

Initial Environmental Examination

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BAN: Urban Public and Environment Health Sector Development Program: Khulna Sanitary Landfill

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 24 May 2013)

Currency unit	–	Taka (Tk)
Tk.1.00	=	\$0.01285
\$1.00	=	Tk. 77.810

ABBREVIATIONS

ADB	–	Asian Development Bank
BBS	–	Bangladesh Bureau of Statistics
BCC	–	Behavior Change Communication
BOD	–	Biochemical Oxygen Demand
CC	–	City Corporations
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
KCC	-	Khulna City Corporation
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
SLF	-	Sanitary Landfill
SO	–	Safety Officer
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.

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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 Khulna Sanitary Landfill subproject in Khulna City Corporation 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. As per ECR 1997, it is included the Red Category in item 43 and described as 'Land-filling by industrial, household and commercial wastes'.

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 Red 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 Khulna Sanitary Landfill 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 60 days to respond from the receipt of the ECC application for a Red category project. After obtaining location clearance on the basis of Initial Environment Examination (IEE) Report, the Environmental Impact Assessment (EIA) Report in accordance with the approved terms of reference along with design of Effluent Treatment Plant (ETP)¹ and its time schedule shall be submitted within approved time limit.

14. The Khulna City Corporation authority applied for environmental clearance for the proposed landfill site from the Department of Environment (DOE) on 20 February 2012. The DOE approved the EIA report and issued Land Clearance Certificate on 10 May 2012 vide Memo No. DOE/Clearance/ 5123/ 2011/ 113 on condition that the Project Proponent shall, after land development and infrastructural development as well as installation of waste treatment and other pollution control equipment, apply for Environmental Clearance Certificate without which

¹ Details in paragraph 38, under the heading of Wastewater/ Effluent Treatment Plant (ETP).

proponent shall not start operation of the project. The scanned copy of the above approval letter has been provided in the ANNEX 4. Clearance from the Khulna Development Authority (KDA) will be obtained before the start of construction activities in the site. There are no schools and churches within the adjacent area of the SLF site.

15. **Other Policies, Plans, and Strategies.** In addition to ECA and ECR, there are a number 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.

16. 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.

17. 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 Khulna SLF Subproject

Acts/ Guidelines	Purpose	Applicability to the Subproject
Environmental Conservation Act, 1995 and Environmental Conservation Rules, 1997	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - As per ECR 1997, it is included the Red Category in item 43 and described as 'Land-filling by industrial, household and commercial wastes'. - 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	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - 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

Acts/ Guidelines	Purpose	Applicability to the Subproject
	goals through providing a uniform guideline for all stakeholders.	concerning issues such as tipping fees and access to municipal land for recycling projects.
Local Government (City Corporation) Act, 2009	<p>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:</p> <ul style="list-style-type: none"> – City Corporation will take all necessary steps to collect and dispose waste from all the roads, toilets, drains, structures and areas 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. 	Construction of SLF 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 the Secondary Transfer Stations for onward transportation to the SLF site of the City Corporation outside the city with a view to arranging a safe and satisfactory disposal.
Medical Waste Management Rules 2008	The main objective is to control overall management including collection, treatment and disposal of medical waste in Bangladesh.	SLF will have a specific section to deal with medical wastes; these hazardous wastes will be collected, transported by special arrangement by the City Corporation and treated separately in the Medical Waste Management section of SLF.

C. Scope of the Study

18. This is the IEE for the Khulna Sanitary Landfill 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)² 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

19. 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.

20. Improvements in solid waste management facilities are needed in Khulna 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.
- (iv) Some improvement in the collection, storage and transportation of solid waste is anticipated after implementation of 8 Secondary Transfer Stations under UPEHSDP in different locations of the Khulna City; but the safe disposal of these wastes in the landfill site has not been properly addressed yet.

21. UPEHSDP will address this issue by implementing modern Sanitary Landfill (SLF) in Khulna, which may then be replicated in other urban centers through further subprojects.

B. Location, Size and Implementation Schedule

22. The Khulna SLF subproject will be implemented on the land acquired by the City Corporation with financial support from ADB through UPEHSDP; photographs of the proposed site are attached as Annex 2.

23. Location of the subproject is shown in the following map (Fig 1). It is in the Upazila of Batiaghata and under Union of Mathabhanga. LGED Upazila road from Rupsha to Batiaghata locally known as Lobon Chora Road passes in the south of the proposed plot for implementation

² LCC already obtained from DOE, the scanned copy given in ANNEX 4.

of the SLF. Total area of land proposed for SLF is 10 hectares (24.7 acres). The shape of the land is nearly rectangular (about 353 meters X 283 meters), which is suitable for construction of sanitary landfill. As per requirement of the EARF selection criteria #8 for waste management, it has been ensured that no habitation or sensitive receptors are within 250 meters of the proposed landfill site. Also it has been confirmed that the landfill (i) will not be constructed in areas where the groundwater table is less than 2 meters below the ground level; (ii) will not be constructed within the flood prone areas; (iii) are not within the environmentally sensitive areas; (iv) will not be constructed within or near water supply wells, and at least 500 meters of any downgraded wells; and (v) will ensure a buffer zone around the landfill with the distance agreed upon with the regulatory agencies. If during construction any of the criteria cannot be adhered to, specific design options will be taken into consideration. NOC from the DPHE will be obtained if proposed landfill is within or near water supply wells or within 500 meters of any downgraded well.

24. Preliminary design of Khulna SLF subproject has begun in the end of 2012 and has been completed in the beginning of the year 2013. 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 18 months. So the operation of the SLF should therefore begin in late 2014 or early 2015.

C. Description of the Project

25. The following are the modules used during the preliminary design of the landfill site:

- Module 1: Administrative Building
- Module 2: Weighing Bridge
- Module 3: Recycling Yard
- Module 4: Wheel Washing
- Module 5: Logistic Area
- Module 6: Area for Medical and Hazardous Waste (Bunkers)
- Module 7: Medical Waste Treatment Facility
- Module 8: Landfill
- Module 9: Composting Plant
- Module 10: Wastewater Treatment Plant
- Module 11: Future Landfill Gas Torch

26. **Administrative Building:** The overall size of the administrative building is 15 meters X 15 meters. This building has the following provisions: reception, meeting room, office, refectory, 2 storages, dressing room for men, dressing room for women, separate WC including shower for men and women, passage, etc. Seven different options have been chosen to facilitate construction by using precast concrete elements. Slight variations will be acceptable in the plan to implement one of the options during final design stage. There is also sanitary block and parking lot in front of the administrative building.

27. **Weighing Bridge:** Weighing Bridge will be installed near the entry gate to facilitate weighing of the total solid waste carried by the dump truck and to maintain a record of total waste taken to the landfill site. Computerized system of weighing and recording will be there in

the Checkpoint Cabin to ensure proper recording in an well maintained database and reporting properly in user friendly formats.

28. **Recycling Yard:** Recycling yard will be utilized for storage of recyclable materials available in the solid waste carried to the landfill site. Similar products will be stored side by side in a systematic way for easy transportation and selling to potential buyers.

29. **Wheel Washing:** Wheels of dump trucks and other vehicles entering the landfill site will be ensured to clean the wheels before ply in the public roads. Vehicles will pass through a depression where water will be available to wet and clean the wheels. There will also be arrangement for spraying water to the wheels and other parts of the vehicles by using water pumps and spraying nozzles.

30. **Logistic Area:** Logistic area is located between the sanitary block and the area for medical and hazardous waste bunkers. This space will be utilized for storage of equipment, machineries, etc. necessary for running the landfill site.

31. **Area for Medical and Hazardous Waste (Bunkers):** This area is reserved for disposal of medical and hazardous wastes. There will be several compartments to deal with wastes from autoclave, ashes from the incinerator, sharps, etc.

32. **Medical Waste Treatment Facility:** This unit will contain autoclave for disinfection of disposable materials that will be taken to the bunkers. Plastic materials will be taken to the recycling plant, disinfected and grinded in the chemical disinfection and shredding unit for re-use. Infectious wastes will be burnt in the incineration unit. Sharps will be disposed in the closed bunkers for burial. Hazardous wastes will also be taken to the specific compartments in the bunkers.

33. **Landfill:** The landfill area will have protective fence of total height 3.00 meters to keep the area free from any trespassers. Surface water drainage ditch will be constructed just inside the protective fence to keep the area dry and free from accumulation of rain water or any other extra wash water within the landfill area. The surface drain will be one meter deep in the natural soil, having bottom width 1 meter, top width 3.5 meters, outside edge slope of 1:1 and inside slope of 2:3. There will be geo-textile lining for the surface drain. Next to the surface drain, one strip of 3 meters width will be kept reserve for installation or construction of utilities.

34. The entire landfill area will be divided into two cells. The cell – 1 will be developed at the present stage and the cell – 2 will be kept reserve for use in future. Landfill wall will be constructed surrounding the landfill area as well as to separate the two cells. The top of landfill wall will be at a level of 5.25 meters.

35. The landfill area will be backfilled by sand layer of variable thickness to attain a level surface for placing the liner system. The liner system will consist of serially from bottom to top (1) clay layer, 0.5 meter, $k < 1.10^{-9}$ m/s; (2) geo-textile; (3) drainage layer, 0.4 meter, $k > 1.10^{-4}$ m/s; (4) HDPE liner, 2.5 mm; (5) drainage geo-composite, $k = 10^{-3}$ m²/s; and (6) drainage layer, 0.4 meter, $k > 1.10^{-4}$ m/s.

36. The main leachate drainage pipe will be HDPE PN10, diameter 300 mm; and the side leachate drainage pipe will be HDPE PN10, diameter 110 mm. Both of these leachate drainage

pipes will be placed above the HDPE impermeable layer. On the other hand, the groundwater drainage pipe HDPE PN10, diameter 110 mm will be placed below the impermeable layer. Geotextile and filtering material gravel 16/32 will be placed around these pipes to prevent entrainment of sand and soil.

37. There will be inspection well in the junction point of main and side leachate drainage pipes. At the end point, there will be groundwater pumping well to pump the groundwater to surface drain. And the leachate will be pumped from the leachate well to the wastewater treatment plant.

38. **Composting Plant:** The overall dimension of the composting plant is 110 meters length X 27 meters width X 5 meters height. It has the following facilities like office room, dressing cum washing room, storage, packaging corner, fixed place for containers, and a big hall room (85 meters X 27 meters) having longitudinal drain passing along one side, etc. There are 3 options for construction namely shelter steel girder (F1), shelter double slab (F2) and pre-stressed beams (F3).

39. **Wastewater/ Effluent Treatment Plant (ETP):** Leachate will be pumped to the collection chamber from the landfill site as well as from the composting plant. Feed pump will be used to transport the leachate from this chamber to the equalization tank. Then treatment of this wastewater will be done by activated sludge method. Methane reactor will be used for separation of methane gas. Sedimentation tank will be used and chemicals like hydrochloric acid, ammonium hydroxide and ferric chloride will be added for effective coagulation. Blowers will be used for aeration. Sludge will be recycled from the final clarifier and extra sludge will be returned to the landfill site for drying. The effluent from the final clarifier will be used for root zone plant system for further polishing. The final effluent from the landfill site will meet the effluent standard as per ECR 1997. The general layout plan of wastewater/ effluent treatment plant has been shown in Fig 4.

40. **Future Landfill Gas Torch:** Decomposing waste in landfills results in biogas and the associated odor and emission hazards. The chemical composition of this gas consists of 45 – 60% methane (CH_4), 25 – 35% carbon dioxide (CO_2), and 10 – 20% nitrogen. Methane is dangerous gas for its flammable properties and in addition it contributes to smog and global climate change. So a landfill gas torch will be installed to burn this hazardous gas. The supply of methane gas will be available from the methane reactor installed in the wastewater treatment plant area of the landfill. Provision for use of biogas will also be there, so in this case supply to the torch will be regulated for continuous supply to the biogas plant.

41. Implementation of small transfer stations under the separate package in UPEHSDP 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.

42. Modern electrical, mechanical machineries and equipment are also included in the subproject to operate the SLF to modern sanitary standards.

43. Figures 2 to 16 provide preliminary site layout plans including different options for administrative buildings, composting plant and medical waste treatment plant.



Fig 1: Khulna Landfill Site Beside Lobon Chora Road (22°45'50"N, 89°34'0"E)

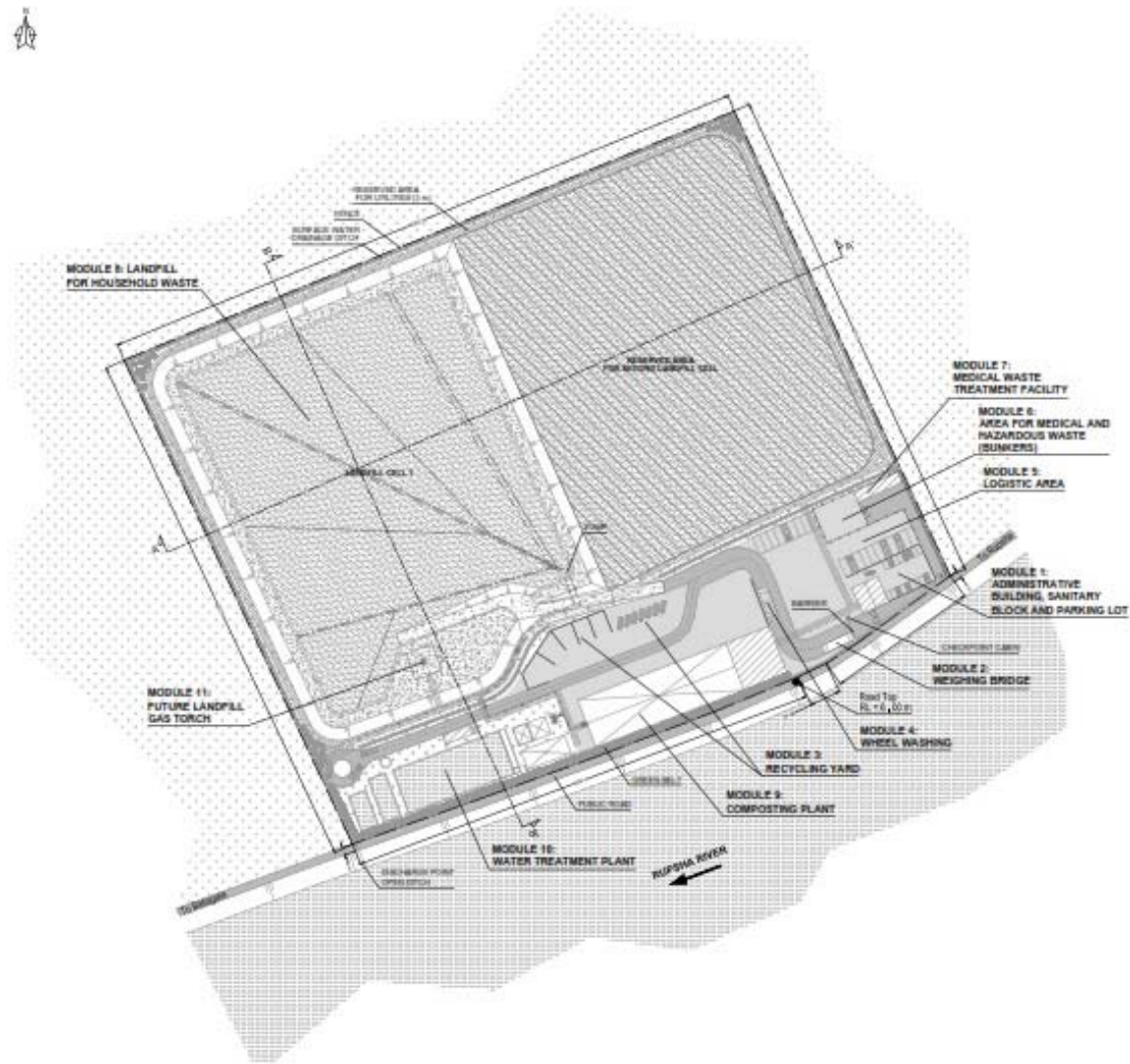


Fig 2: General Layout Plan



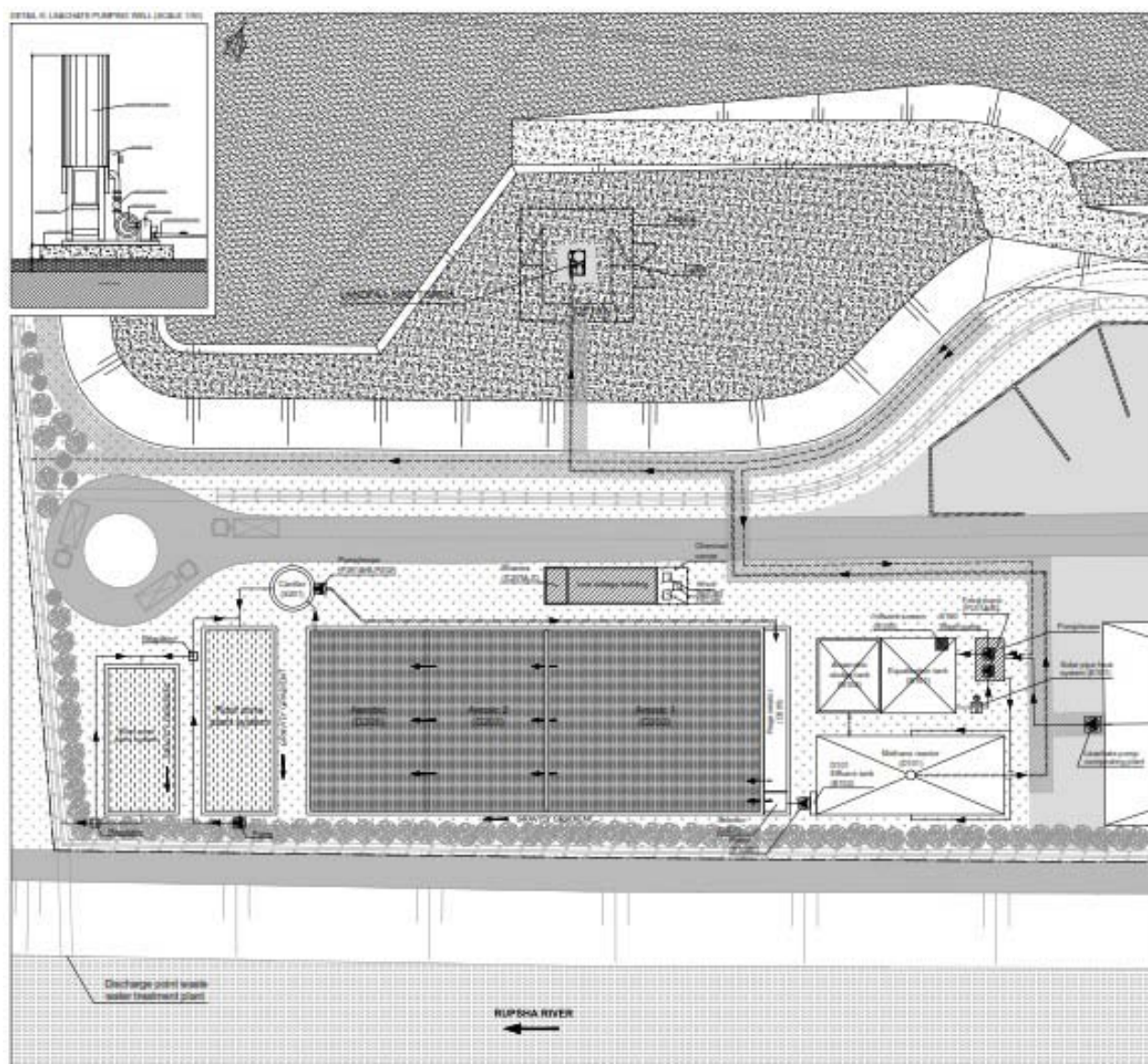


Fig 4: General Layout of Wastewater/ Effluent Treatment Plant

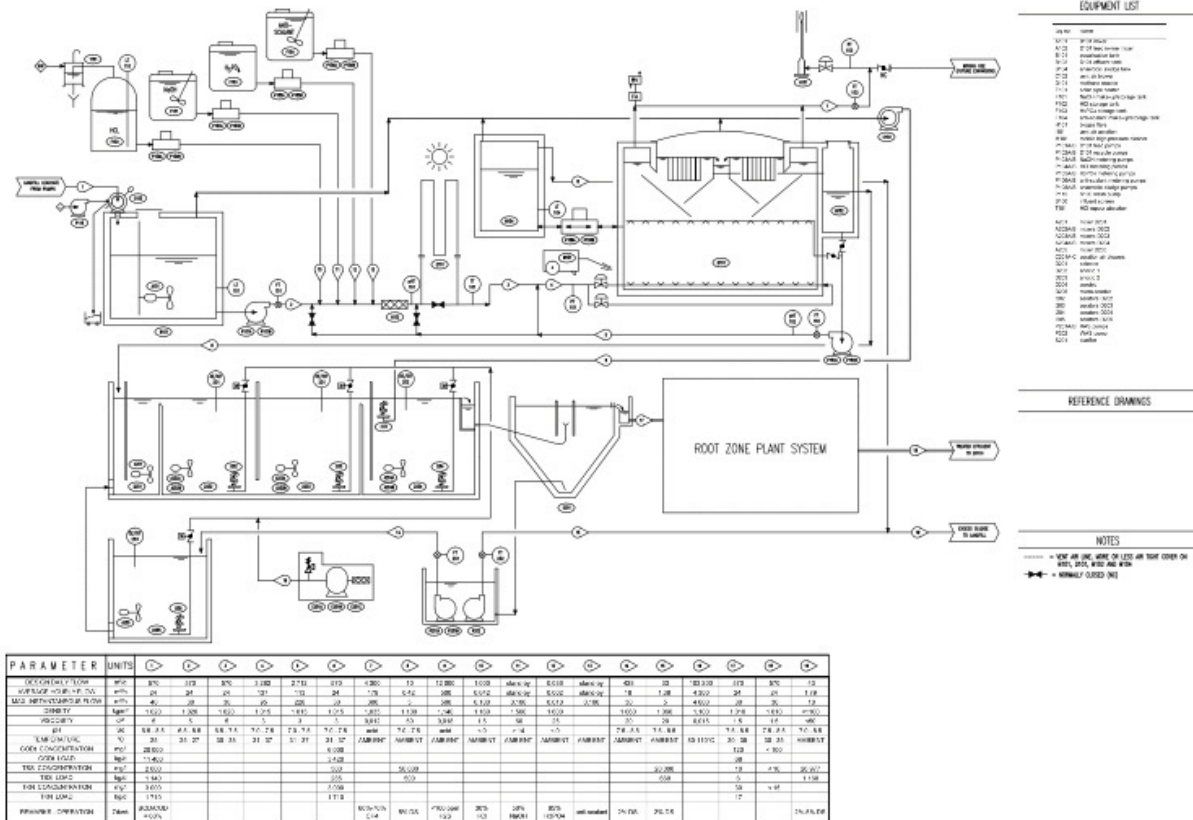


Fig 5: Flow Chart of Wastewater/ Effluent Treatment Plant

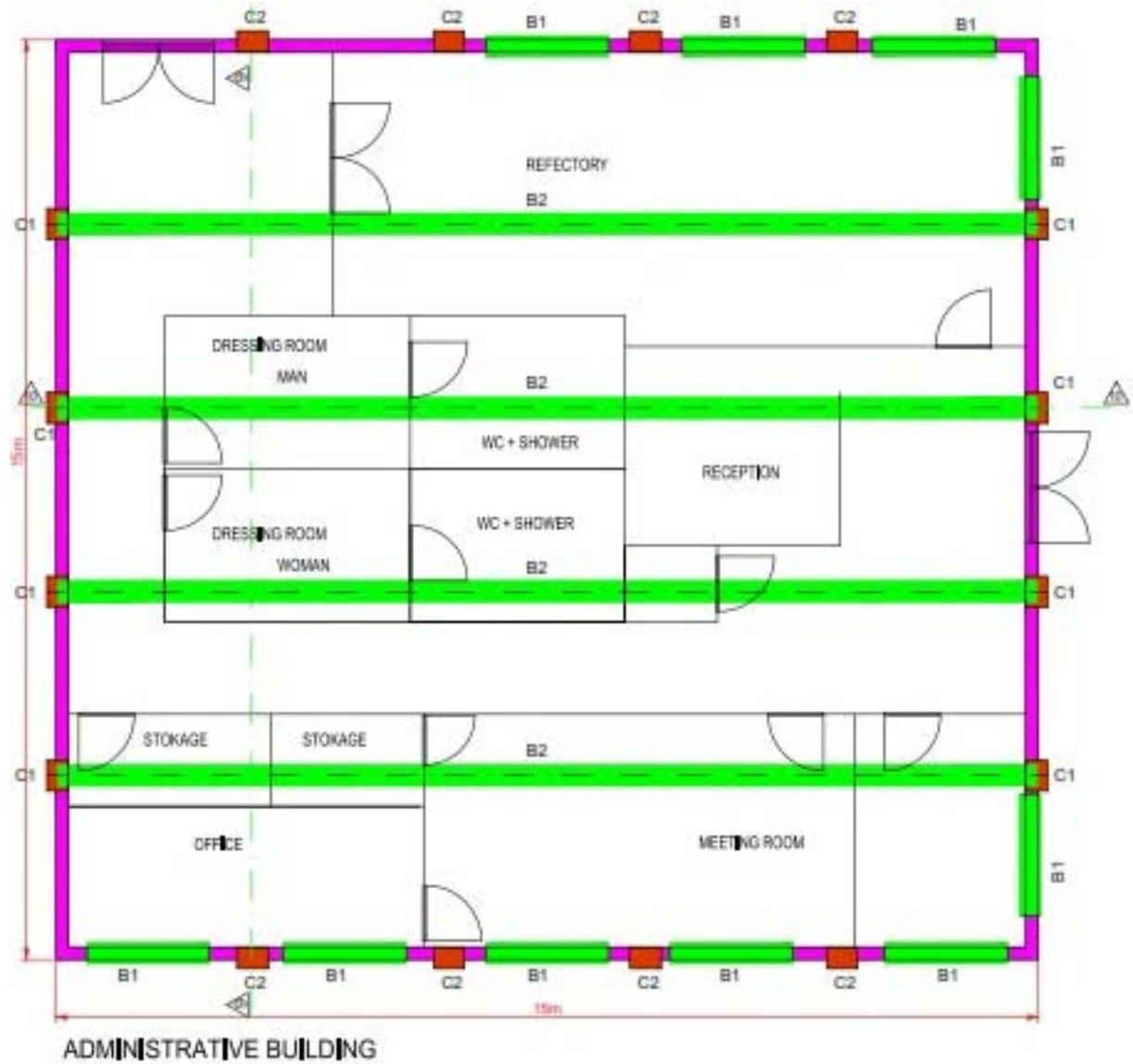


Fig 6: Administration Building Option - 1

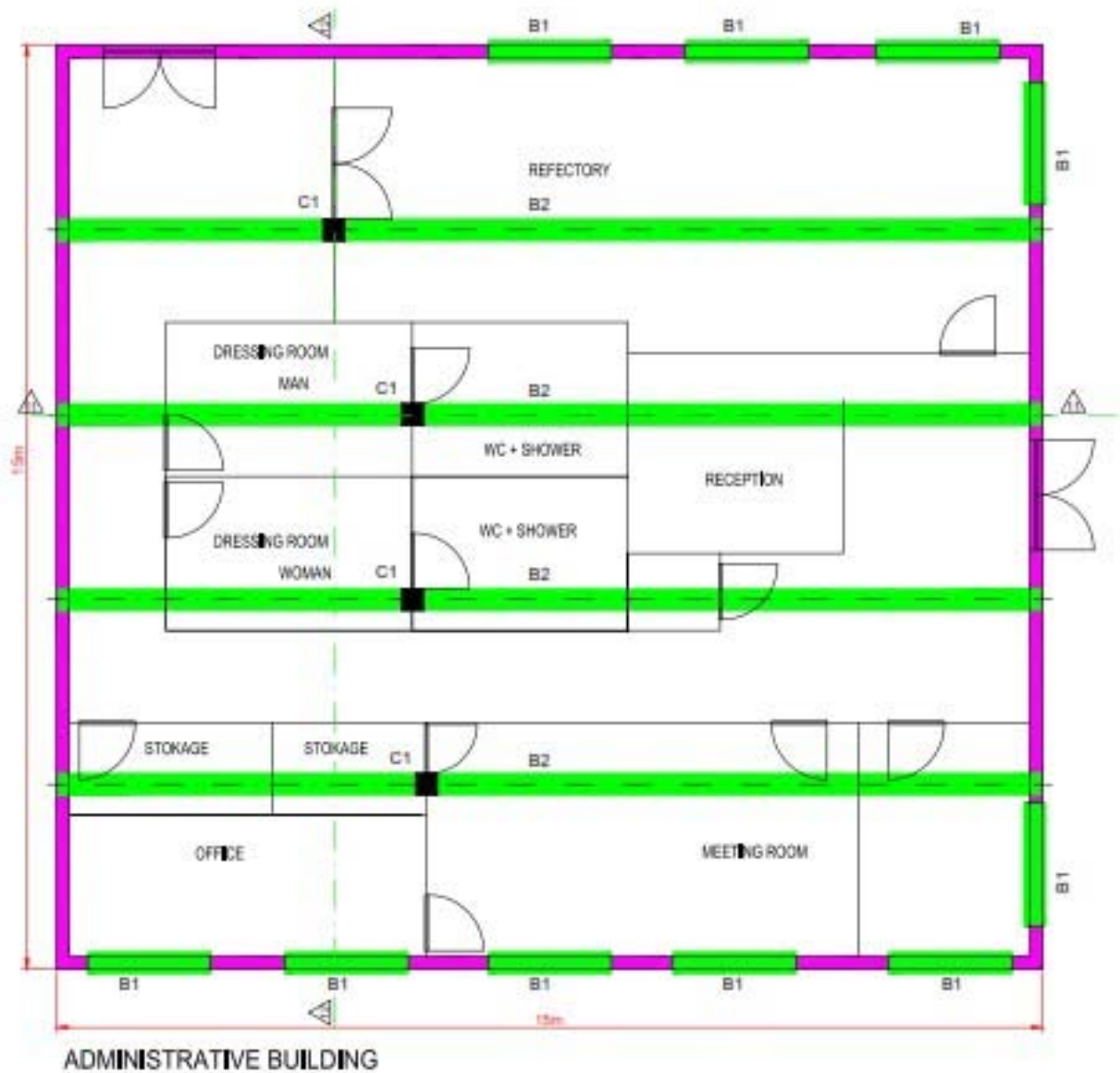


Fig 7: Administration Building Option - 2

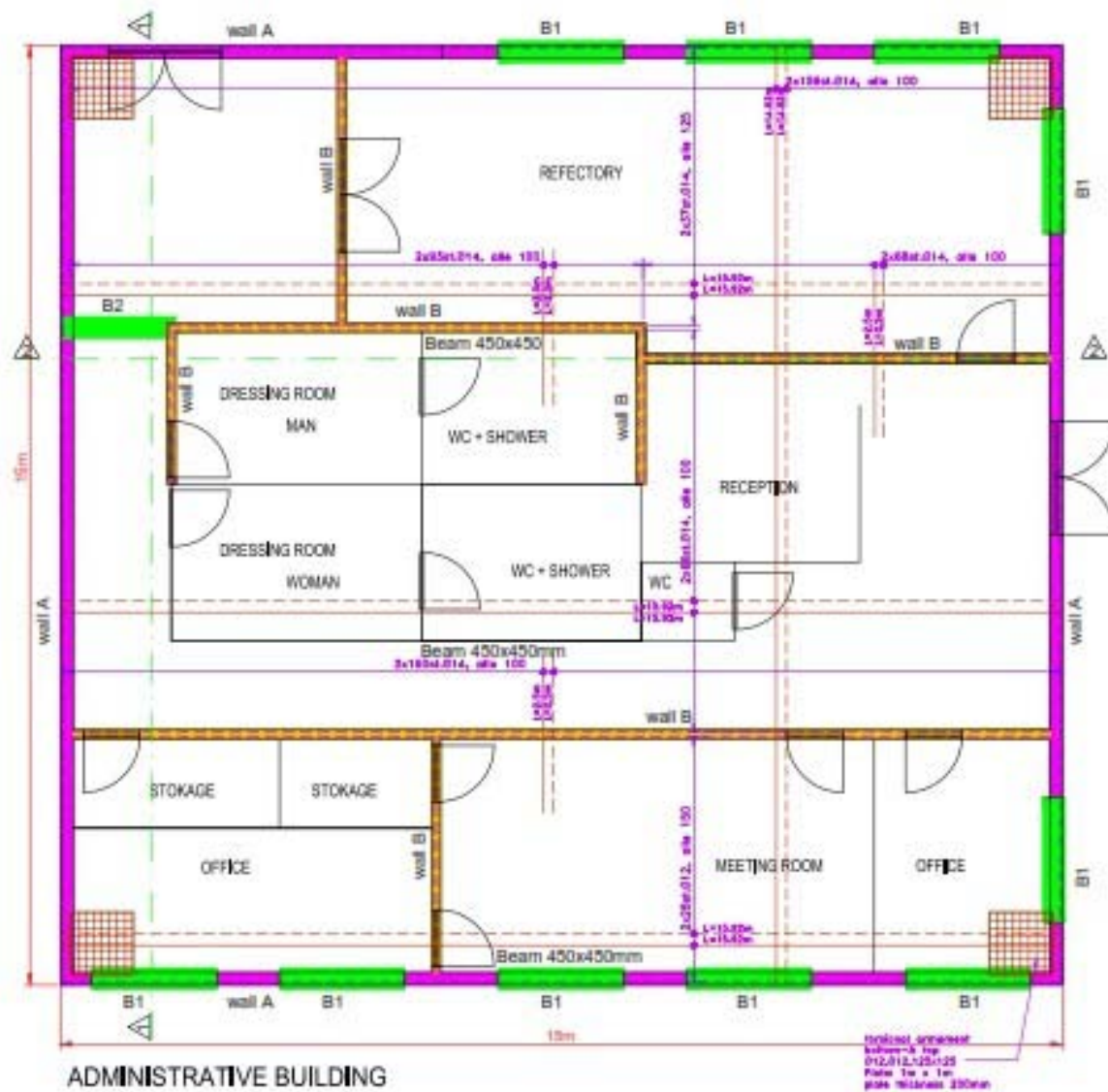


Fig 8: Administration Building Option - 3

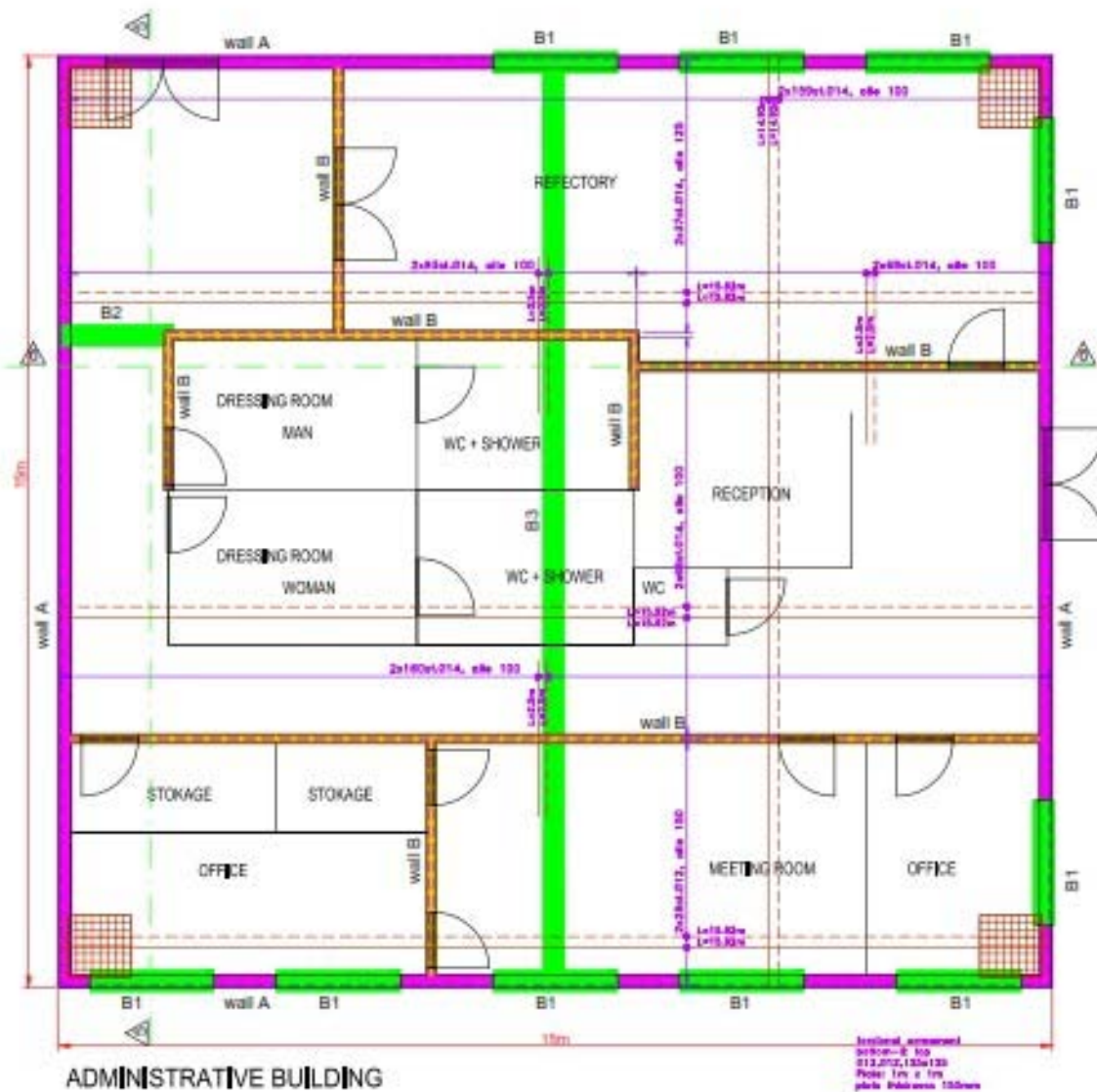


Fig 9: Administration Building Option - 4

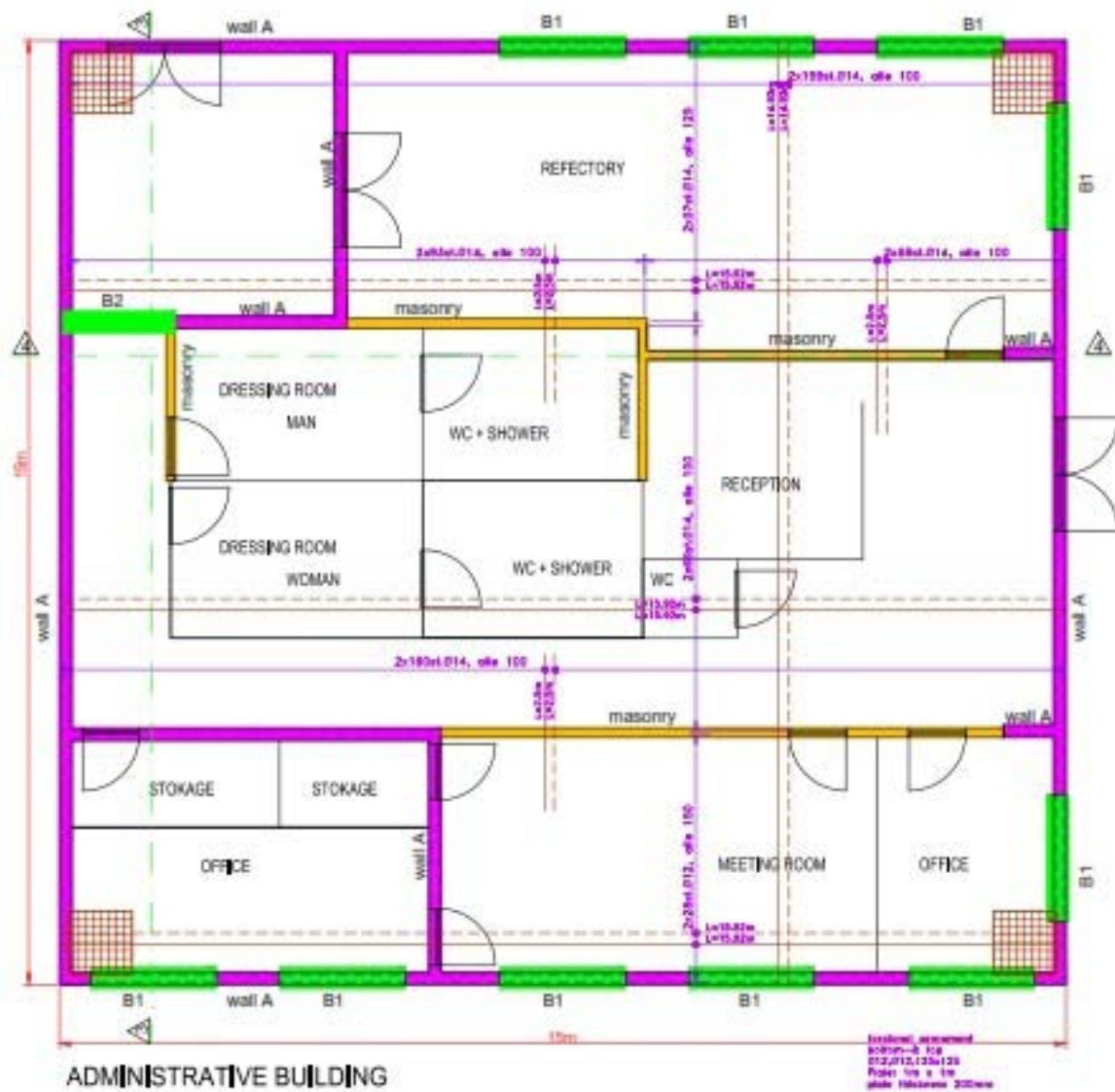


Fig 10: Administration Building Option - 5

Fig 11: Administration Building Option - 6

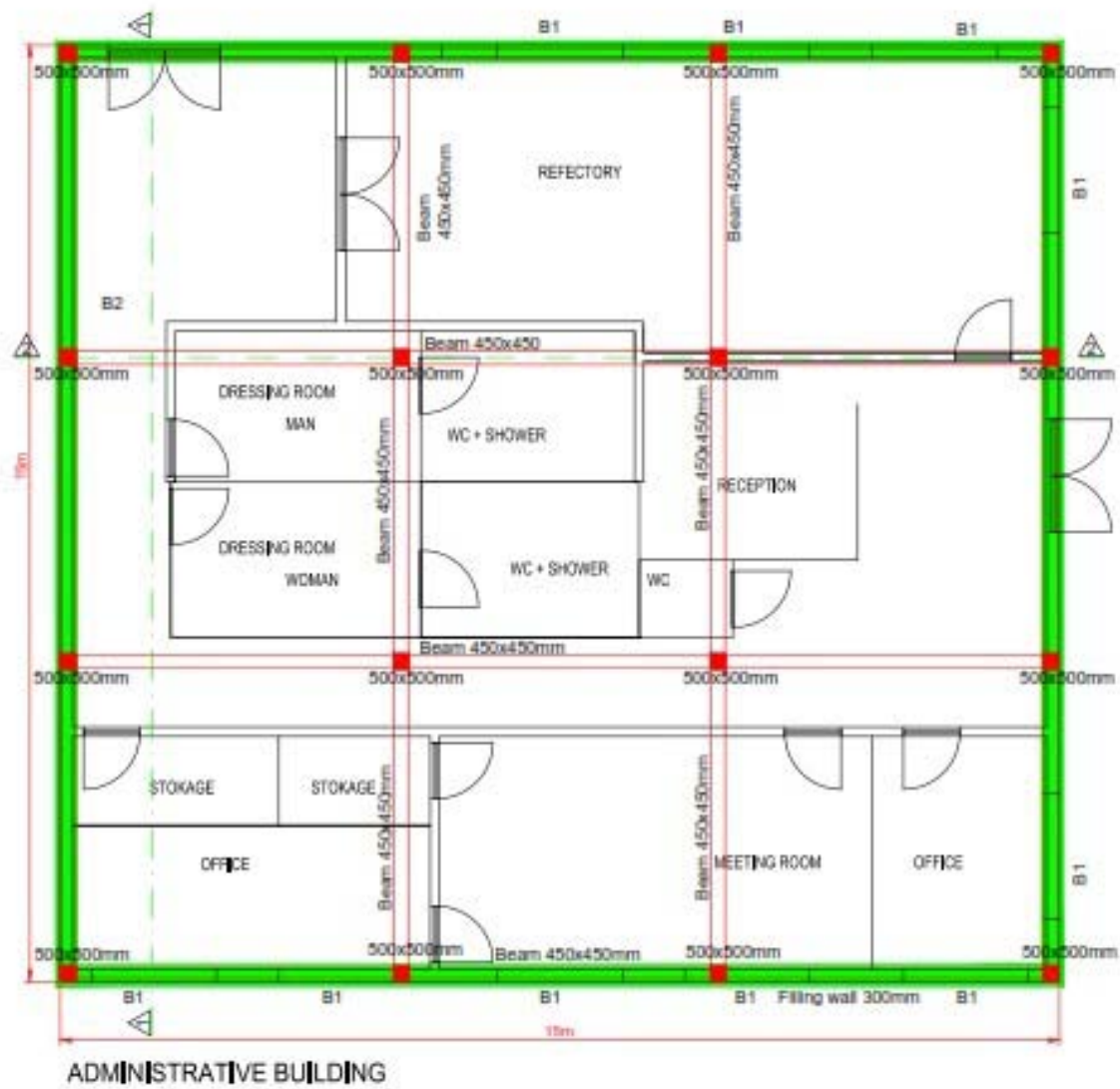


Fig 12: Administration Building Option - 7

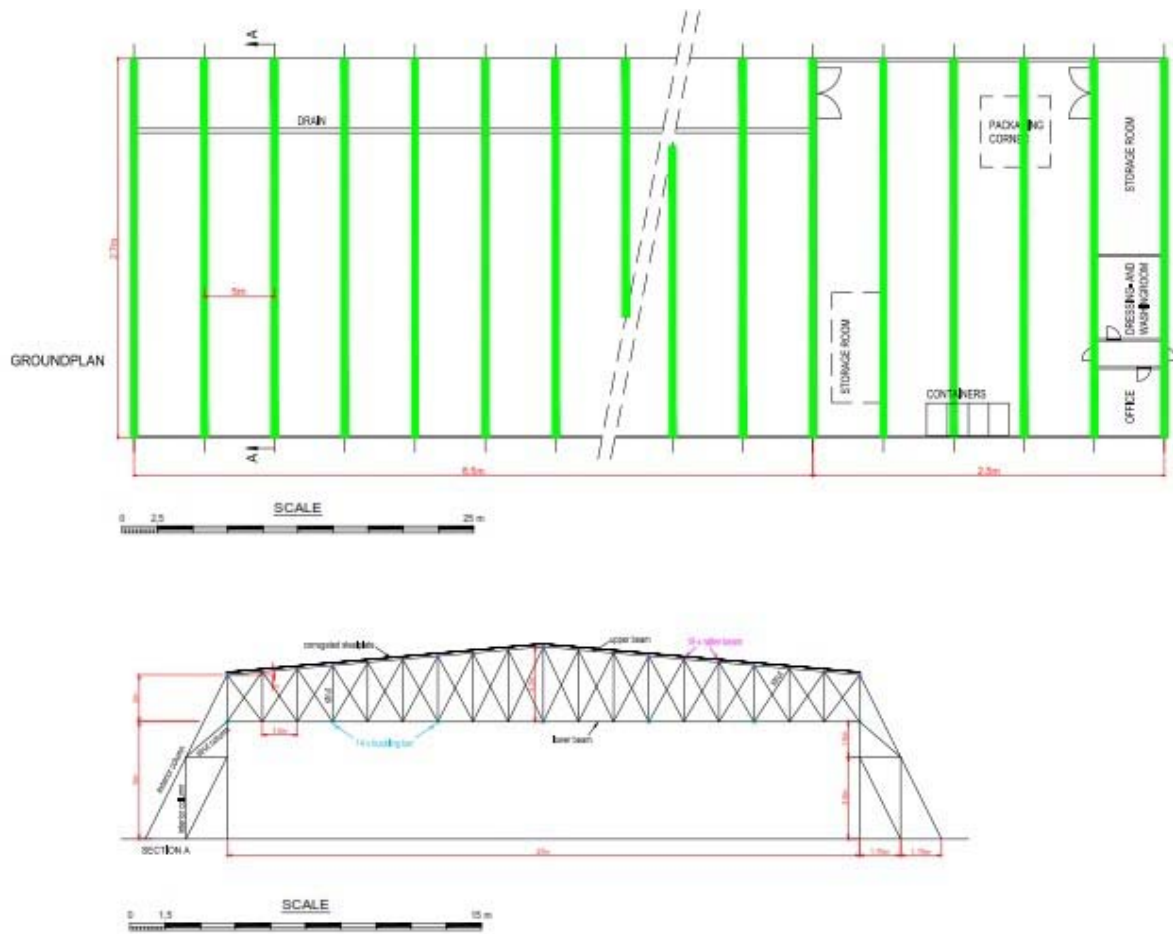


Fig 13: Compost Plant Option - 1

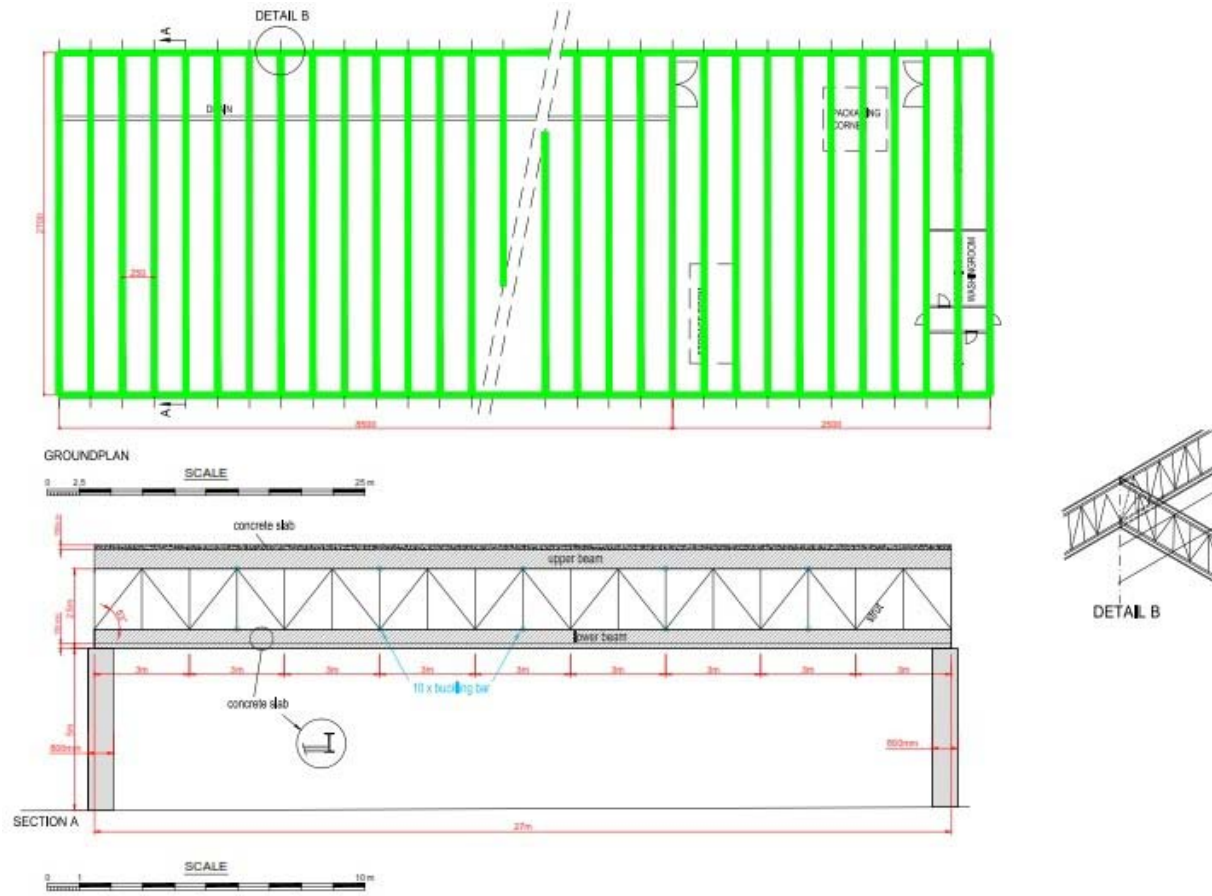


Fig 14: Compost Plant Option - 2

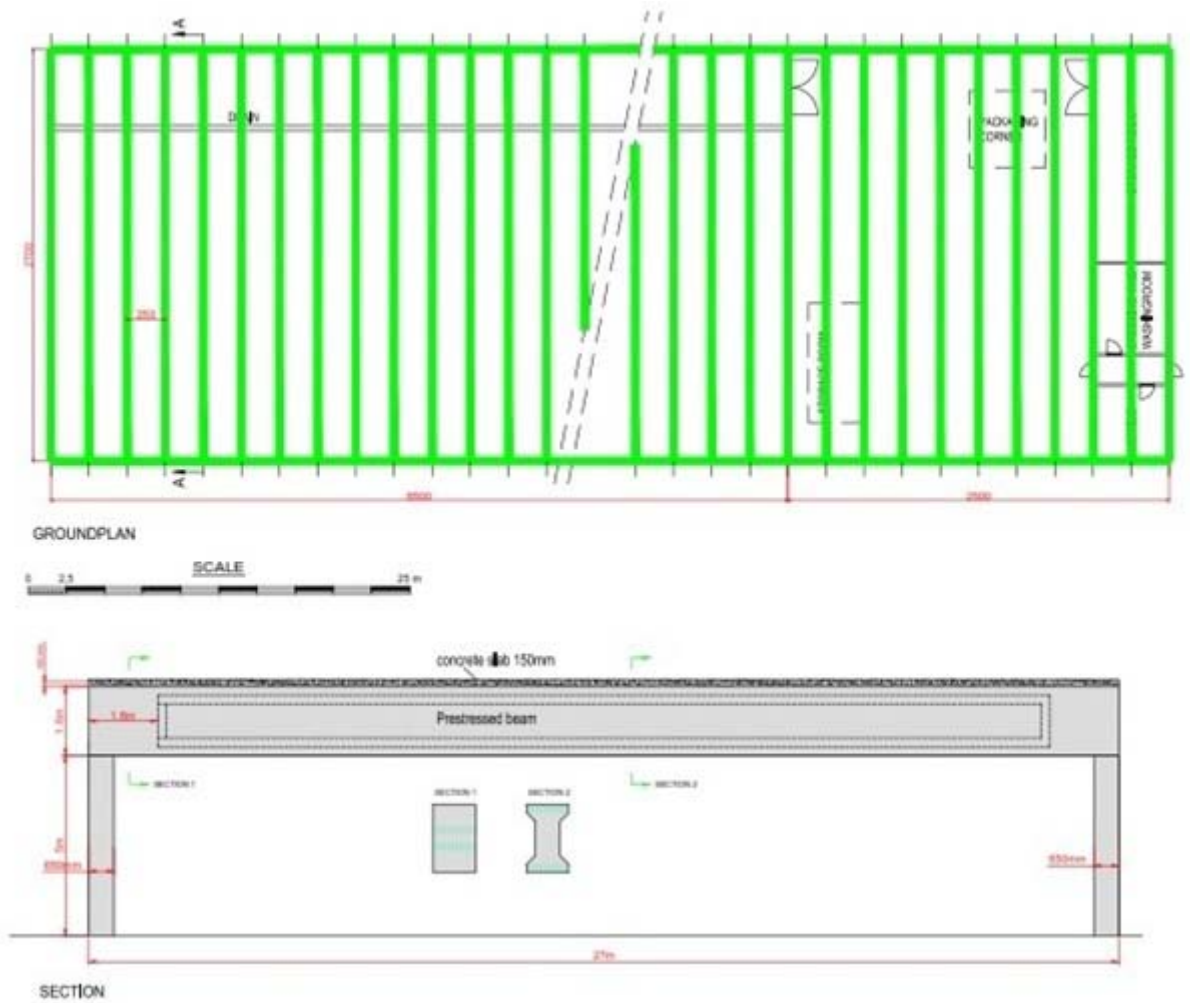


Fig 15: Compost Plant Option - 3

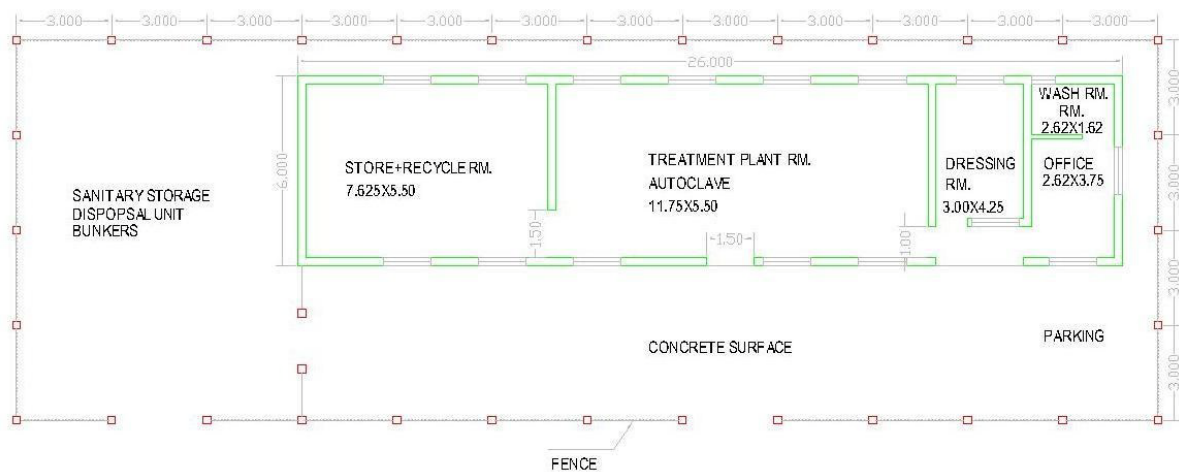


Fig 16: Medical Waste Treatment Plant

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Topography and Soils

44. Bangladesh is dominated by the rivers Ganges, Jamuna and Meghna, which drain large quantities of water from the Himalayan Mountains into the Bay of Bengal, through a complex delta system of tidal tributaries and creeks, formed by sediment deposited by the rivers. The capital city Dhaka is at the northern edge of the delta in the centre of the country, between the confluences of the rivers. Khulna is in the centre of Khulna Division, 130 km south-west of Dhaka, and Chittagong is on the coast in the south-east.

45. Much of Bangladesh lies on the Gangetic-Bengal Plain, and is flat and low lying particularly around the delta, which floods extensively in the rainy season. North of Dhaka the land gradually begins to rise, towards the foothills of the Himalayas in the north. The influence of the rivers is evident in the soils, which are almost entirely alluvial and generally fertile in the central plains, with a predominantly loam and silt consistency. In the northern and eastern hills, soils are well drained, coarse and loamy, and closer to the sea the land is often saline, particularly in the dry season.

46. Khulna is in a floodplain, where the landscape is formed on recent Gangetic estuarine sediments. Soils are therefore alluvial, and fine and loamy on ridges, but more clayey in depressions. Soils are also saline, with a seasonal gradient that peaks in May. The Bio-ecological Map of Bangladesh (Fig 17) locates the district of Khulna in bio-ecological regions 6, 7a and 10 corresponding, respectively to Khulna-Gopalganj peat land, the Sundarbans mangrove land and saline tidal floodplain.

2. Climate

47. The climate is humid and sub-tropical, with a typical three season pattern. In the northern winter (November-February) cool winds blow from the north-east, and the weather is cool and dry, and in Khulna rainfall is <15 mm per month and average temperatures around 22°C. Temperatures start to rise in March and reach the annual maximum of around 30.4°C in April-May, when daytime temperatures can exceed 40°C. Rainfall also increases, and this period is characterized by unstable weather. The monsoon begins in May-June as hot air rises over the Indian subcontinent, creating low pressure areas into which rush the cooler moisture-laden winds from the Indian Ocean and the Bay of Bengal. Around 70-80% of the annual rain falls during this time, and in Khulna the monthly totals are over 300 mm in June, July and August. The rain is often accompanied by strong winds, sometimes exceeding 100 km/h. Temperature and rainfall both decline post-monsoon, returning rapidly to the winter lows.

48. 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, which is around 2,600 mm in Khulna. In the south-western region, continental situation opposes the effects of aerographic lifting and as a result around Khulna there is less rainfall in November-May than in other parts of the country.

49. The climate in Khulna is moderate and humid. Full monsoon is from June to September. The annual rainfall ranges from 1650 to 1800mm. During ebb tide the forest becomes bare by around 2m and at high tide the entire territory of the forests is inundated by flush water.

50. Wind data from the Bangladesh Meteorological Department Climate Division suggests that wind directions vary month-to-month in Khulna, though predominantly in the NW, S, and NE directions. As the SLF will be located in the south of the City and about 2 – 3 kilometer far away, windborne odor, if any will not affect the city dwellers.

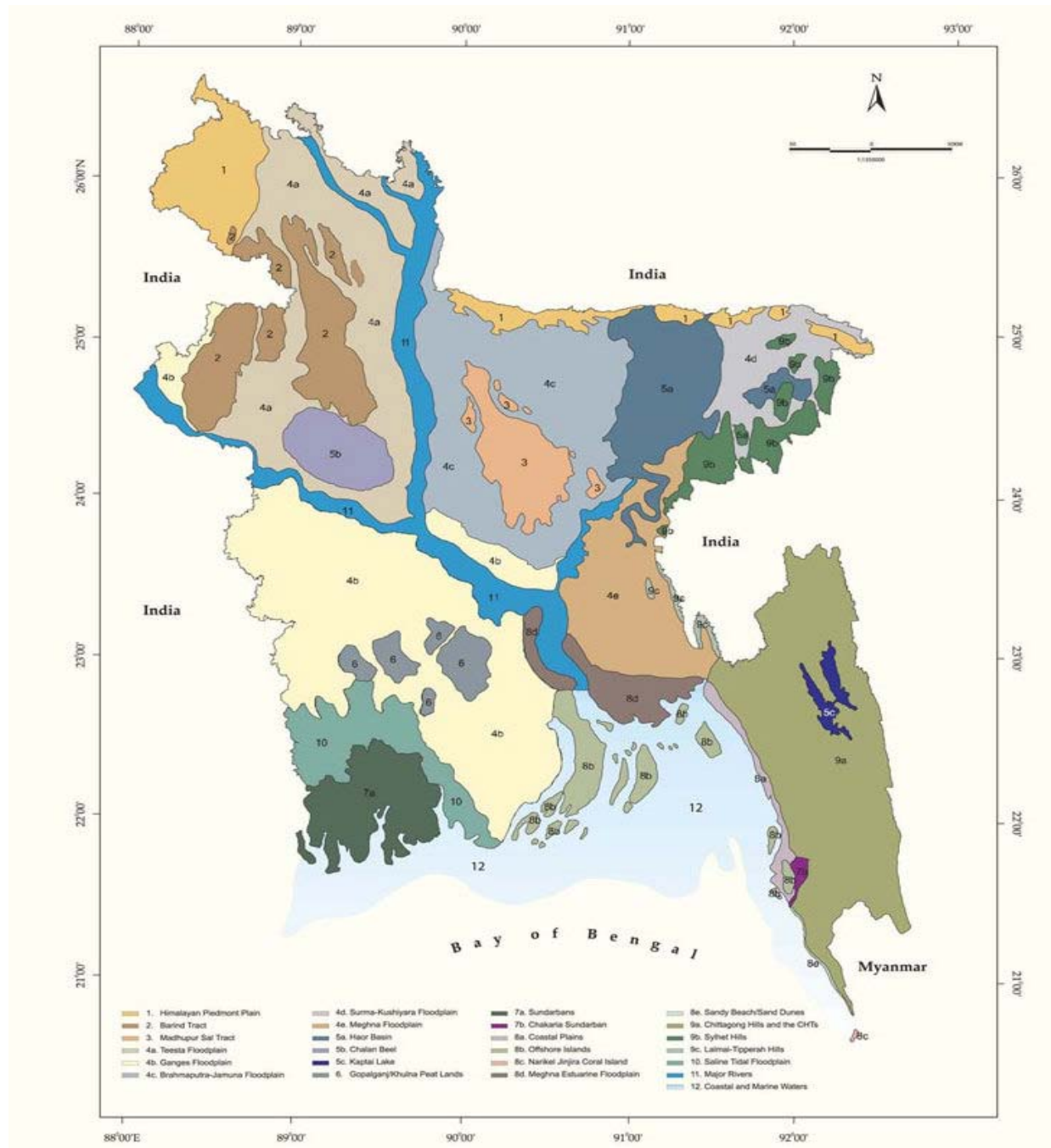


Fig 17: Bio-ecological map of Bangladesh

Source: Internet

51. 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 Khulna. 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 (Fig 18, 19, 20, 21 and 22)³.

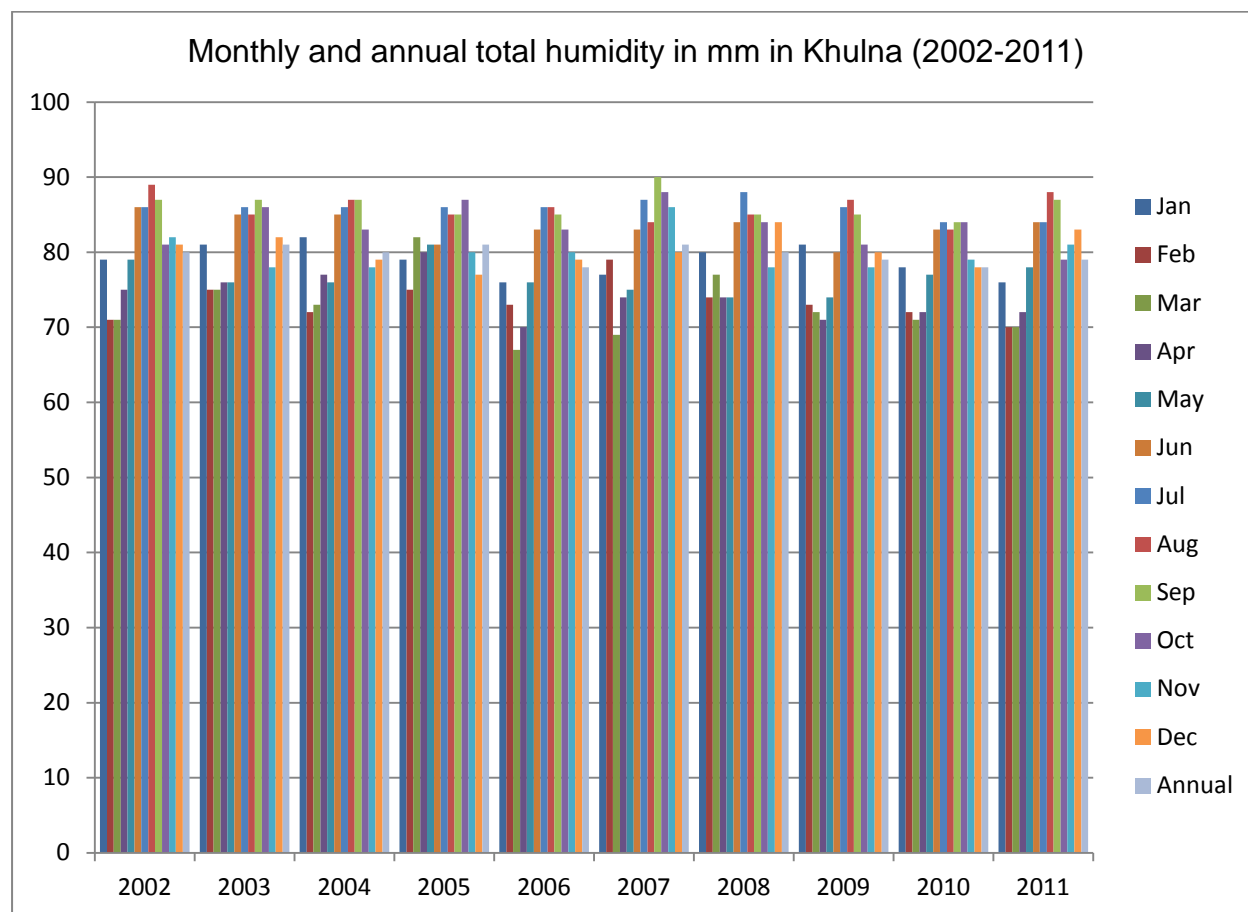


Fig 18: Monthly and annual humidity (%) in Khulna (2002-2011)

³ Source of raw data (Fig. 18, 19, 20, 21 and 22): Bangladesh Meteorological Department, July 2012.

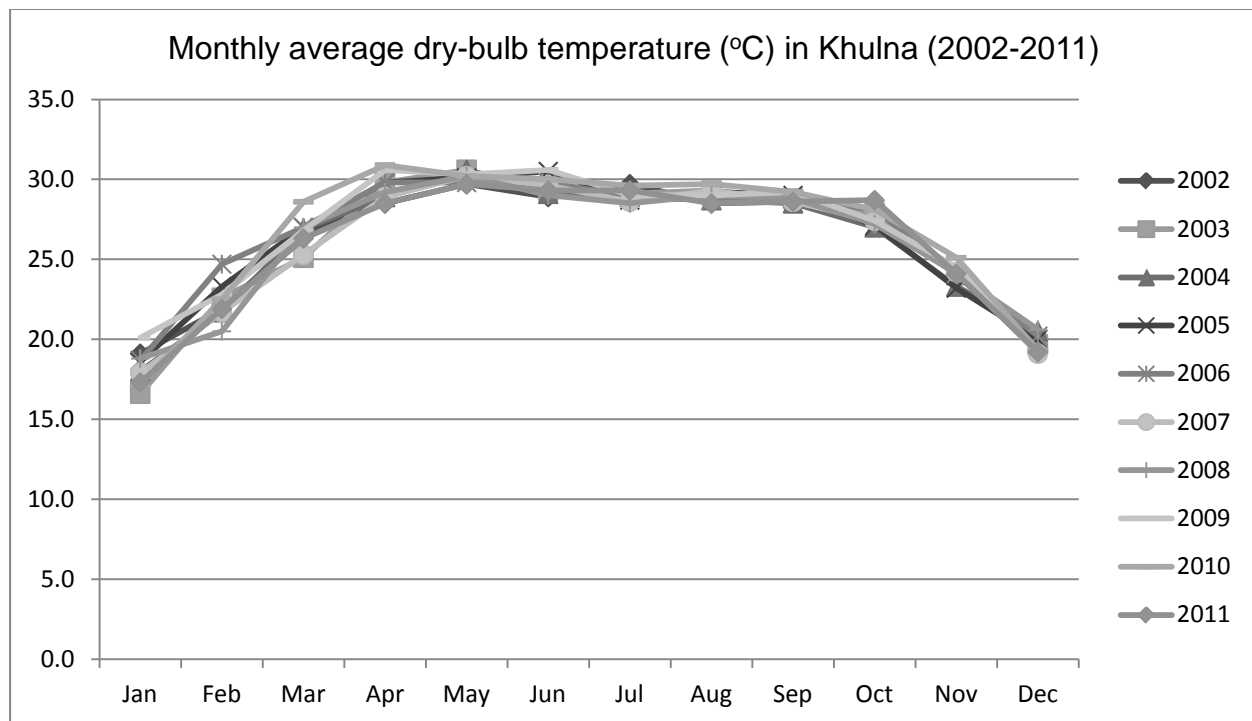


Fig 19: Monthly average dry bulb temperature (°C) in Khulna (2002-2011)

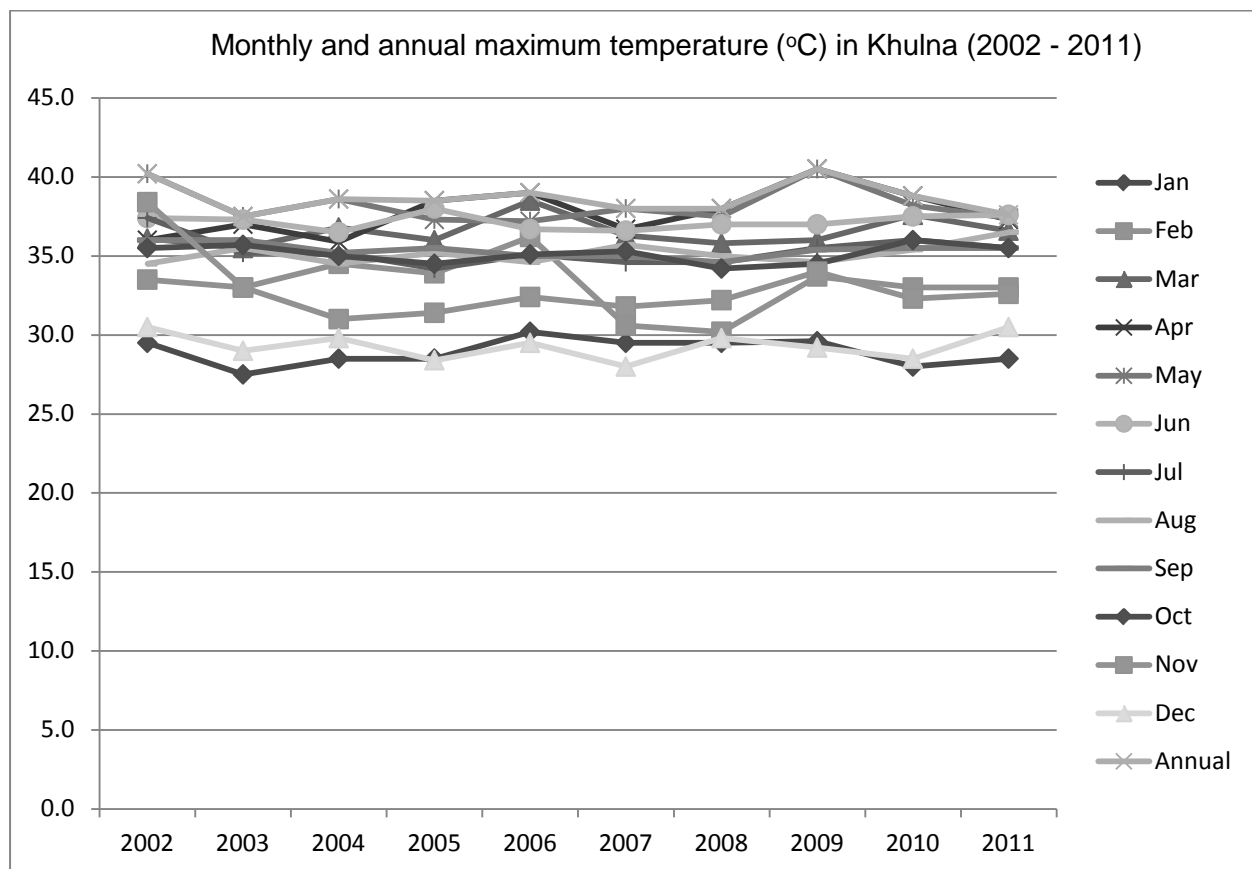


Fig 20: Monthly and annual maximum temperature (°C) in Khulna (2002-2011)

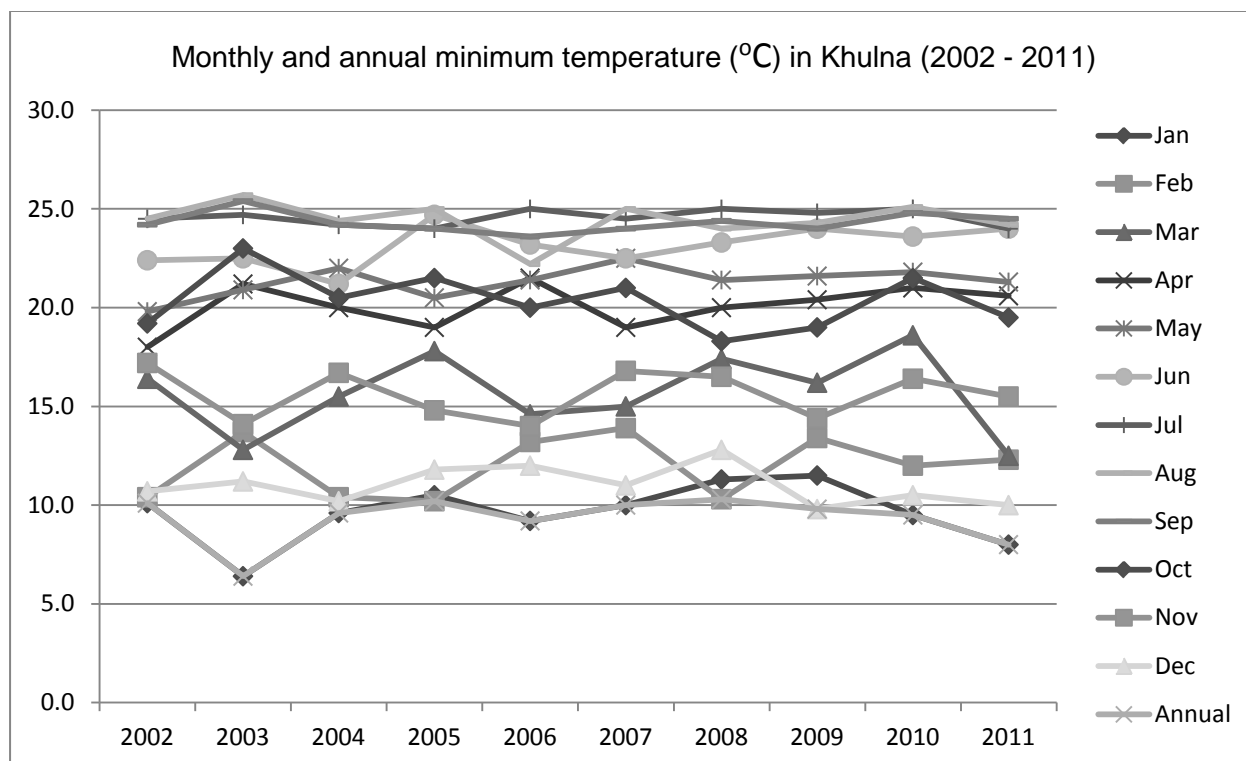


Fig 21: Monthly and annual minimum temperature (°C) in Khulna (2002-2011)

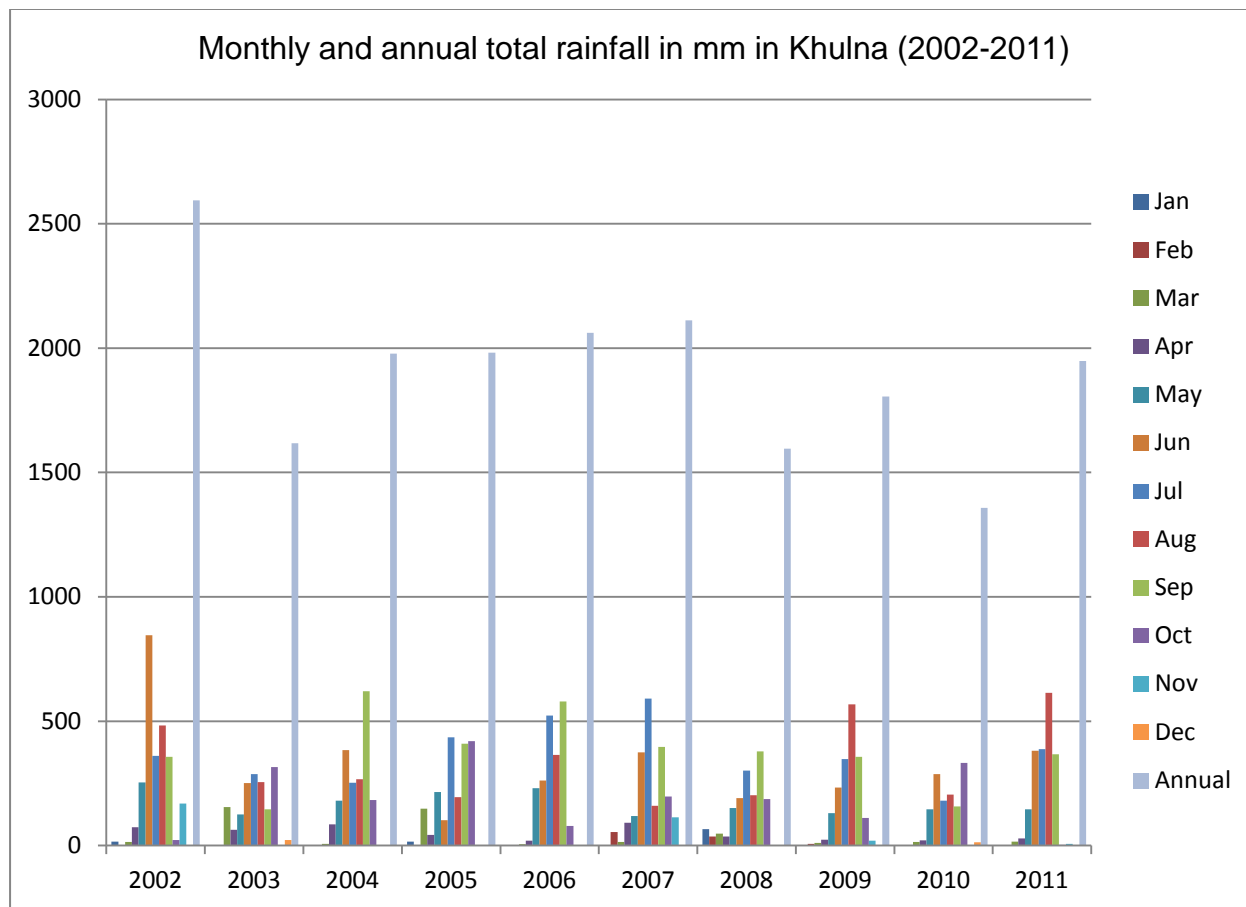


Fig 22: Monthly and annual total rainfall (mm) in Khulna (2002-2011)

3. Air Quality

52. Air quality is significantly better in the city of Khulna compared to those in cities of Dhaka, Chittagong and Rajshahi where rapid pace of 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.

53. 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, sulfur dioxide, oxides of nitrogen, lead, ammonia and hydrogen sulfide. 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 sulfur diesel by buses and trucks, and inadequate control of emissions;
- (iii) Heavy industrialization, and use of cheaper high-sulfur 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.

54. Surveys by the DoE show levels of Suspended Particulate Matter (SPM) and sulfur dioxide (SO₂) in Khulna 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. As the proposed Khulna landfill site is located in a rural agricultural setting quite far from the city center, the air quality is generally good.

4. Surface Water

55. Most of Bangladesh lies within the floodplains of the Ganges, Jamuna and Meghna rivers, which drain a catchment of around 1.72 million km² 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. Dhaka lies in the North Central Region, which is bounded by the Jamuna River to the west, Padma to the south and the Meghna in the east. All rivers in the region show large seasonal variations in flow, and discharge in the Jamuna for example fluctuates between <5,000 cumecs in the dry season to a maximum of around 67,000 cumecs in the monsoon.

56. Flooding is a major problem, particularly as large numbers of squatters inhabit seasonally flooded lands, and measures to reduce flooding by construction of levees (embankments) have been only partially successful. Flooding is caused by several factors, including: rainfall and snow-melt in the upper catchment, which dramatically increase the volume of rivers; spillage from major rivers through breaches in levees that maintain rivers above the level of the surrounding land; and over-bank spillage from smaller internal rivers, most of which do not have levees. Abnormally high floods occur when peak flows in the Jamuna and Ganges systems coincide with local rivers in spate because of rainfall run-off. Most towns include flood-free and vulnerable areas, and in many places natural flood alleviation has been reduced by infilling of low lying land, which has increased recently as the price of real estate has risen. Flooding is compounded by ineffective storm water drainage systems, as surface and underground drains are blocked with refuse and building rubble, and overflow during rain.

57. Like other towns and cities of Bangladesh, the Khulna city dwellers use both surface and groundwater as a source of domestic water. Surface water quality of rivers flowing in and around the city of Khulna as determined by the Khulna Divisional Office of the Department of Environment in April 2011 is as under (Table 2):

Table-2: Surface water quality of the rivers in and around Khulna city

River	Sampling Location	Temp °C	pH	Chloride mg/l	Turbidity NTU	TS mg/l	TDS mg/l	DO	BOD ₅	COD
Moyur	Gallamari Bridge (side point)	31.6	7.61	5899.0	128.0	9670	9480	00	32	672
	Gallamari Bridge (mid-point)	31.4	7.61	5879.0	127.0	9670	9480	00	32	670
Bhairab	Noapara Ghat, side point (high tide)	33.0	7.58	7253.0	127.0	11400	11200	4.6	1.1	110
	Noapara Ghat, mid-point (high tide)	33.2	7.57	7253.0	172.0	11400	11200	4.6	1.1	110
Rupsha	Rupsha Ghat, side point (high tide)	32.6	7.59	8273.0	185.6	12950	12700	4.6	0.7	136
	Rupha Ghat, mid-point (high tide)	32.6	7.59	8273.0	186.2	12950	12700	4.6	0.7	138

Source: Department of Environment (Khulna Divisional Office), May 2012

58. There will be proper arrangement for treatment of effluent from the SLF site. This will meet the requirement of the effluent standard as mentioned in the ECR 1997. The treated effluent will be discharged into the Rupsha river passing about 500 meters south of SLF site preferably by using covered drain and with proper design of the outlet into the river.

5. Groundwater

59. 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.

60. Like urban areas in elsewhere in the country, domestic water in the city of Khulna is mainly abstracted from the surface and middle aquifers, which in many are contaminated by naturally-occurring arsenic, iron and aluminum, plus sewage bacteria, pesticides and industrial chemicals. Groundwater tables often fall by several meters in the dry season, exacerbated by excessive drawdown by tube-wells. Supply of potable water is an increasing problem for the water and sewerage authorities because of the depleting supplies and source contamination.

61. Discussions with KCC officials during a site visit indicated that the water table at the locations of the proposed SLF site is approximately 10 meters below the surface, so there is no problem of water-logging. There were some visible inhabitants in the surrounding area but no sources for the abstraction of drinking water.

62. 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 SLF will be sourced by digging wells in the site. Saline water will be available from shallow aquifers from tube wells having a depth of 60 meters. But it will be necessary to dig up to 300 meters for getting water suitable for drinking purpose. The necessary clearance for digging well will be taken from the KCC.

6. Geology and Seismology

63. The National Seismic Zoning Map (Fig 23) 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 Khulna 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.



Fig 23: National Seismic Zoning Map of Bangladesh

Source: Internet

64. The National Seismic Zoning Map of Bangladesh clarifies the seismological status of the various region of the country. The city of Khulna falls within the low-risk zone. The earthquake risk factor for this zone – 1 is 0.075, while the risk factors for zone – 2 and zone – 3 are 0.15 and 0.25 respectively.

B. Ecological Resources

1. Habitats

65. 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.

66. 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.

67. In both Khulna and Barisal the estuarine landscape was once dominated by mangrove trees, but these have been mainly cleared over the past 250 years as the swamps have been filled to provide land for development. These processes have removed a highly productive and important habitat, leaving an urban area that is a source of pollution and further habitat degradation, plus borrow pits that cover around 10% of the land and are used for aquaculture or as refuse dumps. There are no sensitive ecological features in the surrounding area of the SLF site. The area is generally meant for rural uses.

2. Rivers

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

69. Being nearer to the coastal area, like most of the tidal rivers like Passur, Bhairab and Rupsha in Khulna are similarly polluted by sewage and urban and industrial effluents. However, tidal actions and also during seasonal monsoon, make these rivers devoid of their pollution loads due to cleansing effects. The riverside factories, human waste, oil spilling by boats and vessels are responsible for pollution. Once the Rupsha used to be the heaven of fishes, but now most of the fish species have vanished. Department of Environment and Khulna City Corporation have failed to save the river from pollution, as large numbers of factories on the banks of the river are discharging wastes into the river. Proper treatment of effluent from SLF as per DOE regulations will be ensured before discharging in the river to save it from further pollution in future.

3. Floodplains and Fisheries

70. 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.

71. Despite their poor water quality and deteriorating ecology, most rivers support at least a local fishery, although as noted above these have declined in many areas. Subsistence fishing occurs mainly in the floodplains in the rainy season, using cast nets, push nets and lift nets, and the catch is of mainly small species, of little commercial value. Professional fishermen operate in the main rivers, using small boats and a variety of gears, including gill nets, seine or drag nets, cast nets, hook and line, etc. Catches in these areas are of generally larger fish, including carp, catfish, perch, snake-headed fish, gar, etc, which are taken daily to local markets, or sold to merchants at the jetty. Fishing is normally practiced only by males, and women are mainly involved in support activities such as the repair of nets.

72. Although natural fisheries have declined, there has been a significant increase in recent years in artificial farming, of both fish and shrimp, particularly in the estuarine areas of Khulna. There are large numbers of ponds around Khulna producing shrimp for the domestic market and also for export overseas. However, no fishing farms were seen in the vicinity of the SLF area.

4. Other Aquatic Habitats

73. Like elsewhere throughout the country, there are a variety of other aquatic habitats in Khulna which include man-made lakes in residential neighborhoods, permanent and ephemeral pools in natural lowlands (known as *beels*), 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

74. Mangrove in the Sundarbans wetland of Khulna comprises 25% of the nearly 10% of the total land area of Bangladesh still under forest cover. In conjunction with a similar area in neighboring India this is the largest remaining mangrove forest in the world, and was designated as a UNESCO World Heritage Site in 1997.

75. There are however few natural terrestrial habitats in and around inhabited areas, because in most cases vegetation was cleared many years ago to provide land for development, and for agriculture in the suburbs. Terrestrial plants are now mainly limited to trees, shrubs and flowers grown alongside roads and in parks and gardens, and the crops and fruit trees planted in agricultural areas. 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.

6. Protected Areas and Endangered Species

76. Bangladesh has a number of nature conservation designations, but few areas have been mentioned in gazette, and most of these are not given the protection they are afforded by law. Pressure on land to provide food and income for the burgeoning population is the main problem, and this leads to encroachment into protected areas, which has caused severe habitat degradation in many places. Sundarbans is the only area with an international designation because of its biodiversity, and this is preserved mainly because the area is remote and not easily accessible. The nearest protected and environmentally sensitive area of Sundarbans is about 50 km from the proposed SLF site.

77. Bangladesh is home to a number of endangered species, most notably the Royal Bengal tiger, and the Government recently set aside three areas within the Sundarbans as tiger reserves, but numbers of tigers are low, currently estimated at around 400. Other important species found in Bangladesh include Indian elephants, hoolock gibbons, black bears, the Ganges River dolphin, plus several birds, including Pallas' fishing eagle and Baer's pochard. Threatened reptiles include the Indian python, the crocodile and various turtles. The proposed SLF is located in the plain area thus there are no endangered species. Flora and fauna found in the subproject site are commonly found in rural and underdeveloped areas.

C. Economic Development

1. Industry

78. Various industries in Khulna are accommodated in Shiromoni, Khalishpur, Boyra, Rupsha and Batiaghata areas. Although workers are still primarily male, there has been an increase in the employment of women during the past 30-40 years, particularly in the manufacture of ready-made garments.

79. Like the other big cities of Bangladesh, notably Dhaka and Chittagong, Khulna is undergoing a major transformation, due to its immensely growing population and its status as Bangladesh's third largest city. Because of its strategic location of only 45 km from the port of Mongla, Khulna is considered as a port city like Chittagong. Khulna is known as the city of shrimp, because 75% of shrimp exported from Bangladesh are cultivated in the Khulna zone. It is also known for its lobster, prawn, catfish, and crab. Khulna has some heavy and medium industries like Khulna Hardboard Mills, Bangladesh Oxygen Company, Khulna Oxygen Company, Platinum Jubilee Jute Mills, Star Jute Mills, Dada Match Factory (now Dhaka Match Factory) and Khulna Ship Yard Ltd.

2. Infrastructure

80. 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 underfunding and negligence. Sewerage system is not available in Khulna. 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.

81. There are open concrete storm drains alongside main roads in the Khulna city like most of the urban areas of Bangladesh. Most of these are poorly maintained and blocked with silt and garbage and, as a consequence, frequently overflow during rain. Even those that function are unable to cope with the volume of the monsoon rains, and flooding is frequent in the wet season. Many smaller towns and villages do not have a formal drainage system and storm water is left to stand in the streets and drain away gradually into natural creeks and ditches.

82. In the existing landfill site in Khulna, there is one compost plant with quite large capacity but with very poor and unhygienic management. New compost plant will be installed in the proposed SLF. At present, there are no modern types solid waste transfer stations in KCC area but the collection and transportation of solid waste will be improved substantially after implementation of the 8 secondary transfer stations to be implemented under UPEHSDP.

3. Transportation

83. Transport in Khulna is nearly 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' taxis, which are basically tricycle-structured motor vehicles. There are also traditional manual rickshaws as well as battery operated rickshaws, which are very common.

84. The Dhaka-Khulna Highway, a major arterial highway, is the easiest way to get in the city through land. There is a ferry connection in Paturia on the river Padma, which delays the journey on some occasions. The alternative way is to use the Mawa route, which is shorter but it takes longer time in crossing the ferry. Khulna can also be accessed by rail. Trains are available from Khulna for traveling to the cities of Rajshahi, Dhaka, Chittagong, Sylhet, etc.

85. Khulna is connected by air through the airport in Jessore. Special buses arranged by the airlines companies carry the passengers from Jessore to Khulna and vice versa. Available airlines between Dhaka and Khulna are Regent Airways and United Airways.

4. Land Use

86. In most urban areas the expansion has been inadequately planned and controlled, because of ineffective planning and inadequate policing of the planning laws and implementation of the land use policies. As a result, inappropriate mixes of land uses are commonplace (e.g. residential and industrial), and areas have grown without the provision of supporting infrastructure (water, sanitation, schools, hospitals, etc). Planning problems are compounded by natural and anthropogenic factors, which include: seasonal flooding, which limits the use of large areas; population expansion, which puts a high demand on land; and the high proportion of urban poor, who have little alternative but to erect makeshift shelters on vacant land, increasing the slum areas.

87. The urbanization pattern of Khulna City is characterized by haphazard growth. Land use follows a similar general pattern in most towns and cities, with mainly urban uses in the centre and residential in the outskirts. The town centre normally houses the main business and commercial districts, and contains shops and offices lining the roads, often in high-rise developments. There are also service industries in these areas, including restaurants, convenience stores, vehicle repair, etc, plus residential units, often above the shops and offices.

The urban fringe generally contains the better quality residential developments, and there are also shops and retail outlets, but less industry. There is also some agriculture in the outskirts, particularly in the more rural parts of the city.

88. The proposed site for the SLF is on the land owned by the KCC. The land has been recently acquired by the authority under funding support from ADB. Previously the owners of the individual plots used to use these small plots for agricultural purposes, but now the entire area is vacant and ready for construction of the proposed SLF. The site is about 50 km far from the Sundarbans and the mangroves of the forest will not be impacted due to implementation of the SLF.

5. Power Sources and Transmission

89. The sole Government authority for generation of electricity is the Bangladesh Power Development Board (BPDB). Major agencies in distribution of electricity include the BPDB itself and the Rural Electrification Board (REB). There are a few other specialized power distribution agencies such as the Dhaka Electric Supply Authority (DESA) and Dhaka Electric Supply Company (DESCO) for Dhaka or the Khulna Electric Supply Company (KESCO) for Khulna. The power division of the Ministry of Energy and Mineral Resources is the umbrella organization that controls power generation, transmission and distribution. An Independent Power Project (IPP) of the ministry is under implementation for improvement in generation and distribution of electricity by Government and private agencies. BPDB operates 22 power stations with a total installed capacity of 3,150 mw. The new 15 stations include 2 barge-mounted plants (one at Khulna and the other at Sikalbaha) and 13 conventional ones at Ashuganj, Sylhet, Fenchuganj, Ghorasal, Haripur, Raozan, Baghabari, Bheramara, Saidpur, Barisal, Rangpur, Bhola, and Chittagong.

90. 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.

91. There is transmission line for electricity supply in nearby location only about 300 meters far from the proposed site for SLF. It will be necessary to install a transformer in the site to ensure electric supply there.

6. Other Economic Development

92. Agriculture is important in parts of the urban fringe of the Khulna city like that in most towns and cities of Bangladesh. Rice is the most important crop and farmers plant varieties with different flood tolerances (developed by the Bangladesh Rice Research Institute) in different seasons to obtain two or even three harvests. *Aus* rice is grown in March to June, followed by the flood-tolerant *Aman* in July to October, and in the dry season farmers plant a combination of *Boro* rice and vegetables. Wheat and potatoes are also important, along with fruit, in particular mango, banana and pineapple. Most of the produce is sold in markets in the city, although rice is also exported, after processing in one of the local mills.

93. There is also a growing aquaculture industry, particularly around Khulna, Barisal and other towns in the tidal southern parts of the country, where there are numerous ponds culturing mainly shrimps for markets in Bangladesh and abroad. Timber is also important in many towns,

with large numbers of trees felled in surrounding forests and transported into the townships where they are processed for sale as wood or manufactured as furniture or other products. There are no mineral mines in Bangladesh, although the dredging of sand from riverbeds for use as a building material or to raise land prior to building in floodplain areas is a major activity in some of the larger rivers.

94. There could be a potential for eco-tourism in the estuarine and the Sundarbans mangrove locations of Khulna. It might also be possible to develop agro-based cottage and medium-sized industries in certain farming areas.

D. Social and Cultural Resources

1. Population and Communities

95. Bangladesh has a population of 140 million, of whom 30% (over 40 million people) live in urban areas, and this is predicted to rise to 50% in the next 25 years. Dhaka, with 10 million people in an area of around 800 km² is one of the most densely populated areas in the world. Population of the city of Khulna, as per Bangladesh Statistical Yearbook, 2005 is 1.17m in 0.52m households. 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.

96. Bangladesh is inhabited predominantly by a single ethnic group, Bengali, who constitute more than 98% of the population of the country. According to the 2001 census over 90% of the country is Muslim, and although this includes both Sunni and Shia, Sunnis are in the majority. Other religions are Hindu (9.2%), Buddhist (0.7%) and Christian (0.3%). The average male: female ratio is around 54% to 46% in Bangladesh, instead of the natural 1:1.

2. Health Facilities

97. 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.

98. 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, Chittagong and Khulna they also suffer respiratory problems and other illnesses caused by excessive exposure to traffic pollutants.

99. Khulna Medical College Hospital with more than 500 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 Khulna Shishu Hospital, Islami Bank Hospital, BAVS Hospital, TB Hospital, etc. Notably, the total health service of Khulna is developing day by day. Many non government hospitals and clinics also belong to the city.

100. 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

101. Khulna University, Khulna Medical College, Khulna University of Engineering and Technology, and Khulna Agriculture University are totally funded by the Government. Khulna is home of the nation's most prominent public universities, and is the site of one of Bangladesh's largest universities, the University of Khulna, established in 1991. The university is located in Gallamari beside the river Moyur. Current student enrollment is more than 15,000. The other public university is Khulna University of Engineering and Technology established in 1969. Formerly, it was named Bangladesh Institute of Technology (BIT) and it got the status of university in 2003. The University is situated by the side of the Khulna-Jessore road some 10 kilometers off from the center of Khulna City.

102. Some of the well established Colleges of Khulna are: Azam Khan Govt. Commerce College, Govt. B.L University College, Khulna Govt. Womens College, Govt. M.M City College, Govt. Sundarban College, Govt. Pioneer Womens College, Govt. Coronation school & College, Govt. Khulna City Corporation School & College, Khulna Public School & College, Khulna Model College, Mohsin college, Daulotpur College. Polytechnic Institutes are: Gov. Khulna Polytechnic Institute, Gov. Khulna mohila Polytechnic Institute, City Polytechnic Institute Khulna, Mangrove Polytechnic Institute, Khanjahan Ali Polytechnic Institute, Sundarban Polytechnic Institute, North South Polytechnic Institute, Khulna Technical Institute, Hope Polytechnic Institute, PSTI Polytechnic Institute. And famous and reputed schools are: Khulna Zilla School, St. Joseph School, Munnujan School & College, Model School, Daulatpur Mohsin high School, Khulna Public School & College, and Navy School.

4. Socio-economic conditions

103. With an annual per capita income of \$440, Bangladesh is one of the least developed countries in the world. Agriculture is the dominant sector nationally (employing 50% of the labor force and contributing 23% of the GDP), followed by manufacturing (10% and 16% respectively). With significant growth in the export of ready-made garments, Bangladesh earned around \$10 billion in the last fiscal year, and a further \$5 billion from the export of manpower, mainly to the Middle East.

104. In Khulna city the average household income is Tk. 5,543 per month (US \$ 82) and more than 60% of the population earns between \$58 and \$167 per month. Socio-economic problems in Khulna are similar to those of the other urban centers and include a lack of most of the fundamentals for economic wellbeing. These include: jobs; market outlets for products; capital; adequate micro-credit for the poor; financial and technical support; employment for women; transparency; and a comprehensive information base for the city economy.⁴

105. 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

⁴ Alamgir M, et al (2005): *Integrated Management and Safe Disposal of Municipal Solid Waste in Least Developed Asian Countries*.

job opportunities. As noted above these rarely materialize and the end result is an increase in 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.

106. Khulna city is strategically located in an important hub as far as its development potential. The export of shrimp and the related activities such as shrimp processing, packaging, transportation, shipping, banking, insurance, etc., have further reinforced the development of Khulna to a great extent. The main socio-economic problems in Khulna city are lack of job opportunities, market outlets for products, lack of capital, lack of adequate micro-credit facilities for the poor, lack of financial, technical, and physical support facilities for informal sector activity.

107. 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

108. 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.

109. The Sundarbans is the main attraction that brings visitors to Khulna at present, as those parts of the wetland to which entry is permitted for the general public, are accessible by both water and land from the city. The Royal Bengal tiger inhabits the area; it is said that seeing the tiger enables a person to understand what a tiger means. There are many other rare animals in the area, including monkeys, chitra deer, crocodiles, wild cocks, wild pigs and thousands of kinds of birds. The historically famous Shatgombuj Mosque (Sixty Dome Mosque) is in the Bagerhat District. It is famous for Khan Jahan Ali's mazar. A lake near the mosque has crocodiles. Kuakata is place of tourists' interest; both the rising and the setting of the sun into the ocean can be seen. Travel facilities are available from the Government Tourist Bureau in Khulna and from a variety of private agencies. It may be mentioned here that the proposed SLF site is not adjacent to any of the enumerated archaeological heritage and relics of Khulna.

6. Indigenous Peoples

110. The majority of Bangladesh's people are Bengalis, and approximately 2.5 million are indigenous peoples belonging to 45 different ethnic groups. These peoples are concentrated in the north, and in the Chittagong Hill Tracts (CHT) in the south-east of the country. Their historical background, economic activities, social structure, religious beliefs and festivals make them distinctive. There is no specific pocket in the Khulna City Corporation where indigenous people can be found; rather they have mixed with other people of the community. Within the Khulna City Corporation, they are getting similar facilities as other citizens there; but they are not having enough opportunities within their own community because mainly of the isolated locations in different rural areas.

111. 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

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

113. **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

114. 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 a single site, so it is unlikely that there will be major impacts when the facility is built;
- (ii) The proposed location of the SLF is in an area where the KCC authority has already acquired as per Government regulations and there is no running activities, and also there are no sensitive areas or receptors nearby; and
- (iii) If the SLF operates in the manner intended it should be hygienic and well managed facility that functions with few emissions and without major negative impacts.

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

- (i) The SLF should be adequate in size to accommodate solid waste collected from the target area.
- (ii) All the ancillary facilities for SLF should be provided with safe water.
- (iii) Water points, hoses and cleaning equipment must be provided in appropriate locations in sufficient numbers. Cleaning program must be performed regularly.
- (iv) Industrial three phase electricity should be supplied and a standby generator installed.
- (v) SLF should have its own drain and all drains must be accessible for cleaning for efficient waste water system.
- (vi) The SLF area should be protected by fencing to keep out from trespassing people, animals specially dogs/ cats etc.
- (vii) Strict enforcement of relevant national rules in solid waste management.
- (viii) SLF of KCC 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 construction.

116. 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.

117. No impact is anticipated due to the location as the proposed sites are owned by the Khulna City Corporation. A Resettlement Plan by the KCC authority has been developed to compensate, restore, or relocate any building/ infrastructure that will be affected by the subproject.

B. Construction Impacts

118. **Construction method.** The work comprises the construction of Sanitary Landfill. 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.

119. As explained above the land on which the SLF is to be constructed is currently vacant. This is open space beside the Upazila road and easily accessible by the trucks. So during

construction, there will be some very minor impacts on the people and there will be no issue of resettlement of affected persons.

120. 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.

121. 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.

122. 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 SLF ancillary buildings, 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.

123. 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.

124. 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.

125. **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 straightforward, and will all be conducted at only one site within the jurisdiction of KCC. 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	Khulna SLF site is far from the sea and also such structure constructed in one site only will not affect the coastal resources

Field	Rationale
Agriculture, tourism	There is agriculture in the nearby area but will not be affected by the construction activities; there is no site for tourism at or near this site
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 this site
Physical or cultural heritage	There are no culturally important buildings or locations at or near this site
Indigenous Peoples (IP)	The proposed site is 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 this area
Ecological value	There are no protected areas in the vicinity of this site and no special ecological interest exists within the boundary of the site under consideration; construction should therefore have no ecological impacts.

126. **Impacts due to excavations.** Excavating the foundations for the buildings, roads, surface drains, walkways and other structures on the site will produce around 3,000 m³ 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. The reserved cell of the SLF may be an option for this. 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.

127. 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.

128. **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 this site. However most of the surrounding areas are generally not “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.

129. **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 Khulna City Corporation and currently vacant. So there will be no impact on any site-specific economy.

130. 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.

131. **Impacts on utilities.** There are no temporary infrastructures (power lines, water supply pipes, etc.) on the land proposed for SLF construction; so there will be no economic impacts from the disruption of supply of these facilities due to damage during construction.

132. **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 a semi-urban environment as this. However any such impacts should not be significant in this case, because dump trucks normally have a capacity of 25-30 m³ and the disposal of 3,000 m³ of soil and stone by about 100 truck movements will be spread over a period of few months.

133. **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.

134. 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).

135. **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

136. For the first 2 years of operations of the SLF, the Contractor will manage the operations and maintain⁵ the facility by itself or through a Contractor and if required, modify, repair or otherwise make improvements to the SLF. The Contractor, in consultation with Khulna City Corporation, will also develop a manual for the regular and preventive maintenance of the SLF.

137. The Contractor will be required to keep the ancillary sites of the SLF 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 SLF.

138. Sufficient, safe, potable and constant supply of fresh water will be made available at adequate pressure throughout the premises of the ancillary structures. 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.

⁵ 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 SLF.

139. **Land contamination.** SLF will not contaminate the land the way other industrial operations can. The main reason for this is that SLF will have special impermeable layers underneath. Most land contamination is an aesthetics issue rather than one relating to pollution.

140. **Generation of Waste Materials and By-Products.** In general, pollutants generated from SLF include: wastewater from toilet and cleaning of premises, and leachate from the solid waste.

141. **Water contamination.** The wastes from SLF 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 SLF. The quantity of leachate becomes more in the rainy season. No chemicals are used in the SLF. Although the contaminants are non-toxic in nature, they can introduce bacterial contamination and increase nitrates, phosphates and sulfates concentration in water, leading to health problems.

142. **Generation of Wastewater.** The liquid wastes of SLF are high in biological oxygen demand. The quantity of leachate may also be huge during especially in the rainy seasons. Special drains will be constructed to allow it to reach up to the leachate pond, where proper treatment will be ensured.

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

144. **Noise.** Noise from the establishment can be a nuisance for communities living in the immediate vicinity of the SLF. 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 municipal areas to the SLF site.

145. **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.

146. When the SLF begins to function, it is expected to provide a modern sanitary facility for the workers and staff as well as systematic handling, transportation and disposal 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 SLF is not expected to have significant impacts

Field	Rationale
Geology, seismology	Operating a SLF 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	Khulna SLF site is far from the sea and also such a structure situated in a single location will not affect the coastal resources
Tourism, population and communities, health and	There are no tourist attractions, inhabited areas or health/ education facilities near the SLF site

Field	Rationale
education facilities	
Physical or cultural heritage, archaeology, paleontology	There are also no areas of social, cultural or historical interest or importance near the site
Indigenous Peoples	There are no IP or minority communities near the sites

D. Mitigation Measures

147. 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 SLF workers are trained to the highest standards available in Bangladesh and given refresher training at least annually; and (ii) Khulna 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 Khulna 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 Khulna 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, Khulna 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 Khulna 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 ⁶	- 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

⁶ Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation is reduced.

Parameter	Mitigation Measures
	<p>facility.</p> <ul style="list-style-type: none"> - Recycling and the provision of separate waste receptacles for different types of waste should be encouraged.
Establishing equipment lay-down and storage area ⁷	<ul style="list-style-type: none"> - 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 ⁸	<ul style="list-style-type: none"> - 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.
Education of site staff on general and environmental conduct ⁹	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 Khulna 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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

⁷ Storage areas can be hazardous and unsightly and can cause environmental pollution if not designed and managed carefully.

⁸ Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

⁹ These points need to be made clear to all staff on site before the project begins.

Parameter	Mitigation Measures
	<p>that is potentially dangerous or that he/she is not trained to do.</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 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.

Parameter	Mitigation Measures
Community and public awareness	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 all temporary services.
Dust and air pollution	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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

Parameter	Mitigation Measures
	<p>from being blown out by wind.</p> <ul style="list-style-type: none"> - 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 have been approved by the environment management specialist, or at disposal sites.
Conservation of natural environment	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Develop O&M Manuals to include all aspects of the management and operation of the SLF - Train all SLF 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; - 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 x 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	<ul style="list-style-type: none"> - Do not store wastes outside the SLF areas to avoid issues of aesthetic nature
Wastewater	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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
Vermin and pest	<ul style="list-style-type: none"> - Apply soil cover materials rigorously - Compact wastes properly - Carefully maintain general "good housekeeping"

Parameter	Mitigation Measures
	<ul style="list-style-type: none"> - Inspect site regularly to detect indication of prevalence of pests and vermin - Employ an experienced pest control specialist to deal with this problem in case significant numbers are identified.
Noise	<ul style="list-style-type: none"> - 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.

148. After handing over of the subproject, Khulna City Corporation will be responsible for operating the SLF 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.

149. The successful operation of the SLF in the manner intended should bring significant benefits to the citizens by keeping the environment cleaner than before. Removal of solid waste will be more organized and efficient; the KCC will save some money because of this higher efficiency of waste removal, which can be utilized for staff training and purchase of modern equipments necessary for this kind of operation.

150. 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 will greatly improve as the practices of throwing garbage here and there will decline.

V. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Project Stakeholders

151. Primary stakeholders are:

- (i) Companies that operate on the proposed SLF site;
- (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 SLF site;
- (iv) Workers and companies operating at landfill site elsewhere in Khulna; and
- (v) Companies and private individuals who are benefitted from the existing landfill site.

152. 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

153. 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:

154. 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.

155. 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.

156. 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

157. 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

158. Figure 24 is an organization chart showing how the project will be managed and implemented.

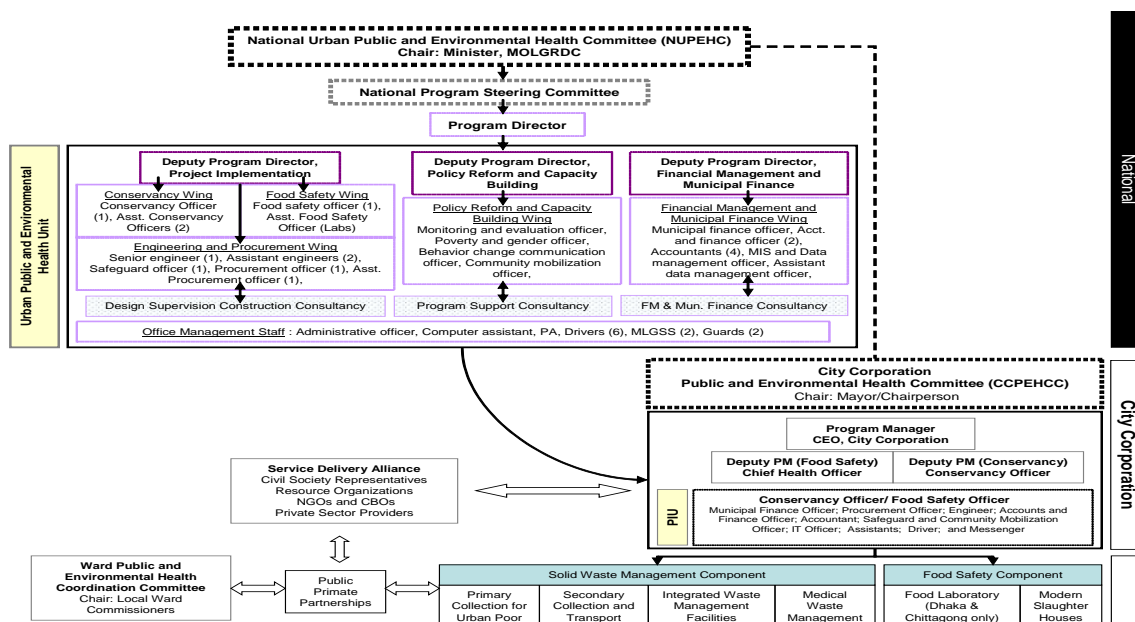


Fig 24: Organization Chart for UPEHSDP

159. **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.

160. **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).

161. 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.

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

- (i) Design, construct, supply, manage and maintain the SLF, 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 SLF 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 Khulna 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 SLF 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 SLF, including all structures forming part thereof;
- (xii) Ensure that the SLF site remains free from all encroachments and take all steps necessary to remove encroachments, if any;

(xiii) Remove promptly from the SLF 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

163. 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 site; (ii) train SLF 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.

164. 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 SLF 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	SLF implementation activities detailed in drawings; safeguard policy requirements as per ADB and Government of Bangladesh rules; safety instructions and use of PPEs ¹⁰ by the staff and workers	1 day	Staff and workers of the Contractor

¹⁰ **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

Description	Contents	Schedule	Participants
Program 4 Action plan for implementation of the SLF	Detailed action plan for implementation of the subproject in a timely and qualitative manner	1 day	Staff and workers of the Contractor

C. Environmental Management Action Plan

165. 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 7 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.

166. **Environmental monitoring program.** Prior to commencement of any civil work, the contractors will submit a compliance report¹¹ 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.

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.

¹¹ 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 SLF workers are trained to the highest standards available in Bangladesh and given refresher training at least annually; and (ii) Khulna City Corporation and UPEHU staffs 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	<ul style="list-style-type: none"> - Establish extensive coordination with Khulna 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 Khulna 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	<ul style="list-style-type: none"> - In all instances, Khulna 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 Khulna 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 ¹²	- 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

¹² 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
	<ul style="list-style-type: none"> - 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 Khulna 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. 					<p>documents</p> <p>Identify and obtain clearance from DoE for disposal sites of excavated soils and contaminated materials</p>
Hauling of Construction Materials	<ul style="list-style-type: none"> - The contractor must maintain all the materials necessary in his inventory so that these can be easily 	Contractor	DSC	Construction method statement	As work progresses	<p>Construction method</p> <p>Detailed design documents</p>

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<p>hauled to the construction site when needed.</p> <ul style="list-style-type: none"> - Advance signage for affected parking areas must indicate duration and alternative parking arrangements. 					
Access	<ul style="list-style-type: none"> - 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	<p>Construction method</p> <p>Detailed design documents</p> <p>Zero complaints from community/sensitive receptors</p>
Occupational health and safety	<ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> (i) no alcohol/drugs on site; (ii) prevent excessive noise; 	Contractor	DSC	<p>Occupational health and safety plan</p> <p>Number of accidents and work-related injuries</p> <p>Complaints from community</p>	As work progresses	<p>Construction method</p> <p>Detailed design documents</p> <p>Zero accident and work-related injuries</p> <p>Zero complaints from community and workers</p>

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<p>(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.</p> <p>- 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.</p> <p>- The rules that are explained in the worker conduct section must be followed at all times.</p>					
Community health and safety	- Contractor's activities and movement of staff will be restricted to designated construction areas.	Contractor	DSC	<p>Complaints from community</p> <p>Activities based</p>	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
	<ul style="list-style-type: none"> - 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 can take place by way of 			on the communication and participation strategy		

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<p>leaflets placed in the postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist.</p> <ul style="list-style-type: none"> - 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. 					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<ul style="list-style-type: none"> - 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) 					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	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	<ul style="list-style-type: none"> - 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
Construction	- The contractor is to ensure	Contractor	DSC	Approved	As work	Approved location plan

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
camps and storage areas	<p>that open areas or the surrounding bushes are not being used as toilet facility.</p> <ul style="list-style-type: none"> - 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. 			location plan Complaints from community	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
Dust and air pollution	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. 	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
Utilities	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. 	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
	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. <p>Waybills proving disposal at each site should be provided for the environment</p>	Contractor	DSC	<p>Complaints from community</p> <p>Waste disposal manifest/record</p>	As work progresses	<p>No dumped wastes and litter at work sites at all times</p> <p>Zero complaints from community</p>

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	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 archaeological value, which	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
	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	<ul style="list-style-type: none"> - Develop O&M Manuals to include all aspects of the management and operation of the SLF - Train all SLF 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 adjacent areas should be 	Contractor (up to service delivery period) Khulna City Corporation	Khulna 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
	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 SLF premises to avoid issues of aesthetic nature	Contractor (up to service delivery period) Khulna City Corporation	Khulna 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) Khulna City Corporation	Khulna 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 SLF should be properly graded and disposed of by appropriate methods. - Disposed into a solid waste bin (skip) and immediately transport out of the SLFs in a closed wheel-barrow or similar other device.	Contractor (up to service delivery period) Khulna City Corporation	Khulna 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) Khulna City Corporation	Khulna 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
Vermin and pest	- Apply soil cover materials rigorously - Compact wastes properly	Contractor (up to service delivery period)	Khulna City Corporation (up to service delivery period)	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

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<ul style="list-style-type: none"> - Carefully maintain general “good housekeeping” - Inspect site regularly to detect indication of prevalence of pests and vermin - Employ an experienced pest control specialist to deal with this problem in case significant numbers are identified. 	Khulna City Corporation	period) Independent Monitoring Agency			regulations
Noise	<ul style="list-style-type: none"> - 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. 	Contractor (up to service delivery period) Khulna City Corporation	Khulna 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
Water use	<ul style="list-style-type: none"> - Minimize water use through dedicated metering of water consumption 	Contractor (up to service delivery period) Khulna City Corporation	Khulna 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	<ul style="list-style-type: none"> - SLF workers should undergo regular medical check-up - SLF workers should be provided with protective gear like head cover, gloves, etc - Provide training on safety to staff to avoid accidents - Regularly monitor the SLF to ensure compliance with occupational health and safety rules 	Contractor (up to service delivery period) Khulna City Corporation	Khulna 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

167. 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

168. 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.

169. 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 (Khulna City Corporation). All monitoring during the operation and maintenance phase will be conducted by Khulna City Corporation; therefore, there are no additional costs.

170. 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.

171. 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 Khulna 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 SLF. 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 Khulna SLF

Item	Quantity	Unit Cost (TK.)	Total Cost (TK.)	Sub-total
1. Monitoring during Construction (1.5 years)				
Domestic Environmental Specialist	1 x 6 month	300,000 ¹³	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)				

¹³ Unit cost of domestic consultants is based on current rates and includes fee, travel, accommodation and subsistence.

Item	Quantity	Unit Cost (TK.)	Total Cost (TK.)	Sub-total
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

172. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Khulna SLF 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 SLF 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.

173. 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.

174. 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 a functioning SLF 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.

175. In the construction phase there are not expected to be major negative impacts because the construction work is relatively 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.

176. Operation and maintenance of the completed SLF will be the responsibility of the contractor up to the end of the service delivery period and afterwards, the Khulna 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 SLF 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, transported and disposed to proper positions on a daily basis.

177. 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 SLF 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 Khulna City Corporation to achieve expected standards.

178. If these and the other mitigation measures recommended by the IEE are implemented, then the SLF 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.

179. 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 SLF 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.

180. 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

181. 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

182. The environmental impacts of the proposed SLF subprojects in the Khulna 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.

183. In relation to Bangladeshi ECR 1997, the Khulna SLF subproject is considered to have significant environmental impacts and can be classified as Red 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 although further study to prepare EIA report for impact assessment at a later stage will be necessary.

ANNEX 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 Landfill site is located in city corporation owned land. At present this is not 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 water quality, and pollution of receiving waters)?		X	

Screening Questions	Yes	No	Remarks
▪ 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	

ANNEX 2: Photographs of the Proposed SLF Site and the Surrounding Areas



Roots of paddy remains after harvesting



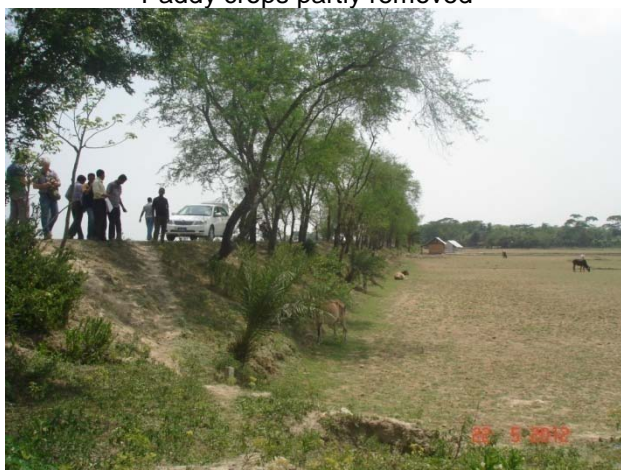
Trees beside road alignment



Paddy crops partly removed



Open grazing field for cattle



View along the road embankment



View towards village in the north west side

ANNEX 3: Records of Public Consultations Conducted

The stakeholders' consultation meeting was held at Landfill site beside Lobon Chora Road, Batiaghata, Khulna at 2-00 PM on 1 January 2013 with local people and Khulna City Corporation (KCC) officials.

The meeting was held with local people and Conservancy Officer (Mr. S. K. Tasaduzzaman) of KCC. Among the local people, most of them were laborers and engaged in agriculture activities and small businessmen who participated actively in the consultation.



Meeting at SLF site in Khulna

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 KCC has undertaken a project to construct one modern slaughterhouse, one sanitary land fill and 8 secondary transfer stations in KCC 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 Sanitary Landfill (SLF) is owned by the Khulna City Corporation. It is a quite big area of about 24.7 acres acquired by the KCC as per GOB rules with funding from ADB through UPEHSDP, and it will be sufficient for construction of an SLF as per design adopted in UPEHSDP. It is at present temporarily being used as agricultural land. The participant from the KCC clearly stated that the area proposed for construction of SLF will be kept free from any kind of external hindrance by the own initiative of the KCC during the construction activities by the contractor 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 SLF. It was disclosed to the participants that the local people would get preference during selection of staff and workers for running the SLF 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 SLF.

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: 2-00 P.M.

Date: 1/1/2013

Place of meeting: Landfill site, Khulna

Union: Mathabhanga

Thana: Batiaghata

Serial Number	Name of Participant	Father's/ Husband's Name	Address	Mobile Number	Signature
1	Md. Nur Islam	Md. Ali Kha	Putimari	01720-312365	
2	Md. Salehin	Siddiqur Rahman	Putimari	01925-221114	
3	Maulana Md. Mizanur Rahman	Abdul Kader	Putimari	01712-690187	
4	Md. Sagir Howladar	Abdus Sattar	Mathabhanga	01724-600001	
5	Md. Sheikh Masud Ali	Md. Siddiqur	Rupsha, Khulna	01913-212764	
6	A. Rakib	Md. Saheb Ali	Baniakhmar	01733-616141	
7	Md. Ziaur Rahman	Md. Mujibur Rahman	Digholia	01717-007705	
8	A. K. M. Tasaduzzaman	Sheikh Rashed Ali	CO, KCC	01711-275255	
9	Md. Shamim	Khurshed Sheikh	Putimari	01933-813782	
10	Md. Akbar	Shartul Sardar	Dashchoot	01964-569068	

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

Time: 2-00 PM

Date: 1/1/2013

Place of meeting: Landfill site, Khulna

Union: Mattahonga Thana: Batiyake

[illegible]

ANNEX 4: Location Clearance Certificate from the Department of Environment

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20.05.12

Government of the People's Republic of Bangladesh
Department of Environment
www.doe-bd.org
Head Office, Paribesh Bhavan
E-16 Agargaon, Dhaka-1207

DPD (PT) / APD (PB)

Memo No : DoE/Clearance/5123/2011/118

Date: 09/05/2012

Subject: Approval of Environmental Impact Assessment Report for Proposed Sanitary Landfill under Urban Public and Environmental Health Sector Development Project (UPEHSDP) in Khulna.

Ref: Your Application dated 20/02/2012 and 09/04/2012.

With reference to the above, the Department of Environment (DOE) is pleased to approve Environmental Impact Assessment (EIA) Report for Proposed Sanitary Landfill under Urban Public and Environmental Health Sector Development Project (UPEHSDP) in Khulna. This approval authorizes and regulates the following activities:

1. Project Proponent may undertake activities for land development and infrastructural development of the project.
2. Project Proponent may open L/C (Letter of Credit) for importing machineries for the project which shall also include machineries relating to waste treatment plant and other pollution control devices.
3. The activity under Proposed Sanitary Landfill under Urban Public and Environmental Health Sector Development Project (UPEHSDP) shall not result in the loss of containment of any materials that would affect health or will have damaging impact on the environment or natural resources.
4. Proper and adequate mitigation measures shall be ensured throughout the proposed Proposed Sanitary Landfill under Urban Public and Environmental Health Sector Development Project (UPEHSDP).
5. No solid waste can be burnt in the project area. An environment friendly solid waste management should be in place during the whole period of the project in the field.
6. Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.
7. All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative/functioning on a continuous basis.
8. To reduce dust, spraying of water over the earthen materials should be carried out from time to time.
9. Adequate considerations should be given to facilitate drainage system for run off water from rain.
10. Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies.
11. Resettlement plan should be properly implemented and people should be adequately compensated.
12. Construction material should be properly disposed off after the construction work is over.

1/2

Location Clearance Certificate for the SLF P-1

13. As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DOE to ensure the environmental management properly.
14. The Environmental Management Plan to be prepared under the EIA study shall strictly be implemented and kept functioning on a continuous basis.
15. In case of any emergency, the following information shall immediately be reported to Khulna Divisional office and Headquarters of the Department of Environment (DOE) simultaneously
 - a) Nature of incident (land slides, fire, accident, collision, etc.)
 - b) Personnel affected (injured, missing, fatalities, etc.)
 - c) Emergency support available and its location (standby transport, medical facilities, etc.)
 - d) Weather conditions
 - e) Current operations (abandoning the site, fire fighting, etc.)
16. All pollution incidents shall be reported immediately and simultaneously to the Khulna Divisional Office and Headquarters of the Department of Environment at Dhaka.
17. There shall be specific format for Environment Monitoring. Environmental Monitoring Reports shall be made available simultaneously to DOE Head Quarter and Khulna Divisional Office on a monthly basis during the construction period of the project.
18. The project authority shall extend active cooperation to DOE officials to facilitate their visit to the site as and when necessary.
19. Violation of any of the above conditions shall render this approval void.
20. Project Proponent shall, after land development and infrastructural development as well as installation of waste treatment plant and other pollution control equipment, apply for Environmental Clearance Certificate without which proponent shall not start operation of the project.

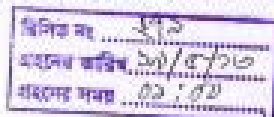
[Signature]
10.05.2011

(Syed Nazmul Ahsan)
Deputy Director (Environmental Clearance)
&
Member Secretary
Environmental Clearance Committee

Chief Executive Officer
Khulna City Corporation
Khulna, Bangladesh.

Copy Forwarded to :

- 1) Private Secretary to the Hon'ble Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
- 2) Director, Department of Environment, Khulna Division, Khulna.
- 3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.



Location Clearance Certificate for the SLF P-2