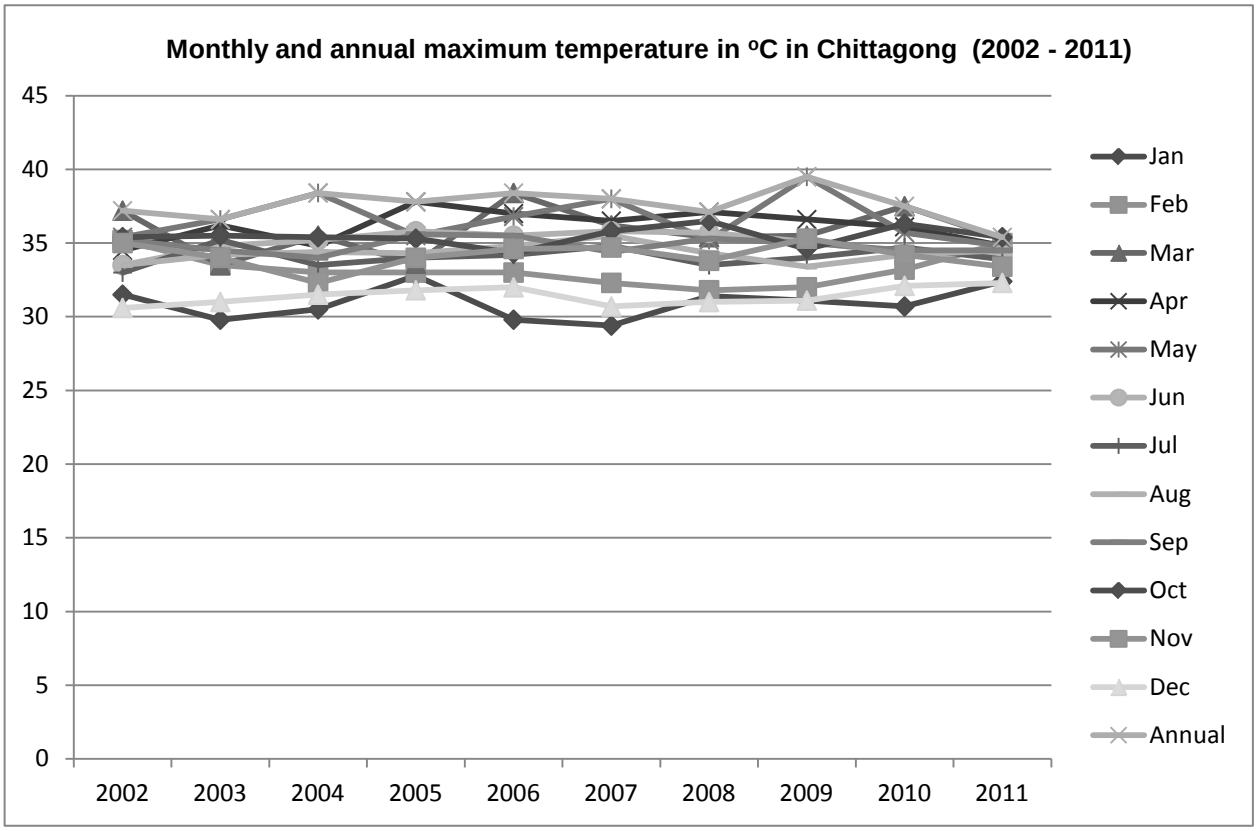


Figure 29: Monthly and annual maximum temperature (oC) in Chittagong (2002-2011)

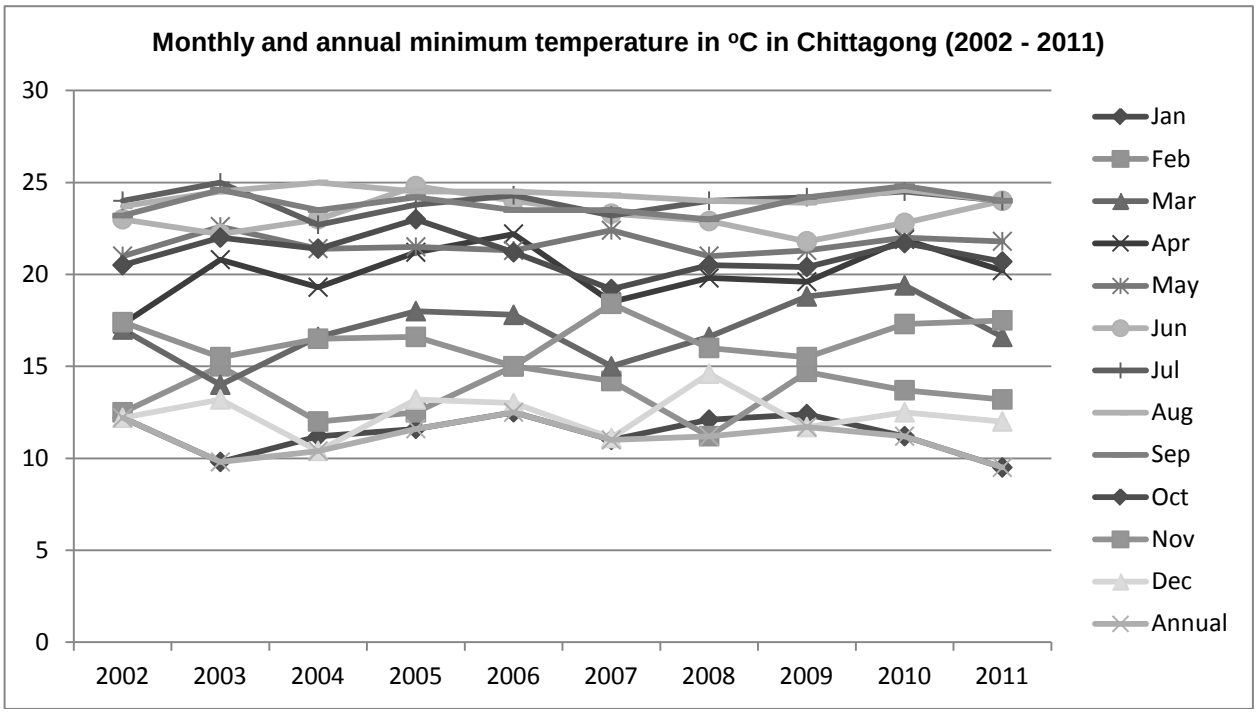


Figure 30: Monthly and annual minimum temperature (oC) in Chittagong (2002-2011)

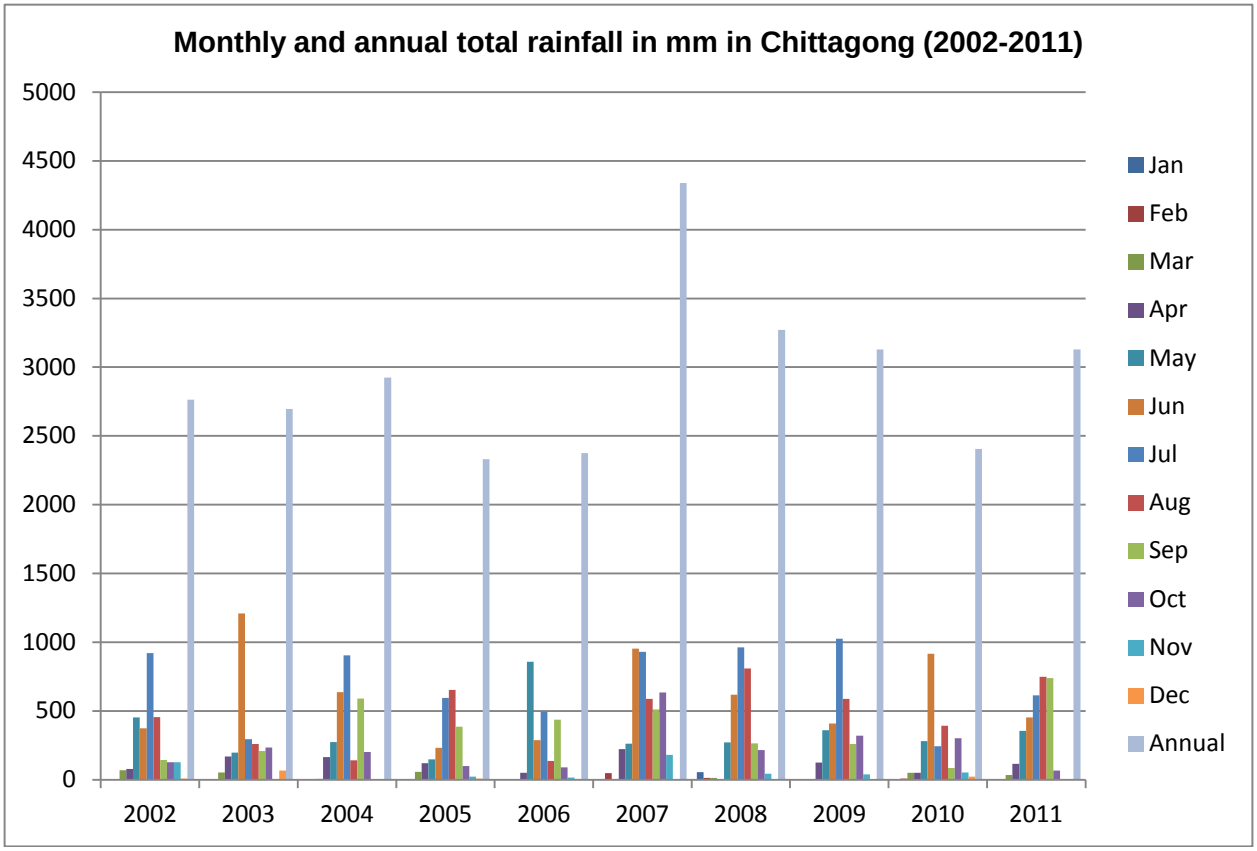


Figure 31: Monthly and annual total rainfall (mm) in Chittagong (2002-2011)

3. Air Quality

45. Air quality is generally good in rural Bangladesh, where there are few industries and low densities of people and vehicles. The situation is very different in the cities, where urbanization, industrialization and overcrowding create major air quality problems. In 1988 the World Bank estimated that 15,000 deaths per year and a million cases of major illness are caused by air pollution in Dhaka, Chittagong and Rajshahi.

46. The main atmospheric pollutants are those produced by vehicles and industries and in particular by the burning of fuels. These include particulate matter, hydrocarbons, carbon dioxide, carbon monoxide, sulphur dioxide, oxides of nitrogen, lead, ammonia and hydrogen sulphide. Many of these cause respiratory problems in humans, plus other diseases if substances accumulate in the tissues. The main causes of the poor air quality are:

(i) Poor roads and traffic management leading to severe traffic congestion;
(ii) Use of high sulphur diesel by buses and trucks, and inadequate control of emissions;
(iii) Heavy industrialization, and use of cheaper high-sulphur fuels (coal, wood and tyres) by smaller industries like brick kilns; and
(iv) Poor solid waste management, so burning is the common method of treating garbage.

47. Surveys by the DoE show levels of Suspended Particulate Matter (SPM) and sulphur dioxide (SO2) in Chittagong and other cities that exceed Bangladesh Air Quality Standards, and levels of atmospheric lead that are above World Health Organization (WHO) standards. These should fall over the next few years however, as laws are enforced reducing the number of two-stroke vehicles, and consumers change to vehicles using lower cost unleaded petrol and compressed natural gas.

4. Surface Water

48. Most of Bangladesh lies within the floodplains of the Ganges, Jamuna and Meghna rivers, which drain a catchment of around 1.72 million km^2 in India, Nepal, China, Bhutan and Bangladesh. Only 8% of the catchment is within Bangladesh, and because of its topography, flood-risk and population density, the quality and quantity of surface waters are major issues for the country. Chittagong lies in the South East Region, which is beside the river Karnafuli and the Halda is a tributary to this river in the upstream. Karnafuli is the largest and most important river in the Chittagong region, which originates in the Lushai hills in Mizoram state of India.

49. Like other towns and cities of Bangladesh, the Chittagong city dwellers, too, use both surface and groundwater as a source of domestic water. Principal difference lies in use of supply water based on treatment with some application of chlorine in Chittagong and other population centers. Pollution of rivers is a major problem, because of the discharge of industrial wastewater and inadequate sewerage system. Oil, waste materials and other toxic chemicals, discharged from ships and factories routinely pollutes the Chittagong port channel and the Karnaphuli river mouth that threatens the very existence of the prime sea port of the country. The sewerage system by using pipelines is not available in the city; the entire area is covered by open drains beside the roads. These open drains discharge to the canals and ultimately to the Karnaphuli river. The canals are very often clogged due to indiscriminate dumping of municipal solid waste and other polluting materials. Water quality of the river Karnafuli and Halda at various locations are shown as under (Table-2):

Table-2: Surface water quality of the river Karnafuli and Halda near Chittagong

Location	pH	Chloride (mg/l)	T. Alkalinity (mg/l)	TS (mg/l)	TDS (mg/l)	SS (mg/l)	DO (mg/l)	BOD5 at 200 C, 5 days	COD (mg/l)
Karnafuli River	6.36 – 9.86	2 - 13148	5.64 – 121	46 - 27700	45 - 20000	14.4 - 51000	0.00 – 7.91	0.21 – 9.17	11.39 – 179.87
Halda River	5.65 – 7.34	2.41 – 73.5	6.28 - 90.78	100 - 740	30 - 200	20 - 653	3.02 – 9.90	0.70 – 5.08	14.78 – 49.28
WHO Standard	NYS	600	-	-	-	-	4 - 6	6	NYS

Source: Pak. J. Anal. Environ. Chem. Vol. 11, No. 2 (2010) 1 – 11; NYS – Not Yet Started.

50. The distance of the proposed STSs and effluent discharge point to the river Karnafuli is variable because 12 STSs are located in different places in the city. The leachate from the individual STSs will not be very big quantity if cleaned everyday on a regular basis and it will be allowed to drain through the drainage system of the CCC.

5. Groundwater

28. There are three main aquifers in the central region of Bangladesh:

(i) An upper (composite) aquifer, which can reach depths of 50 m and is covered with an upper silty clay layer of less than 20 m;
(ii) A middle (main) aquifer of fine to heavy sands, which is generally 10-60 m thick and in most areas is hydraulically connected with the composite aquifer above; and
(iii) A deep aquifer of medium, medium-to-fine or medium-to-coarse sand, which is generally found at depths below 100 m.

51. Chittagong WASA can supply only 175 MLD of water. CWASA has water supply pipeline of 570 km. Production from surface water is 91 MLD from only one treatment plant in Mohara. There are 52 DTW in the entire CWASA jurisdiction. The production from ground water is 84 MLD. Present shortfall of water supply is about 325 MLD. With available supply, demand of about 33% of the city population can be met. The ratio of surface water and ground water is 52:48. Ground water in Chittagong city contains high iron concentration (2~8 mg/l). That is why the wells strainer and the gravel pack become clogged with iron bacteria causing decline in water production within few years of installation. Again ground water of southwest area of the city contains Chloride and recently some well water found to contain Manganese and Nitrate concentration exceeding the limit of Bangladesh Standard (As per JICA feasibility study report 2000, Manganese 0.17~0.28, Nitrate 1.2~13). Also, it is found that the ground water level in the city center has been declining. As CWASA is not able to meet the demand of water in the city, many household and industries have constructed their own deep tube wells. It is obvious that due to abstraction of water by CWASA and private tube wells, the ground water development in aquifer within Chittagong city area is in near limitation. As a result, the ground water would no longer be a sustainable source of raw water for CWASA.[2]

52. Supply of potable water is an increasing problem for the water and sewerage authorities because of the depleting supplies and source contamination. Water for the STSs will initially be

[2] Status of Water and Sanitation Services in Chittagong WASA by Mohammed Osman Amin, Member Engineering, Chittagong WASA.

sourced from CWASA supply but provision will be kept for digging well within the site for construction of STSs. The necessary clearance for digging well will be taken from the CWASA. The ground water table in each of the STS sites is far more than 2 meters below the ground levels; so there is no risk of contamination of ground water resources during the operational stage of the STSs.

6. Geology and Seismology

53. The National Seismic Zoning Map (Fig 32) produced by the Geological Survey of Bangladesh (GSB), divides the country into three regions: a high risk zone between Mymensingh and Sylhet in the north and north-east; a medium risk zone stretching diagonally from Rajshahi in the north-west through Dhaka and Comilla to Chittagong and Cox's Bazar in the south-east; and a low-risk zone in the south and south-west, around Khulna and Barisal. In the medium risk zone, shocks of moderate intensity are possible, with a probable maximum magnitude of 6-7 on the Richter scale. Seismic events in Bangladesh are relatively infrequent but historically have been severe. The Assam earthquake of 1897 was the largest in the region's history, when a force of 8.7 on the Richter scale caused extensive damage across Assam, Bengal and Bihar.

54. Chittagong city is the second largest metropolitan city of Bangladesh. It is a unique example in the country showing distinctive geomorphic divisions, ranging from undulating hill topography to tidal mud flats. Based on land satellite and SPOT imageries, 3D-aerial photographic interpretation, and ground survey eight major geomorphic units of the city have been identified, which are: tertiary hills, piedmont and valleys, alluvial plain, old tidal plain, tidal mud plain, supra tidal plain, natural levee and sandy beach. The general topography of the city can broadly be divided into two nearly equal halves following the Dhaka-Chittagong rail lines; the undulating north and plain south.

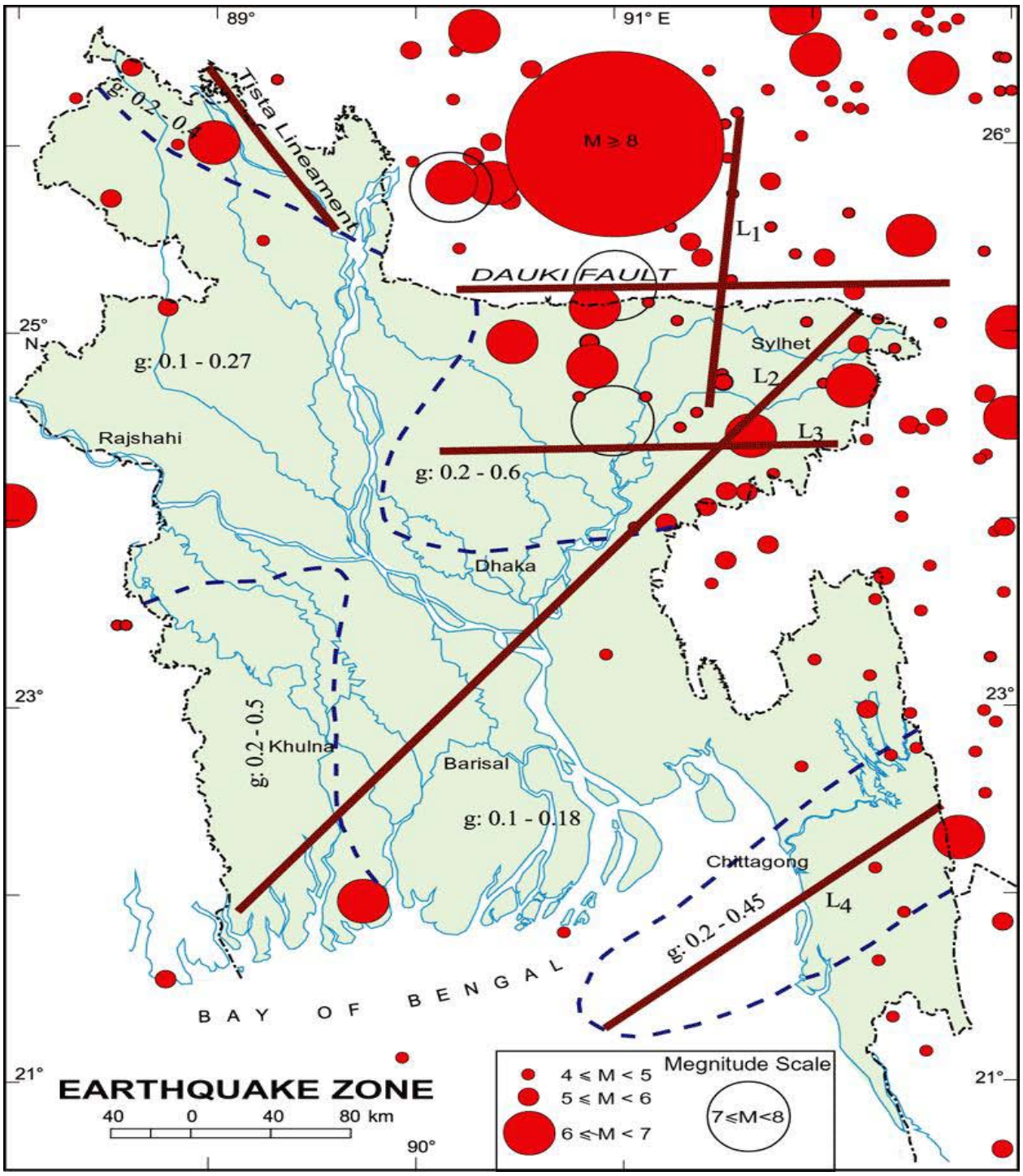


Figure 32: National Seismic Zoning Map of Bangladesh

Source: Internet.

B. Ecological Resources

1. Habitats

55. The main physical features of Bangladesh are its mainly flat and low-lying topography, the dominant presence of the major rivers that drain enormous catchments in surrounding countries, a seasonal monsoon that swells river volumes for several months each year, and the resulting floods that inundate large areas of land. It is not surprising therefore that those aquatic habitats are the country's most important ecological resources.

56. There is a wide array of aquatic habitats throughout the country: natural and man-made, permanent and ephemeral, of varying sizes and characteristics. The rivers and floodplains are the most important, as they support species that are exploited by man, are the most productive of the habitats, and attract other important species, such as birds. However, as in other environmental sectors, the rapid urbanization and industrialization of the country and its expanding population (particularly the urban poor who use natural resources to supplement both food and income) have brought large scale damage and degradation to these areas.

2. Rivers

57. Most rivers in Bangladesh suffer under the influence of man, from the disposal of solid and liquid waste in urban and industrial areas around Chittagong and the other cities and towns, and from the diversion of water upstream for irrigation and/ or power generation.

58. The river Karnafuli passes on the eastern side of the main Chittagong city. The major rivers of this region are: Karnafuli and its tributaries (e.g. Rainkhiang, Kasalong, Halda, Ichamoti, etc.); Bakkhali, Sangu, Matamuhuri, Naf, and Feni. Kutubdia and Maheshkhali channels are the coastal channels of the region. Continuous dumping of highly toxic liquid and solid wastes into the Karnafuli river has created a situation that deteriorated the quality of water in the river. The riverside factories, human waste, oil spilling by boats and vessels are responsible for pollution. Once the Karnafuli used to be the heaven of fishes, but now most of the fish species have vanished. Department of Environment and Chittagong City Corporation have failed to save the river from pollution, as about 300 factories on the banks of the river are discharging wastes into the river.

3. Floodplains

59. Floodplains are the natural lowlands alongside rivers, which are inundated each year in the monsoon as the increased volumes of water overflow river banks. These zones are important ecologically as they are the areas into which the adults of many species of fish migrate to breed. Floodplains are rich in nutrients from the inundated soil and decaying vegetation, and are also rich in food in the form of dead insects, soil invertebrates, and aquatic plankton that frequently bloom under such conditions. They are also protected from the strong currents in the main river, so are ideal areas for young fish to feed and grow, before entering the main river when water levels decrease. These areas also frequently attract large numbers of water birds, to feed on the juvenile fish in the shallow waters.

60. Chittagong coastal plain extends from the Feni River to the Matamuhuri delta, a distance of 121 kilometers. It comprises gently sloping piedmont plains near the hills, river floodplains alongside the Feni, Karnafuli, Halda and other rivers, tidal floodplains along the lower courses of these rivers, a small area of young estuarine floodplain in the north, adjoining the sub-region

Young Meghna estuarine Floodplain, and sandy beach reaches adjoining the coast in the south. Sediments near the hills are mainly silty, locally sandy, with clays more extensive in floodplain basins. The whole of mainland is subjected to flash floods. Flooding is mainly shallow and fluctuates in depth with the tide (except where this is prevented by river or coastal embankments). The average daily rise in the tide is about two meters. Some soils on tidal and estuarine floodplains become saline in the dry season.

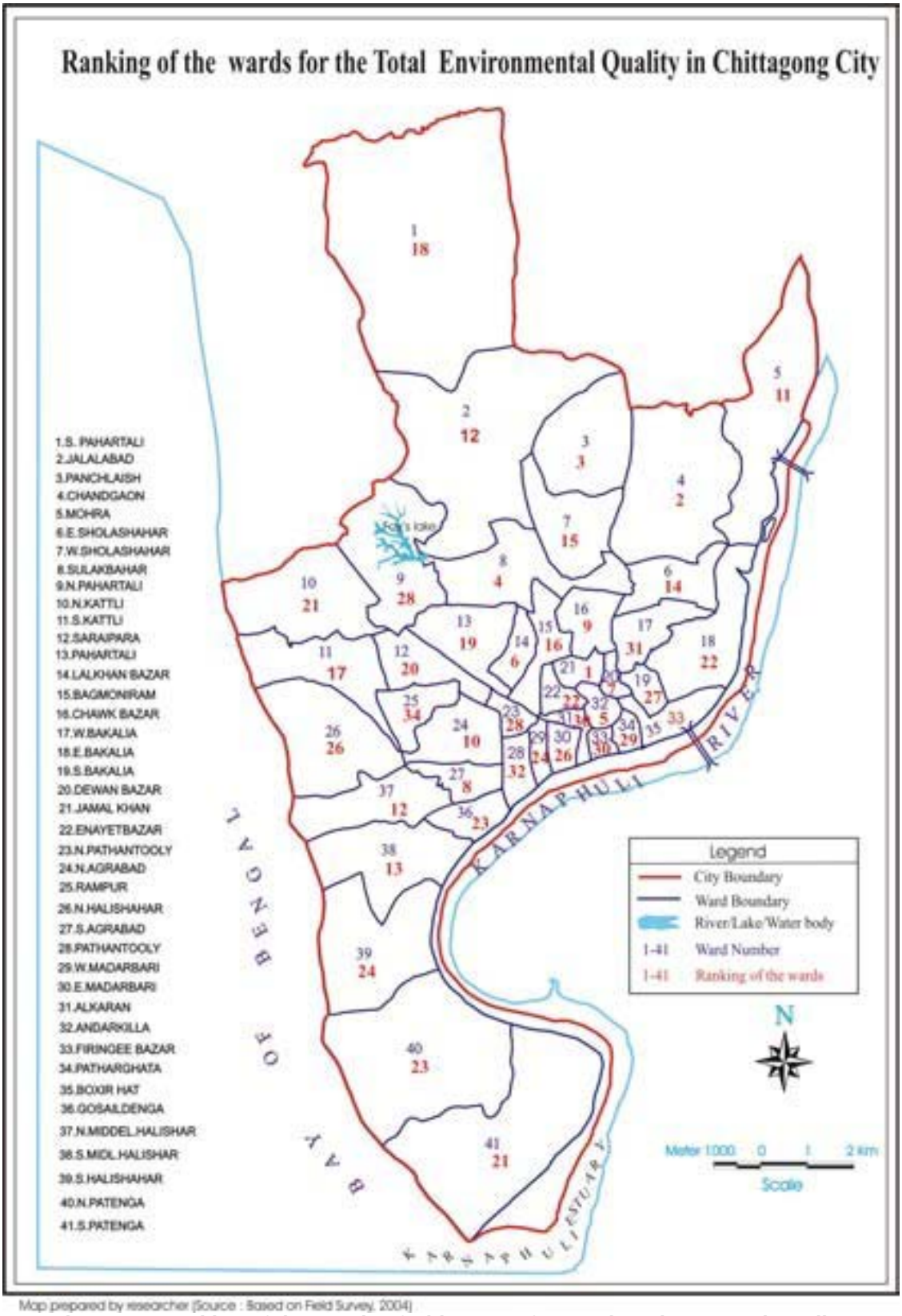
4. Other Aquatic Habitats

61. There are a variety of other aquatic habitats throughout the country, and in urban areas these include man-made lakes in residential neighborhoods, permanent and ephemeral pools in natural lowlands (known as *bheels*), and flooded borrow pits excavated for building material. These are generally of little ecological value as the water is frequently polluted, and these areas are often characterized by dense growths of the water hyacinth *Echicornica crassipes*, which out-competes other plants through its rapid growth, although species such as water chestnut and lotus can be seen in places.

5. Terrestrial Ecology

62. The city of Chittagong is almost denuded of the trees and vegetation that once had beautified and made its environment congenial to terrestrial ecology specific of this area. Now trees are available on the hills only. Rapid and continuous growth in the city population has encouraged various land-grabbers and mushroom growth of land development firms with a resultant erasure of wetlands, trees, greeneries, vegetation and forest lands in and around the city and replaced by widespread concrete jungles in the name of high-rise buildings. The urban terrestrial fauna is very limited as a result, and mainly consists of animals able to live close to man, such as lizards and geckoes, scavenging birds like house sparrow and crows, mice, rats and other rodents, plus jackal, mongoose, squirrel and monkeys. There is a wider range of species in the farming areas, but even these are mainly animals that are commonly found close to man, such as cattle egrets. Fig. 33 gives an idea about the ranking of total environmental conditions of 41 wards of the Chittagong city on the basis of study based on information from 492 respondents in household level.[3]

[3] Kathmandu University Journal of Science, Engineering and Technology, Vol 1, Number IV, August 2007.



Map prepared by researcher (Source : Based on Field Survey, 2004)

Figure 33: Ranking of the Wards of Chittagong for Total Environmental Quality

6. Protected Areas and Endangered Species

63. The beautiful buildings, mosques and shrines of Chittagong bear witness to its history from the ancient times to the present. Most of the old and new buildings of the city are built on top of low hills and hillocks and also along the valleys and plains. The massive Court Buildings which accommodate the Civil Courts, Criminal Courts and the offices of the Divisional Commissioner, Deputy Commissioner, and the District and Session Judges are on top of Fairy Hill. The top of this hill offers a panoramic view of the town below. One can see the Karnafuli River up to its mouth and the Port area along its bank, the Deang and Banskhali Ranges to the south and the Hill Tracts to the east. All along the foothills are situated the General Post Office, the Municipal High School, New Market, and the Chittagong Development Authority Building. The General Hospital stands on top of the Rangmahal hill. The Telegraph Office, Divisional Forest Office, residences of the Divisional Commissioner and the Deputy Commissioner are situated on top of a hill range known as the Tempest Hills. The nearest protected and environmentally sensitive area the famous shrine of Bayazid Bostami is about 6 km from the proposed STS site.

64. The Chittagong region is characterized by three distinct ecological zones: inter-tidal zone, coastal plains and extensive hill areas. The northern and eastern parts of the region constitute the hilly areas and are commonly known as the Chittagong Hill Tracts. This area is covered with a deep evergreen and deciduous forest which is a habitat of many wildlife species such as the Asian Elephant *(Elephas maximus)*, White Duck *(Cairina scutulata)*, Banrui *(Maris crassicaudata)*, Banchhagal *(Capricornis sumatraensis)*, Shajaru *(Hystrix indica)* and other endangered species. The coastline consists of a 100 km long sandy sea beach on the Bay of Bengal. The remainder of the region consists of plains. The proposed STSs are located in the plain areas thus there are no endangered species. Flora and fauna found in the subproject site are commonly found in developed and urban areas.

C. Economic Development

1. Industry

65. Besides an oil refinery and oil-blending plants, the Chittagong city has large cotton and jute-processing mills, tea and match factories, chemical and engineering works, an iron and steel mill, and fruit-canning, leather-processing, and shipbuilding industries.

66. Chittagong is a commerce and industry hub, and a port city, in southeastern Bangladesh and the capital of an eponymous district and division. The city is home to Bangladesh's busiest seaport and has a population of over 5.5 million, making it the second largest city in the country.

67. Chittagong is one of the fastest growing cities in the world, with a GDP of $25 Billion. A major commercial and industrial centre, the city also has a globally competitive special economic zone. With the Port of Chittagong being expanded and developed, the Dhaka Chittagong Highway being upgraded into 4 lane divided highway, and Shah Amanat International Airport being upgraded, regional neighbors of Bangladesh have eyed Chittagong as a future regional transit hub. The port city is seen as crucial to the economic development of landlocked southern Asia including Northeast India, Bhutan, Nepal and parts of Southern China and Burma.

2. Infrastructure

68. Infrastructure is a major problem in all towns and cities in Bangladesh, where many facilities are inadequate to serve the needs of such a large population, after decades of under-funding and neglect. Sewerage system is not available in Chittagong. Throughout the rest of the country people use a variety of methods including septic tanks, pit latrines, and open defecation. Septic tanks malfunction because of inadequate design, construction or maintenance, or because the high water table impedes the soak-away function. Many buildings, including high-rise developments, have no sanitation system at all, and discharge their effluent into lakes, rivers, drainage ditches or onto open ground, causing unsightly areas, health risks and water pollution.

69. Solid waste in urban areas is the responsibility of the city corporation (CCC), and in most locations NGOs or CBOs operate the primary collection service, removing waste from houses and businesses each day, mainly on cycle-rickshaws. These carry waste to Secondary Transfer Stations (STS) at various locations around the town, from where it is carried for final disposal by vehicles operated by the city corporation. There is one dumping site in Madhya Halishahar in Chittagong, where poor practices create an unsightly and insanitary facility. Also the disposal is by open dumping with little or no management or pest control, and as a result these areas are highly insanitary and hazardous to public and environmental health. But new initiatives have been taken to construct sanitary landfill site including facilities for management of medical waste under the present program of UPEHSDP. After implementation of UPEHSDP, it will be possible to utilize these facilities for safe disposal of STS and slaughterhouse wastes as well as other hazardous wastes from the CCC.

70. In the landfill site, there is one compost plant with quite large capacity but with very poor and unhygienic management. It is expected that new compost plant will be installed in the sanitary landfill site to be developed under the UPEHSDP. At present, there are no transfer stations in CCC area but the collection and transportation of solid waste will be improved substantially after implementation of the 12 STSs proposed in this subproject.

3. Transportation

71. Transport in Chittagong is similar to that of the capital, Dhaka. Large avenues and roads are present throughout the metropolis. There are various bus systems, taxis, and as well as smaller 'baby' or 'CNG' taxis, which are basically tricycle-structured motor vehicles. There are also traditional manual rickshaws, which are very common.

72. The Dhaka-Chittagong Highway, a major arterial highway, is the only way to get in the city through land. It is a very busy and a risky highway, currently it is a 2-lane highway, with upgrading to 4 lanes being implemented. Chittagong can also be accessed by rail. It has a station on the meter gauge eastern section of the Bangladesh Railway. The headquarters of this railway are located here. There are main two railway stations in Station road Chittagong. Trains are available traveling to the Bangladeshi cities of Dhaka, Sylhet, Comilla, and Bhairab.

73. Shah Amanat International Airport serves as Chittagong's sole international airport, and the only route to get in the city by air. It is the second busiest airport in Bangladesh. It has international service to destinations such as Middle Eastern like Abu Dhabi, Dubai, Sharjah, Jeddah, Ras Al Khaimah, Muscat and Kolkata. Right know Middle Eastern low-cost carriers like Flydubai, AirArabia, RAK Airways, Oman Air fly from here to international destinations in the

Middle East. It was formerly known as MA Hannan International Airport, but was renamed on April 2, 2005 by the Government of Bangladesh.

4. Land Use

74. The proposed sites for all 12 STSs are on the land owned by the CCC and at present being used as temporary dumping places for municipal solid wastes collected from the locality. These are located on the sides of wide roads, and part of the road width is being used for construction of STSs. In five cases where the STSs have been extended over the canals are: STS – 4 Rahattarpool Mirza Khal, STS – 6 Bohoddarhat Chaktai Khal, STS – 7 in front of Mirzapur Tea on Bayezid Bostami Road, STS – 8 K-Block, Boro Pool, DT Road and STS – 11 DT Road Bi-lane in front of Nishkriti. Extension to the canals has reduced encroachment to the roads, which has been favorable for traffic movement. The columns of the STSs to be placed in the canals have been so designed as to minimize the obstruction of water flow in the canals.

5. Power Sources and Transmission

75. The Bangladesh Power Development Board (BPDB) is responsible for the generation of power in the country, and distributes electricity to retail customers, as well as to two other distribution utilities: the Rural Electrification Board (REB); and the Dhaka Electric Supply Authority (DESA) in the capital. Electric power is generated in hydro, steam, gas-turbine and diesel power plants, and all the generating stations are interconnected through a national grid. As per details in February 2011, the total installed capacity of power generation is 6658 MW and the maximum power generation is 4699 MW.4 Karnafuli Hydro Power Station is the only hydropower plant in the country located at Kaptai, about 50 km from the port city of Chittagong. This plant was constructed in 1962 as part of the 'Karnafuli Multipurpose Project', and is one of the biggest water resources development projects of Bangladesh. After being commissioned in 1962, the plant could feed the national grid with 80 MW of electricity. In later years, the generation capacity was increased in two phases to a total of 230 MW. The plant not only plays an important role in meeting the power demand of the country but is also vital as a flood management installation for the areas downstream. The other two big power stations in the Chittagong region are Raozan (420 MW) and Sikalbaha (60 MW).

76. Power is provided to most urban areas through a network of electricity pylons and poles, mainly located beside roadways. This provides connections to individual houses, and revenue collection is by individual household meters. Generation is insufficient to offer a continuous supply, and the providers operate a system of “load-shedding” whereby they turn off the supply for 1-2 hours each day to conserve the resource. Hotels, businesses and the more wealthy residents increasingly use their own generators to augment the supply from the national grid.

6. Other Economic Development

77. The economic development of the country largely depends on the efficiency of Chittagong port. The sea-borne exports of Chittagong consist chiefly of readymade garments, knitwear, frozen food, jute and jute products, leather and leather products, tea, and chemical products. There is also a large trade by country boats, bringing chiefly cotton, rice, spices, sugar and tobacco. Sailing ships built in Chittagong include the *Betsey*, the *Argo*, and the *Mersey*. Ship breaking was introduced to the area in 1969. This industry is concentrated at Faujdarhat, a 16

[4] Source: Bangladesh Economic Review 2011(Bangla Version).

kilometers long beach 20 kilometers north-west of Chittagong. Chittagong is also home to a large number of industries from small to heavy.

78. Around 40% of the heavy industrial activities of the country is located in Chittagong city and adjacent areas, which include Dry-dock, Dock yards, Oil refinery, Steel mill, Power plant, Cement clinker factory, Automobile industry, Pharmaceutical industry, Chemical plants, Cable manufacturing, Textile manufacturing, Jute mill, Urea fertilizer factory along with other private sector medium size industrial developments and activities. A Korean company, Youngone Corporation, has established a special Korean Export Processing Zone (KEPZ) in the port city of Chittagong. The KEPZ is built on a land area of nearly 1,000 hectares and is expected to attract foreign direct investment worth $1 billion. There is as well a Karnaphuli Export Processing Zone, with the same acronym (KEPZ).

D. Social and Cultural Resources

1. Population and Communities

79. Chittagong city has a population of 5.5 million, male 54.36% and female 45.64%. Population density per square km is 15,276. Islam is the most common religion among the people. 83.92% of the populations are Muslims. Other major religions are Hinduism (13.76%); Buddhism (2.01%), Christianity (0.11%) and others (0.2%). The population has increased tremendously during the last two to three decades because of various reasons.

80. One of the main reasons for the population growth has been the influx of rural migrants, attracted by the prospect of easier lives and increased incomes in urban areas. When these fail to materialize the inevitable result is an increase in the urban poor and an expansion of slums. Thirty five percent the urban population of the country now lives in slums, which is almost 15 million people, and in the six cities under UPEHSDP there are almost 10,000 slums, 55% in Dhaka and 20% in Chittagong.

2. Health Facilities

80. Health facilities are generally more widely available in towns and cities than in the rural areas, but the cost of the service means that it is not widely used by poorer people and slum dwellers in particular. This along with various other factors, including poor sanitation and nutrition (which decrease immunity and resistance), overcrowding (which facilitates disease transmission) and poor public and environmental health mean that the urban poor suffer disproportionately from ill health. As a result, child morbidity and mortality, malnutrition and growth retardation are all higher in slum areas. There are also gender inequalities, with mortality in years 1- 4 being 28 per 1,000 births in boys, compared to 38 in girls.

81. People in urban areas suffer many of the diseases associated with overcrowding and poor sanitation, including dysentery, diarrhea, whooping cough, gastro-enteritis, TB, etc. In the larger cities like Dhaka and Chittagong they also suffer respiratory problems and other illnesses caused by excessive exposure to traffic pollutants.

82. Chittagong Medical College Hospital with more than 600 beds is the largest government-run health service provider. This huge medical facility has many wards, cabins and units. At present this facility also provides medical treatment of ICU and CCU for the serious patients. Other medical service institutes in the city include General Hospital, Upazila Health Complex, Family Welfare Center, TB Hospital, Infectious Disease Hospital, Diabetic Hospital, Mother and

Children Hospital and Police Hospital. Notably, the total health service of Chittagong is developing day by day. Many non government hospitals and clinics also belong to the city. Chittagong Metropolitan Hospital, Surgiscope Hospital, CSCR, Centre Point Hospital, National Hospital etc. are the noteworthy non government hospitals and clinics of Chittagong City.

83. Public health facilities provide good service, but many are under staffed and under resourced, and ratios of beds per numbers of population are inadequate. Facilities are significantly better in the private sector, but care is expensive, and out of reach of any but the wealthier citizens.

3. Educational Facilities

84. Chittagong University, Chittagong Medical College and Chittagong University of Engineering and Technology are totally funded by the Government. Chittagong is home to two of the nation's most prominent public universities, and is the site of one of Bangladesh's largest universities, the University of Chittagong, established in 1966. The university is located in a remote place from the city (22 km north) of Chittagong. Current student enrollment is more than 20,000. The other public university is Chittagong University of Engineering and Technology established in 1968. Formerly, it was named Bangladesh Institute of Technology (BIT). The University is situated by the side of the Chittagong-Kaptai road some 25 kilometers off from the center of Chittagong City. The Asian University for Women (AUW) is another famous higher education centre located in Chittagong, is being established as a leading institution of higher learning for women.

85. At present, in Chittagong, there are some more private universities like BGC Trust University Bangladesh (2002), International Islamic University, Chittagong, University of Science and Technology-USTC (1992), Southern University, Bangladesh(1998), Premier University (PU), and University of Information Technology & Sciences. Recently Chittagong Government Veterinary College (CGVC) has been upgraded to Chittagong Veterinary and Animal Sciences University (CVASU) which is consisting of one faculty with 300 students providing theoretical, out campus work based learning and excellent scientific and technological education. It is the first university in Bangladesh of this type. Some examples of private medical colleges of Chittagong are: Chittagong Ma O Shishu Medical College, Southern Medical College, Chittagong International Dental College, BGC Trust Medical College, etc.

4. Socio-economic conditions

85. The port city of Chittagong accommodates almost 3% of the total population and is the second most urbanized area in the country. In this area people are engaged in various activities, mainly laboring, business, industry, and transport and communication. There are around 200 garment factories, in which more than two hundred thousand people work, mainly women. Other types of manufacturing are also major employers, as is the construction industry. In a study based on BBS data, Chittagong region has the highest per capita per month income of Tk. 6,430 followed by Barisal (Tk. 5,970), Khulna (Tk. 5,960), Sylhet (Tk. 5,690), Dhaka (Tk. 5,540) and Rajshahi (Tk. 4,980).5

86. The trend for rural-urban migration is largely a result of a lack of secure employment and sustenance in the rural areas, so people move to the cities where they believe there are better job opportunities. As noted above these rarely materialize and the end result is an increase in

[5] Rahman & Hossain: Convergence in per Capita Income across Regions .

the urban poor, and an expansion of the slums. More than 82% of the population of Bangladesh lives on less than $2 per day, and such people are mainly the urban poor and the rural poor. Slum dwellers in the towns and cities include people who are in regular employment, plus large numbers who are unemployed and who obtain an income from the streets where they can. Employed slum dwellers work mainly in construction or in factories, or as domestic servants, rickshaw operators, street vendors, etc.

87. Waste pickers are observed at the existing dumping site and consist of male, females, and children. This is often their primary source of livelihood made from recycling waste.

5. Physical and Cultural Heritage

88. Bangladesh has many sites, buildings and artifacts that are of historical and cultural significance. Many date back to the British colonial period from the mid-19th to the mid-20th centuries, and some are from earlier periods, including the Muslim era of the 13th to 17th centuries, the Sena dynasty of the 12th and 13th centuries, and even the Gupta Buddhist era of the 4th to 7th centuries A.D. However, construction practices that pay scant regard to the possible discovery of ancient remains have meant that most of the older sites that remain are located well away from urban areas.

89. The main archaeological heritage and relics of Chittagong are Bronze statues (8th and 9th centuries, in Anwara Upazila), Fakira Mosque (Hathazari), Musa Khan Mosque (1658), Kura Katni Mosque (1806), Kala Mosque (16th century), Chhuti Khan Mosque (Mirsharai), Kadam Mobarak Mosque (1719), Andar Killah Mosque, Wali Khan Mosque (1790), Badar Awlia Dargah, Bakshi Hamid Mosque of Banshkhali (1568), Chittagong Court Building (1893), Collegiate School, Ethnological Museum (1974). None of the 12 proposed STS sites are adjacent to any of the enumerated archaeological heritage and relics of Chittagong.

6. Indigenous Peoples

90. Most inhabitants of Bangladesh are Bengali (around 98%) and Muslim (around 90%), so this ethnic group comprises the majority of inhabitants of all the towns and cities. There are also small communities of certain ethnic minorities (mainly Hindu, Buddhist and Christian), who also live in urban areas, either integrated within the majority community or living in specific locations, such as the Hindus who live in Shakhari Bazar, Tanti Bazar and Shyam Bazar in old Dhaka, and the Buddhists and Christians who live in Chandgaon and Shadarghat in Chittagong respectively.

91. Environmental degradation has made their lives even more difficult. They have become the victims of the negative impacts of modernization, as they lack the education and awareness to be able to harness and enjoy the positive benefits that Bangladesh's economic growth has created.

IV. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

92. The present report assesses the impacts of the proposed activities on various environmental attributes of the project site.

93. **Methodology.** Issues for consideration have been raised by the following means: (i) input from interested and affected parties, if any; (ii) desktop research of information relevant to the proposed project; (iii) site visit and professional assessment by environment specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and

potential impacts based on the environment specialist's past experience. Categorization of the project and formulation of mitigation measures have been guided by ADB's REA Checklist for Urban Development (Annex 1) and ADB Environment Policy.

A. Location and Design Impacts

94. In the case of this subproject there are few impacts that can clearly be said to result from the design or location. This is because:

(i) The infrastructure involves relatively straightforward construction at few single small sites, so it is unlikely that there will be major impacts when the facility is built;
(ii) The proposed locations of the STSs are in areas where the CCC authority is already using part it for dumping municipal solid waste and it will be stopped temporarily before the actual construction works will start and also there are no sensitive areas or receptors nearby; and
(iii) If the STSs operate in the manner intended it should be hygienic and well managed facility that functions with few emissions and without major negative impacts.

95. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. The concepts considered in design of the STSs are:

(i) All the STSs should be adequate in size to accommodate solid waste collected from the target area.
(ii) All the STSs should be provided with safe water.
(iii) Water points, hoses and cleaning equipment must be provided in sufficient numbers. Cleaning program must be performed regularly.
(iv) Industrial three phase electricity should be supplied and a standby generator installed.
(v) Each STS should have its own drain and all drains must be accessible for cleaning for efficient waste water system.
(vi) The STSs should be protected by fencing to keep out from trespassing animals specially dogs/ cats etc.
(vii) Strict enforcement of relevant national rules in solid waste management.
(viii) STSs of CCC could be managed by private organizations/ parties through competitive bidding process following government public-private partnership guideline.
(ix) Techniques, installation, management and training should be focused on minimization of water consumption, minimization of energy use, minimization of emission to air and minimization of noise.
(x) Future extensions or possibilities to add some other installation should be kept in mind during the design and during the period of built.

96. Interested contractors will bid based on the concept and details included in the bid documents. The bidders will be advised to make their own diligence study prior to the bidding. Necessary documents and studies will be made available to them for their evaluation. It will be up to the bidders to maximize the use of resources made available to them.

97. No impact is anticipated due to the location as the proposed sites are owned by the Chittagong City Corporation. A Resettlement Plan by the CCC authority has been developed to

compensate, restore, or relocate any building/ infrastructure that will be affected by the subproject.

B. Construction Impacts

98. **Construction method.** The work comprises the construction of 12 Secondary Transfer Stations. The following are the scope of work:

(i) Preparation of the ground by forming to level and grade and excavating locally for foundations or, if necessary, by excavating unsuitable fill material and replacing with imported compacted backfill.
(ii) Shaping of ground to suit footings and floor slab layout and falls and to allow exterior ground drainage.
(iii) Laying and backfilling over underground and under floor drains.
(iv) Boxing foundations and placing reinforcing with column starter bars.
(v) Pouring of slab and footings and curing.
(vi) Construction of unreinforced masonry infill panels.
(vii) Placing reinforcing, boxing, and pouring columns.
(viii) Placing reinforcing for lintel beams and pouring concrete.
(ix) Casting in bolts and anchor plates as necessary in the columns and lintels.
(x) Fabrication and fixing roof trusses and bracing.
(xi) Placing and fixing purlins.
(xii) Fixing roof cladding, gutters and downpipes.
(xiii) Wall framing with cladding panels and insect mesh as necessary.
(xiv) Fixing of external rails for sliding doors.
(xv) Placing and fixing internal beams for rails plus fitting rails and hangers.
(xvi) Constructing weather covers for sliding door rails.
(xvii) Hanging of hinged doors.
(xviii) Internal wall and floor plastering as required.
(xix) Painting as required.
(xx) Electrical Services.
(xxi) Supply and/ or manufacture and installation of mechanical equipment.
(xxii) Construction of external effluent disposal system.
(xxiii) Construction of solid waste disposal systems.

99. As explained above the lands on which the STSs are to be built are currently being used as temporary solid waste dumping sites. These are generally open spaces beside the main roads and easily accessible by the trucks used for onward transportation of the wastes to the sanitary landfill sites. So during construction, there will be some very minor impacts on the people and there will be no issue of resettlement of affected persons.

100. Most of the site will be excavated to around 1.50 meter to create the cavities for the foundations of the buildings and paved areas. This will be done by backhoe digger and the excavated sand and soil will be loaded into trucks and transported to the municipal landfill for disposal.

101. All of the buildings and other structures will have Reinforced Cement Concrete (RCC) foundations, so metal reinforcing bars will be put into position in the cavities by hand. Concrete (mixed on site) will then be poured into the cavities to form the foundations and floors of the buildings and other structures and the paved surfaces of the roads.

102. The above-ground RCC elements will then be created by enclosing lengths of metal reinforcing in wooden shuttering and pouring in concrete, which sets to form the structure. This is then repeated in the next portion of reinforcing and so on to create the completed structure. The brick walls of the STS area, toilets and boundary wall will then be created between the RCC supports by masons laying bricks and mortar by hand. Surfaces will be finished by plastering or tiling, and corrugated iron roofing will be applied and connected up by hand. Doors, windows, electrical fittings and pipe-work for water supply and drainage will also be added by craftsmen and laborers.

103. All materials will be brought to site on small trucks and offloaded and positioned by hand, and a small crane will be used for any heavier elements such as the steel supports and reinforcing bars, doors and the metal gates for the entrance to the site. All debris will be cleared at the end of construction by loading into a truck and depositing at the municipal landfill. Disposal sites for excavated soils and contaminated materials will be identified and agreed upon with the DoE before the commencement of any civil works.

104. There is sufficient space for a staging area, construction equipment, and stockpiling of materials. However, the contractor will need to remove all construction and demolition wastes on a daily basis.

105. **Screening Out Areas of No Significant Impact.** From the descriptions given it is clear that implementation of this subproject will not have major environmental impacts because the construction work is relatively small scale and straightforward, and will all be conducted at only 12 small sites within the CCC. Because of this there are several aspects of the environment that are not expected to be affected by the construction process and these can be screened out of the assessment at this stage as required by ADB procedure. These are shown in **Table 3**, with an explanation of the reasoning in each case. These environmental sectors have thus been screened out and will not be mentioned further in assessing the impacts of the construction process.

Table 3: Fields in which construction is not expected to have significant impacts

Field	Rationale
Climate	Short-term production of dust is the only effect on atmosphere
Geology and seismology	Excavation will not be large enough to affect these features
Forests, wildlife, endangered species, protected areas	There are no forests, protected nature conservation areas or important habitats or species at or near this site
Coastal resources	Chittagong STS sites are not far from the sea but these are generally deep inside the city and such small structures will not affect the coastal resources
Agriculture, tourism	There is no agriculture or tourism at or near these sites
Population and communities	Construction will not affect population numbers, location or composition
Health and education facilities	There are no schools, clinics, hospitals, etc at or near these sites
Physical or cultural heritage	There are no culturally important buildings or locations at or near these sites
Indigenous Peoples (IP)	The proposed sites are not used by indigenous peoples or minority communities
Archaeology, paleontology	No material of archaeological or paleontological significance has been found by previous construction projects in these areas
Ecological value	There are no protected areas in the vicinity of these sites and no special ecological interest exists within the boundary of the sites under consideration. Construction should therefore have no ecological impacts.

106. **Impacts due to excavations.** Excavating the foundations for the buildings, roads, walkways and other structures on sites will produce around 1,200 m^3 of waste soil and stone. This is a relatively small quantity so it can be taken to the municipal disposal site without special precautions to reduce the amount of dumping. The material could be put to beneficial use if it was utilized at the landfill to cover waste, so arrangements should be made by the Contractors with the landfill operators to deposit the waste in a suitable location where it can be used for this purpose. In any case, disposal sites for excavated soils and contaminated materials will be identified and agreed upon with the DoE before the commencement of the excavation activities.

107. Excavation is likely to be conducted in the dry season to avoid the difficult conditions that can occur when earthworks are carried out during rain. Precautions will therefore be needed to limit dust so that it does not affect surrounding areas or workers on site. Another physical impact associated with large-scale excavation is the effect on drainage and the local water table if groundwater and/ or surface water collect in the cavities as they are dug.

108. **Impacts due to alteration of the site.** The presence of diggers, trucks and other vehicles and machinery and the developing structures as they are created will gradually alter the landscapes of these sites. However most of these areas are generally not very “busy” visually and there are no features of any special landscape interest at or around the site, so it should not be necessary to mask the construction site from view by erecting screens.

109. **Impacts on site-specific economy.** All of the construction related to this subproject will be conducted on land that is at present owned by the Chittagong City Corporation and being used as solid waste dumping and storage sites. So there will be some temporary impacts on the waste collection system of the Chittagong City Corporation as well the income of people who are engaged in picking recyclable materials due to construction of this subproject.

110. Construction work can provide short-term socio-economic gains for local communities if contractors employ local people in the workforce. To ensure that these benefits are directed to communities that are most affected by the work, contractors are often encouraged to employ people who live in the immediate vicinity of construction sites. This is possible in this case because of the presence of inhabitation in the locality, so the contractor should offer employment to any persons who are willing to work on the present site (in breaking bricks and in other activities) and who are not already employed by some other company. Such persons are economically disadvantaged and this would be improved by even a relatively short period of temporary employment.

111. **Impacts on utilities.** There are some temporary infrastructures on the land in some of the STS sites (power lines, and possibly also water supply pipes) so there could be minor economic impacts from the disruption of supply of these facilities due to damage during construction.

112. **Impacts on accessibility.** Excavation work can also have economic impacts if heavy vehicles carrying materials to site and transporting excavated waste to the disposal site cause significant disruption of traffic, particularly where work is conducted in an urban environment such as this. However any such impacts should not be significant in this case, because dump trucks normally have a capacity of 25-30 m^3 so the disposal of 1,200 m^3 of soil and stone will require a relatively small number of truck movements: around 45.

113. **Impacts on social and cultural resources.** Construction activities inevitably produce noise and dust, and these plus the visual appearance of the site and restrictions in access

caused by excavation and the presence of vehicles and machinery, are generally the factors that disturb people who live or work in the vicinity. These should however not be major problems in this case as there are no people living on or near this site and the people who work there are already well adapted to this type of disturbance. The construction work is also small in scale, so it should not be necessary to apply measures to reduce noise, dust or other disturbance, beyond the dust suppression measures.

114. There are no major permanent public buildings at or near the site, and given the current land-use there are unlikely to be any locations that are of any special social or cultural importance to the community (shrines, meeting places, etc). This should be confirmed by consulting laborers who work on the site during the detailed design stage and in the unlikely event that there are such locations; assistance should be given in relocating the site and any associated artifacts.

115. **Impacts on health and safety.** As is usual on construction sites, the health and safety of workers will need to be protected by measures which the contractor will be required to produce and apply. As adjacent areas are heavily used for the storage and processing of building materials, the contractor should also include measures to assure the safety of the public.

C. Operation and Maintenance Impacts

116. For the first 2 years of operations of the STSs, the Contractor will manage the operations and maintain[6] the facility by itself or through a Contractor and if required, modify, repair or otherwise make improvements to the STSs. The Contractor, in consultation with Chittagong City Corporation, will also develop a manual for the regular and preventive maintenance of the STSs.

117. The Contractor will be required to keep the STSs clean, tidy and orderly condition free of litter, waste material (whether solid or liquid) and debris. The Contractor will also be responsible for the maintenance of the approach roads to the STSs.

118. Sufficient, safe, potable and constant supply of fresh water will be made available at adequate pressure throughout the premises. Suitable facilities for washing of hands and nail brushes should be there, soap or detergent will be provided for the workers. All sanitary facilities will be equipped with suitable flushing appliance.

119. **Land contamination.** STSs do not contaminate the land the way other industrial operations can. The main reason for this is that STSs do not use any chemicals that can have any detrimental effect on the environment. The wastes originating from STSs help enrich the soil and make it more productive. Most land contamination is an aesthetics issue rather than one relating to pollution.

120. **Generation of Waste Materials and By-Products.** In general, pollutants generated from STSs include: wastewater from toilet and cleaning of premises, and leachate.

121. **Water contamination.** The wastes from STSs can end up in water bodies, polluting water resources. The main pollutants are wastewater from toilets and from cleaning of the premises, and the leachate from the stored solid waste in the STS. The quantity of leachate

[6] Maintenance activities will include replacement of equipment and consumables, and also horticultural maintenance and repairs to equipment, pavements and other civil works which are part of the STSs.

becomes more in the rainy season. No chemicals are used in STSs. Although the contaminants are non-toxic in nature, they can introduce bacterial contamination and increase nitrates, phosphates and sulphates concentration in water, leading to health problems.

122. **Generation of Wastewater.** The liquid wastes of STS are high in biological oxygen demand. But the quantity will be small and it will be allowed to drain through the existing municipal covered surface drains.

123. **Odor.** The tropical climate of Bangladesh enhances the process of degeneration of any organic material remaining in the solid waste collected from the locality. Therefore, the STS premises always give a particular stink. Excessive odor is a nuisance to locals and attracts vermin and scavengers.

124. **Noise.** Noise from the establishment can be a nuisance for communities living in the immediate vicinity of the STS. Major sources of noise are the chaos created by the laborers working in the operation of the site and heavy vehicular movement to transport solid waste from the STS.

125. **Health, hygiene, and safety.** Spread of diseases to workers and their families may occur due to inadequate provision of safety equipment and lack of practice of safety rules and precautions.

126. When the STS begins to function, it is expected to provide a modern sanitary facility for the workers and staff as well as systematic handling and transportation of solid waste without causing environmental pollution. Providing this occurs there should be few negative environmental impacts and there are several fields that should be unaffected. These are identified in Table 4 below, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

Table 4: Fields in which operation and maintenance of the completed STS is not expected to have significant impacts

Field	Rationale
Geology, seismology	Operating a STS should not affect these factors
Forests, wildlife, endangered species, protected areas	There are no forests, protected nature conservation areas or important habitats or species at or near the site
Coastal resources	Chittagong STS sites are not far from the sea but these are deep inside the city and such a small structure will not affect the coastal resources
Tourism, population and communities, health and education facilities	There are no tourist attractions, inhabited areas or health/ education facilities near the STSs sites
Physical or cultural heritage, archaeology, paleontology	There are also no areas of social, cultural or historical interest or importance near the sites
Indigenous Peoples	There are no IP or minority communities near the sites

D. Mitigation Measures

127. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, the subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and O&M can be mitigated to acceptable levels with the following mitigation measures (Table 5).

Table 5: Recommended Mitigation Measures

Parameter	Mitigation Measures
Planning phase	
Updating of safeguard documents	- As this subproject will be implemented on the basis of turnkey contract, the detailed design will be done by the contractor, and the IEE/ EMP will be updated at the time of detailed design and will be revised by the DSC team.
Capacity Building	- Develop and submit for approval a capacity building and training program to ensure (i) all STS workers are trained to the highest standards available in Bangladesh and given refresher training at least annually; and (ii) Chittagong City Corporation and UPEHU staffs are given a high level of training and other support sufficient to achieve the expected standards.
Work schedule	- Ensure careful planning and scheduling of the activities. - Prepare a traffic management plan and road safety plan.
Barricades and warning signs	- Use easily transportable barricades and warning signs such as those made of high reflector plastic materials. - Also use aluminized rolled warning signs to warn the public.
Workers	- Employ workers with adequate experience, training, and know-how. It is always advantageous for the contractor to employ workers with adequate experience, training, and know-how in the line of work that they are doing. These people are usually reliable and can be counted upon to exercise good judgment in the field.
Community and public awareness	- Establish extensive coordination with Chittagong City Corporation, Design and Supervision Consultants (DSC), Department of Environment, operators of landfill sites - A massive information campaign must precede any construction activity in order to make the public aware of the extent of the problem that might be present during the period of construction. - Open liaison channels should be established between Chittagong City Corporation, the contractors, and interested and affected parties such that any queries, complaints, or suggestions can be dealt with quickly and by the appropriate persons.
Legislation, permits, and agreements	- In all instances, Chittagong City Corporation, contractors and consultants must remain in compliance with relevant local and national legislation. - A copy of the IEE must be kept on-site and disclosed in Chittagong City Corporation, Local Government Division, Ministry of Local Government, Rural Development and Cooperatives, and ADB websites. - Ensure Environmental Clearance is obtained prior to award of turnkey contract.
Access to site	- Access to site will be via existing roads. The contractor will need to ascertain the existing condition of the roads and repair damage due to construction.
Setting up of construction camp[7]	- Choice of site for the contractor's camp requires the DSC environment management specialist's permission and must take into account location of local residents, businesses, and existing land uses. A site plan must be submitted to the environment management specialist for approval. - If the contractor chooses to locate the camp site on private land, he must get prior permission from the environment management specialist and the landowner. - Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. - Recycling and the provision of separate waste receptacles for different types of waste should be encouraged.
Establishing equipment lay-down and storage area[8]	- Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by children, animals, etc. - The contractor should submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.
Materials management – sourcing[9]	- The contractor should prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, clay liners,

[7] Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation is reduced.
[8] Storage areas can be hazardous and unsightly and can cause environmental pollution if not designed and managed carefully.
[9] Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

Parameter	Mitigation Measures
	etc), and submit these to the environment management specialist for approval prior to commencement of any work.
Education of site staff on general and environmental conduct[10]	- Ensure that all site personnel have a basic level of environmental awareness training. - Staff operating equipment (such as excavators, loaders, etc.) should be adequately trained and sensitized to any potential hazards associated with their task. - No operator should be permitted to operate critical items of mechanical equipment without having been trained by the contractor. - All employees must undergo safety training.
Construction phase	
Excavated materials	- Hauling vehicles must always be present at the excavation site. - The contractor can process the excavated materials and use these as selected backfill materials. - If excavated materials are not suitable for reuse, the contractor should deposit these in an area designated by Chittagong City Corporation. - Coordinate with the landfill operators for the disposal of excavated materials. - Identify and obtain clearance from DoE for disposal sites of excavated soils and contaminated materials. - Obtain from the environment management specialist approval for disposal of excavated materials. - Remove waste rapidly by loading material onto trucks as soon as it is excavated; - Cover or damp down working areas and stockpiled soil in dry, windy weather; and - Use tarpaulins to cover loose material during transportation to and from the site. - Maintain record of excavated materials, disposal dates, and methods. - Conduct the work in the dry season will reduce these impacts, and as the excavation in this case is shallow and small in scale there should be no impact on the water table.
Hauling of Construction Materials	- The contractor must maintain all the materials necessary in his inventory so that these can be easily hauled to the construction site when needed. - Advance signage for affected parking areas must indicate duration and alternative parking arrangements.
Access	- The contractor should make available in his stock steel plates and wooden planks which will be deployed on top of excavations to provide temporary access to buildings, street crossings, and other areas where these will be necessary. - Advance road signage must indicate the road detour and alternative routes. Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/ complaints.
Occupational health and safety	- Employ workers with adequate experience, training, and know-how. - These workers should be led by an experienced supervisor or engineer, who will provide the leadership in daily activities. - A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers should be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. - The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, a translator should be called to the site to further explain aspects of environmental or social behavior that are unclear. - The rules that are explained in the worker conduct section must be followed at all times.
Community health and safety	- Contractor's activities and movement of staff will be restricted to designated construction areas. - Should the construction staff be approached by members of the public or other stakeholders, staff should assist them in locating the environment management

[10] These points need to be made clear to all staff on site before the project begins.

Parameter	Mitigation Measures
	specialist or contractor, or provide a number through which they may contact the environment management specialist or contractor. - The conduct of the construction staff when dealing with the public or other stakeholders should be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. - Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the environment management specialist's permissions. - Provide walkways and metal sheets where required to maintain access for people and vehicles. - Consult businesses and institutions regarding operating hours, and factor this in work schedules. - The contractor is to inform neighbors in writing of disruptive activities at least 24 hours beforehand. This can take place by way of leaflets placed in the postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist. - Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints. - The contractor will ensure that there is provision of alternate access to business establishments during the construction, so that there is no closure of these shops or any loss of clientage. - The contractor will ensure that any damage to properties and utilities will be restored or compensated to pre-work conditions. - Lighting on the construction site should be pointed downwards and away from oncoming traffic and nearby houses. - The site must be kept clean to minimize the visual impact of the site. - If screening is being used, this must be moved and re-erected as the work front progresses. - Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors. - Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of these include: noise generated by jackhammers, diesel generator sets, excavators, etc. - Noisy activities must be restricted to the times given in the project specification or general conditions of contract. - The environment management specialist and contractor are responsible for ongoing communication with those people who are interested in or affected by the project. - A complaints register (refer to the grievance redressal mechanism) should be housed at the site office. This should be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the contractor. This register is to be tabled during monthly site meetings. - Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. - The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. - The contractor should immediately take the necessary remedial action on any complaints/ grievances received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/ grievance.
Community and public awareness	- Storage facilities and other temporary structures on-site should be located such that they have as little visual impact on local residents as possible. - Special attention should be given to the screening of highly reflective materials on site. - In areas where the visual environment is particularly important (e.g. along commercial/ tourism routes) or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction.
Construction camps and storage areas	- The contractor is to ensure that open areas or the surrounding bushes are not being used as toilet facility.

Parameter	Mitigation Measures
	- The contractor should ensure that all litter is collected from the work and camp areas daily. - Bins and/or skips should be emptied regularly and waste should be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the contractor for review by the environment management specialist. - The contractor should ensure that his camp and working areas are kept clean and tidy at all times. - After construction work, all structures comprising the construction camp are to be removed from site or handed over to the property owner/community as per mutual agreement (if established on private/community land). - The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these should be cleaned up. - All hardened surfaces within the construction camp area should be ripped, all imported materials removed, and the area should be top soiled and regressed. - The contractor must arrange the cancellation of all temporary services.
Dust and air pollution	- Vehicles travelling to and from the construction site must adhere to speed limits so as to avoid producing excessive dust. - Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. - Vehicles and machinery are to be kept in good working order and to meet manufacturer's specifications for safety, fuel consumption, etc. - The contractor is to have the equipment seen to as soon as possible should excessive emissions be observed,
Noise levels	- Noise-generating equipment must be fitted with silencers. - If a worker is exposed to noise above a noise exposure limit, the contractor must investigate options for engineered noise control such as using low-noise excavators, jackhammers, drills, and power generators. - If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection.
Utilities	- Prepare a list of affected utilities and operators - Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.
Water quality	- Every effort should be made to ensure that any chemicals or hazardous substances do not contaminate the soil or water on-site. - Care must be taken to ensure that runoff from vehicle or plant washing does not enter the surface/ground water. - Site staff should not be permitted to use any stream, river, other open water body, or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing, or for any construction or related activities. Municipal water (or another source approved by the environment management specialist) should instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting etc. - All concrete mixing must take place on a designated, impermeable surface. - No vehicles transporting concrete to the site may be washed on-site. - No vehicles transporting, placing, or compacting asphalt or any other bituminous product may be washed on-site. - All substances required for vehicle maintenance and repair must be stored in sealed containers until they can be disposed of or removed from the site. - Hazardous substance/ materials are to be transported in sealed containers or bags.
Waste management	- Wastes must be placed in the designated skips/bins which must be regularly emptied. These should remain within demarcated areas and should be designed to prevent wastes from being blown out by wind. - Littering on-site is forbidden and the site should be cleared of litter at the end of each working day/night period. - Recycling is to be encouraged by providing separate receptacles for different types of wastes and making sure that staff is aware of their uses. - All waste must be removed from the site and transported to a disposal site or as directed by the environment management specialist. Waybills proving disposal at each site should be provided for the environment management specialist's inspection. - Construction rubble should be disposed of in pre-agreed, demarcated spoil dumps that

Parameter	Mitigation Measures
	have been approved by the environment management specialist, or at disposal sites.
Conservation of natural environment	- As the work front progresses; the contractor is to check that vegetation clearing has the prior permission of the environment management specialist. - Only trees that have been marked beforehand are to be removed, if cutting of trees is required. - Clean the entire area and maintain immediately after completion of the construction activities to make sure that existing tranquility of the surrounding area is not disturbed in any way.
Cultural and historical environment	- Consult laborers who work on the site during the detailed design stage and in the unlikely event that there are social and cultural resources in the site; assistance should be given in relocating the site and any associated artifacts. - All the staff and laborers of the contractor are to be informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, jewelry, remains, fossils etc. - If something of this nature is uncovered, Department of Archaeology should be contacted and work should be stopped immediately.
Safeguards supervisors	- The contractor should appoint one environment safeguard supervisor who will be responsible for assisting the contractor in implementation of EMP, coordinating with the DSC, consultations with interested/ affected parties, reporting, and grievance redressal on a day-to-day basis. The resettlement issue will be resolved before the site will be handed over to the Contractor for construction activities.
Operation and maintenance phase	
General	- Develop O&M Manuals to include all aspects of the management and operation of the STSs - Train all STS workers to the highest standards available in Bangladesh and given refresher training at least annually - Control access for public/personnel; - Lock rooms or cages for waste storage; - Separate entrance and exit ensuring segregation of livestock and carcass product, to prevent cross contamination and ensure that animals do not see others being slaughtered; - Ensure proper functioning of refrigeration to maintain the cold chain from point of slaughter to dispatch; - Clean toilets daily; - Provide clean hand washing areas adequate soap and towels; - Provide clothing and laundry service for workers; and - Clean facility after the work of each day. The waste storage area and other adjacent areas should be sprinkled or sprayed regularly with disinfectants to avoid any spread of disease. - Insert plates and stops to prevent vermin from gaining access to the building. Where insect screening is required, this should consist of nylon insect mesh securely fixed to 150 × 50 reinforcing mesh with galvanized tie wire. Edges should be finished with a screw fixed beading strip where possible (all galvanized). - Audit implementation of O&M procedures at regular intervals (by an Independent Monitoring Agency)
Land contamination	- Do not store wastes outside the STS premises to avoid issues of aesthetic nature
Wastewater	- After treatment, the discharge standards need to be followed similar to the standards mentioned in Schedule 10 of the ECR 1997 for inland water discharge
Odor	- Audit odor to identify and characterize sources and determine any action required. - Store wastes properly inside the premises, preferably in an aerated area to minimize biodegradation and foul odor - Vendors should be asked to pick up waste on a daily basis to minimize degradation and odor - Enclose wastes and by-products during transport, loading/unloading and storage - Carry out frequent cleaning of material storage areas to prevent odor
Noise	- Activities and vehicle movements should be avoided after hours. - Vehicles should be fitted with silencers. - Vehicles and machinery are to be kept in good working order.

128. Chittagong City Corporation will be responsible for operating the STSs and will be given support by the project in the form of staff training and financial assistance. ADB, LGD, Urban Public and Environment Health Unit (UPEHU) will need to ensure that the budget for such support is sufficient to ensure that the management and operation of the facility is to the expected high standard and that the elements listed above are provided.

129. The successful operation of the STSs in the manner intended should bring significant benefits to the citizens by keeping the environment cleaner than before. The facility should also provide an opportunity for saving some money for Chittagong City Corporation because it would reduce the expenditure of CCC up to about 50% in collection and transportation of solid waste. And the CCC should re-invest this amount in staff training and equipment for the STSs, and ultimately in establishing similar facilities elsewhere in the city.

130. Citizens will also gain from improved health as they will lose fewer working days through illness and will spend less on healthcare. In time there will be wider improvements in quality of life at various locations in the city as the general environment and public health near existing STSs will greatly improve as the practices of throwing garbage here and there will decline.

V. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Project Stakeholders

131. Primary stakeholders are:

(i) Companies that operate on the proposed STSs sites;
(ii) People who work at the site, either employed by a company or self-employed;
(iii) Companies and workers operating in areas adjacent to the STSs sites;
(iv) Workers and companies operating at STSs elsewhere in Chittagong; and
(v) Companies and private individuals who are benefitted from the existing STSs.

132. Secondary stakeholders are:

(i) LGD as the Executing Agency and UPEHU as implementer;
(ii) Other government institutions whose remit includes areas or issues affected by the project (City Corporations, Planning Authorities, Department of Public Health Engineering, Local Government Engineering Department, Ministry of Finance, Ministry of Health, Ministry of Environment, Roads and Highways Department, etc);
(iii) NGOs, CBOs and other representatives of persons who may be affected by the project;
(iv) The beneficiary community in general; and
(v) The ADB.

B. Consultation and Disclosure

133. LGD/ UPEHU will extend and expand the consultation and disclosure process significantly during implementation of UPEHSDP. The UPEHU will appoint an experienced NGO to handle this key aspect of the program, who will conduct a wide range of activities in the target urban areas to ensure that the needs and concerns of stakeholders are registered, and are addressed in project design, construction or operation where appropriate. The program of activities will be developed during the detailed design stage, and is likely to include the following:

134. Consultation during detailed design:
   (i) Focus-group discussions with affected persons and other stakeholders (including women's groups, NGOs and CBOs) to hear their views and concerns, so that these can be addressed in project design where necessary; and
   (ii) Structured consultation meetings with the institutional stakeholders (Government bodies and NGOs) to discuss and approve key aspects of the project.

135. Consultation during construction:
   (i) Public meetings with major stakeholders to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and
   (ii) Smaller-scale meetings to discuss and plan construction work with primary stakeholders to reduce disturbance and other impacts, and provide a mechanism through which affected persons can participate in project monitoring and evaluation.

136. Project disclosure:
   (i) Public information campaigns (via newspaper, TV and radio) to explain the project to the urban populations and prepare them for any disruption they may experience once the construction program is underway;
   (ii) Public disclosure meetings at key stages to inform the public of progress and future plans, and to provide copies of summary documents in the Bangla language; and
   (iii) Formal disclosure of completed project reports by making copies available at convenient locations in each target town, informing the public of their availability, and providing a mechanism through which comments can be made.

C. Public Consultations Conducted

137. Different techniques of consultation with stakeholders were used by the PPTA Consultants during the planning stage of project preparation (interviews, public meetings, group discussions, etc). A questionnaire was designed and environmental information was collected. Apart from this, a series of public consultation meetings were conducted during the project preparation. Various forms of public consultations (consultation through ad hoc discussions on-site) have been used to discuss the project and involve the community in planning the project design and mitigation measures. Issues discussed and feedback received along with details of date, time, location, and list of participants are given in Annex 3.

VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Implementation Arrangement

138. Figure 34 is an organization chart showing how the project will be managed and implemented.

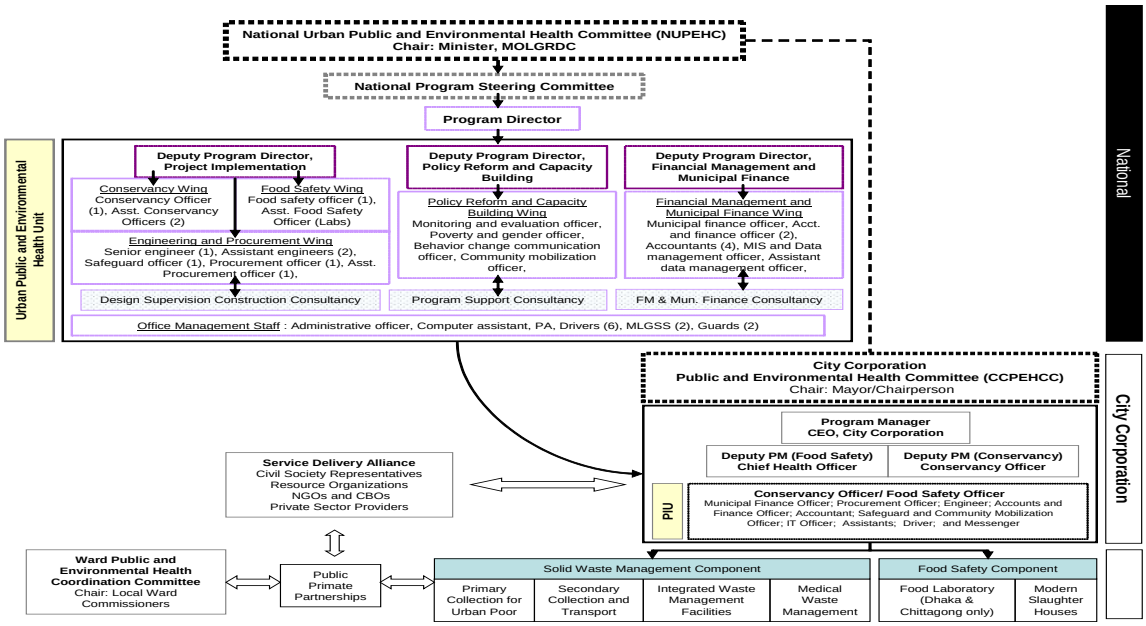


Figure 34: Organization Chart for UPEHSDP

139. **Local Government Division/Urban Public and Environmental Health Unit**. LGD of the Ministry of Local Government, Rural Development and Cooperatives (LGRDC) will be the executing agency (EA) for UPEHSDP providing overall guidance for program implementation. LGD will have the overall responsibility to plan, organize, manage, supervise, coordinate and monitor the progress achieved. LGD will establish a support unit called the Urban Public and Environmental Health Unit (UPEHU) who will be responsible for day-to-day program implementation and will be headed by a full-time program director. UPEHU will function as the Program Management Unit (UPEHU), with responsibility for day-to-day implementation. A Safeguards Officer (SO) to coordinate resettlement and environmental safeguards for UPEHSDP will be part of the Policy and Program Wing of the UPEHU. Through the SO, the UPEHU will ensure environmental compliance with ADB policy and national law across the entire program. This includes: (i) pre-approving final IEEs prior to submission to ADB for review and approval, and (ii) assisting in resolution of complaints and grievances related to IEE implementation not resolved at the CCPIU level.

140. **City Corporations/Program Implementation Units.** City Corporation Project Implementation Units (CCPIUs) will be established in each City Corporation. The CCPIUs will include a Safeguards and Community Mobilization Officer (SCMO) who will receive training from the International Environmental Specialist (IES) and Domestic Environmental Specialist (DES) who will be assigned to work with the CCPIU staff to help monitor subprojects and to transfer implementation capability to the CCPIU team. The SCMO will work closely with the IRS and DRS in planning, implementing, and monitoring all project activities. The CCPIUs will: (i) screen and categorize sub-projects; (ii) assist in, public meetings and other consultation with stakeholders; (iii) facilitate activities of the IES/ DES in applying for Location and Environmental Clearances (LCs/ECs).

141. **Environmental Specialists.** A Design, Supervision, and Construction Consultant Team (DSC) will be contracted to assist the UPEHU and CCPIUs in implementing and managing the investment subprojects including environmental planning. Towards this, International and Domestic Environmental Specialists (IES and DES) within DSC will prepare IEEs in accordance

with both ADB and Government of Bangladesh (GoB) policies during the feasibility and detailed design stage, and supervise contractors, with support from CCPIUs, during the construction process. The IES and DES will work in close coordination with UPEHU and CCPIUs. They will coordinate with the SO in the UPEHU to ensure all IEEs comply with ADB and GoB rules and guidelines. The IES and DES will also provide necessary training to CCPIUs to facilitate their monitoring of environmental impacts during construction and operation. It will provide support ensuring that all tasks of the CCPIU with regard to environmental implementation and monitoring are achieved. The IES and DES, in coordination with the contractors, will revise this IEE during detailed design stage and will ensure revised/updated IEE is approved by ADB and disclosed in LGD/ UPEHU and ADB websites.

142. **Contractors.** The Contractor shall at its own cost and expense:

(i) Design, construct, supply, manage and maintain the STSs, in accordance with the provisions of the contract, good industry practice and applicable Laws;
(ii) Observe and fulfill the environmental and other requirements as specified in the IEE/ EMP and under all applicable laws and applicable permits at all time during the service delivery period;
(iii) Apply for and obtain all necessary clearances and/ or approvals for the construction of the STSs from all the concerned governmental agencies;
(iv) Coordinate with DSC IES and DES on updating the IEE/EMP based on detailed designs;
(v) Procure and maintain in full force and effect, as necessary, appropriate proprietary rights, licenses, contracts and permissions for materials, methods, processes and systems used in or incorporated into the subproject;
(vi) Provide all assistance to the Project Manager as may be reasonably required for the performance of its duties and services under this subproject;
(vii) Provide to DSC IES and DES reports on a regular basis during the service delivery period in accordance with the provisions of the contract;
(viii) Appoint, supervise, monitor and control the activities of sub-contractors under their respective project contracts as may be necessary;
(ix) Make efforts to maintain harmony and good industrial relations amongst the personnel employed by Chittagong City Corporation in connection with the performance of the contractor's obligations under the contract;
(x) Develop, implement and administer a surveillance and safety program for the STSs and the users thereof and the contractors' personnel engaged in the provision of any services under any of the project contracts including correction of safety violations and deficiencies, and taking of all other actions necessary to provide a safe and hygienic environment in accordance with applicable laws and good industry practice;
(xi) Be responsible for safety, soundness and durability of the STSs, including all structures forming part thereof;
(xii) Ensure that the STSs sites remains free from all encroachments and take all steps necessary to remove encroachments, if any;
(xiii) Remove promptly from the STSs site all surplus construction machinery and materials, waste materials (including, without limitation, hazardous materials and waste water), rubbish and other debris and keep the area in a neat, clean and hygienic condition and in conformity with the applicable Laws and applicable Permits.

B. Capacity Building

143. A training program has been developed to build the capability of EA, city corporations, and CCPIUs. This will be conducted by the DSC and contractors. The contractor will be required to (i) conduct environmental awareness and orientation of workers prior to deployment to work sites; (ii) train STSs workers to the highest standards available in Bangladesh and given a refresher training at least annually during the service delivery period; and (iii) provide EA, CCPIUs, UPEHU, etc. a high level of training and other support sufficient to achieve the expected standards.

144. The suggested outline of the training program is presented in Table 6. The capacity building and training program will be updated during the detailed design stage to incorporate the contractors output.

Table 6: Indicative Capacity Building and Training Program for STSs Subproject

Description	Contents	Schedule	Participants
To be conducted by DSC			
Program 1 Orientation workshop	**Module 1 – Orientation** ADB Safeguards Policy Statement Bangladeshi Environmental Laws and Regulations **Module 2 – Environmental Assessment Process** ADB environmental process, identification of impacts and mitigation measures, formulation of an environmental management plan (EMP), implementation, and monitoring requirements Review of environmental assessment report to comply with ADB requirements Incorporation of EMP into the project design and contracts	1 day	EA, LGD, UPEHU, and city corporation officials involved in the project implementation CCPIUs
Program 2 Orientation program/ workshop for contractors and supervisory staff	Environmental issues during construction Implementation of EMP Monitoring of EMP implementation Reporting requirements	1 day	CCPIUs contractors
To be conducted by contractors			
Program 3 Orientation and safety Issues	STSs implementation activities detailed in drawings; safeguard policy requirements as per ADB and Government of Bangladesh rules; safety instructions and use of PPEs[11] by the staff and workers	1 day	Staff and workers of the Contractor
Program 4 Action plan for implementation of the STSs	Detailed action plan for implementation of the subproject in a timely and qualitative manner	1 day	Staff and workers of the Contractor

[11] **Personal protective equipment** (**PPE**) refers to protective clothing, helmets, goggles, or other garment or equipment designed to protect the wearer's body from injury. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. Protective equipment may be worn for job-related occupational safety and health purposes, as well as for sports and other recreational activities. "Protective clothing" is applied to traditional categories of clothing, and "protective gear" applies to items such as pads, guards, shields, or masks, and others.

C. Environmental Management Action Plan

145. The EMP will guide the environmentally sound construction of the subproject and ensure efficient lines of communication between the CCPIUs, DSC, and contractors. The EMP identifies activities according to the following three phases: (i) site establishment and preliminary activities, including finalizing IEE/EMP; (ii) construction stage; and (iii) post-construction/ operational stage. Table 8 outlines the mitigation measures and persons responsible for implementation and monitoring. The EMP will be updated by DSC during the detailed design stage. Note that the final IEE/EMP should be reviewed and cleared by the EA and ADB at time of detailed design and prior to commencement of construction work.

146. **Environmental monitoring program.** Prior to commencement of any civil work, the contractors will submit a compliance report[12] to the DSC ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. The DSC will review the report, and thereafter CCPIUs will allow commencement of civil works. CCPIUs and the DSC will be responsible for monitoring.

[12] This compliance report will include information on (i) barricades and warning signs; (ii) area for setting up of construction camps; (iii) methodology for surveys; (iv) area for establishing lay-down and storage; (v) sources of materials; (vi) records of environmental awareness, safety training, and orientation of workers prior to deployment to work sites; (vii) contact information of the environmental and resettlement supervisors; and (viii) construction method statement.

Table 7: Environmental Management Action Plan

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
Planning phase						
Updating of safeguard documents	- As this subproject will be implemented on the basis of turnkey contract, the detailed design will be done by the contractor, and the IEE/ EMP will be updated at the time of detailed design and will be revised by the DSC team.	DSC with input from the contractor	CCPIU	Updated IEE/EMP	---	ADB Environment Policy EARF ECR 1997
Capacity Building	- Develop and submit for approval a capacity building and training program to ensure (i) all STSs workers are trained to the highest standards available in Bangladesh and given refresher training at least annually; and (ii) Chittagong City Corporation and UPEHU staff are given a high level of training and other support sufficient to achieve the expected standards.	Contractors	DSC CCPIU	Capacity building and training program	---	EARF All applicable laws and regulations
Work schedule	- Ensure careful planning and scheduling of the activities. - Prepare a traffic management plan and road safety plan.	Contractors	DSC CCPIU	Plan and schedules	Prior to approval of detailed design documents	Detailed Design documents
Barricades and warning signs	- Use easily transportable barricades and warning signs such as those made of high reflector plastic materials. - Also use aluminized rolled warning signs to warn the public.	Contractors	DSC CCPIU	Lists and samples of warning signs and barricades	Prior to approval of detailed design documents	Detailed design documents
Workers	- Employ workers with adequate experience,	Contractors	DSC CCPIU	Workers list (for internal	Prior to approval of	Detailed Design documents

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	training, and know-how. It is always advantageous for the contractor to employ workers with adequate experience, training, and know-how in the line of work that they are doing. These people are usually reliable and can be counted upon to exercise good judgment in the field.			monitoring)	detailed design documents	
Community and public awareness	- Establish extensive coordination with Chittagong City Corporation, Design and Supervision Consultants (DSC), Department of Environment, operators of landfill sites - A massive information campaign must precede any construction activity in order to make the public aware of the extent of the problem that might be present during the period of construction. - Open liaison channels should be established between Chittagong City Corporation, the contractors, and interested and affected parties such that any queries, complaints, or suggestions can be dealt with quickly and by the appropriate persons.	Contractors	DSC CCPIU	Communication and participation strategy	Prior to approval of detailed design documents	Detailed Design documents
Legislation, permits, and agreements	- In all instances, Chittagong City Corporation, contractors and consultants must remain in compliance with relevant local and national legislation. - A copy of the IEE must be kept on-site and disclosed in Chittagong City Corporation, LGD, Ministry of Local	Contractor	DSC CCPIU	All applicable permits and approvals	Prior to start of civil works and as necessary	Ensure location clearance and ECC from DoE as per guidance provided in ECR 1997 is obtained prior to award of turnkey contract

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	Government, Rural Development and Cooperatives, and ADB websites.					
Access to site	- Access to site will be via existing roads. The contractor will need to ascertain the existing condition of the roads and repair damage due to construction.	Contractor	DSC CCPIU	Traffic management plan	Prior to approval of detailed design documents	No complaints received Minimal traffic disturbance
Setting up of construction camp	- Choice of site for the contractor's camp requires the DSC environment management specialist's permission and must take into account location of local residents, businesses, and existing land uses. A site plan must be submitted to the environment management specialist for approval. - If the contractor chooses to locate the camp site on private land, he must get prior permission from the environment management specialist and the landowner. - Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. - Recycling and the provision of separate waste receptacles for different types of waste should be encouraged.	Contractor	DSC CCPIU	Location plan	Prior to approval of detailed design documents	Approved location plan Construction method No complaints received
Establishing equipment lay-down and storage area	- Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by children, animals, etc.	Contractor	DSC CCPIU	Location plan	Prior to approval of detailed design documents	Approved location plan Construction method No complaints

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	- The contractor should submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.					received
Materials management – sourcing	- The contractor should prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, clay liners, etc), and submit these to the environment management specialist for approval prior to commencement of any work.	Contractor to submit sources of materials to DSC	DSC CCPIU	Lists of sources	Prior to approval of detailed design documents	Section 6 of contract All applicable permits (e.g. from Mining Department for quarries, borrow pits, sands and gravel)
Education of site staff on general and environmental conduct[13]	- Ensure that all site personnel have a basic level of environmental awareness training. - Staff operating equipment (such as excavators, loaders, etc.) should be adequately trained and sensitized to any potential hazards associated with their task. - No operator should be permitted to operate critical items of mechanical equipment without having been trained by the contractor. - All employees must undergo safety training.	Contractor	DSC CCPIU	Records of training	Prior to start of civil works and every new employee	Revised/Updated IEE/EMP (capacity building)
Construction phase						
Excavated materials	- Hauling vehicles must always be present at the excavation site.	Contractor	DSC	Construction method statement	As work progresses	Construction method Detailed design

[13] These points need to be made clear to all staff on site before the project begins.

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	- The contractor can process the excavated materials and use these as selected backfill materials. - If excavated materials are not suitable for reuse, the contractor should deposit these in an area designated by Chittagong City Corporation. - Coordinate with the landfill operators for the disposal of excavated materials. - Obtain from the environment management specialist approval for disposal of excavated materials. - Remove waste rapidly by loading material onto trucks as soon as it is excavated; - Cover or damp down working areas and stockpiled soil in dry, windy weather; and - Use tarpaulins to cover loose material during transportation to and from the site. - Maintain record of excavated materials, disposal dates, and methods. - Conduct the work in the dry season will reduce these impacts, and as the excavation in this case is shallow and small in scale there should be no impact on the water table.					documents Identify and obtain clearance from DoE for disposal sites of excavated soils and contaminated materials
Hauling of Construction Materials	- The contractor must maintain all the materials necessary in his inventory so	Contractor	DSC	Construction method statement	As work progresses	Construction method Detailed design

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	that these can be easily hauled to the construction site when needed. - Advance signage for affected parking areas must indicate duration and alternative parking arrangements.					documents
Access	- The contractor should make available in his stock steel plates and wooden planks which will be deployed on top of excavations to provide temporary access to buildings, street crossings, and other areas where these will be necessary. - Advance road signage must indicate the road detour and alternative routes. Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints.	Contractor	DSC	Construction method statement	As work progresses	Construction method Detailed design documents Zero complaints from community/sensitive receptors
Occupational health and safety	- Employ workers with adequate experience, training, and know-how. - These workers should be led by an experienced supervisor or engineer, who will provide the leadership in daily activities. - A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site;	Contractor	DSC	Occupational health and safety plan Number of accidents and work-related injuries Complaints from community	As work progresses	Construction method Detailed design documents Zero accident and work-related injuries Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	(ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers should be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. - The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, a translator should be called to the site to further explain aspects of environmental or social behavior that are unclear. - The rules that are explained in the worker conduct section must be followed at all times.					
Community health and safety	- Contractor's activities and movement of staff will be restricted to designated	Contractor	DSC	Complaints from community	As work progresses	Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	construction areas. - Should the construction staff be approached by members of the public or other stakeholders, staff should assist them in locating the environment management specialist or contractor, or provide a number through which they may contact the environment management specialist or contractor. - The conduct of the construction staff when dealing with the public or other stakeholders should be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. - Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the environment management specialist's permissions. - Provide walkways and metal sheets where required to maintain access for people and vehicles. - Consult businesses and institutions regarding operating hours, and factor this in work schedules. - The contractor is to inform neighbors in writing of disruptive activities at least 24 hours beforehand. This			Activities based on the communication and participation strategy		

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	can take place by way of leaflets placed in the postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist. - Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints. - The contractor will ensure that there is provision of alternate access to business establishments during the construction, so that there is no closure of these shops or any loss of clientage. - The contractor will ensure that any damage to properties and utilities will be restored or compensated to pre-work conditions. - Lighting on the construction site should be pointed downwards and away from oncoming traffic and nearby houses. - The site must be kept clean to minimize the visual impact of the site. - If screening is being used, this must be moved and re-erected as the work front progresses. - Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	nuisance to neighbors. - Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of these include: noise generated by jackhammers, diesel generator sets, excavators, etc. - Noisy activities must be restricted to the times given in the project specification or general conditions of contract. - The environment management specialist and contractor are responsible for ongoing communication with those people who are interested in or affected by the project. - A complaints register (refer to the grievance redressal mechanism) should be housed at the site office. This should be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the contractor. This register is to be tabled during monthly site meetings. - Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. - The contractor must address queries and complaints by: (i) documenting details of such					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. - The contractor should immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/grievance.					
Community and public awareness	- Storage facilities and other temporary structures on-site should be located such that they have as little visual impact on local residents as possible. - Special attention should be given to the screening of highly reflective materials on site. - In areas where the visual environment is particularly important (e.g. along commercial/ tourism routes) or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction.	Contractor	DSC	Complaints from community Activities based on the communication and participation strategy	As work progresses	Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
Construction camps and storage areas	- The contractor is to ensure that open areas or the surrounding bushes are not being used as toilet facility. - The contractor should ensure that all litter is collected from the work and camp areas daily. - Bins and/or skips should be emptied regularly and waste should be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the contractor for review by the environment management specialist. - The contractor should ensure that his camp and working areas are kept clean and tidy at all times. - After construction work, all structures comprising the construction camp are to be removed from site or handed over to the property owner/community as per mutual agreement (if established on private/community land). - The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these should be cleaned up. - All hardened surfaces within the construction camp area should be ripped, all imported materials removed, and the area should be top soiled and regressed. - The contractor must arrange the cancellation of	Contractor	DSC	Approved location plan Complaints from community	As work progresses	Approved location plan Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	all temporary services.					
Dust and air pollution	- Vehicles travelling to and from the construction site must adhere to speed limits so as to avoid producing excessive dust. - Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. - Vehicles and machinery are to be kept in good working order and to meet manufacturer's specifications for safety, fuel consumption, etc. - The contractor is to have the equipment seen to as soon as possible should excessive emissions be observed,	Contractor	DSC	Vehicle emission testing records Complaints from community	As work progresses	No visible increase in dust and particulate matters Zero complaints from community
Noise levels	- Noise-generating equipment must be fitted with silencers. - If a worker is exposed to noise above a noise exposure limit, the contractor must investigate options for engineered noise control such as using low-noise excavators, jackhammers, drills, and power generators. - If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing	Contractor	MASC environment management specialist	Complaints from community Noise level monitoring record	As work progresses	ECR 1997

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	protection.					
Utilities	- Prepare a list of affected utilities and operators - Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	Contractor	DSC	Number of affected utilities Length of time to restore disrupted services	As work progresses	No disrupted service
Water quality	- Every effort should be made to ensure that any chemicals or hazardous substances do not contaminate the soil or water on-site. - Care must be taken to ensure that runoff from vehicle or plant washing does not enter the surface/ground water. - Site staff should not be permitted to use any stream, river, other open water body, or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing, or for any construction or related activities. Municipal water (or another source approved by the environment management specialist) should instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting etc. - All concrete mixing must take place on a designated, impermeable surface. - No vehicles transporting concrete to the site may be	Contractor	DSC	Complaints from community Waste disposal manifest/record	As work progresses	No visible increase in water pollution due to the project Zero complaints from community

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	washed on-site. - No vehicles transporting, placing, or compacting asphalt or any other bituminous product may be washed on-site. - All substances required for vehicle maintenance and repair must be stored in sealed containers until they can be disposed of removed from the site. - Hazardous substance/ materials are to be transported in sealed containers or bags.					
Waste management	- Wastes must be placed in the designated skips/bins which must be regularly emptied. These should remain within demarcated areas and should be designed to prevent wastes from being blown out by wind. - Littering on-site is forbidden and the site should be cleared of litter at the end of each working day/night period. - Recycling is to be encouraged by providing separate receptacles for different types of wastes and making sure that staff is aware of their uses. - All waste must be removed from the site and transported to a disposal site or as directed by the environment management specialist. Waybills proving disposal at each site should be provided	Contractor	DSC	Complaints from community Waste disposal manifest/record	As work progresses	No dumped wastes and litter at work sites at all times Zero complaints from community

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	for the environment management specialist's inspection. - Construction rubble should be disposed of in pre-agreed, demarcated spoil dumps that have been approved by the environment management specialist, or at disposal sites.					
Conservation of natural environment	- As the work front progresses; the contractor is to check that vegetation clearing has the prior permission of the environment management specialist. - Only trees that have been marked beforehand are to be removed, if cutting of trees is required. - Clean the entire area and maintain immediately after completion of the construction activities to make sure that existing tranquility of the surrounding area is not disturbed in any way.	Contractor	DSC	Vegetation clearing	As required	Only allowed trees/vegetation to be cleared
Cultural and historical environment	- Consult laborers who work on the site during the detailed design stage and in the unlikely event that there are social and cultural resources in the site; assistance should be given in relocating the site and any associated artifacts. - All the staff and laborers of the contractor are to be informed about the possible items of historical or	Contractor	DSC	Chance finds	As necessary	All chance finds shall be reported and turned over to the Department of Archaeology.

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	archaeological value, which include old stone foundations, tools, clayware, jewelry, remains, fossils etc. - If something of this nature is uncovered, Department of Archaeology should be contacted and work should be stopped immediately.					
Safeguards supervisors	- The contractor should appoint one environment safeguard supervisor who will be responsible for assisting the contractor in implementation of EMP, coordinating with the DSC, consultations with interested/affected parties, reporting, and grievance redressal on a day-to-day basis.	Contractor	DSC	Hiring and actual work	As work progresses	Continuous work output and reporting records
Operation and maintenance phase						
General	- Develop O&M Manuals to include all aspects of the management and operation of the STSs - Train all STS workers to the highest standards available in Bangladesh and given refresher training at least annually - Control access for public/personnel; - Clean toilets daily; - Provide clean hand washing areas adequate soap and towels; - Provide clothing and laundry service for workers; and - Clean facility after the work of each day. The waste storage area and other	Contractor (up to service delivery period) Chittagong City Corporation	Chittagong City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual Public health survey (5 years)	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	adjacent areas should be sprinkled or sprayed regularly with disinfectants to avoid any spread of disease. - Audit implementation of O&M procedures at regular intervals (by an Independent Monitoring Agency)					
Land contamination	- Do not store wastes outside the STSs premises to avoid issues of aesthetic nature	Contractor (up to service delivery period) Chittagong City Corporation	Chittagong City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Wastewater	- After treatment, the discharge standards need to be followed similar to the standards mentioned in Schedule 10 of the ECR 1997 for inland water discharge	Contractor (up to service delivery period) Chittagong City Corporation	Chittagong City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	ECR 1997 (Rule 13: The standard limits of the discharge of liquid wastes shall be determine in accordance with the standards specified in Schedule 10)
Other wastes	- All other wastes arising in the STSs should be properly graded and disposed of by appropriate methods. - Disposed into a solid waste bin (skip) and immediately transport out of the STSs in a closed wheel-barrow or similar other device.	Contractor (up to service delivery period) Chittagong City Corporation	Chittagong City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Odor	- Audit odor to identify and characterize sources and determine any action required. - Carry out frequent cleaning of material storage areas to prevent odor	Contractor (up to service delivery period) Chittagong City Corporation	Chittagong City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Noise	- Activities and vehicle movements should be	Contractor (up to service delivery	Chittagong City Corporation (up to	Specifications in the O&M	As determined in the O&M	As specified in the O&M Manual and all

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	avoided after hours. - Vehicles should be fitted with silencers. - Vehicles and machinery are to be kept in good working order.	period) Chittagong City Corporation	service delivery period) Independent Monitoring Agency	Manual	Manual	applicable laws and regulations
Water use	- Minimize water use through dedicated metering of water consumption	Contractor (up to service delivery period) Chittagong City Corporation	Chittagong City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Health, hygiene, and safety	- STS workers should undergo regular medical check-up - STS workers should be provided with protective gear like head cover, gloves, etc - Provide training on safety to staff to avoid accidents - Regularly monitor the STSs to ensure compliance with occupational health and safety rules	Contractor (up to service delivery period) Chittagong City Corporation	Chittagong City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations

D. Reporting

147. The DSC will submit monthly monitoring reports to CCPIU, and the CCPIU will send semiannual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

E. Environmental Costs

148. The contractor's cost for site establishment, preliminary activities, construction, defect liability activities, and environmental mitigation measures related to EMP implementation during planning, design, construction, and operations will be incorporated into the contractual agreements and engineers costs, which will be binding on him for implementation.

149. The mitigation measures during the operation phase (after the service delivery period) are again of good operating practices, which will be the responsibility of the implementing agency (Chittagong City Corporation). All monitoring during the operation and maintenance phase will be conducted by Chittagong City Corporation; therefore, there are no additional costs.

150. The activities identified in the EMP mainly include site inspections and informal discussions with workers and local community, and this will be the responsibility of CCPIU with the assistance of DSC, costs of which are part of project management.

151. Table 8 presents the estimated cost to implement the EMP. The EMP and the costs for the EMP implementation will be updated during detailed engineering design. The figures show that the total cost of environmental management and monitoring for all subprojects in Chittagong is Tk 22.5 million. This includes: the cost of the Independent Monitoring Agency, which will spend one week every month for five years, monitoring the operation of the STSs. It includes the cost of all surveys (long-term bi-annual wastewater monitoring will be done by DOE and test costs borne by operator according to DOE fee rates as per Schedule 14 of the ECR, 1997) and other expenses associated with implementing the EMP for this subproject during project implementation. It also includes the cost of the long-term survey of public health proposed in the EMP for this subproject.

Table 8: Environmental Management and Monitoring Costs for Chittagong STSs

Item	Quantity	Unit Cost (TK.)	Total Cost (TK.)	Sub-total
1. Monitoring during Construction (1.5 years)				
Domestic Environmental Specialist	1 x 6 month	300,00014	1,800,000	
Survey Expenses	Lump Sum	2,000,000	2,000,000	3,800,000
2. Monitoring during Operation (5 years)				
Independent Monitoring Expert	5 x 3 month	300,000	4,500,000	
Supporting Staff	5 x 3 month	200,000	3,000,000	
Survey Expenses	Lump Sum	5,000,000	5,000,000	12,500,000
3. IEEs/EIAs required by ADB policy & national law				
Domestic Environmental Specialist	1 x 12 month	300,000	3,600,000	
Expenses (surveys, consultation, disclosure)	Lump Sum	1,000,000	1,000,000	4,600,000
4. Survey of Public Health (5 years)				

[14] Unit cost of domestic consultants is based on current rates and includes fee, travel, accommodation and subsistence.

Domestic Consultant	5 x ½ month	300,000	750,000	
Supporting Staff	5 x ½ month	200,000	500,000	
Other Expenses	Lump Sum	500,000	350,000	1,600,000
TOTAL COST (TK.)				**22,500,000**

VII. FINDINGS AND RECOMMENDATIONS

A. Findings

152. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Chittagong STSs subproject. Potential negative impacts were identified in relation to the design, construction and operation of the infrastructure, and mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects of program development, and as a result some measures have already been included in the outline designs for the infrastructure. These include:

(i) Ensuring that the site selected for the STSs is owned by the Government and does not contain any residential property, to avoid the need to relocate households; and
(ii) Selecting a site that is in an uninhabited area where there are no sensitive receptors because the people in the goat/ cattle market do not stay there permanently. The tin-shed located in the corner will be dismantled by the own initiative of the CCC before the construction activities begins.

153. This means that the number of impacts and their significance has already been reduced by amending both the design and location of elements of the subproject.

154. Regardless of these and various other actions taken during the IEE process and in developing the subproject, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because functioning STSs can have major negative impacts on public health and safety, and environmental quality, if it is not operated to the highest professional standards. Because of these factors the most significant impacts are on the physical environment and the human environment.

155. In the construction phase there are not expected to be major negative impacts because the construction work is relatively small scale and straightforward and will be conducted at a single site. Other mitigation and enhancement measures are included in the EMP, which also shows the location of the impact, the body responsible for the mitigation, and the program for its implementation.

156. Operation and maintenance of the completed STSs will be the responsibility of the contractor up to the end of the service delivery period and afterwards, the Chittagong City Corporation. It will be vital that the facility operates to the highest professional standards because if this is not the case it could easily replicate the practices and effects that are common at existing STSs and *ad hoc* solid waste dumping places in the city. These include impacts on:

(i) **Worker health and safety.** if equipment, procedures and hygiene are inadequate;

(ii) **Environmental quality.** if solid waste is not properly collected and transported on a daily basis.

157. The IEE includes a number of measures relating to the design to ensure that the facility operates to a high standard and avoids these and other impacts. The main measures are that:

(i) All aspects of management and operation should be set out in O&M manuals prepared by an international expert in STSs management;
(ii) Implement of the procedures is checked and audited by an Independent Monitoring Agency every month for the first five years;
(iii) All workers are trained to the highest available standards and re-trained annually;
(iv) Ensuring sufficient training and financial support to the Chittagong City Corporation to achieve expected standards.

158. If these and the other mitigation measures recommended by the IEE are implemented, then the STSs should operate without significant negative impacts. Public health should therefore improve and there will also be economic benefits for the people in general because there will be less possibility of getting sick and subsequent absence of the workers in offices and factories. In time there should also be improvements in environmental quality around existing STSs as these practices

159. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries during the construction stage, and weekly monitoring of all practices at the STSs for the first five years of operation, by the IMA. Any requirements for remedial action will be reported to LGD/ UPEHU and ADB. There will also be a longer-term survey to monitor the expected improvements in public health.

160. Finally, stakeholders were involved in developing the IEE through face-to-face discussions on site and a large public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project. The IEE and other documents will be made available at public locations in the town and summaries will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation, when a nationally-recognized NGO will be appointed to handle this key element to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

B. Recommendations

161. There are two straightforward but essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. These are that LGD/ UPEHU should ensure that:

(i) All mitigation, compensation and enhancement measures proposed in this IEE report (Table 7) are implemented in full, as described in this document; and
(ii) The EMP of this report is updated during detailed design and also implemented in full during construction and operation period.
(iii) A copy of the EMP shall be kept on-site during the construction and operation period at all times.

(iv) The EMP shall be made binding on all contractors operating on the site, and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document shall constitute a failure in compliance.

VIII. CONCLUSIONS

162. The environmental impacts of the proposed STSs subprojects in the Chittagong City have been assessed according to ADB guidelines and results reported in this IEE. The potential adverse environmental impacts are related to the (i) construction period, which can be minimized by the mitigating measures and environmentally sound engineering and construction practices; and (ii) operation period, which can be managed by the mitigation measures and environmentally sound O&M practices. Therefore, as per ADB Environment Policy, the project is classified as environmental category B and does not require further environmental impact assessment.

163. In relation to Bangladeshi ECR 1997, the Chittagong STSs subproject is considered to have some potential for environmental impacts and can be classified as Orange – B category. The environmental impacts can be mitigated by the measures mentioned in this IEE and EMP. So this IEE document will be sufficient and acceptable to DoE as part of the ECC application and further study for impact assessment will not be necessary.

APPENDIX 1: ADB RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area…			
▪ Densely populated?		**X**	
▪ Heavy with development activities?		**X**	The STS sites are located in city corporation owned lands. At present these are being used for dumping of municipal solid wastes.
▪ Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site		**X**	
• Protected Area		**X**	
• Wetland		**X**	
• Mangrove		**X**	
• Estuarine		**X**	
• Buffer zone of protected area		**X**	
• Special area for protecting biodiversity		**X**	
• Bay		**X**	
B. Potential Environmental Impacts Will the Project cause…			
▪ impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services.		**X**	
▪ deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed?		**X**	
▪ degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests)?		**X**	
▪ dislocation or involuntary resettlement of people?		**X**	There will be no dislocation or involuntary resettlement of people.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable group?		**X**	
▪ degradation of cultural property, and loss of cultural heritage and tourism revenues?		**X**	
▪ occupation of low-lying lands, floodplains and steep hillsides by squatters and low-income groups, and their exposure to increased health hazards and risks due to pollutive industries?		**X**	
▪ water resource problems (e.g. depletion/degradation of available water supply, deterioration for surface and ground		**X**	

Screening Questions	Yes	No	Remarks
water quality , and pollution of receiving waters?			
▪ air pollution due to urban emissions?	**X**		During construction activities for hauling of materials and operations of excavation equipment; During operations, odor from the solid wastes due to agitation and mixing
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical and biological hazards during project construction and operation?	**X**		During construction activities – occupational health and safety due to physical hazards; During construction activities – occupational health and safety due to physical and biological hazards
▪ road blocking and temporary flooding due to land excavation during rainy season?		**X**	
▪ noise and dust from construction activities?	**X**		During construction phase only
▪ traffic disturbances due to construction material transport and wastes?	**X**		During construction phase only
▪ temporary silt runoff due to construction?	**X**		During construction phase only
▪ hazards to public health due to ambient, household and occupational pollution, thermal inversion, and smog formation?		**X**	
▪ water depletion and/or degradation?		**X**	
▪ overpaying of ground water, leading to land subsidence, lowered ground water table, and salinization?		**X**	
▪ contamination of surface and ground waters due to improper waste disposal?	**X**		During construction phase only
▪ pollution of receiving waters resulting in amenity losses, fisheries and marine resource depletion, and health problems?		**X**	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		**X**	
▪ social conflicts if workers from other regions or countries are hired?		**X**	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		**X**	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		**X**	

APPENDIX 2: PHOTOGRAPHS OF THE PROPOSED STS SITES AND THE SURROUNDING AREAS

STS – 1 at Sirajuddoula Road

STS – 3 at Nazir Ahmed Road

STS – 7 at Bayezid Bostami

STS – 8 at K-Block DT Road

STS – 9 at Port Connecting Road

STS – 10 at Mohazonghata

APPENDIX 3: RECORDS OF PUBLIC CONSULTATIONS CONDUCTED

The stakeholders' consultation meeting was held at STS site, Namunabazar Khoar, Chittagong at 12-30 PM on 7 January 2013 with local people and Chittagong City Corporation (CCC) officials.

The meeting was held with local people and Conservancy Officer (Mr. Shahid) of CCC. Among the local people, most of them were laborers and engaged in repairing rickshaws who participated actively in the consultation.

Meeting at Namunabazar Khoar STS site in Chittagong

The Environment and Safeguard Specialist of Package-C Consultants welcomed all participants in the meeting and explained goals and objectives of the project. He told that the Government of Bangladesh through the CCC has undertaken a project to construct one modern slaughterhouse, one sanitary land fill, one food laboratory and 12 secondary transfer stations in CCC area to keep the city free from environmental pollution. This project will benefit the local people by improving the environmental conditions.

It was known from the discussion that the land proposed for construction of the Secondary Transfer Station (STS) is owned by the CCC. It is a small area but it will be sufficient for construction of a standard size STS as per design adopted in UPEHSDP It is at present temporarily being used as a place for parking and repairing of rickshaws. The participant from the CCC clearly stated that the area proposed for construction of STS will be cleared by the own initiative of the CCC before any construction activities will start in the site.

It was disclosed in the meeting that the project would be implemented soon and the local people would get benefit of getting employment as soon as the construction works would start. They also expressed their willingness to get long-term deployment after the implementation of the STS. It was disclosed to the participants that the local people would get preference during selection of staff and workers for running the STS in a sustainable manner.

The participants were convinced that the socio-economic and environmental condition of the local people and the locality would be definitely better after implementation of the subproject and they showed their willingness to cooperate whole heartedly during construction and operation and maintenance phase of the STS.

There were no issues left for discussion and the meeting was closed with a vote of thanks to all participants.

Ministry of Local Government, Rural Development and Cooperatives
Urban Public and Environmental Health Sector Development Project (UPEHSDP)
Attendance Sheet

Time: 12-30 PM Date: 7/1/2013

Place of meeting: STS site at Namunabazar Khoar, Chittagong Union:W/30 Thana:D Mooring

Serial Number	Name of Participant	Father's/ Husband's Name	Address	Mobile Number	Signature
1	Matin	Amir Hossain	East Motherbari	01926685780	
2	Kalam	Asmat Ali	Purbo Motherbari	01927385230	
3	Riaz	A Motaleb	Purbo Motherbari	01823925035	
4	Rafizul	Md. Delwar Hossain	Purbo Motherbari	01772574172	
5	Siddique	A Malek	Purbo Motherbari	01770486453	
6	Faruk	Md. Raja Miah	Purbo Motherbari	01735966532	
7	Hanif	Md. Hasan	Purbo Motherbari	01814701249	
8	Shahidul Islam	Mafizur Rahman	Fakir hat	01712550697	
9	Md. Saifuddin	Md. Kabir Ahmed	Purbo Motherbari	01811393148	
10	Doulat Khan	Nezamot Khan	Kadam Mubarak	-	

Ministry of Local Government, Rural Development and Cooperatives
Urban Public and Environmental Health Sector Development Project (UPEHSDP)

Attendance Sheet

Time: 12-30 PM Date: 7/1/2013

Place of meeting: Nameenbagar Khoar STS site Chittagong Union: W/30 Thana: Double Mooring

Serial Number	Name of Participant	Father's/ Husband's Name	Address	Mobile Number	Signature
1	[illegible]	[illegible]	East Nasirabad	01926685780	[illegible]
2	[illegible]	[illegible]	[illegible]	01927385230	[illegible]
3	[illegible]	[illegible]	[illegible]	01823925035	[illegible]
4	[illegible]	[illegible]	[illegible]	01772574172	[illegible]
5	[illegible]	[illegible]	[illegible]	01770486453	[illegible]
6	[illegible]	[illegible]	[illegible]	01735966532	[illegible]
7	[illegible]	[illegible]	[illegible]	01814701249	[illegible]
8	[illegible]	[illegible]	11	01712506677	[illegible]
9	[illegible]	[illegible]	11	01811393148	[illegible]
10	[illegible]	[illegible]	[illegible]	——	[illegible]