GARBAGE MANAGEMENT SYSTEM IN LOW INCOME SETTLEMENTS -A CASE STUDY OF BAUNIABANDH SETTLEMENT IN MIRPUR, DHAKA

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

DHAKA, BANGLADESH

JULY, 2009

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A thesis

Submitted to the Department of Urban and Regional Planning in partial fulfillment of the degree of

MASTER OF URBAN AND REGIONAL PLANNING

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Thesis Acceptance Form

The thesis titled **"GARBAGE MANAGEMENT SYSTEM IN LOW INCOME SETTLEMENTS -A CASE STUDY OF BAUNIABANDH SETTLEMENT IN MIRPUR, DHAKA"** submitted by **Md. Sumon Rahman, Roll No. : 040415005 F, Session April 2004** has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Master of Urban and Regional Planning** on 29th July, 2009.

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I hereby declare that this thesis has been prepared in partial fulfillment of the requirement for the Degree of Master of Urban and Regional Planning at the Bangladesh University of Engineering and Technology, Dhaka, and has not been submitted anywhere else for any other degree.

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Dedicated to

My Parents

ACKNOWLEDGEMENT

ABSTRACT

Bangladesh is facing high rate of urbanization. The population density of DCC area is 20,591persons per sq. km and continuous migration is a major cause. The employment opportunities are lagging far behind the urbanization rate, as a result most migrants remain underemployed or unemployed. They undertake a wide range of informal economic activities with low earning and the low income settlements or slums become the ultimate shelter for low income group in the city.

In the low income settlements there is shortage of urban services, NGOs deal with basic services like water supply, sanitation, education, health and hygiene but rarely with garbage or solid waste management. The ultimate result is poor environmental condition and this poses various risks to healthy living.

In Dhaka, City Corporation is providing conservancy service with shortage of sufficient manpower, fund and logistics. At present it can collect only 37% of the total waste generated in the city. In the study area, Community Based Organization (CBO) is engaged in door-to-door garbage collection. Each day they can collect about 10.62 m^3 or 4.88 tons garbage that is 70% of the total generation.

In Bauniabandh most of the households (landowners & tenants) are poor with average monthly income of Taka 5629.00; about 51.1% of the respondents live in their own house; approximately 79.5% of the households consist of 4-6 family members; average per capita per day expenditure for food is Taka 26.97. Among the landowners approximately 61.17% are rehabilitee. Both the landowners and tenants have very limited family space. About 72% of households depend on the NGO assisted healthcare service and about 58.5% of family heads have received primary education. Approximately 89% of households use piped water supply. About 95% households have access road, wide or narrow.

It was found that approximately 62% of households have participated at least in one garbage management meeting. About 80% of households expressed that they are aware then before regarding the necessity of proper garbage management through the active support of NGOs. The collected garbage is dumped at the edge of the water body next to the study area and some uncollected garbage are thrown in the open space, road, drain, etc. Both the collected and uncollected garbage of the study area is polluting the living environment as DCC does not collect the garbage from the local dumping site. The present garbage management system is enhancing the filling up the low land/ water bodies adjacent to the Bauniabandh. The water bodies next to the study area acting as the retention pond for a vast area of the city like Mirpur11,12, 13, Pallobi, Manikdi, Matikata, Bhashantek, Cantonment, etc. If the low land is filled up or blocked by infrastructure development a large area will face immediate and long term environmental degradation as well as planned urban development will be interrupted.

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Abbreviations and Acronyms

ARBAN	Association for Realisation of Basic Needs
BBS	Bangladesh Bureau of Statistics
CBO	Community Based Organization
CC	Cement-Concrete
CDF	Community Development Federation
CEG	Community Environment Group
DCC	Dhaka City Corporation
DoE	Department of Environment
DSK	Dushosto Shasto Kendro
DWASA	Dhaka Water and Sewerage Authority
EIA	Environmental Impact Assessment
ETP	Effluent Treatment Plant
GoB	Government of Bangladesh
HBB	Hard Brick Build
HCS	Hauled container system
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
kg	Kilogram
LDC	Less Developed Countries
MoEF	Ministry of Environment and Forest
NEMAP	National Environmental Management Action Plan
NGO	Non Government Organization
PATSC	Poverty Alleviation Through Social Change
PEVT	Primary Education and Vocational Training
RAJUK	Rajdhani Unnayan Katripakha
RCC	Reinforced Cement Concrete
RMG	Ready Made Gaments
RRR	Reduce-Reuse-Recycle
SCS	Stationery Container System
SMA	Statistical Metropolitan Area
SWM	Solid Waste Management
TDH-F	Teredes Hommes Foundation
Tk	Taka
UNDP	United Nations Development Program

Glossary of Local Terms

Acre	A measure of land area (1 acre = 100 decimals & 2.471 acre = 10000 square metres)
Bazar	Market
Jhupri	Sub-standard housing made of bamboo, Polithyne, rope, straw etc, Low in height
Karchupi.	A local handicraft, made on cloth specially Sharee etc.
Katha	A measure of land area (1 katha = 720 Square feet)
Kutcha	Temporary structure or vulnerable to very light disaster
Pucca	Brick built, Permanent structure
Ward	Smallest electoral units of city corporation. For the operational convenience municipal areas are divided into several wards. The ward boundaries area specified by Government Gazette

Chapter One: Introduction

1.1. Background and Present Status of the Problem

Bangladesh is one of the poorest countries of the world with large population 144.503million (BBS, 2009) and has an area of 147570 sq. km. The projected population of the country is 151.41 million and 158.96 million in 2011 and 2015 respectively (BBS, 2009). The population density is 979 persons per sq. km. At present the 25.39% of the total population live in urban area (BBS, 2009). Dhaka is the capital and primate city of Bangladesh. The area of the Dhaka City Corporation (DCC) consists of 90 wards is around 360 sq. km (www.dhakacity.org) with a population of 7000940 (BBS,2009). So the population density in DCC area is 19447 persons per sq. km. The estimated population for Dhaka Statistical Metropolitan Area (SMA) in the year 2008 is 12797394 (BBS,2009).Dhaka city is the centre of all important economic and administrative activities, as a result thousands of commuters come to the city by day and leave the city by night. The population growth rate of Dhaka city is 3.97%. Considering the previous increasing rate and assumption, the total population prediction for Dhaka City Corporation could be 7566875; 9192990 and 11168556 by the year 2010, 2015 and 2020 respectively. The amount of waste generation concurs along with the population density.

Dhaka city is under the pressure of huge migration [the rate being 10.4] from the rural and other cities of the country (BBS,2005). Whatever the reasons for migration, the objective of migration is to enjoy better opportunities in urban areas. Influx of migration causes rapid urbanization. But employment opportunities are growing far less rapidly than population, the surplus population, though formally unemployed are undertaking a wide range of economic activities such as day laborers, rickshaw pullers, cart and van pullers, drivers and helpers of buses, tempos, scooters and taxi drivers, maid servants, vegetable vendors, small businesses etc (World Bank, 2007). The low paid workers require low cost shelter to live. As a result, the informal settlements become the ultimate shelter for the low income group in the city.

In low income settlements, dwellers suffer from the acute shortage and low-quality of basic urban services. The population density is very high 891 people per acre (One world, 2007). In most of the cases one family lives in one room. In the low income

settlements there is shortage of safe water supply and people suffer from poor health and hygiene due to lack of proper sanitation. There is no garbage or waste management practices in the low income settlements as the dwellers cannot afford the cost, the ultimate result is poor environmental condition and which consequently is a threat to safety of life.

At present the total solid waste generation in 90 wards is around 3909 ton/day (Clean Dhaka Master Plan, Vol-1) the per capita waste generation rate is 0.56kg per day (Enayetullah, 1995). The projected waste generation rate per day 4624 tons will be in 2015 (Dhaka City Corporation, 2005). Dhaka City Corporation is responsible to collect and dispose the generated solid waste in the DCC area. Approximately 44% (Yousuf & Rahman, 2009) of the total waste is collected by the DCC and the rest 56% remains uncollected or thrown illegally by the residents into the vacant land, low land, on street, and along the drain (Ahmed, 2005).

At First, Community Based Organization has been developed in 1987 in the Kalabagan area of Dhaka City to collect waste from house-to-house. This initiative by the community keeps clean the neighborhood which is appreciated highly. Over the last years CBOs approach have been extended almost all parts of Dhaka City. NGOs/CBOs are operating primary waste collection (house-to-house) with DCC's approval. Some NGOs/CBOs have got approval from DCC but they can not start their activities yet.

In up to early 90s the DCC was the only agency for collection, transport and dump the waste of the city. In 1987 a community level initiative was first introduced for door to door waste collection in Kalabagan of the city by the local motivated people. As it was highly appreciated, in few years CBOs approach have been extended almost all parts of Dhaka City, except the low income settlements/ slums because the households have to pay collection charge. Different NGOs have tried to introduce the door to door waste/ garbage collection system for the low income group/slum but it does not sustain. The community is interested but could not pay the charge regularly. As they could not pay the charge, the maintenance and salary of the engaged person is irregular and finally the service stops. Most of the low income settlements are built on illegal, disputed or private land. Many slums do not have minimum standard access road like *TA* block slum in Pallobi, Boubazar slum & Beribandh slum in Rayerbazar, Islambag slum at

Lalbag etc. It is very difficult to provide services these categories of low income settlements/slum.

In Bauniabandh the door to door garbage collection system was initiated in early 2000, under Primary Education and Vocational Training (PEVT) project by Association for Realisation of Basic Needs (ARBAN). The organizer arranged collection Van & other accessories and introduced the system under a management body from the community for overall operation and maintenance. The charge a nominal service charge for the service but the community did not pay the charge and finally the service stopped. The community informed that the DCC does not collect the garbage and they can not afford the charge for community level garbage management system regularly. They applied for assistance to NGOs for cleaning the garbage. The NGOs occasionally take steps to clean the drain one or twice in year but not the overall the settlement

Many national and local NGOs are implementation community development projects in Bauniabandh like Education, Vocational Training, Health, Water supply, sanitation, IGA, etc with the assistance of international NGOs like Plan Bangladesh, Tere des Hommes Foundation etc. Different activities have taken by the NGOs to raise awareness regarding the impact of poor garbage management.

Presently in Bauniabandh the door to door garbage collection and dumping in the local dumping site system has introduced again. Five management groups have been formed for overall operation and maintenance of garbage management system in five blocks (A, B, C, D & E). They collect the nominal fee Tk.5 & Tk.7 (for C block). Five container-van & ten garbage collectors are engaged for collection of garbage from five blocks. The collected garbage is dumped at the embankment on the eastern & north-eastern side of the settlement. The sites are on the edge of water body. The garbage spread diseases through polluting air, surface and ground water. The present practice of garbage management in Bauniabandh is creating pollution and enhancing filling up the water body.

The government agencies along with the international, national, local Non Government Organization (NGOs) and Community Based Organizations (CBOs) are working to improve the living condition in low income settlements through providing services and

amenity. But the garbage management is not given due emphasis in low-income settlement areas. Most of the organizations that cover the garbage management activities include it as a secondary concern under other program. The proper management of garbage is a prime concern in the modern urban planning. Dhaka City Corporation is implementing a solid waste master plan with the technical and financial assistance of Japan International Cooperation Agency (JICA). So it is essential to promote the proper garbage management in the low income settlement areas of Dhaka City.

1.2 Objectives with Specific Aims and Possible Outcomes

The main objectives of this study are:

- To identify the approaches to waste management system in the low income settlement of the study area.
- To explore dwellers access and participation in the services.
- To identify environmental risks associated with garbage management in the study area.
- To recommend planning guidelines to minimize the problems.

1.3 Justification of the study

This study has tried to explore the operation and maintenance system of garbage management in low income settlement, in this case the Bauniabandh slum. The system is running more or less successfully compared to many other garbage management initiatives in the high or middle income areas of the city, because of support of the CBOs and NGOs. In many garbage management (collection & primary disposal) systems in the different part of the city, dwellers participate only by paying charges. In very rare case dwellers are directly involved with it. But in the study area, the community dwellers are directly involved with organization, management and evaluation of the system through formation of Community Development Federation. The charge paid by the dwellers are nominal (Tk.5-7 per family per month) in respect to many other CBO/NGO or privately managed system where charge is higher (taka 30 to 200 per family per month).

1.4 Scope of the study

This study is based community participation in garbage management in low-income settlement. This study has investigated dwellers access in garbage management, the form of participation, and the environmental risk on the planning perspective. There are options for detail investigation of environmental risk associate with the present garbage management system. The presented data are collected from field through questionnaire survey, observation and discussion with the community people. This study discusses on management system and participation of dwellers in management in the system. This study has also discussed dwellers perception regarding environmental risk through the existing garbage management in the community. This study did not diagnose the elements of garbage and risk of different elements of environment as well as human life. There are options for detail Environmental Impact Assessment (EIA) and demarcating the direct affecting area due to loss of water body in the study area.

1.5 Limitation of the study

During the study, some problems were encountered. These are as follows-

- ▣ All the household-heads of the surveyed family were not available for investigation during the data collection. In this case other family member was interviewed.
- ▣ Inadequate knowledge of households regarding waste pattern, disposal and its environmental impact did not provide sufficient information.
- ▣ Sometimes CBOs did not provide accurate data regarding their activities.
- ▣ Some households denied providing any information.

1.6 Organization of the study

Chapter 1 includes background information and the identification of problems. It also explore objectives, explains the justification, scope and limitation of the study.

Chapter 2 The research methodology explains how this research was conducted. Some queries on specific issues like low income group, low-income settlements, garbage, garbage management, elements of solid waste/ garbage management, classification of waste/ garbage etc was conceptualized through reviewing related research, journals, books, web publication/ materials.

Chapter 3 discusses about the existing solid waste management system of the Dhaka City Corporation.

Chapter 4 describes the study Area Bauniabandh slum and also describes the general features of the area.

Chapter 5 discusses the existing garbage management practice in the study area. It investigates the garbage generation, collection, collection time, collection charge, charge & time preference of the households, garbage disposing or dumping.

Chapter 6 discusses about participation/ involvement of the local households in the garbage management system at Bauniabandh slum. The access is explained with respect to socio-economic indictors like education, income, resident status, occupation etc. It also discussed the people's awareness and motivational activities of NGOs. The community's evaluation of the existing garbage management system is also discussed.

Chapter 7 discuses the associated risk of the existing garbage management system in Bauniabandh slum. It also discussed the immediate effects of poor garbage management and the long term impact of the present practice.

Chapter 8 includes recommendations and conclusion.

Chapter Two: Methodology

2.1 Introduction

The waste and waste management is a major concern in modern urban planning. Most human activities generate waste of different in types. The waste generation is related with residential, industrial or clinical activities. First, the waste management required proper identification of waste, projection of total waste generation with the time & population growth, the severity or negative impact of waste. Then it requires preparing policy and plan for waste management, it includes the waste reducing plan, waste collection methods, waste transportation and then dispose/ dumping methods. In this study an investigation on the garbage management practice in low income settlement has been done and the study findings are elaborated in different chapters.

2.2 Research queries

The research is designed on the basis on some queries. This research poses the following questions -

i)   How the garbage management (collection & disposal) in low income settlement is operating with a nominal or free of charge from the dwellers?

ii) What are the strategies of the facilitators (NGOs/ CBOs) to support the service in the study area?

iii) What is the form of participation of the dwellers in the management system?

iv) Is there any environmental risk associated with the existing practice of garbage management in the study area?

2.3 Operational terms

Definition of garbage / waste: Garbage is those items that are useless, unwanted or discarded materials mostly organic generated from household activities. Spoiled or waste food that is thrown away, generally defined as wet food waste. It is used as a general term for products discarded. It includes dust, kitchen waste, residual of food, household sweeping etc. In this study garbage and waste is used as synonyms.

Garbage /waste management system: Garbage management system is a scientific and technical procedure of collection, transportation, dumping and disposing of garbage in preplanned site. In this study the garbage management system in low income settlement is referred as the door to door collection and dumping in the local open land/low land.

Dwellers access in garbage management: All the households of Bauniabandh have equal access to the service but the dwellers have to pay monthly charge for garbage management service. Some households are not interested for paying charges, in that case the organizer try to motivate them (household) for paying charges.

Dwellers participation in garbage management: The participation in the service means the households willingness for taking the garbage management service. Also participation in the management activities and participate by paying service charge.

2.4 Classification of waste

On the basis of garbage generation the waste can be categories as follows-

    i) Residential waste
    ii) Commercial waste
    iii)Institutional waste
    iv)Industrial waste
    v) Medical waste
    vi)Construction and demolition waste
    vii)Sanitation waste, street ;
    viii) Street sweepings waste

The amount of waste can be reduced through practicing Reduce-Reuse-Recycle (RRR). There are many items in the waste that can be separated from the others like plastic, and paper, glass, iron metal etc. The plastic, iron metal, glass items can be recycled. Sometimes the plastic bottles are thrown after use; the plastic bottles can be used multiple if households are little-bit careful. Reuse of items can reduce the amount of waste, recycling the plastic, iron metal and glass will also reduce the amount of garbage. In the study the following categories of are generated mostly.

    i)   Household or domestic waste

    Residential or domestic waste refers to household wastes that are generated from daily life. The major elements of domestic waste are kitchen or food waste including sweepings, torn plastic, torn cloths, plastic bottle, mixed materials, etc. many

households use wood as fuel that produce ash which is also included in this category. Many households waste can be separated before dispose.

ii) Commercial waste

Commercial garbage is arising from commercial activities taking place in kitchen markets, wholesale market, shops, restaurants, etc. In the study area there are many commercial establishments such as kitchen-market, shops, restaurants, wholesale business of seasonal fruits etc. So a remarkable amount of the commercial waste is generated in the study area.

iii) Institutional waste

Wastes generated from different institutions such as schools, college, madrasha, mosque, office, service centre etc are comprised in this class. Food waste also has significance in this category. The paper related items that generated from institutions of the study area can be recycled

iv) Construction debris

Construction debris includes waste arising from any land excavation or formation, civil/building construction, site clearance, demolition activities, road works and building renovation. It includes various types of building debris, rubble, earth, concrete, timber and mixed site clearance material. Construction waste differs considerably from household waste and for its disposal heavy duty vehicles and equipments are required. The construction debris can be disposed/ stored by the municipality separately and these wastes can be used for land filling.

v) Sanitation waste

Sewerage wastes are those generated from the latrine. In Dhaka major portion of the houses have septic tank for storage of sanitary waste. These septic tanks are cleaned once or twice in a year as required. For the poor community or even other income group sometimes discharge the sanitary waste to the lowland, ditch / pond or drain directly. It creates serious environmental pollution and great threat to the health safety. If the sanitary waste can be sensitized and converted to compost separately it can be a good source of organic fertilizer. Country like Philippines, Australia has got success in sensitization and composting of sanitary waste.

vi)   Street sweepings waste

This category of waste mainly consists of leaves from parks, dry soil, sand and stones. Street sweepings contains considerable amount of household refuse, drain clearings, human and animal faecal matter in developing countries.

vii)   Medical waste

Medical wastes are those elements/ components generated from hospitals, clinics and diagnostic centers. Most hospitals discharge their waste in the public dustbins that is harmful for the waste pickers and the people as well. Medical waste consists of general or non-hazardous and hazardous wastes. The general waste (papers, clothes, medicine container, polythenes, metals etc.), pathological waste (body parts, organs, tissues, body fluids etc.), infectious waste (waste from patients with infectious diseases, waste from surgery, linen soaked bandage, solid plaster), anatomical waste (orthopedic, ENT, EYE, Obs, etc.), cytotoxic waste (expired cytotoxic drugs, leftover cytotoxic drugs etc.), pharmaceutical waste (date expired medicine and vaccines) and sharp waste (syringes, needles, blades, broken glass etc.).

2.5 Elements of garbage management system

Proper garbage management will improve the quality of environment. It has cumulative effect on public health, income and social change. An effective garbage management improvement is to provide services at a cost which is affordable to both the consumer and the organization responsible for managing services. There is a scope for developing small scale private activities at the local level to satisfy the demand for improved service.

Garbage management services are to ensure the satisfactory storage, collection and disposal of wastes and the cleaning of streets and other public places. It includes:

- Regular collection of waste from houses or communal collection points;
- Eliminating solid waste from drains, roadsides, open plots and around solid waste storage facilities,
- Appropriate disposal of the waste.
- Reduce waste at source

The wastes must be collected and transported away from the community, usually to a municipal disposal area on the fringes of the town or city. For a sustainable garbage management system the following elements should be integrated-

- ***Promotion of local micro-enterprises:*** For sustainable garbage management system local micro-enterprise, CBO, NGO should be involved in primary awareness rising campaign and primary waste collection from households or communal storage.

- ***Maximizing waste recovery***: The quality & sustainability of service depends on the percentages of waste collected and disposed. For sustainable garbage management system maximum garbage should be collected.

- ***Municipal management:*** The municipality or city corporation is the statutory organization to provide garbage management service to its dwellers. Municipal level interventions should focus on secondary collection, transport and disposal. In developing countries like Bangladesh it is almost free of cost service. The central government provides revenue budget allocation for garbage management to the municipal authority.

Storage, collection, transportation, processing and disposal of waste are the major elements of garbage management system. Elements of garbage management have been discussed as follows:

2.5.1 Storage of garbage

Garbage should initially be stored within the generation site. In garbage management system the following storage methods are exercised before local level collection.

Household storage: Household waste should be stored in a container that is easy to empty and clean. Many households use small plastic basket, pot, poly bag etc for garbage storage at house before primary collection.

Communal storage: The communal or shared storage refers that a common storage for a small community of 12- 20 household. It is a common option for low-income communities. It has common problem that few containers of insufficient capacity which are inappropriately located. Containers are usually open, giving access to rats, flies, and animals, which is undesirable for both hygienic and aesthetic reasons. It is unlikely that many householders will want a

communal container outside their house, and location of the containers must be done in conjunction with the residents. In some cases householders are prepared to walk longer distances to a larger communal storage point.

Enclosures constructed from concrete, masonry or timber is commonly used for communal storage. The capacity is typically in the range 1 to 10 cubic meters. It has some common Problems that are the full capacity of' the enclosure is rarely utilized because people throw their waste; removing wastes from the enclosure is unpleasant and unhygienic; scavenging animals and flies have unlimited access; and a large enclosure may be used for defecation and urination.

Fixed storage **bins** refers chamber of four walls without cover, the walls are normally less than 1.5 meters high so that waste can be dropped directly inside. There is an opening covered by a flap in one of the walls to enable wastes to be raked out.

Concrete pipe sections or 200-litre oil drums placed upright along the roadside are sometimes used as communal waste containers. Their capacity is small, they are difficult to empty and waste tends to be spread around.

2.5.2 Collection systems

Garbage should preferably be collected on a daily basis. As the household garbage are mostly kitchen waste so longer periods between collections are undesirable in hot climates since putrefies quickly at high temperatures. If households are bound to store for long time after garbage generation at house it will decrease participation required from the individual householders. There are four basic concepts of garbage collection-

Collections from Communal storage- through this system the service provider collect waste from communal storage that is usually located at minimum distance from household. Dwellers required carrying the waste from the house to the communal storage container, which may entail walking considerable distances.

Street corner collection when a collection vehicle halts at predetermined places and householders carry their solid waste to the vehicle

Roadside collection, when the householder leaves the household storage container by the side of the road at an appointed time and it is emptied by the sweeper.

House collection, when the workers collect the waste container from within the boundaries of the plot; this involves the minimum effort on the part of the householder.

2.5.3 Collection vehicles

Modernized, effective, and environmentally friendly vehicles are employed in developed countries for garbage collection, and transportation though these are expensive. On the contrary, vehicles that are used for collection and transportation in Less Developed Countries (LDC) are not environment friendly, most of vehicles spared liquid from garbage, it creates offensive odor during transportation at road. Vehicles that are commonly used are handcarts, Tricycle, open truck, container carrier, trailer, etc.

Handcarts- The simplest handcart consists of an open box on wheels with a capacity of 20 to 40 Kg. Such handcarts are widely used in street sweeping and general cleaning, and can be used for transferring waste from communal containers; they are suitable for areas having a high population density. However, loading and unloading can be messy as it frequently involves emptying the contents out of the cart on to the ground when transferring the waste.

Tricycles- The use of the pedal tricycles to power a frame carrying portable containers speeds up the transfer operation and increases the radius of collection. This type of vehicle is most popular mode in existing garbage management practice. It can carry 30 to 40 cft. of garbage in a single trip. It is operated by 2 labourer (sweeper/ collector & Van puller) who works together.

Tractor-trailer units are much quicker than animal carts and are quite common for moving waste short to medium distances, typically up to a few kilometers. However, this is not always efficient and it is often the case that the trailer could be towed by a much smaller, less powerful vehicle.

Small pick-ups provide an attractive option in congested areas. Such pick-ups can penetrate streets where access widths are less than 3 meters. Their capacity is limited to about 1000 - 3000 liters depending on the design.

2.5.4 Waste disposal

In cities like Dhaka, Kolkata and many other large cities in terms population, generate huge amount of garbage in their daily life. It is essential to dispose garbage in appropriate way otherwise it will deteriorate the surrounding environment and cause public health hazard. The following waste disposal methods are observed in different cities of developed and developing countries.

i) Open dumping

The most common and easy method of garbage disposal is open dumping in developing countries. Waste is unloaded in open spaces from dumping truck or by laborer. Waste pickers are often allowed in the site, animals and flies move around that make unpleasant sight to the people. Offensive odor is spared-over the surrounding area at dumping site through wind. Leachate produced from waste pollutes the ground water. Diseases can be carried by fly, bird or animals from the dumping sites.

ii) Sanitary landfill

Sanitary landfill is the controlled deposition of waste such that dangers to public health and the environment are avoided. Waste is deposited in strips and leveled in layers of up to 2 meters depth. The width of the strips will depend upon the number of vehicles required to unload waste at the same time, but will typically be in the range 6 to 30 meters. The surface of each layer is covered with soil (or other suitable inert material) to a depth of 150 to 250 mm. This reduces odors and flies, and helps to contain the heat generated by decomposition of the organic matter, which assists in the destruction of fly larvae and pathogens. Sanitary landfill is usually the cheapest method of refuse disposal, and is comparatively simple to operate. However, careful site selection and good management are essential to minimize the risk of surface water or ground water pollution.

iii) Incineration

Incineration is a process of destroying waste through burning at high temperature. The minimum temperature required for incineration is 850° C in the combustion chamber. Incineration is often used to produce electricity by burning waste materials. Modern incinerators employ elaborate pollution control measures on exhaust gases to reduce the amount of released toxic products. This technology is controversial for producing toxic gas and ash residue, and energy recovered through the process is inefficient. On the other

hand, incineration is a recognized method to dispose the hazardous waste materials for example medical waste. This method is very expensive.

iv) Composting

Composting is a promising and environment friendly waste management option. The organic material is recycled as compost that can be used for agricultural. Based on the air requirement composting can be categories in two method aerobic and anaerobic methods. In aerobic method continuous air supply is required this method can produce organic fertilizer. On the other hand anaerobic methods of composting are practiced to generate of gases such as methane during the process, in order to produce power from the waste materials.

2.6 Local level initiatives in garbage management system[1]

Local level initiatives refers the system of garbage management where community is directly involved in the whole system through forming Groups, committee, federation etc. The households can form micro-enterprises to collect garbage from house to house through local municipal sweepers or private sweepers. These systems can be split into three groups:

- Area-based systems in which individual householders pay sweepers;
- Area-based systems in which the sweeper is paid centrally by the local organization; and
- Small-scale local contractors who organize service delivery and collection of payments.

2.6.1 Area-based system which pays sweepers individually

A group of households or a local activist can start to improve the waste collection system in their area by hiring a waste collector. The initiator should introduce the garbage collector to all households and fixing a monthly charge. The households will pay the charge to the sweepers directly in a fixed time period. Success of the system depends on the level of consciousness of the dwellers.

The system is depended on the willingness of the household as it is managed by the local group or social activist. The sweepers' interest is to have a regular payment for their

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[1] Cotton, A.P. and Tayler, W.K(2000) *"Services For The Urban Poor"* Water Engineering and Development Centre, http://www.lboro.ac.uk/wedc/publications/sftup.html

labour of garbage collection and disposal. The sustainability depends on the willingness of payment.

This system is significant in several ways-

- it shows the beginnings of a positive change in public attitude, in that users decide to act rather than waiting for government to come and do the work; this opens up the potential for micro-enterprise in primary collection.
- users have a direct role in performance monitoring
- if the system is introduced in previously un-served areas, users can see a definite impact through more clean and healthier local environment;
- sweepers have a comparatively secure, emerging market for their service; the assurance of regular minimum payments is an added incentive, and direct payment by households opens options for the negotiation of higher rates and charges for additional work, which sweepers often do;
- an important consequence of a more secure market is that sweepers are more willing to invest in the purchase of equipment such as simple tools and carts:
- Relationships of trust are developed in the community.

2.6.2 Area-based system which pays sweepers collectively

This approach is almost similar to the previous one 2.6.1. The important distinction here is that organizer collect charge from households and pay salary of the sweepers. Some expenses such as buying equipment and paying for simple repairs are also borne by the organizers who perform this work on a voluntary or non-profit basis. The local organization performs the responsibility for handling defaulters. The important additional implications of this system are-

- Monitoring of the system further develops since the user group both facilitates the system and undertakes some financial control
- The system becomes closer to a ́paid labour' situation rather than a sweepers' enterprise; this may forbid sweepers to direct negotiation with households: but still they have some opportunities for additional work and tips
- The user organization may need to invest.
- There is an option for income as saving for further development. The savings attract investors from outside.

2.6.3 Small-scale contractors

An individual or contractor starts a waste collection programme as a business. They employ sweepers, introduce them to the households and charge fixed collection fees. The sweepers' salaries plus all capital and running costs are paid by the contractor, who tries to make a profit. The system is driven by the profit motive and survives through its ability to recover costs and generate a cash surplus for the contractor/entrepreneur. This may be positive environment for the micro-enterprise development. in addition:

- the role of entrepreneur changes from sweeper to a comparatively larger scale contractor. The sweeper's role becomes as salaried employee;
- these system operate on a relatively large scale: typically 500 to 1000 house-holds;
- the entrepreneur usually keeps operations at a level which can be managed individually, without external support or interference

2.7. Legal status of solid waste management

a)   DCC Ordinance of 1983

At section 78 of DCC ordinance stipulates as follows:

78. Removal, collection, and disposal of refuse.

i) The corporation will make necessary arrangements for removal of refuse from all public streets, public latrines, urinals, drains and all buildings and land vested in the corporation, and for the collection and proper disposal of such refuse.

ii) The occupiers of all other buildings and lands within the corporation shall be responsible for the removal of refuse from such buildings and land subject to the general control and supervision of the corporation.

iii) The Corporation may cause public dustbins or other suitable receptacles to be provided at suitable places and where such dustbins or receptacles are provided the Corporation may, by public notice, require that all refuse accumulating in any premises or land shall be deposited by the owner or occupier of such premises or land in such dust-bins or receptacles.

iv) All refuse removed and collected by the staff of the Corporation or under their control and supervision and all refuse deposited in the dustbins and other receptacles provided by the Corporation shall be property of the Corporation.

The occupiers can not throw waste into the places not provided or appointed by the Corporation (13. of the Third Schedule of the Ordinance). The acts shall constitute an offence of the ordinance and be punished after conviction according to the Section 150-153 of the Ordinance.

b) Environmental conservation act and rules

Environmental Conservation Act of 1995 and Environment Conservation Rules of 1997 require that the person who proposes or undertakes industry or project must have to acquire Environmental Clearance Certificate (Section 12 of the Act). The Rule has divided the industries and projects into four categories based on the environmental impact and pollution load. These categories are i) Green, ii) Orange-A, iii) Orange-B and iv) Red. The industries and projects under the Orange-B and Red categories are required to submit report on Initial Environmental Examination (IEE) and layout plan of Effluent Treatment Plant (ETP). Environmental Impact Assessment of each Industry or Project under red category has to be approved by the Department of Environment (DoE) before its establishment. Prior to setting up, final clearance from DOE is required for the projects or industries under Orange-B and Red category. Land filling by industrial, household and commercial wastes falls within RED Category, which is included as most harmful or dangerous industrial units and projects (Rule 7. and Schedule-1 of the Rules).

c) National sanitation strategy 2005

This strategy has been prepared by the Local Government Division of Ministry of Local Government Rural Development & Co-operatives. The strategy addresses the issues related with the solid waste management. It emphasizes on proper solid waste management for healthy living environment. It encourages GO-NGO-Community partnership to implement the sanitation improvement programs (GoB, 2005).

d) Act for preservation of play ground, open space, parks and natural water bodies in metropolitan, divisional and district town, 2000.

According to the Act for Preservation of play ground, open space, parks and natural water bodies in metropolitan, divisional and district town, 2000, requires prior consent of the

Government for changing the structure of specific lands such as open place, playing field or natural reservoir of water by *filling land*, building construction and any other construction that alter the original Master Plan of RAJUK.

e) National environmental management action plan (NEMAP), 1995

The National Environmental Management Action Plan (NEMAP) has been prepared by the Ministry of Environment and Forest (MoEF) of the Government of Bangladesh through consultation with the people from all walks of life by organizing workshop at local, regional and national level. NEMAP has identified different types of activities related to environmental degradation and suggests for undertaking environmental friendly development programs in all sectors. The plan recommends taking initiatives in the field of water supply, sanitation, solid waste management, environmental awareness and so on. Considering the recommendations of the plan, the Government has launched various projects as for example, community based water supply and sanitation, community based solid waste management and community based waste water treatment (GoB, 1995).

2.8. Literature review

Absar (1999) mentioned that women are engaged in ready made garments (RMG) by the push of poverty or pulled by the opportunity of the city. Workers of the multi-billion dollar industry earn less than one dollar per day and live hand to mouth. Due to low income workers cannot afford ever the minimum standard living. Insecurity is always with them. Most of them go to work on foot as they can not afford transportation cost.

Ahmed and **Rahman (2000),** in "*Water Supply and Sanitation*" discussed the solid waste management system at chapter 14 in detail with figure, chart, diagram and explained in the write-up. Important definitions of different waste like refuse, garbage/ food waste, rubbish, Residential waste, commercial waste, municipal waste, industrial waste, agricultural waste, hazardous waste, resource recovery, re-use, recycling, material conversation and energy recovery. They printout the effects of solid waste mismanagement in Bangladesh as i) foul odor from the waste storage bins, ii) blocking the drainage system resulting in wastewater overflow iii) spreading of waste by scavenging birds and animals iv) polluting the surface water bodies and ground water v) land pollution from waste containing toxic substance vi) transmission of vector-borne diseases vii) health risk to solid waste workers and scavengers etc. The quantity of waste generation depends on the geographical

location, season of the year, population characteristics, legislation, people's attitude, etc. Authors analyzed the collection system as **Hauled container system (HCS)** –*removable large containers are used for storage the garbage at the garbage production area and the mechanical carrier carry the container at the disposal site, empted and returned to the original location* **Stationery Container System (SCS)** *the container remains at the collection point the scavenging vehicle collect's the garbage from the container, two types of vehicles are used in SCS-mechanically loaded compactor and manually loaded vehicles.*

Ahemed (2005) in his thesis discussed that solid waste remains uncollected and degrades the environment. He mentioned two types of waste collection system exists in Dhaka city Primary waste collection system (from households to container) is carried out by Community Based Organization (CBO)s or NGOs and secondary waste collection system (container to disposal site) is conducted by Dhaka City Corporation (DCC). He marked that due to inappropriate carrying system waste spreads out along the street from overloaded uncovered rickshaw van during waste collection from households. He found that around 85% of households are satisfied with the service level of primary waste collection organized by CBOs/NGOs. He also found that different unauthorized groups are engaged in primary waste collection system in the same ward with support from the Ward Commissioner interfering with the CBO's activities. The thesis stated that 51.33% storage capacity of bin or container is unused because of its inappropriate design and careless dumping of waste into it. DCC cannot use 56.87% of total transport capacity because they make less number of trips by transport vehicles. It is the result of low maintenance of vehicles, lack of willingness of driver/ sweeper. Many vehicles are under repair always. The majority of households are not satisfied with DCC solid waste service. The study stated that the engagement of private company in solid waste management in Dhaka city can serve in 25.87% less cost than that of DCC. It is recommended that CBO/NGO may be involved in secondary waste collection and street/drain cleaning besides primary collection.

Ali and **Snel (1999)** studied on community based initiatives in solid waste management. They studied on the Karachi Administration Women's Welfare Society (KAWWS) which is a group of housewives based in a higher middle income area known as the Karachi Administration Society (Baloch Colony). The study categorized community-based

initiatives in the collection of solid wastes from residential neighborhoods in developing countries, considering three general categories and suggested the followings for supporting local initiatives in the primary collection of solid waste-

⇨ Strong motivational activities are needed to start the activity and for participation of communities, waste collectors and municipal government.

⇨ Awareness raising and education are important in changing attitudes towards the health and environmental benefits of improved waste management.

⇨ Partnership with the municipality is essential for sustainable management system.

⇨ Institutional and financial sustainability is crucial.

⇨ All the income group and gender are equally important for the system of waste management.

⇨ For sustainable waste management technical details are very important.

In community based waste management there are three main actors involved in local initiatives: i) householders who generate the waste; ii) waste collectors, who are the men and women who collect the waste; and iii) intermediary organizations, such as NGOs and CBOs, whose roles can vary crucial.

The study emphasized that the following terms should be properly addressed for successful community based initiatives in garbage/ waste management, these are-

Willingness to participate- many communities feel that it is solely a municipal responsibility to undertake the collection, transportation and disposal of waste. So strong participation the part of the community cannot be assumed, and willingness to manage schemes is initially low.

Linkages with the municipality- waste collection is a statutory function and the households contribute to the cost of the services through their municipal taxes. Waste collection schemes cannot be sustained without establishing strong linkages between the community and the municipality. Community-based collection schemes could only a part of the municipal system if the linkages between the communities and the municipalities are addressed.

Finance- in community-based waste collection schemes initial investment/ financing for equipment and cost recovery is a crucial issue. This has to be addressed both at the community level and at the city level.

Ability of the poorest to pay - some households in low-income areas live in extreme poverty and their ability and willingness to pay for waste collection schemes is very limited.

Reliability of workers- waste collectors are those individuals who have been hired by the community or municipality to collect waste either from door-to-door or from waste transfer points. These workers are often perceived by the community to be unreliable.

Location and space for communal bins- the waste collected from door-to-door has to be stored daily before it is transported. This requires adequate space for communal bins to be allocated. Space is also needed for other resource recovery activities such as composting.

Gender sensitivity- women are to a large extent responsible for household waste management, as they are mostly responsible for households' management including cooking in developing countries. A proportion of municipal sweepers (waste collectors) are female. There is an important gender dimension at both levels.

Equipment- primary waste collection schemes require appropriate equipment for collecting, loading and transporting the waste. For an efficient waste collection system, it is important to use affordable equipment which is appropriate to the physical nature of the area and to the characteristics of the waste

Transfer and transportation of waste- a reliable primary waste collection scheme depends upon the design and location of transfer points and subsequent haulage of waste by the municipality to the disposal sites.

Anschütz (1996) explored role of community members and local leaders in community based solid waste services. It stated that community members are active in proper hygienic behavior, in contributions in cash, kind or labour, in participation in consultation, and in administration and management. Women and youths often perform special roles in community-based solid waste services. Women are involved as initiators, managers, operators, political activists, educators, and watchdogs of the community. Youths are mainly active as operators of solid waste services.

It also analyzed that different agents/ organizations like Micro-enterprises, community-based organizations, governmental institutions and NGOs can be involved in different task of garbage management like operation, supervision of operation, fee payment, education,

recruitment and training. It also identified & categorized the social and management problems encountered by community-based solid waste management in five categories: low participation of households, management problems, social problems influencing operation, financial problems and failing cooperation with municipalities.

It compared the forms of community participation in water supply and solid waste management projects. Differences between water supply and solid waste management projects is : a solid waste service is a continuous maintenance system, while water supply projects include a construction phase; water supply is usually a greater felt need in low-income neighborhoods than solid waste and it yields more tangible benefits; solid waste is a socially and culturally more complex issue than water supply. Due to these differences some problems experienced in the solid waste sector were not encountered in the water sector, such as the negative attitude of servants and watchmen, the low status of operators, and the low priority of the issue for municipalities and communities.

Finally the study mentioned the possible solutions for better management and participation as i) proper motivation & awareness raising, ii) the provision of incentives, non-payment, modification of basis, place or time of payment for prompt payment, iii) necessary rules, regulations and sanctions for bad behaviour, iv) education, caretaking arrangements for change in attitude, v) lower scale user groups for increasing social control.

ASCE (1986) "*Urban Planning Guide"* in its Chapter 15 gives the idea of urban solid waste system planning as an essential element of community facilities plan. In the book, the methodology of solid waste management planning is discussed. In the planning process it discussed the technical aspects, financial aspects institutional issues and legal aspects. The evaluation plan, model and process are also discussed.

Barlowe (1958) in the book **"*Land Resource Economics*"** at chapter 9 location factors affecting land use, the location and land use is discussed with respect to production of agricultural production. The comparative advantages of transportation and institutional arrangement are discussed for market location and production house/ firm. The less transportation time & cost attracts people to produce a special type of production. The author has mention that the market place or the business districts form the urban area gradually. It is mentioned that cities usually begins as a village, this process is often haphazard, poorly planned and frequently expensive. Business districts spill over into the

surrounding residential areas. Sometimes the expansion is all in one direction or it may be follow a single street (ribbon development). In the chapter, Concentric zone theory, Sector theory and multiple nuclei theory has discussed to explain the Urban Land Use determinants.

Bhatia and **Gurnani (1996)** in "*Urban waste management privatization*" presented study findings on Calcutta. In the study they estimated total urban waste per day 140,000 ton for 2001. In India 98% municipalities manage waste by themselves with the efficiency of collection 59-82%. The problems of municipalities are marked as week infrastructure, poor financial status of municipal bodies, use of improper equipment for collection and transportation, lack of political and bureaucratic will, poor motivation of workers, waste of labour in re-handling of refuse, etc. In Calcutta 40% of waste is being handled by private operators. The private sector was engaged for loading and transportation of waste. The private operator loaded to open body truck that is environmentally unfriendly and hazardous. The cost of waste handling from collection point to dumping ground is Rs.225/- per tonne. Modern equipment, trouble free operation and motivated workforce can ensure efficient waste management.

Cotton and **Tayler (2000)** elaborated different stages of service facilitation for the poor community. At Section two, partnership among the stakeholders is discussed. Different partners are Local politicians; User groups and community; NGOs; External donor agencies; local institutions (municipalities, Urban Development Authorities,) etc. At section three- the frame work for action planning is elaborated. Three major component of action planning i.e. Local Action Plan, Network service plan and consensus building are discussed. At section 4e, solid waste management is discussed. In the book, objective marked as i) maximizing resource recovery through reuse and recycling of garbage ii)regular collection of waste from house or communal collection point iii) eliminating solid waste from drains, roadsides, open plots, and around solid waste storage facilities and iv) appropriate disposal of the waste. At section five, the details of implementation procedure has discussed including procedure of legal approval, source of funding, standardization of cist estimation, project procurement, performance reporting etc. At section six, the operation and maintenance is discussed.

Enayetullah et al **(2005)** estimated the total waste generation in urban areas of Bangladesh that consists of 6 city corporations, 298 Pourashavas (municipality) and 210 urban centres. In urban areas 10% increased in day time as people come to these area for business, Job, study or other purposes. In the study the seasonal variation of waste generation marked as 46%. The average waste generation in urban centers of Bangladesh is 13332.89 ton/day. In the composition of waste food& vegetable waste is dominated by 67.65%. Waste that are collected from urban centers 69% to77% are compostable. The cost and collection rate of waste collection is varied in different urban area, in Dhaka city 37% waste is collected by 669.98taka cost per ton. In Dhaka city 1.2 cleaners are working for 1000 population and 0.5 trucks per 15000 populations. The collected waste is dump for sanitary land filling. In the existing collection rate 137.24 acres of land of 4meter depth is required, if the collection rate is 100%, 273.21 acres of land will be required each year for sanitary land filling.

Flechner (1974) in "*Land Banking in the Control of Urban Development*" point-out the goals of urban land banking as –

- Shaping regional and community growth
- Curbing urban sprawl
- Capturing increases in land value created by government investment
- Improved management and control of the land market or "perfecting the land market"
- Acquiring land for public uses
- Protecting land with unique environmental qualities
- Lowering the costs of public investments
- Subsidizing low and moderate income housing

Hossain (2005) marked that poverty is a set of interlocking actors such as physical weakness, Social isolation, vulnerability and powerlessness. He studied three neighborhoods of Dhaka city Adabor, Gandaria and Kalshi. In expenditure and purchasing pattern section he mentioned that average monthly households expenditure is taka 4156($70) and the poor purchase the food items like rice, pulse, potatoes and vegetables at a low cost from retail shops of neighborhoods. They live in squatter settlements of private

or govt. land. They suffer from the lack of social services like healthcare services, medicines, low education and employment training.

Kelly and **Becker (2000)** in "*Community Planning, An Introduction to the Comprehensive Plan*" discussed the adaptation of planning regulation such as Regulating use (use zoning), Regulating intensity (Zoning density), regulating Dimension (Height zoning), the zoning map that works well in planned established neighborhoods, standards for adequate public facilities control i.e water, wastewater, storm water, streets and roads; at different chapters of the book like *chapter 9*-decisions that changes the land, *Chapter 10*-Conttrolling the use of Private Land, *chapter-11* Controlling the Development of Land and Chapter-12 Controlling When and Where Development Take Place.

Khan (nd,) in "*Turning Dhaka into a healthy city: The solid waste management*" discussed about the existing solid waste management (SWM) system of the DCC, problems of the existing system, manpower and logistics including departments of DCC engaged in SWM, legal dimension, recommends actions for scientific SWM, he urges for the participation of DCC, Rajdhani Unnayan Katripakha (RAJUK), DoE, Dhaka Water and Sewerage Authority (DWASA), CBO, NGOs, and the City dwellers as stakeholder. He analyzed composting as a resources retrieving from waste.

World Bank (2007) in the "*Bangladesh Development Series 17*" it is remarked that Dhaka city is receiving 300,000 to 400,000 new migrants annually, mostly poor. It is projected that the population of the city will be 20 million in 2020 that will make it the world's third largest city. Most migrants come from rural areas in search of new livelihood options. These people have significant contribution to Dhaka's economic growth, as they provide much needed labor to manufacturing, services, and other sectors. This migration, however, also adds tremendous strain on an already crowded city with limited inhabitable land due to the city's topography, limited infrastructure, and a low level of public services.

The city is increasingly characterized by large slums, poor housing, excessively high land prices, traffic congestion, water shortages, poor sanitation and drainage, irregular electric supply, unplanned construction, increasing air pollution and poor urban governance which results in growing problems of law and order.

It is marked that there is no comprehensive policy on urbanization and urban poverty. 16 to 40 different bodies involved in one way or another in urban matters in Dhaka with little coordination and planning, that creating major gaps in services and infrastructure ranging from weak electrical supply to inadequate land and housing options, and major traffic congestion. The poor are particularly affected as they do not have the resources to find alternatives for meeting their basic needs.

This study reflects a comprehensive look at poverty in Dhaka with an aim to provide the basis for an urban poverty reduction strategy for the Government of Bangladesh, local authorities, donors, and NGOs. The study suggested for **i)** developing and implementing a comprehensive strategy for urban poverty reduction **ii)** implementing institutional mapping, reform and capacity building of key agencies / institutions (RAJUK, DCC) affecting urban growth and poverty reduction **iii)** implementing the National Housing Policy to ensure shelter for the poor **iv)** improving service delivery and access to infrastructure for the urban poor **v)** addressing crime and violence in slum areas.

Yousuf and **Rahman** (2009), in a journal article "***Transforming Open Dumping into Sanitary Land Fill: A Development Effort in Waste Management***" mentioned the present activity of the Dhaka City Corporation (DCC) to improve the waste management scenario. The conventional open dumping system of waste disposal is transforming to systematic sanitary land filling. This is the first ever sanitary land filling initiative in Bangladesh. Semi-aerobic waste stabilization technique has been adopted which is comparatively rapid in waste decomposition. The technique includes piped oxygen supply and collection of leachate. Surface water quality, ground water quality, landfill gas, odor, noise, soil, leachate, etc. are monitored with standard monitoring parameter.

Yousuf (2000) in a conference paper "***Community waste management –possibilities of partnership***" mentioned the major constrains of solid waste management in Dhaka city as the rapid growth of industries, lack of financial resources, inadequate trained manpower, inappropriate technology and lack of awareness of the community. The Dhaka City Corporation (DCC) is funding the solid waste service from the municipal tax revenue to ensure a healthy life, cleaner city and better environment for the city dwellers. The growing population has increased the financial burden for waste collection and disposal. It is difficult to obtain dumping sites with in the city and trucking out the waste out of the

city is expensive. Realizing the problem of DCC in waste collection, the communities have stated to organize to their own informal waste collection services for keeping their localities clean. The community managed House to house waste collection has increased the rate of waste collection in DCC. The innovative idea expended into a major environmental movement in the city. Recently, more than 100 communities have started to organize their own informal waste collection service for collection of garbage at the community level that increased 20% of garbage collection, stated in the paper. It has also created approximately 400 jobs.

Waste concern, a local NGO has started community based decentralized composting with the organic portion of waste. It has encouraged the community as local people have participated in source separation and door step collection. The paper stated that to make the different innovative initiatives sustainable, there should be linkages between the formal and informal sector.

The DCC has made arrangement for GO-NGO partnership to look for economically sustainable solution for management of waste. The aim of this program to organize door to door collection for better environment; to raise awareness on environmental sanitation & personal hygiene and to convert the waste to eco-friendly compost. The community based composting can solve the disposal problem as well as it can be environmental, economical and social benefit both for municipality and community.

Presently, in Dhaka city the different type of waste (household, industrial, medical, etc) are in the same waste collection bins and these waste are disposed off on lowland in uncontrolled manner. Wastes that have market value are being reclaimed or salvaged for recycling. Recycling is a method of resource conservation and environmental protection. A large number of people are depending on recycling. The organic food waste can be converted into organic fertilizer.

In the paper the potential implications of waste recycling / composting are –

- cleaner and healthier environment through participatory awareness raising and changing household practices,
- labor-intensive indigenous, creation of employment opportunity for poor;
- Enhance Social mobility, integrity, strong sense of community sprit,
- Reduce burden of formal sector etc.

The paper has also indicated the existing constrains and possible solutions for this community initiatives of waste management. Constrains are land scarcity, lack of interest

& trust of formal sector, etc. The possible solution can be motivation of households for source separation, demonstration for the municipal authority, initially the compost may be supplied free of cost, the importance of organic fertilizer should be well demonstrated to farmer, etc.

The paper presenter recommended for incorporating waste management with recycling in the ordinance; support for the community based initiatives and multi-sectoral interventions of DCC, DoE, Ministry of Agriculture, Environment, and UNDP.

Zahur (2007) in "*Solid waste management of Dhaka city: Public Private Community Partnership*" discussed the major sources of waste generation. She mentioned the impact of solid waste on environment to be very dangerous that pollutes ground & surface water, air, soil, and causes aesthetic problem. She mentioned that 170 communities of different size (50 to 300 households) have started community based garbage collection system. The system has created 500 jobs. She observed clean and healthier environment were created as well as job opportunity etc.

As stated in the literature review that the poor community has low capacity to pay for services. Different services are being provided to the poor by government and NGOs in free of cost or in nominal charges. The poor community live in the low income settlements, cannot afford the minimum standard of living. The poor use their earnings for purchase the food items and rent for shelter. The community based garbage management initiatives are operating in middle or higher income group area by CBO or private service provider where the dwellers can pay the charge regularly. Different studies justifies that the community based initiatives for garbage management are practicing comparatively higher or middle income group area. In low income group like Bauniabandh the solid waste management provider are not interest. Different studies recommended that in services should be provided in slum as subsidy. Services should be provided for poor as social responsibility. The basic services like education, health, water supply, sanitation, road, drain, waste management etc should be provided to low income group for capacity building. The present practice of solid waste management shows that sanitary land filling is mostly practice where as 69%-77% of the collected waste is compostable. Composting can protect the lowland conversion through sanitary land filling. Recycling is a method of resource conservation and environmental protection. Recycling and Community based

composting of waste can be environmental, economical and social benefit both for municipality and community. It can also provide job opportunities at different level.

2.9 Outline of the Methodology

To perform the study efficiently and achieve its objective, present study has been pursued sequential steps stated underneath.

2.9.1 Conceptualization and selection of the study topic

To conduct this research work first of all the concept of garbage, concept of garbage management, and community participation, associated risk of poor garbage management etc was conceptualized. Then the specific study topic was selected.

2.9.2 Formulation of objectives

Objectives are the guidelines to show the way to achieve the goal of the study. Objectives help to understand the difference of this study with compared to similar other studies. The objectives of this study are selected to explore the existing garbage management situation and also the associated environmental risk with the existing garbage management practice in the study area.

2.9.3 Study area selection

The study has conducted on a low income settlement (Bauniabandh) in the city where there is lack of proper practice in garbage management, and some organizations are trying to improve the situation. The study area has a unique identity as rehabilitation project of government. The plots of the study area are similar in size and facilities such as access road, drain etc.

2.9.4 Sampling & Sample Size Determination

The population of the study area is about 25000 which consist of about 5000 household. The study area has 5 blocks (A, B, C, D & E) and it is a resettlement project of the government. Five blocks has considered as five clusters and the clustered random sampling technique has applied to determine the sample size. 4% of the households are surveyed for the present study purpose. The Sample size is 200.

2.9.5 Data collection

The data used in this study are collected from two sources - Primary sources and secondary sources. For primary data questionnaire are prepared and surveyed. Primary sources are NGOs and slum dwellers of the study area. Separate Questionnaires has prepared for the organizations (NGO, CBO) involved in garbage management, dwellers

and Community leaders of the study area. Before surveying a field test of the questionnaire has taken place to verify that the questionnaire adequately brings out the desired information. Primary data also collected through observation survey, like photographs. Data also collected from secondary sources, such as NGOs reports and publications, various books, journals, publications of different organizations, newspapers and different web sites etc.

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│        ▼                                          ▼           │
│   Questionnaire survey                      NGO report        │
│                                                              │
│                                             Books, journals, │
│                                             newspaper, websites│
│        ▼                                                     │
│   Observation survey                                         │
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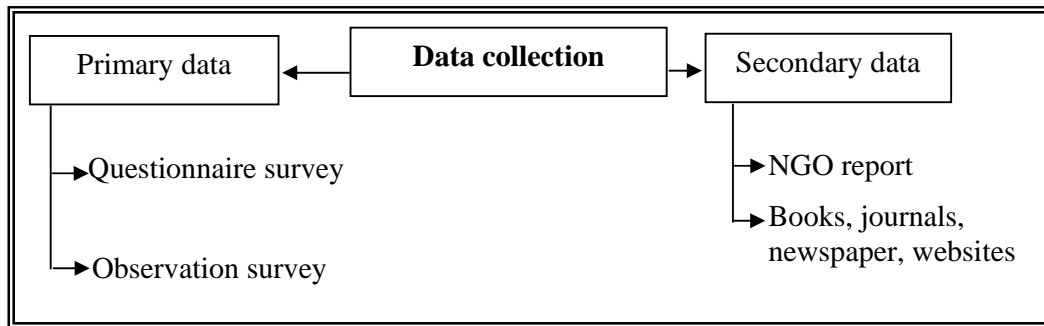
2.9.6 Data analysis

After completing data collection, a database created using SPSS software and necessary analysis done by the same software. Tables are created by using the SPSS. Necessary editing on tables has done by MS–Word software. Description and literal analysis has done by the same software. MS word has used for report compilation. Statistical analysis shown in the report on people's participation, income & willingness to pay, perceptions regarding the garbage management, environmental concern, etc.

2.9.7 Draft Thesis Preparation & Presentation

After data analysis the draft thesis report has prepared and submitted for presentation. For presentation MS-PowerPoint has used.

2.9.8 Submission of Final Thesis

After the presentation on the draft thesis necessary corrections has taken form the board members and finalized as per. And then the final thesis has submitted for approval.

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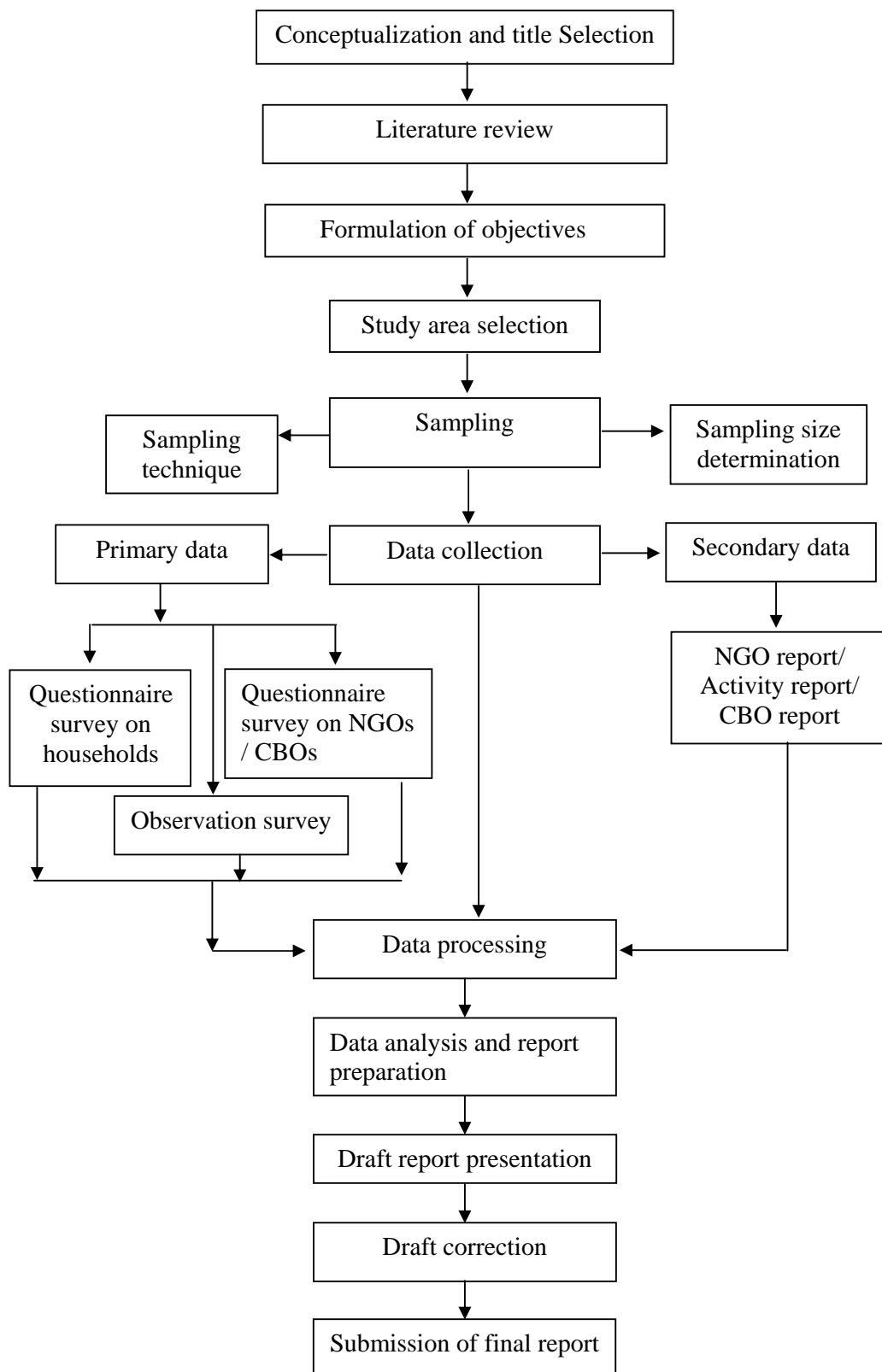
Flow Chart 2.1: Methodology of the Study

Chapter Three: Existing Waste Management Situation of the DCC

3.1 Introduction

Dhaka is already a mega city. The rapid urban growth has increased waste generation. Presently on average 3909 tons of wastes are generated per day with dry & wet seasonal variation. Garbage/waste generation is higher than the institutional arrangement and capacity of management of the city authority. DCC is trying to manage the garbage generated in the city but due to lack of sufficient fund for logistics and man power presently can collected approximately 44% of generated waste. At present the community based garbage collection is a popular collection method. The CBOs involved as a need of the community for door to door garbage collection. The CBOs collect garbage and transport to local dumping/ disposing site. They dump into the DCC dustbin, garbage container, trailer, etc. The DCC's collection vehicles collect the garbage from the local dustbin, container, trailer located on the main roads by open or covered truck and also by the container carrier. The DCC vehicles dump the garbage in the final dumping sites of the DCC.
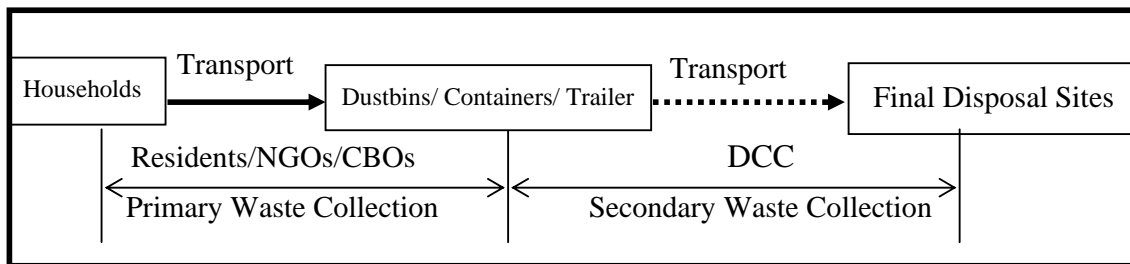
Source: Clean Dhaka Master Plan, Vol.1

The City Corporation provides the service of sweeping, dumping, transporting and disposing of waste generated on the roads. The road conservancy management by the following steps-

- DCC sweeps roads & clean drains daily.
- Accumulate wastes from roadside.
- Cleaners collect & transfer to the nearest dustbin/container.
- DCC's truck dump to the dumping depots.

At the final sanitary land fillings sites of DCC, heavy equipments like bulldozers, tire dozers, pay loaders & excavators are used for the proper management of garbage. DCC also clean, collect, transport the garbage dumped in to the drains. If the drains are not cleaned properly in the rainy season the storm water will not runoff and will create

temporary water logging. In the last few years the city dwellers experienced urban flooding caused by indiscriminate waste dumping.

3.2 Waste generation features of Dhaka city

The human activities of Dhaka City, as well as other cities of the world generate waste. The population of the city is very high. The institutional arrangement for garbage management is far behind the demand.

3.2.1 Waste generation volume and quality

Waste generation in Dhaka City is summarized below-

Item	Parameter	
Estimated generation	Domestic waste	: 1,950 t/d
	Business waste	: 1,050 t/d
	Street waste	: 200 t/d
Generation rate	Domestic waste	: 0.34 kg/d/person
	(domestic + business + street) waste	: 0.56 kg/d/person
Bulk density	All waste average	: 0.24 t/m3
Food waste contents	Domestic waste	: 67 %
	Market waste	: 60 %
Calorific value	All waste average	: 550 to 850 kcal/kg

Source: Clean Dhaka Master Plan, Vol-1,

3.2.2 Waste collection and disposal

The clean Dhaka master plan project started with four dumping sites namely Uttara, Beribandh, Amin Bazar, and Matuail. Presently Amin Bazar and Matuail are under operation other two sites are filled up. Presently 70% of the collected wastes are dumped at Matuail for sanitary land filling and the rest are dumped at Amin Bazar. The present disposal capacity of Matuail landfill site is 3.1 million tons it will be able to support up to 2012, according to Clean Dhaka Master Plan the capacity of the site will be increased after 2012 through extension. Amin bazaar landfill site was established in 2007 its capacity is 3.1 million tons. Waste collection and disposal are summarized below.

Item	Parameter	
Share of disposal volume by dump site	Matuail	: 70%
	Amin Bazar	: 30%
Collection rate by Zone	max. Zone 5	: 71 % of generation
	min. Zone 8	: 19 %
	10 zones average	: 44 %

Source: Clean Dhaka Master Plan, Vol-1.

3.3 Primary collection

3.3.1 Task allocation in waste collection

Dhaka City Corporation Ordinance is the basic law regarding street/drain cleaning, waste collection and transportation. According to Section 78 of the Ordinance, DCC is allowed to provide dustbins or other receptacles at suitable places, and to require residents to bring their waste to the dustbins or receptacles. DCC is responsible for secondary waste collection to remove waste from its dustbins/containers, and transport the waste to final disposal sites. Residents are responsible for bringing their waste to DCC's waste collection points where dustbins/containers are located.

3.3.2 Private initiative in primary waste collection

It is commonly observed that NGO/CBO or private firm are engaged in primary collection in Dhaka City. Various local civil societies or CBOs duplicated the system of door-to-door collection introduced in Kalabagan in 1987 that uses rickshaw van as basic collection tool. It is said that more than 130 organizations were providing the door-to-door waste collection services in 1999 and the number is still increasing.

Source: Clean Dhaka Master Plan, Vol-1; Khan (n.d)

Plate-3.1: Photographs of different type vehicles used for garbage collection and transport to the dumping site

3.3.3 DCC initiative in primary waste collection

In 2002, DCC introduced an approval system of NGOs/CBOs/private organization for providing door-to-door waste collection services ward-wide. DCC has given approvals to 47 NGOs/CBOs to work in 57 areas; however, not all NGOs who got approvals have started their activities as shown in Figure 3.1

Figure 3.1: CBOs and NGOs activity in Dhaka city for garbage management
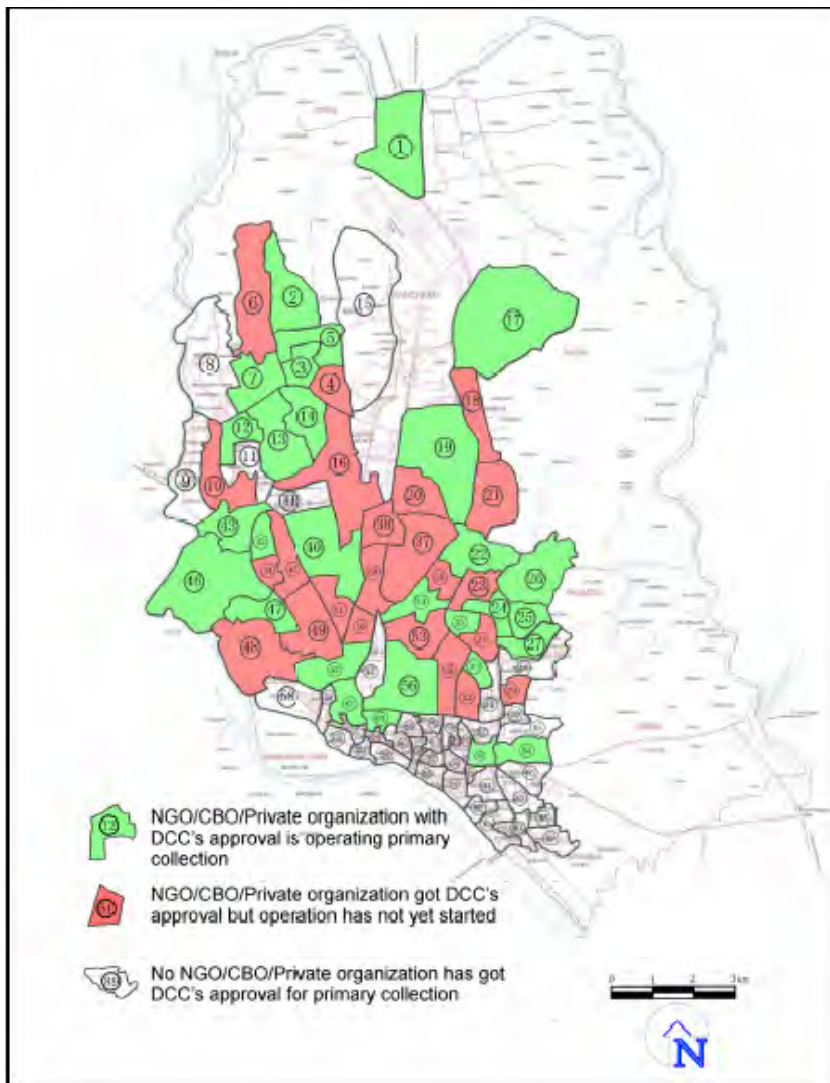
Source: Clean Dhaka Master Plan, Vol-1,

3.3.4 Service charge for door-to-door Collection by NGO/CBO

The service charges collected by NGOs/CBOs vary, depending upon the areas and revenue groups as shown in Table 3.1

Table 3.1: The garbage collection charges for different areas of Dhaka city

Revenue	Area	Service Charge (per month) (Tk)	
High	Gulshan	Hotel	500-1,000
	Banani (Ward No. 19)	Resident -High	100-300
Middle & Low	Khilgaon (Ward No. 23)	Resident - Middle	10
		Resident - Low	10 or free
Middle & Low)	Mirpur (Ward No. 6)	Resident - Middle	20
		Resident - Low	10 or free
		Industry	100-500

Source: Clean Dhaka Master Plan, Vol-1,

3.4 Secondary collection/transport and road/drain cleaning

The secondary collection refers the collection of waste / garbage from the roadside container, dustbin, trailer etc. The container mover carries the containers to the dumping site, the container cleaner unload the container. The open or covered trucks collect the garbage from the dustbin and transported to the dumping site. The organization of secondary collection & transportation discussed below.

3.4.1 Organization and activity for secondary collection and transport

a) Conservancy department

Conservancy department is the core organization for solid waste management; it undertakes street and drain cleaning, carrying street and drain waste to dustbins/containers, and loading and unloading of waste at places of dustbins/containers and disposal sites. Conservancy Department consists mostly of field workers and very few officers at headquarters.

b) Transport department

Transport department has two parts- central pool and conservancy pool. The conservancy pool is in charge of transportation of waste from dustbins/containers to disposal sites. The number of drivers in the Conservancy Pool is less than the number of open trucks and container carrier mover. Some drivers are working in 2-shifts to cover the shortfall.

c) Engineering department
Engineering department is involved in solid waste management for operating heavy equipment at disposal sites and repair of vehicles and heavy equipment used at two workshops: *Mechanical Engineering Division –I* is responsible for repair and maintenance of vehicles used for transport of garbage. Procurement of conservancy vehicles is also

responsibility of this department. *Mechanical division–II* is responsible for dressing and compaction of solid wastes at the final dumping depot. It uses mostly the heavy vehicle like chain dozer, excavator, pay loader, wheel dozer, hydraulic crane, forklift, power trailer etc. This division carries out the procurement, maintenance and repair of these equipments. Civil Engineering Circle is also involved in the field of facility construction and site development for waste disposal.

d) Store and purchase department

Store and Purchase department procures conservancy appliances, such as brooms and baskets, at the request of the Conservancy Dept. Store and Purchase Department also purchases spare parts for vehicles and equipment.

e) Urban Planning Department

This department undertakes the pilot project. It assists the Conservancy department regarding the garbage management.

3.4.2 Deployment of manpower and vehicles for collection/transport

a) Regulatory basis of deployment of resources

There are no regulations, by-laws/guidelines or public notices for installation of dustbins and container. Ward Commissioners makes a request to the Mayor for the installation of such receptacles. When the Mayor approves the request, the order is given to the Conservancy department to install them. The Conservancy department then asks Engineering department to construct the dustbins or to install containers. Currently, DCC has a policy not to construct new dustbins, but to replace them with containers. Deployment of additional vehicles/drivers as well as additional cleaners also starts with requests by Ward Commissioners. Currently, there are about 1,000 receptacles are deployed in the city.

⇨ Dust bin-688 units

⇨ $6m^3$ container-260 units

⇨ $12 \ m^3$ container- 123 units

✓ total 1,071 units

b) Manpower Allocation to Collection and Transport Sector

Manpower allocation is summarized by assignment in Table 3.2. The significant point of cleaners work is variation of working hours. The working hours vary from 2 to 8 hours

with average about 4 hours for DCC cleaners, while private cleaners work from 4 to 8 hours with average 6 hours.

Table 3.2: DCC's Manpower for field level SWM operation

Workers category	Assignment	Number	Total
DCC worker			
Road Cleaner	Ward	5,003	6,992
Deep Drain Cleaner	Zone	284	(6.880
Storm Sewage Cleaner	Zone	119	cleaners
VIP Road Cleaner	Zone	178	are
Market Cleaner		425	deployed to
Other Cleaner	Zone	19	Zones and
Truck Cleaner	Ward	663	Wards)
Special Truck Cleaner	Zone	189	
Container Cleaner	Central	112	
Truck Driver	Ward	266	266
Container Driver	Central		
Private worker	Zone 9 & 10		
Road Cleaner		359	578
Deep Drain Cleaner		86	
Truck Cleaner		106	
Truck Driver		27	

Source: Clean Dhaka Project, Vol-1,

d) Sufficiency of trucks and drivers

Transport department is making a request to increase the number of vehicles by 150 together with 200 more drivers to the Mayor. The number of driver is apparently insufficient: 266 drivers were assigned to operate 283 trucks. The number of trucks is considered still sufficient to transport 1.5 times as much waste as achieved in 2004. Provided that 307 drivers achieve 1,400 t/d of transport, 452 drivers are proportionally required to run the trucks currently in use at their full capacity as shown in Figure 2.3. The current solution is to use trucks with more frequent trips to dump site by more drivers and longer operating hours.

e) Composition of trucks

DCC regularly uses three types of trucks as follows.

- ✓ Open Truck (OT): 3 ton, 5 ton for dustbins on wider road, 1.5 ton for narrow road
- ✓ Container Carrier (CC): 3 ton, 5 ton for containers on wider road
- ✓ Trailer Truck (TT): 20 ton for big market

Loaded amount of each type of trucks was observed at the entrance of Matuail dump site for three months as part of Pilot Project. As the result of observation, it was found that OT 1.5 ton and trailer exhibit larger load than rated capacity. CC 3 tons were almost fully loaded to their rated capacity, whereas OT 3 tons and CC 5 tons were just loaded about 70% of rated capacity.

Regarding the frequency of trips for dumping in a day, OT made 1 to 2 trips a day while CC made 2 to 10 trips a day and about 3 trips on average. The combination of three types works well in spite of the minor problem of partial inefficiency. Owing to short distance to dump site, the trucks keep chassis, tires and engine better than the age of vehicle. On the other hand the body for loading is comparably worse because of corrosion. The same deterioration is found in containers which are mostly eroded inside by leachate generated from raw waste.

f) Slow vehicle repair

The repair usually takes a long time. Half of the vehicles that finished repair in 2004 took two years since the request of repair. Major repair is contracted with private workshops outside DCC. The tender document needs final decision by the Mayor and the process takes a long time to complete. Because of the limited frequency of Mayor's sanction, there is an inevitable waiting for application to the Mayor. A fundamental improvement in this inefficiency is urgently needed.

g) Lack of management

The lack of management is increasing the cost and decreasing the service quality. According to the Clean Dhaka Master Plan (CDMP) report the number of trips recorded in logbook counted almost twice as many as those recorded at the entrance of dump site. Estimation of fuel is associated with the trip. The discrepancy of trip number in two sources implies the expense for fuel is questionable. Most conservancy trucks are not equipped with distance meter in the cabin, which gives an essential data for rational valuation of fuel consumption. The absence of this equipment is overlooked by the top management of DCC.

3.4.3 SWM expenditure

DCC prepares expenditure accounts after closing of the financial year. Neither 'department-wise expenditures' nor 'operation-wise expenditures' are available. Total

SWM expenditures have increased each year up to approximately Taka 480 million in the financial year 2002-03, which accounted for 18% of DCC's total expenditures, and 42% of its own revenues of the year. The unit SWM cost of DCC in the financial year of 2002-03 is estimated at Taka 930/ton (= US$ 14 /ton) as shown in Figure.

Figure 3.2: Distribution of expenditure for Solid Waste Management year 2002-03
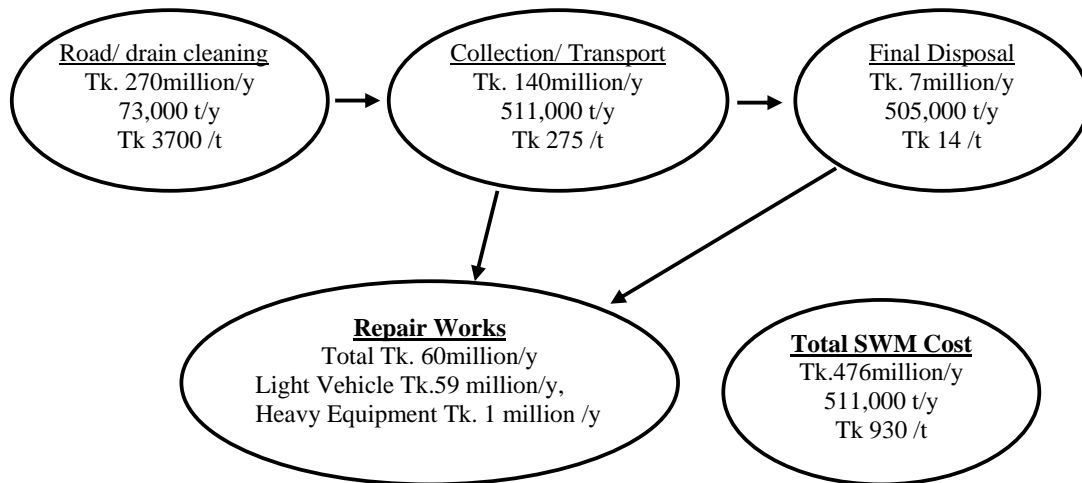
Source: Clean Dhaka Master Plan, Vol-1,

3.5 Final disposal
3.5.1 Existing landfill sites in operation

a) Remaining capacity of existing landfill Sites in operation

DCC uses presently operating two landfill sites: namely, Matuail and Amin Bazar; Matuail is the only official landfill site owned by DCC. The total area of Matuail landfill is about 40 hectare. The site started full scale operation in 2007. Semi-aerobic landfill system has been adopted to reduce the polluting load on environment and speed-up the stabilization of the disposed waste. At the present rate of dumping (1700ton/day), the estimated lifetime of the site is 20years.

3.5.2 Operation and management of landfill site
a) Management of landfill site

Dhaka City Corporation implementing the clean Dhaka master plan under which the Matuail open dumping site is transforming into sanitary landfill site. Semi-Aerobic landfill system has adopted for land filling. Wastes are decomposed rapidly in a semi-aerobic

system. In this system perforated pipe network is installed below the solid wastes for collection of leachate produced in the landfill as well as supply of oxygen into the deposited waste.

Figure 3.3: Diagram of semi-aerobic waste stabilization process
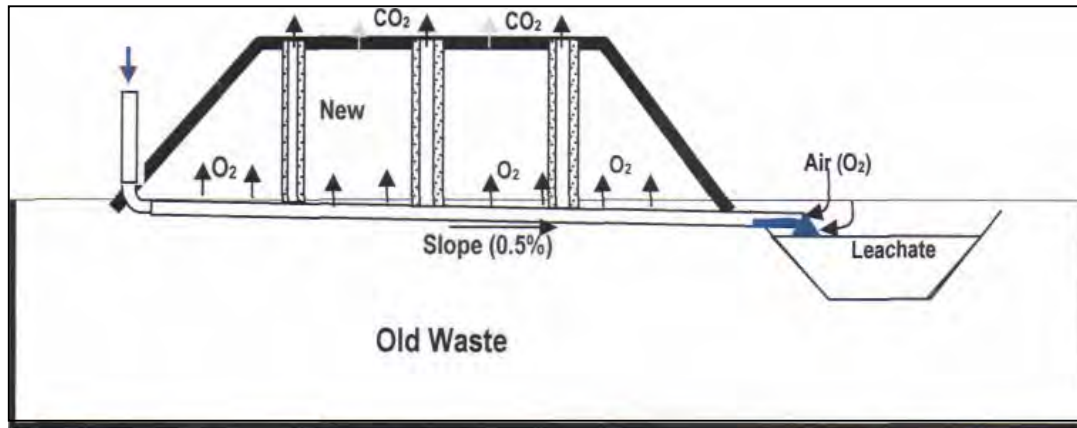
Source: Yousuf and Rahman(2009)

The heat generated by the bacterial activity in waste also released through the pipe network. In the semi-aerobic system, the stabilization process is comparatively faster, the odor and fire-hazards are less.

b) Present improvement of matuail landfill site[2]

The main components considered for the Matuail Landfill Project are access roads, rain water drainage, weighbridge, car wash facility, control building, leachate collection and management, gas management system etc.

- ⮕ **Access roads:** To facilitate easy movement of waste transporting vehicles in the dumping area access roads are constructed on old waste using old waste, construction debris and bricks. To enhance the dumping operation and easy movement of trucks and the heavy equipments dumping platforms are constructed with an approximate size of 30m. X 30m.

- ⮕ **Rain water drainage: I**n the Matuail landfill site total 2470 meter of RCC drainage network with average width of 0.75 meter and bed slope of 0.1% has been constructed surrounding the landfill area to facilitate proper and adequate drainage of rain water.

- ⮕ **Weighbridge**: Weighbridge has constructed as one of the most essential facilities for the proper management of sanitary landfill as well as comprehensive solid waste

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[2] Yousuf, T.B. and Rahman, M.M (2009), "*Transforming Open Dumping into Sanitary Land Fill: A Development Effort in Waste Management*" Journal of Material Cycles and Waste Management, Springer, Japan, Vol-11, No3, September 2009, PP-277-283.

management. The waste loaded trucks are weighed in truck scale with a maximum weigh calibration of 30 tons with the precision of 5kg. Weigh bridge data is analyzed to find out the area wise waste generation rate, inefficient vehicles, inefficient routes, and trip times by vehicle and area. The analyzed data is being used to prepare further action like annual management plan through route optimization, vehicle allocation, provisioning of manpower and other waste management facility etc.

➲ **Car wash facilities:** The vehicles that are used for waste transporting and dumping needs wash properly to dissipate odor and to increases longevity of the trucks operational life. For this purpose car wash pool constructed with high-pressure water jet pump with 3 horse power capacity facilitate washing of 3 trucks at a time.

➲ **Flood lighting:** The site is operating 24 hours so lighting is playing a vital role in sanitary landfill operation for this purpose electric sub-station and standby generator facilities are provided in the site. 4 flood light towers each having 12 lights with 2000 watts capacity to lit the site area adequately to ensure smooth night time operation and as well as security.

➲ **Control and administrative building:** A control office building has been constructed to facilitate close monitoring of landfill operation, onsite management & control of sanitary landfill facilities, functioning of landfill management unit and coordination with solid waste management department. The Control building at Matuail accommodated two computer rooms for the weigh bridge operation, three office rooms, one environmental laboratory, one store room and three wash rooms. The following table shows the organization of Landfill Management Unit (LMU)-

Table 3.3: Organization of Landfill Management Unit (LMU)

Name of post	Number staff(s)
Site Manager	01
Assistant Site Manager Assistant Site Manager (Civil) Assistant Site Manager (Mechanical) Assistant Site Manager (Electrical)	03
Computer Operator	03
Landfill Inspector	03
Assistant Mechanic	01
Assistant Store Keeper	01
Machine Operator	09
Helper	03
MLSS	01
Total	25

Source : Yousuf and Rahman, 2009.

3.6 Recycling/Compost

The recycling of waste is the cost effective method. The recycling practice at households' level can reduce the amount of garbage. The paper, plastic, polythyne, glass, iron scrap can be separated before disposing at households' level. The reusable items like tin/plastic container, plastic/glass bottle can be reused. The Reduce-Reuse-Recycle technique can be widely advocated by the authority.

3.6.1 Outline of recycling activities in Dhaka city

a) Status of recycling industry in Dhaka city

According to "Bangladesh Statistical Yearbook 2001"and "Profile of Dhaka City", the labor force excluding unemployed persons is estimated at approximately 1.2 million. On the other hand, approximate 74,000 people are engaged in recovering material out of solid waste, according to the interview survey by the Study Team. This means that approximately 6% of the total labor force in Dhaka City is in the recycling sector.

b) Stakeholders of recycling activities

Recycling stakeholders of municipal solid waste are composed of three principal groups: namely, collectors, buyers and factory/shops for recycled products. Recycling factories are usually small-sized and located in old Dhaka area; they process material collected from inside and outside of the city. There are special groups that function as collector and buyer. They are called *feriwalla* and they collect waste from waste generator (households) by paying cash in exchange for recyclable wastes. *Feriwalla* also buys recyclable wastes from other collectors.

c) Compostable wastes

At present, there are five small-scale compost plants in Dhaka City. The total capacity of 5 plants totals 19 tons/day; however, they are at present producing approximately 1.5 tons per day only in Dhaka City as a whole due to weak demand, according to Waste Concern. The products of kitchen waste is valued one digit lower than that of other recycle materials, according to the interview survey results with manufacturers and dealers.

Chapter Four: Study area

4.1 Introduction

The Bauniabandh under the ward no-5 of Dhaka City Corporation (DCC) has been selected as the study area for the present study. The study area is low income resettlement project of government. The dweller of previous Bhashantek slum was resettled in the study area in 1989. Government allocates 2568 plot to the dwellers. Before resettlement project the Bauniabandh area was a slum where 234 households were living. The present inhabitants (land owners) of this area are living in this area for almost two decades.

4.2 Location

The area is planned in a gridiron pattern. Almost all plots have access road of 3 to 12 feet width. The study area is almost like D in shape. Northern, Eastern and Southern side is protected by the embankment cum road of 30 feet width. On the western side a wide road exists. A well planned road is under construction from Mirpur Cantonment to Khilkhet through Dhaka Cantonment has passed through the North-eastern side of the study area. Low land is located next to the embankment. So, drain and storm water can easily be drain-out to the low land through sluice gate. After 20 years of establishment, the area has become a well connected to the adjacent developed and planned settlement.

4.3 Growth of the study area

The study area was a low lying area in 80s. Under the Bhashantek punurbason project the area was developed by land-filling and embankment. Basic infrastructure such as HBB road and drain was constructed for the dwellers under the project. Each plot was facilitated by nuclear housing and pit latrine. According to the statement of aged dwellers of the study area that there was canal from TURAG River to Bhashantek (Mirpur-13), through the canal active navigation exists up to the late 80s. Due to growth many structure the canal / lowland has converted to developed land.

Map 4.1 : Location of the study area in DCC

Garbage dumping site for cantonment

Legend

Study area

Water body/low land

Under construction Road

2   0   2   4 Kilometers

N
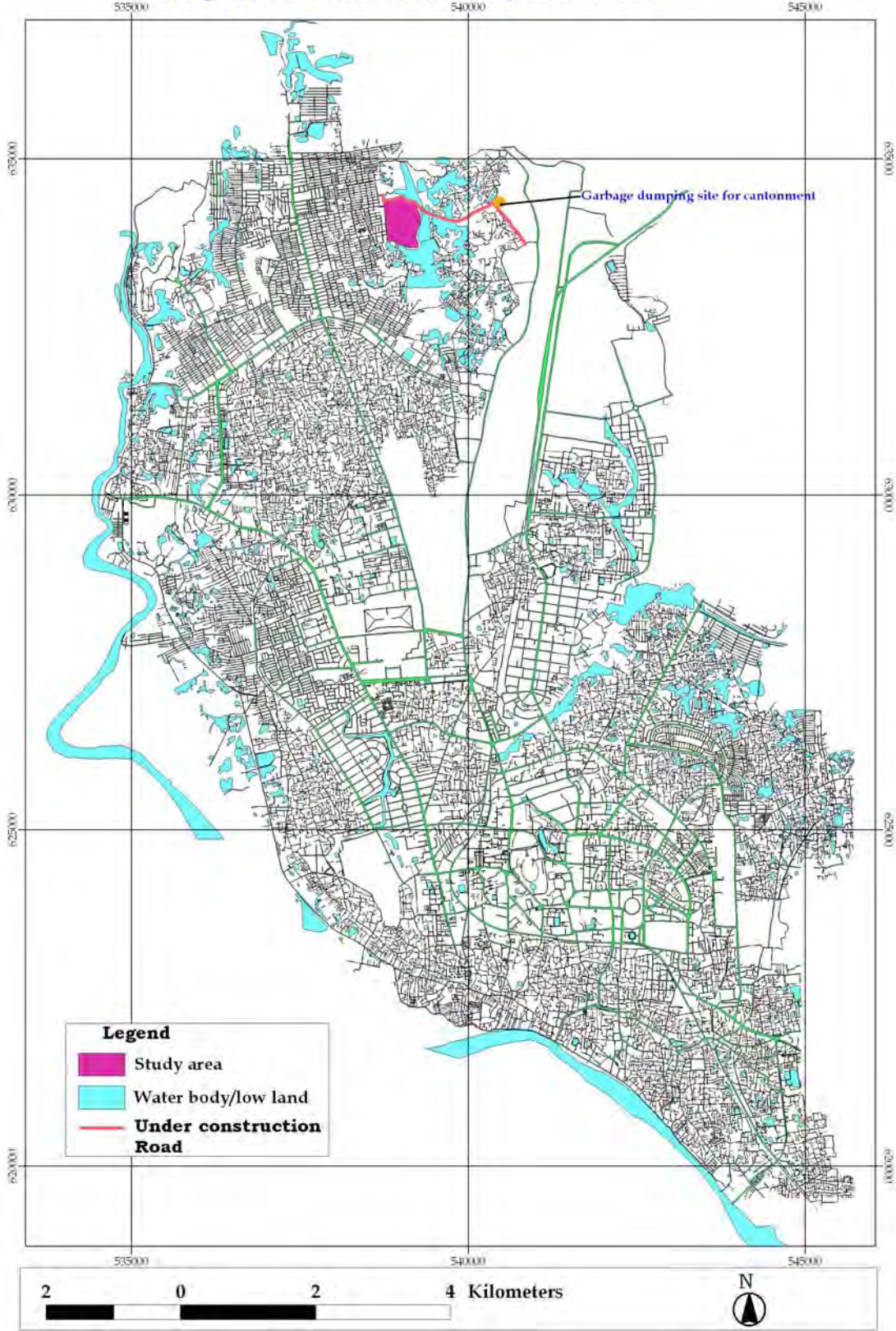
Source : Google Earth.

Plate 4.1: Adjacent area of the Bauniabandh canal

Map 4.2: The Plan of the Bauniabandh Slum
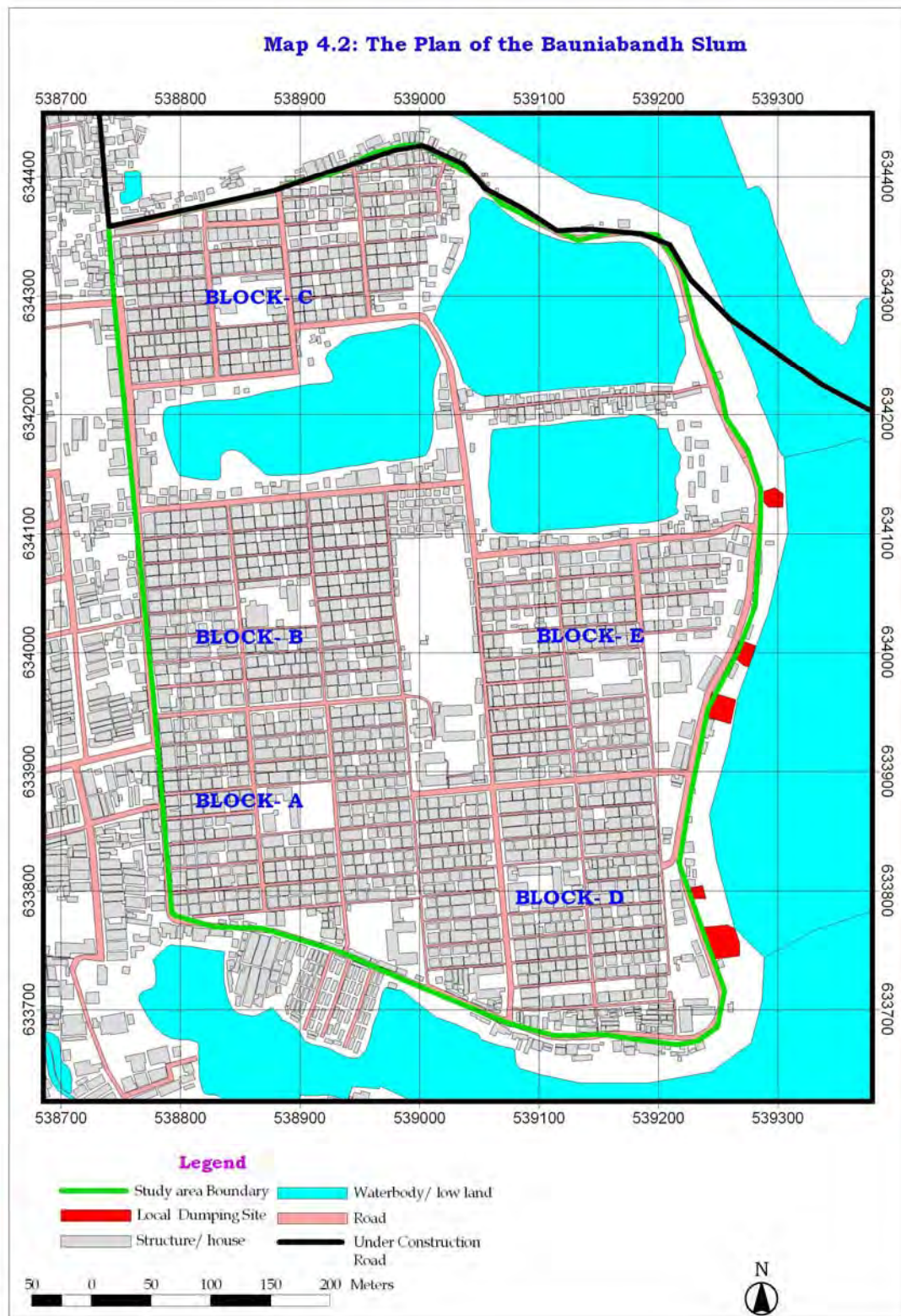
Source: Rajdhani Unnayan Katripakkha, (2008),

4.4 Population and service facilities

The area of the study area is about 40 acres and the present population is about 50000 (field survey) with 5000 household. The density of population is 1250 per acre. As the study area grew under a government development project, so some basic facilities were provided under the project. The project provided a plot of 0.75 *Katha* with nuclear housing consisting pit latrine and a tube-well (Tara pump) for each 12 households. Every plot has access road. Concern Universal, an international NGO was associated from the very early stage of the project. After the resettlement, different National and International NGO have implemented different projects for the community development. Now the study area has piped water supply to every plot, electricity supply, educational institutions (school & madrasha), drainage, Access road, healthcare facilities, religious establishment etc. Gas line has reached to the door of each household though every household can not afford it yet due to high connection charge.

Due to implementation of development project of different organizations the dwellers are more conscious regarding basic life style such as health, education, environment than many other low income settlements. Dweller maintain sanitation practice, use pure water for drinking & others purposes, as they are concern regarding environment they have start garbage management system on their own interest with assistance from NGOs.

4.4.1 Water supply facility

The total community has piped water connection. Every legal plot owner including the tenants of the respective houses has piped water access to it. They use it for bathing, cleaning, cooking and drinking. Water is supplied for three times daily in the morning 6-9 am at noon 12-3pm and at evening 7-10pm. Most of the houses have constructed small or big water reservoir with iron/ concrete cover to store the supplied water. Many households have installed hand tube-well in water reservoir.
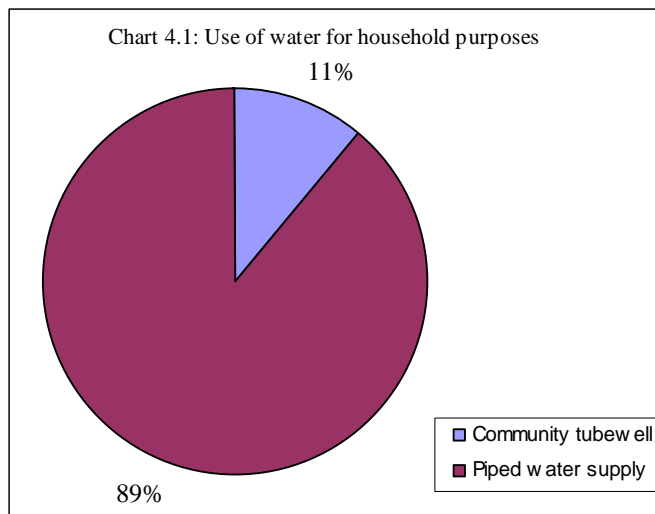
Chart 4.1: Use of water for household purposes

11%

89%

☐ Community tubewell
■ Piped water supply

Though the dwellers have the piped water supply but sometimes they suffer from the waterborne diseases like dirrhoea etc, because they do not practice the proper health & hygiene education. Many households located at the pond edge use hand tube well installed in the pond or near to the pond. On the other hand, many latrines (ring- slab) are constructed on the pond. The pond is totally polluted from multiple sources such as hanging/ open/ ring-slab toilet; storm water runoff to the pond; directly thrown garbage / waste; etc. Tube-wells that are installed on / into the pond can not ensure the pure water because the source is polluted. Water reservoirs are not clean enough, so it is a risk of health. Most of the households take bathing near to the water reservoir as a result water of the reservoir polluted. It increases health risk.

4.4.2 Drainage facility

The study area is a planned settlement. So the basic urban services are provided. The entire allotted plot has drainage connection as a basic urban service. In the study area there are tertiary (10"), secondary (18"), and primary (36") drains. These drains are runoff to the collectors (5-10' wide) of sluice gate. Water is drain-out to the nearest low land other side of embankment.

Table 4.1: Drainage service at the community

Access drain	Frequency	Percent
Government provided	182	91.00
No facilities	18	9.0
Total	200	100.0

Source: Field survey, September, 2008

Under the present management system of the study area these drains are not cleaned. Moreover the DCC/ DWASA do not care about it. As a result these drains have become breeding ground of mosquitoes, flies, and other diseases. Though there were a community initiative to clean the drains near to his/ her house but they are not aware. According to above table 91% of households of Bauniabandh have drainage connection for surface water runoff. The poor drainage condition has leaded the community to environmental risk. It very much vulnerable to water logging as most of the drains are not flowing well.

4.4.3 Sanitation facility

In the study area there is no sewerage system by the DWASA. The PIT latrine is common. But many household use open or hanging latrine. Many latrines are located on the edge of three ponds and it is vulnerable for the health and environment of the community. Many households have the outlet of latrine to the pond. These households are not the legally allotted of the government rehabilitation. The influential have constructed the house at open space, bank of pond etc. These households do not have the legal electricity, water supply drainage as well as the latrine facilities.

Table 4.2: Sanitation facilities of the community

Sanitation Facility	Frequency	Percent
Pit latrine with Bio-gas connection	182	91.0
Community PIT latrine	10	5.0
Open latrine	8	4.0
Total	200	100.0

Source: Field survey, September, 2008

Different NGOs are assisting the community dwellers as facilitator and trying to raise awareness regarding the proper sanitation education. Among the surveyed households 91% have the access to the latrine connected with the biogas plant.

Plate 4.2: Piped water supply used by installing hand tube-well, households at the edge of pond

Plate 4.3: All households have drainage facility at door step

Plate 4.4: Long-term deposition of garbage in drain block water flow

Plate 4.5: Many latrine are connected with pond in Bauniabandh

Plate 4.6: A biogas plant located at Block A, in Bauniabandh

4.4.4 Access road

All the allotted plots of Bauniabandh have access road. Each block has 22-24 lanes and the plots are located on both side of each lane. Moreover some plots are located at the intersection of 15′-40′ feet wide road. So the corner plots have the at least two categories of road as access road.

Chart 4.2: Access road facility in bauniabandh

5%

95%

Yes ■ No
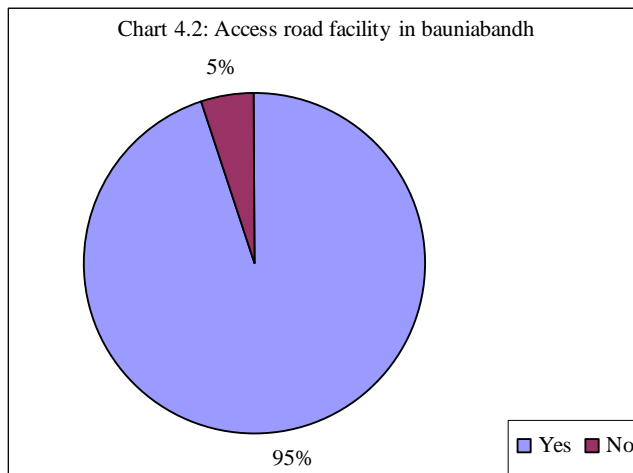
In the study area 95% households have the direct access road. But the present condition of the roads is very poor. For a long time these roads are not repaired. Most of the roads are not useable for vehicle. The garbage collecting van-pullers face problem due to poor road infrastructure. Many households are engaged in road encroachment as they have constructed room on the road and drain.

4.4.5 Energy Supply

Energy refers means of cooking energy. In the study area, the supply of piped gas is available at the door step but many dwellers can not afford the gas connection charge (12000/-official charge). As a result they use cooking fuel like kerosene or use firewood as fuel. Some households have taken the gas connection and the landowners share the kitchen (gas burner) with the tenant for a monthly charge 150.00 -160.00 taka. The households who do not have the options of sharing the kitchen with landowners use kerosene or use firewood as fuel and their monthly expense for this purpose is 300.00 – 450.00 taka. The following table shows the data of households' expenditure for cooking fuel/ gas with respect to the households' income

Table 4.3: Expenses for cooking energy with respect to income range

Income range (Taka)	Source of Energy			Total
	GAS	Wood	Fuel/ kerosene	
Up to 3000	0	3	0	3
3001-5000	43	65	7	115
5001-7000	25	25	3	53
7001-9000	15	3	0	18
Above 9000	11	0	0	11
Total N	94	96	10	200
%	47	48	5	

Source: Field survey, September, 2008

As per above table, for cooking purpose 47% households use natural gas, 48% households use firewood and the rest use kerosene .

Chart 4.3: Source of energy
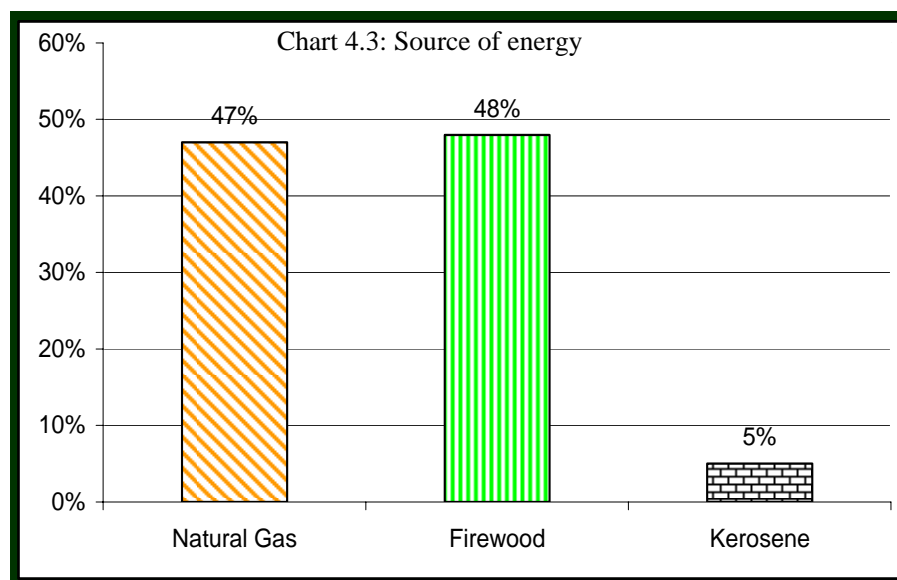
There are different income groups who use the same energy for cooking such as among the natural gas user 22.5% (income group3001-5000), 12.5% (income group 5001-7000), 7.5% (income group 7001-9000), and 5.5% (income group above 9000); Among the firewood user 1.5% (income group up to 3000), 32.5% (income group3001-5000), 12.5% (income group 5001-7000), 1.5% (income group 7001-9000. The average monthly expenditure for energy of firewood/ kerosene user is higher than the gas user but as they can not effort the connection charges they are bound to use the alternate of natural gas. It is found that the average per month expenditure of all households in Bauniabandh for energy is 330.05 taka.

> During the field survey the dwellers of the community informed that few years earlier DCC provided road sweeping and drain cleaning services but the service stopped suddenly.

Plate 4.7: Most of the roads are poorly managed in Bauniabandh. Households have encroached the road & drain

Plate 4.8: Many households use Gas as energy for cooking

Plate 4.9: In Bauniabandh there is still demand of wood as fuel

4.5 Functions of the study area

The total population of the study area is about 50000. For the study purposes 200 households were surveyed. The area was developed aiming for housing of the Rehabilitee with necessary infrastructure such as road, drain, tube-well as water supply, PIT latrine, space for mosque & school, open space, etc. 2568 plots were distributed for the dwellers. Many settler of the project have sold their plot to others and left the area. The main criteria of the area is residential, many others activities are taking place along with this such as handicraft business, salvage shops, small scale cap sewing, Schools, NGOs offices, Madrasha, Medicine shops, restaurants, Bazar, Wholesale shops of seasonal fruits such as Banana, Coconut, etc.

Plate 4.10: Children engaged in earning.

Table 4.4: Residential Status of the dwellers

Living status	Frequency	Percent
Own house	103	51.5
Tenant	91	45.5
Freehold	6	3.0
Total	200	100.0

Source: Field survey, September, 2008

The table above shows that 51.1% of the respondents are live in their own plot and 45.5% of the households are tenant. The tenant pays monthly rent along with pay for water and electricity bill. Many house has the gas connection, some landowners share their gas burner with the tenants for monthly charge fixed by the landowner. There are some households who live on the embankment on unauthorized plot. These land/ plots are illegally occupied by the musclemen of the area. The households who live in these plots not in free but comparatively lower rent than other sections of the study area. At the

freeholds there is no formal access road, drain, no electricity or illegal electricity connection.

The Chart shows that 79.5% of the households consisting of family member 4-6 persons, where as 15.5% has the member 7-9 persons per family. During the survey it is found that in the study area, about 50% households earning member(s) leaves for work in the morning within 8.30 a.m. Most of the households have more than one earning member. There are many options for earnings in the study area

Chart 4.4: Household size

among them *karchupi* is the most common where kid to aged person can be a worker.
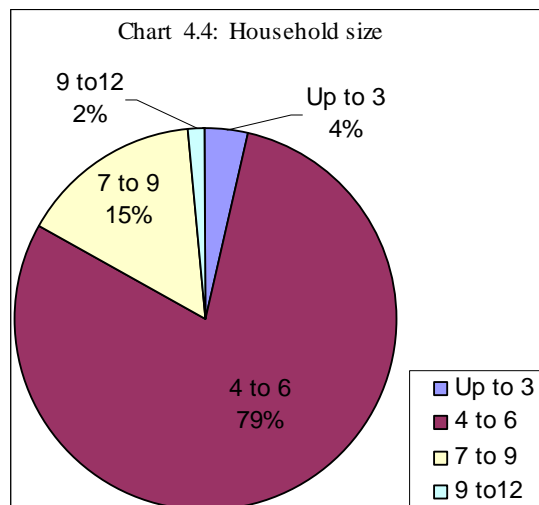
Table 4.5: Occupation of the household

Occupation of the household head	Frequency	Percentages
Day labor	8	4.00
Rickshaw/Van puller	11	5.50
Garment worker	19	9.50
Bus/ Truck driver	4	2.00
Transport worker	16	8.00
Industrial worker	15	7.50
Business	34	17.00
Mason	2	1.00
Vendor	14	7.00
Tailor	5	2.50
Mechanics	8	4.00
Private Service	12	6.00
Tempo/ taxi driver	11	5.50
Handicraft business	32	16.00
Overseas employee	5	2.50
CNG driver	1	0.50
Salvage	2	1.00
Grocery	1	0.50
Total	**200**	100

Source: Field survey, September, 2008.

The table (table-4.000) shows that 17.00 % of the household are engaged in different categories business, 16.00% are engaged in handicraft activities. In the study area

handicraft (karchupi) is a popular, low cost and available source of income. Children along with others are engaged in this activity. There are many garments, popular transport route (*Pallobi to Motijheel, Azimpur etc*), small & medium industry are located in *Mirpur-pallobi* area, so there is option of low paid worker, day labor. As a planned and well connected transport route, in recent years *Mirpur-pallobi* area has become a unique residential area for middle & higher-middle income groups. 8 % household heads are engaged in transport related work, 4% are mechanics in workshop, and 5.5% are tempo/taxi driver.

4.6 Income-expenditure pattern

The urban poor are mostly employed in self-managed low paid jobs in the informal urban sectors like rickshaw pulling, street vending and selling, construction work, driving and transport work, factory work and personal servicing etc. The rates of income, wage and productivity are very low among the urban poor. The condition of female-headed households is comparatively more miserable than male-headed households.

"Every member should earn to sustain" the main survival strategy of the urban poor. This is why female participation in the direct urban work force is considerably higher among the poor than among their rural area. Sometimes the female members use domestic spaces for income generating activities. This type of home based work is a manifestation of the urban poor women's involvement in the household production.

Chart 4.5: Income and expenditure of households
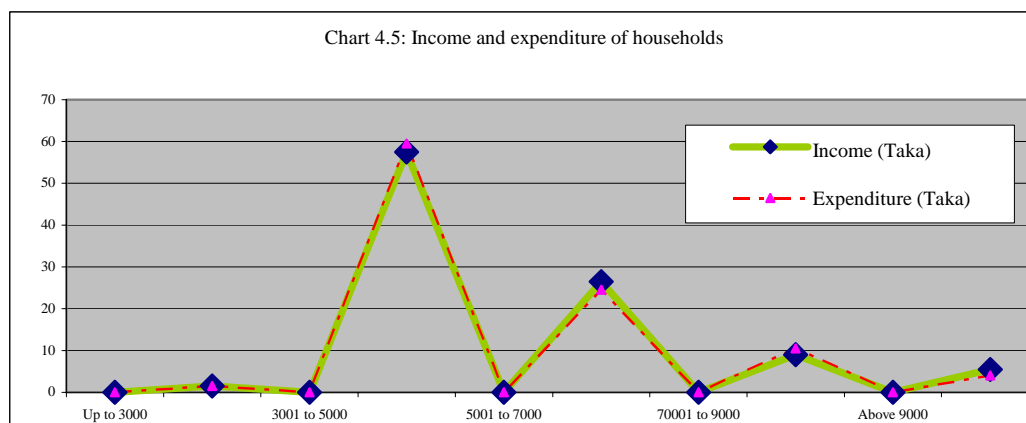
Source: Field survey, September, 2008

In the study area, 57.5% households are in the income range of 3001-5000 per month. The average monthly income taka 5629.00 (US $ 80.41) It is found that the poor households mostly spend their earnings to fulfill the basic needs like food (average

59

expenditure taka 4247.00) and shelter. Most of the households spend their total income within the month. Negligible percentage of the households merely can save a little portion of their family income. The poor households mostly purchase the food items like rice, pulse, potato, salt, oil, and vegetable. They buy bad quality fish from floating vendors or local market at low-cost. They can not effort expensive but necessary items like fruits, meat, milk etc. So malnutrition exists in most of the household, in spite of healthcare support from government and NGO agencies. The following table shows the data of the households on different expenditures.

"Poverty is defined in various absolute or relative terms. For example the intake of calories per person per day (2122 K.cal), income per person per day (Taka 50), and the ability to buy a minimum basket of goods and services for an acceptable standard of living. In the context of urban area poverty is reflected by the condition of shelter and services" (LGED, 2001). According to the quotation at least 1500 (50x30) taka is required per capita per month to fulfill the basic calorie needs of a person.

According to the above table 4.6, per capita monthly expenditure of 92% households of the study area are lower than taka 1500 (50 taka per day). It is also found that the average per capita monthly expenditure for food is taka 809, where minimum is taka 333 and maximum taka 1500. The food is the most basic item for human existence, what ever the price people by the food item more or less as per their affordability. Like others low income settlement, dwellers of the study area expanse major portions of their income used for purchasing the food items like rice, oil, salt, potato, pulses etc. From the collected data, it is also found that the average per person per day expenditure for food is taka 26.97 where minimum is taka 11.10 and maximum taka 50.00. The above table shows that only 5% households can expanse taka 40.01 to 50.00 for each member of family per day. Most of the households are within the limit of taka 40.00 per person per day for food expenses. As their income is low so they are below the poverty line, and live in malnutrition. The following table shows the relationship between number of family member and per capita monthly income.

Table 4.6: Family space with respect to family size

Family space (Sq.ft)	Family size (persons)				Total	Percentages
	Up to 3	4-6	7-9	9-12		
Up to 100	2	13	0	0	15	7.5
101-125	5	39	2	0	46	23
126-150	0	52	10	1	63	31.5
151-175	0	2	0	0	2	1
176-200	0	21	1	0	22	11
201-225	0	7	2	0	9	4.5
226-250	0	25	14	0	39	19.5
Above 400	0	0	4	0	4	2
Total	7	159	33	1	200	100
Percentages	3-5	79.5	16.5	0.5	100	

Source: Field survey, September, 2008

4.7 Conclusion

The study area is a planned resettlement for 2568 households but the present population of Bauniabandh is about 50000 with 5000households. The present population is beyond it was assumed in project planning. Some basic services (like electricity, water supply, gas etc) are provided by the respective authority, but many households still can not afford it. Presently, on average 3family live in a plot (450sq.ft). Among the surveyed households 51% family live in their own plot. Households are engaged in diversified economic activities for livelihood. Remarkable percentages are engaged in informal activities like vendor, salvage, day labor etc. Engaged in home-based handicraft and handicraft business is a popular means of earning where different aged group are engaged with low investment. About 79% households have family member in the range of 4-6. Average monthly income and expenditure is taka 5629.00 and 4247 respectively. On an average 75% of the family income spends for food items. The urban space is limited and scarce resource. In the study area 25% households have 20.1- 25.0 sq.ft per capita room space to live; only 9% households have per capita average room space more than 45sq.ft.

Chapter Five: Present Garbage Management System in Bauniabandh

5.1 Introduction

Bauniabandh is located under the ward no 5 of Dhaka City Corporation (DCC). Previously this area was a low land; the government has developed it under a rehabilitation project. As it is within the jurisdiction of DCC so it is the responsibility of the authority to provide the basic services to the dwellers of Bauniabandh. But, according to the dwellers complain, DCC does not collect the households garbage along with does not clean the drains that are most common and essential service for urban life. As DCC does not pay to ears, the community leaders have taken initiatives with the assistance of NGOs trying to collect the household garbage and dump it outside the area. The area is divided in 5(five) blocks and each block has separate CBO. 5(five) CBOs form combined the Community Development Federation (CDF) for the whole Bauniabandh. CDF works as local counterpart of working NGOs in area. NGOs working for better environment in the area like ARBAN, Dushosto Shasto Kendro (DSK), Plan Bangladesh etc initiated garbage management activities along with health & hygiene program in mid 90s. Previously ARBAN has tried to collect the garbage and charge for garbage management by deploying ARBAN staff to the area but they could not succeed as expected.

Now ARBAN working as facilitator and the local CBOs are working as service provider. ARBAN has provided 5(five) new Tri-cycle Van, basket, spade, scraper, broom, handcarts, for each CBO. The dimension of the tri-cycle van is 3′-0′′ X 2′-6′′X 2′-0′′. On average each van collects 4 (four) Van garbage each day. Each van can carry 0.530941m^3 garbage at a time; the total garbage generated daily is approximately 15.6974 m^3 or 7.22 ton per day [1 m^3 garbage equals to 460 kg]. CBO has deployed two persons with each tri-cycle van for collection of households' garbage. ARBAN, DSK and Plan Bangladesh had organized many training program on different issue of garbage management, clean & healthy household environment, health & hygiene education, healthcare for the community people to make them aware. The owners of commercial establishments (like shops, restaurants, bazaar, etc) of the study area are depended on dump garbage by their own initiative.

5.2 Garbage generation

The amount of garbage generated in each household different in weight. The major component of the waste is food waste.

Table 5.1: Generation of garbage per day per household

Amount of garbage per day	Frequency	Percent
Up to half kg	78	39.0
0.5 to 1 Kg	89	44.5
1- 2 Kg	33	16.5
Total	200	100.0

Source: Field survey, September, 2008

In the study 39.0% households generate less than half kg of garbage per day, 44.5% households generate 0.5 to 1.0 kg of garbage per day and the rest 1.0-2.0 kg of garbage per day. The garbage is usually stored within the house before it disposes to the garbage collection van.
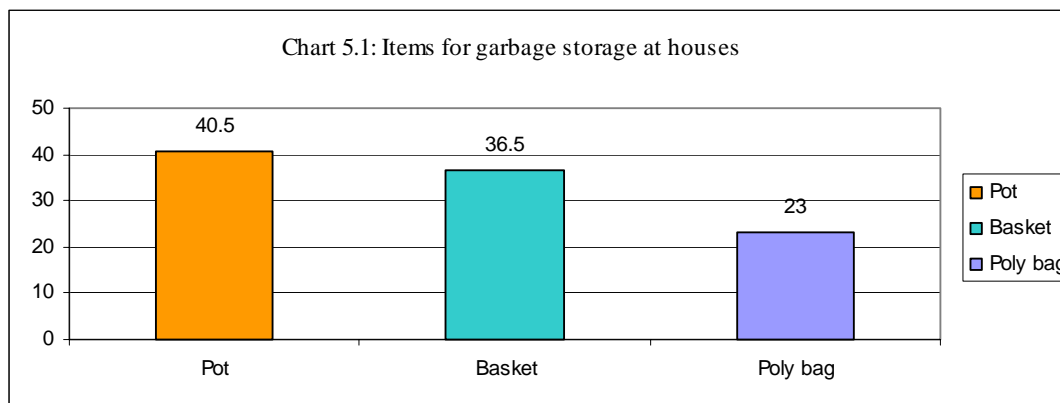
Source: Field survey, September, 2008

Among the households 40.5% use pot made of plastic or clay for the purpose of store the garbage at house before dispose. Though production & use of poly-bag is banned in the country, but it is available in the kitchen market to small & medium shops and used by the common people. 23% households use poly bag to store garbage in house before dispose.

5.3 Garbage collection

The CBO managed garbage collection van is deployed in each block of the study area. Each van is operated by two garbage collectors. The garbage collector uses whistle to aware the households to dispose their household & kitchen garbage to the van. The tricycle van stands on the secondary or primary road as it can not move at the narrow access road (3′ wide). Sometimes collectors carry garbage from the households in a collection

bucket. The garbage collection vans cover the whole area from 8.0 am to 1.0 pm and six (6) days in a week.

Table 5.2: Garbage collection time of the study area

Time of collection	Frequency	Percent	Cumulative percentages
8 am -9 am	36	18.0	20.0
9 am - 10 am	47	23.5	43.5
10 am -11 am	30	15.0	58.5
11 am - 12 pm	27	13.5	72.0
12 pm- 1 pm	56	28.0	100.0
No Fixed time	4	2.0	2.0
Total	200	100.0	

Source: Field survey, September, 2008

The garbage collectors go lane to lane and use whistle to collect garbage. When a van is full they dump it to the local dumping site and they starts again it is found that each van collects five van of garbage daily. As per the above table 18.0% households covered by in the first slot of time 8.0 am -9.0 am. 23.5% households dispose their garbage to the van from 9.0am -10.0 am. During the survey it is found that households are use to with the usual collection time but many of them do not support the existing collection hours. They said that those who are covered in the early hours of garbage collection van try to work on those items first from which garbage is generated like fish, vegetable etc.

Chart 5.2: Households opinion regarding garbage collection time

17%

32.5%

50.5%

- YES
- NO
- No response

source: Field survey, September, 2008
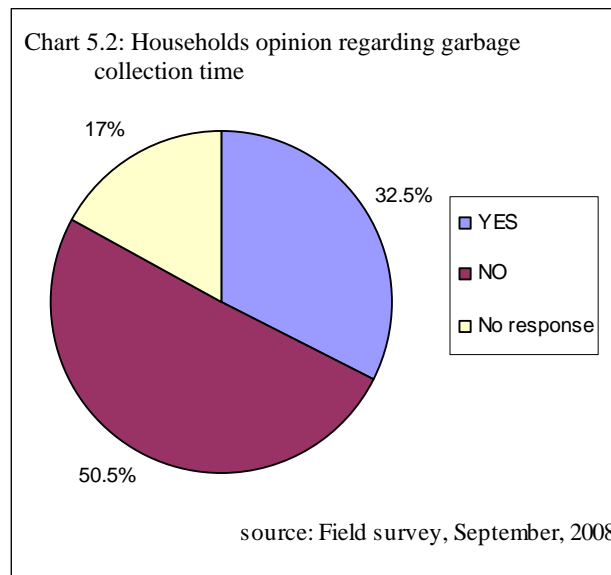
Among the households 32.5% support the existing time of collection, on the other hand 50.5% households do not support the existing time of garbage collection.

In the study many households preferred early morning for disposing the garbage as they leave for work in the morning. Some households preferred noon (2.0 pm- 3.0 pm) as they complete their cooking at noon. Some households prefer evening (5.0 pm- 6.0 pm) as they cook after returning from work.

Table 5.3: Households preference of time for garbage collection

Preferred Time	Frequency	Percent
8 am- 9 am	12	6.0
9 am- 10 am	16	8.0
10 am- 11 am	5	2.5
12 pm - 1 pm	31	15.5
2 pm - 3 pm	11	5.5
3 pm - 4 pm	52	26.0
4 pm - 5 pm	47	23.5
5 pm - 6 pm	21	10.5
No response	5	2.5
Total	200	100.0

Source: Field survey, September, 2008

Among the households 23.5% preferred 4 pm - 5 pm as the garbage collection where as 26.0% preferred 3.0pm-4.0, 15.5% preferred 12.opm-1.0 pm as perfect time for collecting households' garbage.

Households agreed that it is not possible for a single van to reach the households as their preferred time. If garbage is generated after the collection is over by the van, the households have to dispose the garbage in the local dumping site by themselves or have to store in the house up to the next day. Some households find the easiest way that is they dispose garbage in the road, drain or open space.

The chart 6.3 shows that most of the households (60.5%) can dispose the garbage in time and they need not to store garbage in house. On the other hand 16.5% households (those who cook in the afternoon or evening) can not cope properly with the garbage collection time of their area.

Chart 5.3: Time of garbage storage before dispose

65
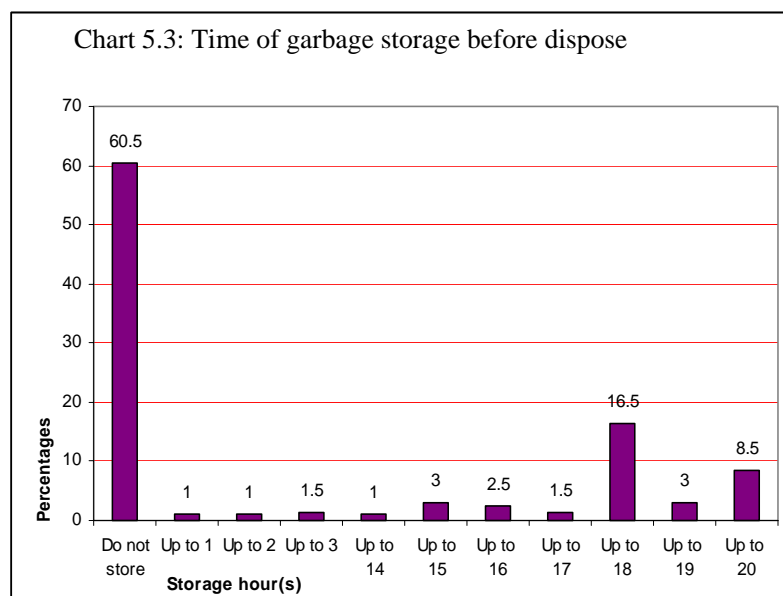
5.4 Garbage collection charge

The CBO collect the nominal charge that was fixed in a meeting of the CDF, CBO & Facilitator jointly. In the study area the dumping side is located outside of the Bauniabandh embankment adjacent to block D & E. Block C is comparatively far from the dumping side considering other 4(four) blocks (A, B, C&D). For this reason garbage collection charge per household at block "C" taka 7.00 where as charge at other 4(four) block is taka 5 per household. Previously at "C" block garbage collection & dumping charge was taka 5 equal to other block. The following table shows the data of surveyed households on charge paid by the dwellers of Bauniabandh.

Table 5.4: Garbage management charge paid by the households

Charge paid (Taka)	Charge paid for garbage collection						Total	
	Do not pay regularly	Sufficient	Moderate	Low	Very low	Do not pay	N	%
0	4	0	0	0	0	34	38	19.0
5	0	28	20	5	4	0	57	28.5
7	0	2	6	0	2	0	10	5.0
15	0	73	6	0	0	0	79	39.5
20	0	13	3	0	0	0	16	8.0
Total	4	116	35	5	6	34	200	100.0

Source: Field survey, September, 2008

There are many opinions regarding the existing garbage management services by the CBOs of Bauniabandh. Many households argued that the service is not satisfactory so that they do not pay. Some households said especially from block D &E that the dumping is just behind their houses, so the offensive odor blows from the side and it is very unhealthy also. So they do not pay regularly. The garbage management committee considers each plot (450sq.ft) as three family and the landowners is responsible to collect the charge from the tenants. But the landowners rarely do the task. The CBO member collects the charge from door to door. Usually per family charge is taka 5-7 but when landowners pay the charge he claimed that he paying taka 15 -20 for his house (plot). According to the above table 39.5% households pays taka 15 for garbage management and they expressed that the charge are paid is sufficient (36.5%), Moderate (3%). Among those households who paid charge taka 5 per month 28.5%, expressed that the charge is sufficient (14%) with respect to the service quality and moderate (10%). Among the surveyed households it is found that 17% do not pay the charge and 2% pays regularly.

Better service is desired by the dwellers but many of them can not afford it. They realize that the service charges they pay are not sufficient for maintenance the existing service. They hope for the cooperation of DCC for removing the garbage from the local dumping site.

Table 5.5: Present charge and preferred charge for garbage management

Preferred charge	Present charge paid for garbage disposal (Taka)					Total	
	0	5	7	15	20	N	%
0 Taka	4	0	0	0	0	4	2.0
Up to 5 Taka	0	2	1	0	0	3	1.5
5-7 taka	24	41	4	0	0	69	34.5
7-10 taka	9	14	4	5	5	37	18.5
10-15 taka	1	0	1	39	4	45	22.5
15-20 taka	0	0	0	35	7	42	21.0
Total	N	38	57	10	79	16	200	
	%	19.0	28.5	5.0	39.5	8.0		

Source: Field survey, September, 2008

There are many opinions regarding the appropriate charge for the existing garbage management services. Among the surveyed households 34.5% express that the charge

Chart 5.4: Preferred charge by the households of Bauniabad
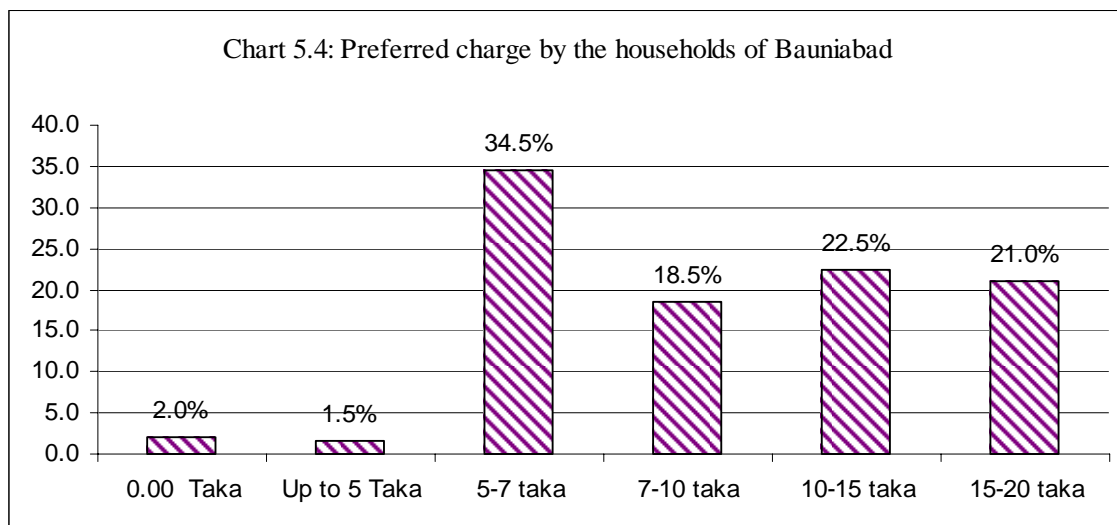
could be 5-7 taka per month, 18.5% preferred charge 7-10 taka, 22.5 % preferred charge 10-15 taka and the rest 21% agreed for taka 15-20 taka. Among the 18.5% who preferred charge 7-10 taka, 4.5% presently do not pay, 7% pays taka 5, 2% pays taka 7, 5% pays taka 15-20 per month. Among the 34.5% who preferred charge 5-7 taka, 12.0% presently do not pay, 20.5% pays taka 5, 2% pays taka 7 per month. Among the 22.5% who preferred charge taka 10-15 taka,0.5% presently do not pay, 0.5% pays taka 7, 19.5% pays taka 15, and 2 % pays taka 20 per month.

There are different arguments among the dwellers regarding the appropriate charge for the existing garbage management system of Bauniabandh. Many households do not support the system but agreed to pay more than the present charge if the service quality is satisfactory.

Table 5.6: Present charge and preferred charge for garbage management

Preferred charge (Taka)		Charge paid for garbage collection						Total
		Do not pay regularly	Sufficient	Moderate	Low	Very low	Do not pay	
0 Taka		4	0	0	0	0	0	4
Up to 5 taka		0	0	3	0	0	0	3
5-7 taka		0	25	12	3	5	24	69
7-10 taka		0	12	13	2	1	9	37
10-15 taka		0	40	4	0	0	1	45
15-20 taka		0	39	3	0	0	0	42
Total	N	4	116	35	5	6	34	200
	%	2.0	58.0%	17.5	2.5	3.0	17.0	100

Source: Field survey, September, 2008

Among the households 19% either do not pay the charge or pays irregularly. It refers that the existing service can not satisfy the all of its stakeholders. 58.0% of the households claim that the charges that are paid by them are sufficient for the existing quality of garbage management service. 17.5% thinks the charge is moderate and 4% think it is low or very low.

Chart 5.5: Dwellers opinion regarding the charge

In the study area, CBO managed garbage management service is provided and they collect the households & kitchen wastes. The owner of commercial or other establishments have to dispose the garbage by self arrangement. As it is found that the per capita expanse in the study area is very low, so the expenditure is low then consumption is low that generate low garbage.

Garbage management practice in Bauniabandh, where the CBO collect the garbage from the households but the secondary waste collection by DCC is missing.
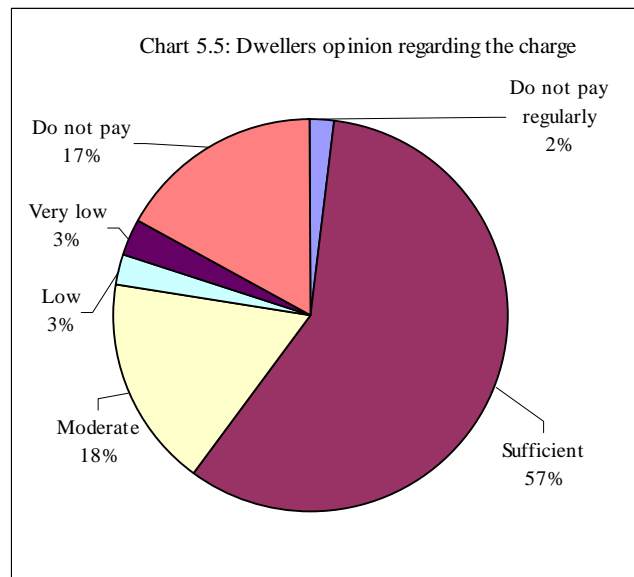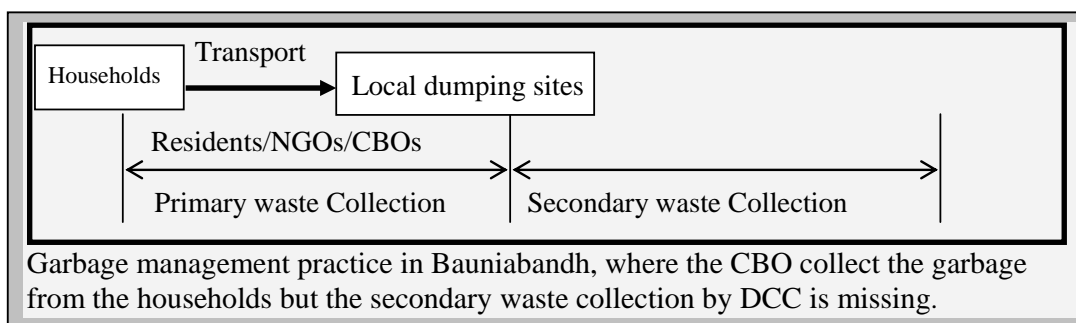
5.5 Garbage dispose

At Bauniabandh there are many households who still do not support the existing garbage management system. They have strong reason behind it also. According to their opinion garbage should be dump outside the area from where DCC will collect the garbage and the offensive odor of garbage will not blow to the community. They also argued that the drain cleaning should be incorporated with the garbage management system. Some of them expressed that they agree to pay more then the present, if garbage is properly dump. In the study area garbage are disposed at four (4) different spot of the Bauniabandh embankment. Among these 4 spot one is large approximately 40feet X 40feet X 20feet, other three are small approximately 25feet X 12feet X 15feet. These spots are not demarcated with any line. So the area is increasing toward the water bodies.

The households are encouraged to dispose the garbage into the garbage collection van or to the local dumping site. Some households still throw the garbage to the open space, drain or road. The following table shows the primary disposal of household garbage.

Table 5.7: Households primary garbage disposal

Education level of the family head		Garbage Disposed				Total
		CBO Tri-cycle Van	Local dumping site	Open space	On street	
Illiterate		33	9	3	0	45
Primary		90	23	1	3	117
High school		22	0	0	0	22
S.S.C		16	0	0	0	16
Total	N	161	32	4	3	200
	%	80.5	16.0	2.0	1.5	

Source: Field survey, September, 2008

Above table shows that 80.5% households dispose their garbage in to the collection van, 16.0% dispose their garbage to the local dumping site by self effort, 3.5% dispose their garbage in to drain, open space or street, etc.

The existing garbage management system of Bauniabandh is covers only the household garbage, but road sweeping and cleaning the drain is also associated with the clean & healthy environment. Major portion of households are aware due to the joint effort of the NGOs & CBOs. NGOs organized different training program for the community people. They also disseminate the health education message through the school sanitation, health and hygiene education. The following table shows the dwellers perception regarding existing garbage management system.

Table 5.8: Community position regarding present garbage management system

Education level of the family head		Support existing garbage management system			Total
		YES	NO	No response	
Illiterate		33	6	6	45
Primary		92	18	7	117
High school		20	2	0	22
S.S.C		16	0	0	16
Total	N	161	26	13	200
	%	80.5	13.0	6.5	

Source: Field survey, September, 2008

Among the households 80.5% support the existing garbage management practices of Bauniabandh where ever 6.5% did not comments on the issue. During the survey it is found that the community demand for the regular cleaning the drains. They expressed that if primary (3´wide) & secondary (1´-6´´wide) drains are not cleared before the monsoon, the drain water will overflow and it will decrease the environmental condition. They have introduced an approach for cleaning the tertiary (10´´wide) drains. There are wide collection drains (wide 5to 10feet) the primary and secondary drains are runoff. The collection drains are runoff into wetland .By this system each households of every lane (Access road) have to clean the drain by rotation. Households push the garbage of drain up to the secondary drain. But secondary & primary drains are not cleared by NGOs, CBOs, DWASA or DCC. The community development federation (CDF) urge for assistance both financial & logistics for cleaning the primary & secondary drains. CDF participate in finance by percentage.

5.6 Conclusion

The present garbage management situation of Bauniabandh is better than many other low income settlement of the city. In Bauniabandh NGO assisted garbage management system is under operation for collection, transport and dispose. In the study area 7.22 tons household garbage are generated per day, where 44.5% households generate 0.5-1.00 kg waste per day. Though poly bag is banned, 23% households use poly bag for house level storage of garbage. Garbage collection vans usually collect garbage from 8.00 am to 1.00 pm but 50.5% households do not agreed with the present timing. About 26% of households preferred time 3.00-4.00 pm for garbage collection. In the present if the households want to dispose the garbage in to the collection van, 18.5% households have to store the garbage up to 18 hours before dispose. 39.5% households pay Taka 15 per month for garbage management service, it include three family in a house. 58% households expressed that the present charge for garbage management is sufficient with respect to the service. About 17% of households do not pay the charge. For better service 22.5% of households said the charge could be Taka 10-15 per month. 80% of households support the existing garbage management initiative in Bauniabandh.

The existing garbage management practice of Bauniabandh is an isolation effort without linkage with the city authority. The primary waste collection (House to house collection) is working well but the secondary waste collection (collection and transport by DCC) is absent. So the system has become isolation from the mainstream of the city. The primary waste collection is successful but not sustainable. The system has to be linked with DCC's waste collection system like other part of the city where the DCC collects garbage from local disposing site/ container/ dustbin etc.

Chapter Six: Analysis of community's access and participation

6.1 Introduction

The existing garbage management system is the outcome of the community urge for better living environment. Community dwellers are engaged from the starting of the garbage management activities at Bauniabandh as stated by the community leaders. In garbage management NGOs are supporting the system as facilitator. The community people organized the Environmental Group/ Committee for each block. These groups are provided training by working NGOs (DSK, ARBAN, PLAN-Bangladesh) regarding environmental issues as well as the health & hygiene issues. Professional trainer was hired by the NGOs for conducting training at training centre as well as in the community. The participants were selected by the community leaders where the participation of different occupational, women, students, CBO member, adolescents, religious leaders, teachers of local schools, member of youth group were ensured.

The trained members worked as counterpart of NGOs in the community. They arranged different awareness activities like rally, leaflets, meeting before lunching the garbage management program. In each block there is a committee for supervised and maintain the activity of garbage collector & van. Each committee consist 18-20 members who are selected on the basis of self motivated persons, Technical persons (like teachers, health-worker, religious leaders, women), CDF representative.

6.2 Participation in garbage management meeting

The garbage management committee of the committee meets in monthly meeting on fixed date, day and time. Moreover to ensure the participation a written notice of the meeting circulated through notice book. The non-committee member community dwellers are welcomed in the meeting if they are interested. Non-EC member can be informed date of meeting from the EC member. In the meeting the non- EC member can raise issue

Chart 6.1: Participation in meeting

No response 1%
NO 37%
YES 62%
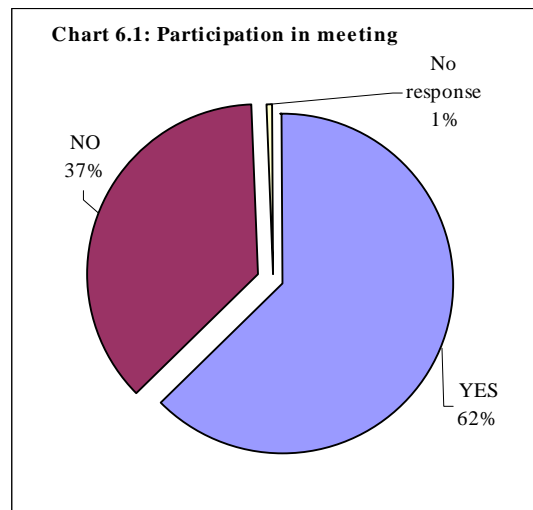
regarding the garbage management problems complain and demands. They can also participate in the decision making also. The chart 8.1 shows percentages of households participated in meeting in garbage management related meeting.

According to the chart (6.1) member(s) of 37% households never participated in meeting regarding garbage management. On the other hand member(s) of 62% households tried to participate in meeting.

6.2.1 Households participation and educational level

The participation in social services related activities required willingness to work for the betterment of the society is associated with consciousness. The executive committee is responsible to supervised the overall garbage collection system in each block, fixation and review the charge, collection of monthly charge, maintain accounts, repair and maintenance of the logistics including the Van. The awareness is raised from level of education and on the ability to adopt with new idea/ theme. The person having education will be more aware than non-educated person.

Table: 6.1: Participation in garbage management related meeting with respect to educational level of household-head

Education level of the family head		No. of meeting attended			
		No Meeting	1 Meeting	2 Meetings	3 Meetings
Illiterate		20	23	2	0
Primary		48	46	14	9
High school		5	12	3	2
S.S.C		4	3	7	2
Total	N	77	84	26	13
	%	37.5	42.0	13.0	6.5%

Source: Field survey, September, 2008

The monthly meeting of garbage management committee is almost open for all of the community. In the meeting general participants can raise any issue regarding the service quality, effectiveness, lacking of the services, problems etc. According to the above table member of 42.0% households attended at least 1(one) meeting, 13.0% households attended 2 meetings, 6.5% attended 3 meetings where as member of 37.5% households never attended in any meeting regarding garbage management. Regarding attendance at the meeting households informed that the meeting is usually held in working hour that's why they can not participate regularly though they feel interest & responsibility.

6.2.2 Residential status and participation

The landowners have strong say in the welfare and living environment of the community. They have better access than the tenants. It is found that landowners are positively engaged with different NGO activities. They try to help as much as possible if the activities are for the wellbeing of the community. It is found that there is strong presentation of the landowners in CDF. The tenants are not regular in these types of activities as they spend their major time for ensuring livelihood. The following table shows the participation in the meeting of garbage management.

Table 6.2: Residential status with respect to number of meeting attended

No of meeting attended	Residential status					
	Landowner		Tenant		Freeholds	
	N	%	N	%	N	%
No Meeting	16	8	**55**	**27.5**	6	3
1 Meeting	53	26.5	31	15.5	0	0
2 Meetings	21	10.5	5	2.5	0	0
3 Meetings	13	6.5	0	0	0	0
Total	103	51.5	91	45.5	6	3

Source: Field survey, September, 2008

According to the above table, among the landowners 43.5% (87) have participated in meetings (1-3 meetings) related to garbage management; 45.5% households of the study area are tenant, 18.0% tenants have participated in meetings (1-3 meetings)where as 27.5% tenants did not participate in any meeting and the freeholds followed them.

6.2.3 Households income and participation

Income is related with the participation low income people have low participation in social service related issue, because they can not manage time in the working hour. So there is a relation regarding meeting participation and income group.

Table 6.3: Meeting attendance with respect to income group

No of meeting attended	Income group				
	Up to 3000	3001-5000	5001-7000	7001-9000	Above 9000
No Meeting	3	51	23	0	0
1 Meeting	0	**52**	**19**	**8**	5
2 Meetings	0	9	7	8	2
3 Meetings	0	3	4	2	4
Total	3	115	53	18	11

Source: Field survey, September, 2008

The above table shows that only 1(one) meeting attended households is the highest in percentages. The participation lost their interest as it directly non-productive. The participation of meeting informed that many people do not feel their own responsibility for community welfare. They think that the CDF/ CBO are enough to run the task. On the other hand CDF/CBO asked the facilitator to organize more awareness rising activities to attract the people and to be encouraged.

6.2.4 Occupational status and participation

Different types of occupational households live in a community, so they are different in social life also. The working hour of a rickshaw / van puller is different than a school teacher or tailor. Transport worker is different then industrial / garments worker. It is found that a rickshaw puller can work for half day (8hours) from 6am to 2 pm. So when a rickshaw puller come back from his days work then other rickshaw puller use the same rickshaw for the rest of the day 2pm to mid night. Other categories of transport worker like Scooter drivers (CNG driver), bus driver & helpers work from morning to mid night continuously. Sometimes they work on alternate day. So, the earning members of every household are very busy to ensure livelihood for family. The following table shows the occupational status of participation of meeting.

Table 6.4: Meeting attendance with respect to occupation of household head

Occupation	No of meeting attended				Total
	No Meeting	1 Meeting	2 Meetings	3 Meetings	
Day labor	6	2	0	0	8
Rickshaw/Van puller	6	5	0	0	11
Garment worker	11	6	2	0	19
Bus/ Truck driver	2	2	0	0	4
Transport worker	7	7	2	0	16
Industrial worker	7	6	2	0	15
Business	9	**11**	**6**	**8**	**34**
Mason	0	2	0	0	2
Vendor	3	9	0	2	14
Tailor	5	0	0	0	5
Mechanics	7	1	0	0	8
Private Service	2	3	7	0	12
Tempo/ taxi driver	2	9	0	0	11
Handicraft business	10	15	6	1	32
Overseas employee	0	3	0	2	5
CNG driver	0	1	0	0	1
Salvage	0	2	0	0	2
Grocery	0	0	1	0	1
Total	77	84	26	13	200

Source: Field survey, September, 2008

The above table-6.4, shows that all occupational have common access to the garbage management system in terms of service and also in the meetings where the garbage management system is coordinated and supervised. According to the table business occupational have a strong presence in the meeting.

6.3 Participation status

In the meeting, all participations are welcomed to raise demands, suggestions or complain. In the meeting the floor is open for the participation to discuss, argue and decision making. The following table shows the data of form of participation by the households with respect to residential status.

Table 6.5: Form of meeting participation with respect to residential status

No. of meeting attended		Residential status			Total
		Landowner	Tenant	Freeholds	
Present as audience		1	3	0	4
Participate in discussion		17	16	0	33
Raised issue regarding need/ demand		53	17	0	70
Participate in decision making		17	0	0	17
No response (non-participant)		15	55	6	76
Total	N	103	91	6	200
	%	51.5	45.5	3.0	

Source: Field survey, September, 2008

Among the households above 60% have participation in meeting. But only 8.5% can participate in decision making where as 35% have raised their demands regarding garbage management. The above data indicates that there is a strong influence of landowners on decision making. The committee member said that the tenants are always on move, in every month many tenant households shift their resident from the Bauniabandh to other slum; on the other hand many households become new tenants of Bauniabandh. As a result the continuous participation from the tenant households is not possible. As a result the CDF/CBO/ committees are influenced by the landowners or tenants living in Bauniabandh for long time.

| Plate 6.1 : Households participation in the meeting (date 07/08/2007), *Source ARBAN* | Plate 6.2 : Households participation in the training/ meeting (date 28/06/2007), *Source ARBAN* |

| Plate 6.3 : Community participation in awareness raising rally (date 30/07/2007), *Source ARBAN* | Plate 6.4 : Community participation in awareness raising rally (date 17/06/2007), *Source ARBAN* |

| Plate 6.5 : Community participation in garbage management training (date 30/07/2007), *Source ARBAN* | Plate 6.6 : Community participation in garbage management training (date 30/07/2007), *Source ARBAN* |

Plate 6.7 : Practical instruction for construction of sanitary latrine, (date 07/08/2007), *Source ARBAN*

Plate 6.8 : Practical instruction for construction of sanitary latrine, (date 07/08/2007), *Source ARBAN*

Plate 6.9 : Community participation in training urban flooding(date 10/02/2008), *Source ARBAN*

Plate 6.10 : Activities for clean environment and plantation , (date 4/07/2007), *Source ARBAN*

Plate 6.11 : Activities for clean environment and plantation, (date 27/08/2007), *Source ARBAN*

6.4 Motivational activities for awareness rising

On an average 62% households have positive response toward the garbage management system as they have participated in different meetings. Different types of motivational activities have taken place from house to house communication, Focus Group Discussion (FGD), Yard meeting, rally, day observance (like-world environment day, world health day, immunization day, education day, international women's day, sanitation week / month etc.) observance, workshop, training at community level, parents meeting at school etc all these awareness raising activates are randomly

Chart 6.2 : Source of motivation

No response 12%

Motivated by NGO 40%

Through CA Activities 39%

Personal feelings 9%
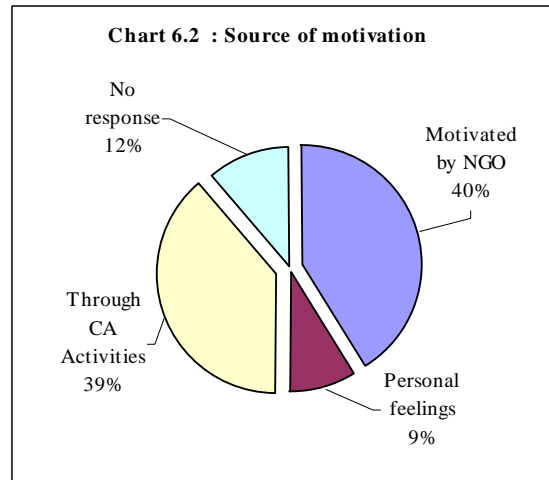
took place by different NGOs in Bauniabandh. So it is possible that same households can be direct stakeholder of different NGO. During the survey households response on their source of motivation through which they become aware. Awareness does not rise in a day, the social worker, CBO member, NGO worker have to work together to motivate community dwellers for participating. The chart 8.2 show that 39% of the community people have become aware by the community awareness activities of NGOs they try to realize the message given by the NGO activities. They expressed that better garbage management have increased the environmental condition of Bauniabandh. Previously they even could not walk on the access road comfortably what is possible now. 40% of households become aware because door to door intensive communication of NGO activist. 9% households feel for the better management of garbage generated in the community. They can realize the risk of continuous degradation of living environment of the community.

6.4.1 Service charge for garbage management and motivation

Every service has a cost more or less. The garbage management service has a cost also. The NGOs as facilitator have provided the logistic support but the CBO has to manage the payment for the deployed persons, regular maintenance of vehicle and others. All these expenditure could not be bared by the NGO or CBO. The community has to be able to

maintain the services by themselves. It is clear to the CBO that the NGOs will show the path but the community has to walk on it. The community also has to maintain it. The following table shows the data of awareness for paying the charge for garbage management.

Table 6.6: Source of motivation of households for paying charge with respect to Educational level of household head

Educational level of household head		Motivated by					Total
		Do not pay	Motivated by NGO	Motivated by CDF	Community Environment Committee	Self Realization	
Illiterate		14	4	21	6	0	45
Primary		24	28	46	13	6	117
High school		0	7	11	2	2	22
S.S.C		0	7	6	3	0	16
Total	N	38	46	84	24	8	200
	%	19.0	23.0	42.0	12.0	4.0	

Source: Field survey, September, 2008

The NGOs organized meetings for ensuring the community participation in garbage management system through involving in management committee and practicing garbage disposal into the community garbage collection van. The NGOs, CDF & CBOs jointly/ separately tried to motivate community people to participate in cost sharing. It is difficult to identify who is motivated by which activity/ organization. The table above is on the basis of the responded preference/ answer of field survey. The NGOs primarily organized Community Environment Group (CEG) to work intensively at the field level. According to the above table 19.0% households still do not pay the charge for garbage management; the garbage management committee could not motivate them, 23% households are encouraged by NGO for paying the charge, 42% households are encouraged by CDF for paying the charge, 4% households replied that they can realize the positive effect of proper garbage management and they willing pay the charge. The primary level educated households have strong participation in each category.

6.4.2 Residential status and motivation for paying service charge

The landowners are the highest percentages of the community. Most of the house has one or more tenant. If landowners do not pay it refers respective tenants also do not pay the charge. If a tenant does not pay the charge regularly & shift the area it is possible that

there may be some dues. The management committee informed some cases like that. For this reason the garbage management committee suggested the landowners should collect the charge from their tenants and pay to the committee. The following table shows the data regarding motivation of the households with respect to residential status.

Table 6.7: Source of motivation of households for paying charge with respect to Residential status of household

Residential status		Motivated by					Total
		Do not pay	Motivated by NGO	Motivated by CDF	Community Environment Committee	Self Realization	
Landowners		10	34	47	8	4	103
Tenant		22	12	37	16	4	91
Freehold		6	0	0	0	0	6
Total	N	38	46	84	24	8	200
	%	19.0	23.0	42.0	12.0	4.0	

Source: Field survey, September, 2008

According to the above table, the landowners are mostly motivated by the CDF. During the field survey the NGO informed that it is not easy to motivate the landowners to pay. As landowners have strong say in the community, so the assistance of CDF was very effective and essential for motivating them. In the study area, 51.5% households live in their own house; among the landowners 5% do not pay charge, 17% encouraged by NGO for paying charge, 2% are self realized persons, 4% motivated by environment committee where as 23.5% of households major portion of this category motivated by CDF. On the other hand, among the 45.5% tenants, 11% do not pay charges, 6% encouraged by NGO for paying charge, 2% are self realized persons, 8% motivated by environment groups; 18.5% of tenants motivated by CDF. It is found that the average income of tenants is lower than landowners. For all households of the study area, a common attitude is found that is dwellers want social services free of cost or even expect to get some money from the services provider. For example, in training program the participants get convinces. A handsome amount is for a day. In case of paying charge, many people try to bypass the charge or not spontaneous though the charge is nominal and the providers do not make any profit.

6.4.3 Households income and motivation for paying service charge

The income is a factor for providing services at the low income settlements. It not so easy task to ensure financial participation for the service by the community. It is found that

many services become ineffective due to lack of proper maintenance. A common excuse of the community is low income though it is true but the minimum charge is affordable by the community. It requires proper awareness of the community for whom the services is provided. The facilitator has to ensure the belongings of the community to the services. If the community partnership is ensured then the service will be sustainable.

Table 6.8: Source of motivation of households for paying charge with respect to family income

| Income range | Motivated by | | | | | Total |
	Do not pay	Motivated by NGO	Motivated by CDF	Community Environment committee	Self Realization	
up to 3000	1	0	0	2	0	3
3001-5000	23	26	**51**	13	2	115
5001-7000	13	13	**16**	9	2	53
7001-9000	1	2	11	0	4	18
Above 9000	0	5	6	0	0	11
Total	38	46	84	24	8	200

Source: Field survey, September, 2008

For the purpose of this study, the income of the households of the Bauniabandh has categorized in five groups. The major households are from the income group of 3000-5000 & 5001-7000. Many people did not agree with payment of garbage management charge as they are poor. As per the above table 42% households are motivated by the CDF for participating in the charge; among this category 25.5% households' income in the range of 3001-500 per month, other households of this income group are motivated by NGO(13%), environment group (6.5%) where as 11.5% do not pay the charge.

6.5 Evaluation of existing garbage management service

The existing garbage management system can not fulfill the total demand of the community due to lack of logistic support and the financial condition. In the other part of the city the community based organization (CBOs) working as assistant of the DCC. Where as the DCC is working to collect and final
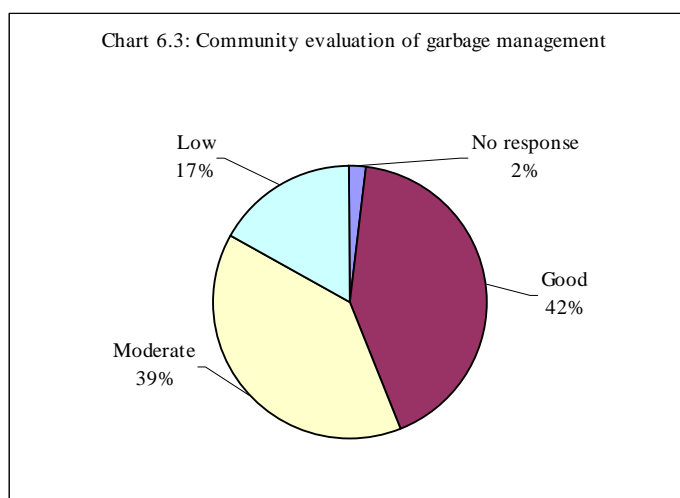
Chart 6.3: Community evaluation of garbage management

Low 17%

No response 2%

Good 42%

Moderate 39%

dispose/ dumping the garbage at DCC dumping sites. But in Bauniabandh the garbage management is limited with the community effort only, the DCC does not collect the garbage from the local community disposition site.

The Chart 6.3 shows that the community response regarding the evaluation of the existing garbage management initiatives at Bauniabandh. Among the responded 42% marked that the garbage management system is good. 39% marked as the service is moderately good and 17% said the service quality is low/poor. During the survey many households said that the service charges they paid for garbage management is not sufficient for the better service then the present.

In Bauniabandh the community initiative for garbage management is often questioned regarding its effectiveness in environmental up-gradation as the present system polluting the low land surface and ground water, air directly. According to the information of the community dwellers the inner condition of Bauniabandh slum is comparatively better then earlier hazardous situation due to lack of any garbage management system.

The following chart shows the response (multiple response set) of the responded regarding the problems of existing garbage management system of Bauniabandh.

Chart 6.4: Major problems of present garbage management
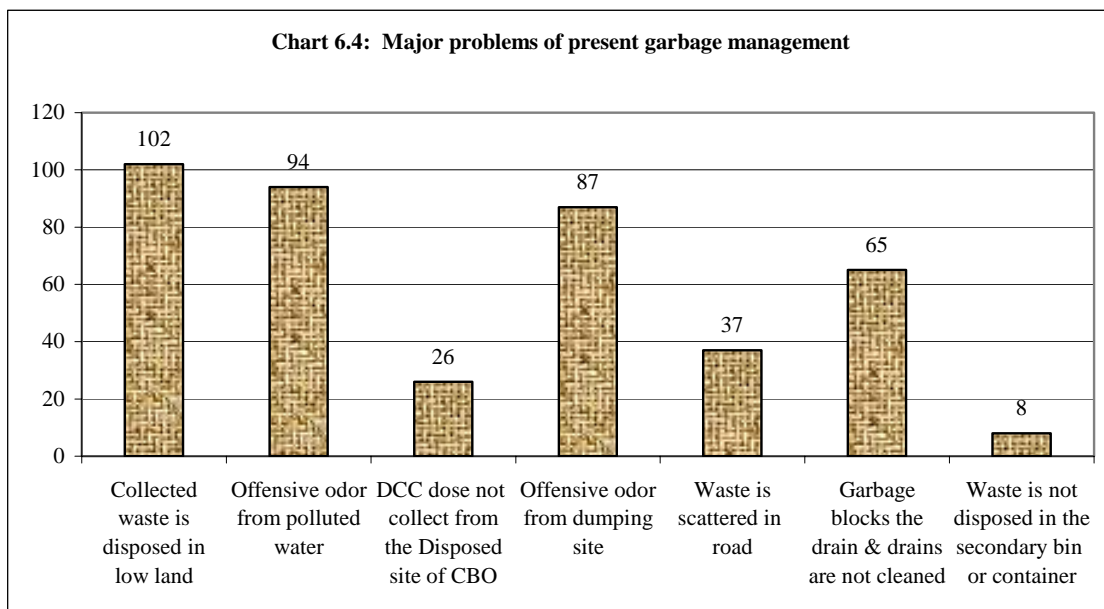
According to the above chart, the community identified seven major lacking or problems of the existing garbage management system of Bauniabandh that is managed by the CBOs with the primary logistic support of NGOs. The community identified the dumping of garbage into the low land as the top of the problems. Other problems are shown below-

Table 6.9: Major problems of the present garbage management practice of Bauniabandh

Major lacking or problems	Response	Position
Collected waste is disposed in low land	102	1
Offensive odor from polluted water	94	2
Offensive odor from dumping site	87	3
Garbage blocks the drain & drains are not cleaned	65	4
Waste is scattered in road	37	5
DCC dose not collect from the Disposed site of CBO	26	6
Waste is not disposed in the secondary bin or container	8	7

Source: Field survey, September, 2008

6.6 Conclusion

The service is for every households of Bauniabandh. All households have equal access to the service but some households are not interested for taking the service. To encourage the people the management committee has formed by the community leaders and the common people. The dwellers have open access to the management committee as executive committee member and also as meeting participant. The participation is associated with the awareness and motivation. Different motivational activities such as group formation, training, rally, environment cleaning activities, day observance etc took place in Bauniabandh.

It is described that about 60% households have more or less participation in the present garbage management system. They have participated in awareness raising activities. It is found that primary educated persons have optimistic participation, on the other hand illiterate and comparatively higher educated persons have low participation. Landowners have better participation than tenant, as they are permanent in Bauniabandh. The households within the average income range have better participation than higher or lower income range households. The households with the business related occupation have more participation than other occupations like day labor, service etc.

NGOs are working in Bauniabandh area for long time to raise awareness and to ensure household's participation. Awareness is essential for physical participation and also to pay charges for services. It is found that the tenants and primary educated persons are motivated by NGOs but for landowners are motivated by CDF & NGOs. Among the households 42% expressed that the service is comparatively good, 17% said the service quality is low. Existing garbage management system has serious draw back that are it creating environmental pollution, spreading offensive odor from the dumping site, it spreading diseases to the community.

Chapter Seven: Environmental risk analysis

7.1 Introduction

The existing garbage management service of Bauniabandh covers the basic idea of the community based garbage collection and disposal system that is also practiced other part of the city. The service of community based garbage collection system basically collects the households' garbage. The road and drains are cleaned by the DCC. In the study area the service of the DCC is not available as mentioned by the community. So the activity of the NGO assisted garbage management committee is not very much effective though they are trying their best in nominal cost. As the garbage collected from Bauniabandh are not taken out from the local dumping site, it creating many other health and environment related problem. People of the adjacent area are at the risk of life and livelihood.

In the study area most of the family earns on daily basis. If the earning member (s) can not go to work for two or three days, then it is difficult to manage the food & other necessaries for the family as the major percentages of live from hand to mouth. They have no savings to cover the emergency need. For emergency needs they borrow money on monthly interest.

In the study area, the deployed 5 garbage collection vans collect the garbage. Each van collects for four van garbage each day. So, every day 20 (5van X 4 times) vans of garbage are collected. Each van can carry $0.530941m^3$ garbage at a time. So the total collected garbage is (20X $0.530941m^3$) 10.61882 m^3 the average weight of 1 m^3 garbage is 460 kg (Ahmed, 2005). As stated by the CBO/ management committee, the vans can collect 60-70% of total garbage, so the total garbage generated daily is approximately 15.6974 m^3 or 7.22 ton per day.

7.2 Immediate environmental risk

The immediate risk of existing garbage management system is directly related with physical environmental pollution such as contamination of air, water, soil etc. It polluting the living environment as well as it is decreasing the socio-economic conditions of Bauniabandh.

7.2.1 Health risk of community

The composition of domestic garbage in low income residential settlements contains "food waste 89.25%, paper 1.86%, polythene 6.39%, cloth 1.38%, leaves and branches 0.43%"[*]. The food wastes are decomposed by the natural process but it takes time and create offensive odor. When the food wastes and other organic items are decomposed, it creates many germs and diseases. The fly & mosquito borne and animal borne (birds, cats, dogs etc) germs are spread into the community from the local dumping site though its carrier. As a result the common diseases of the community are-Scabies, hepatitis, diarrhoea, cholera, fever, spread out of worms, etc.

Garbage Generation

Storage at household level

Collection and Transportation by Collection van

Open dumping of garbage in the local site

Natural decompose

Diseases

Air pollution	Water pollution	Soil Pollution

Spread-out/ carried by

water   Air   Fly/ Mosquito   Cat, dog etc.   Man   others

Food & Water

Human body

Sickness
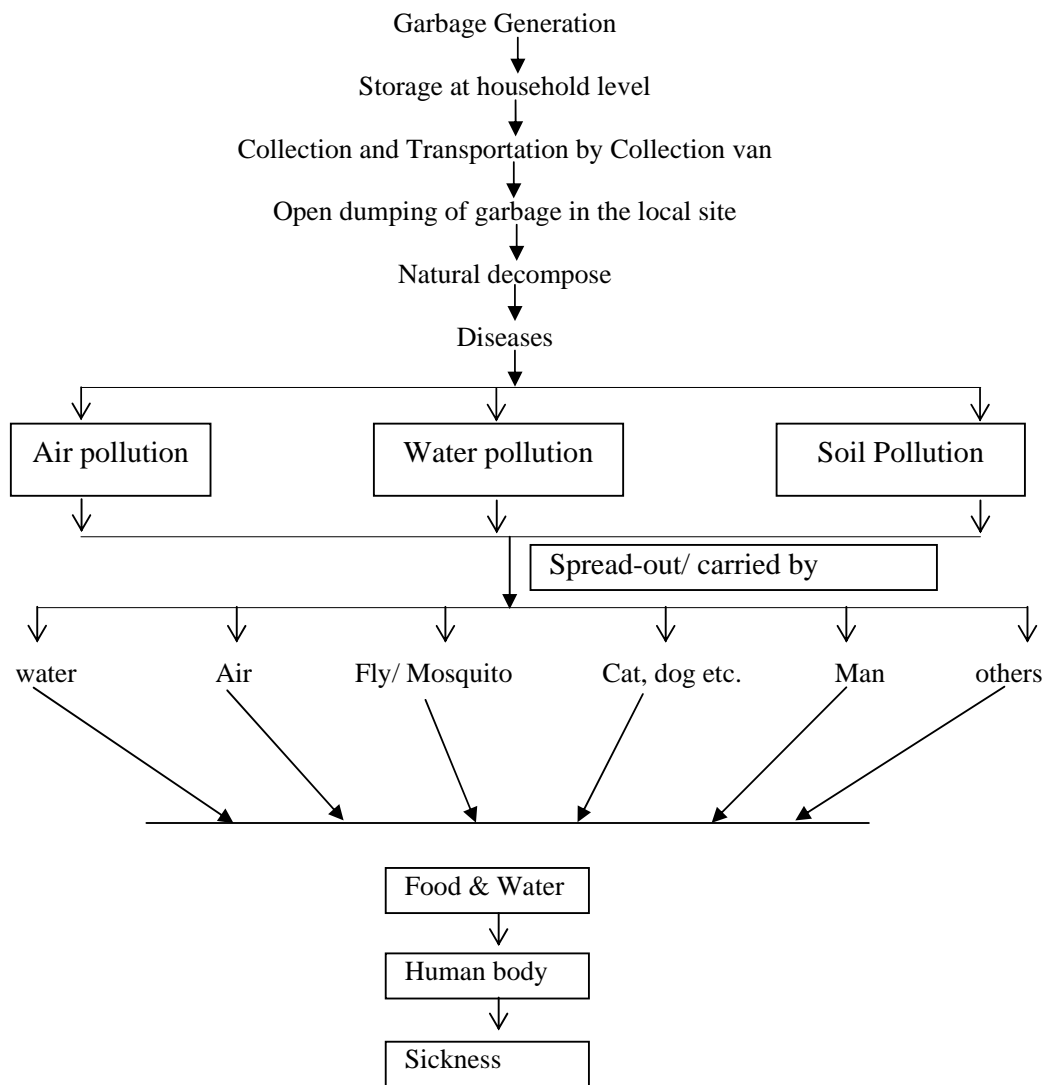
Flow chart 7.1: Effect of poor garbage management (for collected garbage)

[*] Dr. Momen, M.H (2002), Solid waste management in Dhaka city, Bangladesh. Innovation in Community Driven Composting. P-11

All the generated garbage is not collected by the existing system due to lack of logistic support and also lack of cooperation of households. The uncollected garbage is mostly thrown in to the roads, drains, nearby open space, etc. These wastes are finally deposited to the drains and long time deposition in drain cause block. When the drains are blocked it spill-over drain water to road. In the monsoon, the situation is worse then dry season. Sometimes the drain water spill-over to the water reservoirs. It spread-out the water borne diseases to the households.

Garbage Generation

↓

Thrown to drain/ road / open space

↓

Deposited to drain

| Long term depostiotin

↓

Blockage the drains

↓

Spill over of drain water to road

↓

water   Air   Fly/ Mosquito   Cat, dog etc.   Man   others

Food & Water

↓

Human body

↓

Sickness
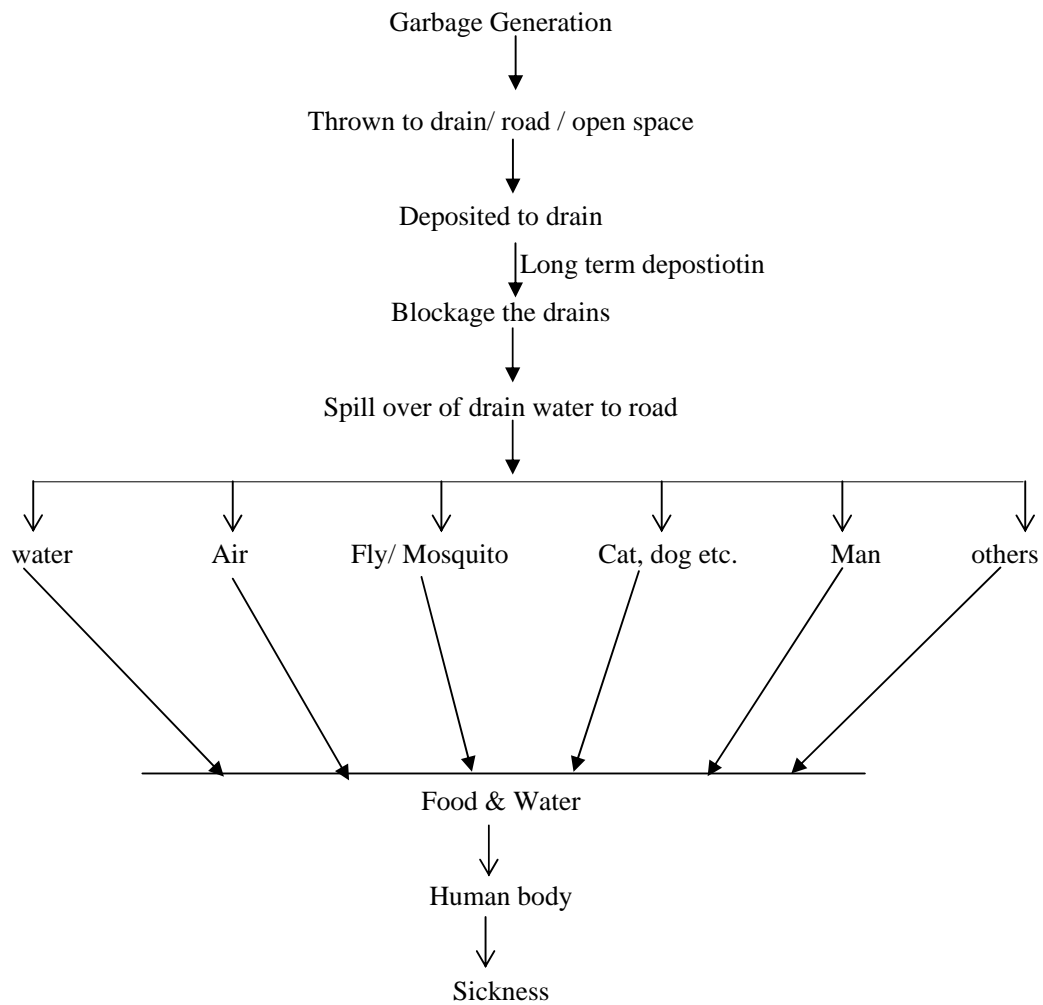
Flow chart 7.2: Effect of garbage (for uncollected garbage)

Plate 7.1: The endless expansion of garbage dumping site towards waterbody

Plate 7.2: Drains are rarely cleaned

Plate 7.3: The water reservoir located on the walk way

Plate 7.4: Long term deposition of garbage in an open

Plate 7.5: Long term deposition of garbage on road

Plate 7.6: Poorly managed drain

The general situation of the poor garbage management is long term and short term sickness. The direct effect of poor garbage management is spread out different diseases. During the survey the community identified the cause of health problems theses are-

⇨ Unhygienic and poor drainage management
⇨ Unhygienic lifestyle
⇨ Lack of health consciousness
⇨ Lack of sanitation system
⇨ Spread out of mosquitoes & fly
⇨ Polluted water
⇨ Polluted Air

Most of the above causes are directly or indirectly related with poor garbage management. If the dumping site can be shifted from the local community most of the health related problem will be disappeared

7.2.2 Risk of environmental degradation

Environmental degradation is associated with the contamination of water, air, soil etc. The air is polluted from the decomposed garbage that generated gaseous element, offensive odor etc. The water is polluted from garbage as they are direct thrown to the pond; the rain water carries the waste to the pond; when drain overflow, the garbage mixed with the pond water from the nearest drain. The soil polluted from the decomposed garbage. The decomposed produced different types of germs and germs mixed with soil. Germs are borne by the domestic animals & birds like duck, hen, cat, dog, cattle etc. Worms can be directly borne by barren foot to human body.

As stated earlier the existing garbage management system can not collect the total garbage of Bauniabandh. The uncollected garbage is thrown to drain at the door step. The tertiary (10˝) drains are cleaned by the dweller them self. But they do not remove garbage from drain. They push the garbage from the tertiary drain to secondary drains (18˝). The secondary and primary (3´) drains are not cleaned by the DCC or CBO. Due to lack of proper sanitation practice, children use drain for defecation. Many drains of the study area have no water flow for long time that enhances the breeding of germs like malaria, diarrhoea, scabies, worm, etc. It also creates offensive odor. The offensive odor and the diseases degrade the living environment. It is observed that there are sufficient

infrastructures (hardware) to ensure the proper sanitation but there is lack of sanitation knowledge. As a result, there is lack of hygiene practice.

The open dumping site located at the edge of water body next embankment on the eastern side of Bauniabandh. As at the edge of water body it is polluting the surface water directly. It is polluting the ground water also. The total surface water is polluted so the ground water should be polluted by the intrusion of contaminated surface water to ground water. The ground water may be clean but the contamination exists. The settlement on the other side of the water body Dewanpara, Matikata, Manikdi, may also be affected by the ground water pollution due to open dumping garbage into water at Bauniabandh.

7.3 Long term environmental risk

The present garbage management practice of Bauniabandh can collect about 70% of the generated waste that is 10.61882 m^3 equivalents to 4884.657 kg garbage per day. Most of the garbage are organic (food waste 89.25%), so after dumping these waste (food waste) will be decomposed by natural process but contaminating the ground & surface water, air & soil.

7.3.1 Risk of water logging

In the study area the average garbage collection rate is 70%.If this system continued and DCC do not collect the garbage from Bauniabandh, 3822.775m^3 or 134926.4727 ft^3 garbage will be collected each year and it will fill up 332.64 sq.ft space of 4 meter depth. Presently the government has under taken a road connection project from the mirpur cantonment to Dhaka cantonment. During the field survey it is found that the road is blocking the water flow as it is constructing with pipe culvert. It is found that there is bridge over the flow of the Bauniabandh khal constructed on the mirpur –manikdi road but the present road constructing by pipe culvert. The pipe culvert may not sufficient for a large area adjacent to the lowland. Moreover deposition of garbage in the low land may block the culvert. So it can be assumed that the road will enhance the local land use change tremendously. If the road is completed the Bauniabandh will be a well connected area in the city. The landowners of the surrounding low-lands will fill up the wet/ low lands very soon. The water bodies will be totally blocked by all sides. Many landowners

of the water bodies have already demarcated their land and trying to fill it up a developed land.

Plate 7.7: The land shown in picture is under risk of land filling by lad developer, picture taken from the under construction road to Bauniabandh

Plate 7.8: The land shown in picture is under risk of land filling by lad developer, picture taken from the under construction road to Bauniabandh

7.3.2 Risk of urban flooding

The existing garbage management system of Bauniabandh can not collect the total garbage generated in the area. Remarkable percentages (30%) wastes are thrown to drain, road and open space that block the flow of drains. The garbage carried by drain water deposited in different unsmooth area of drain and finally at the exit gate of sluice gate of embankment. Sometimes in rainy season the drains are overflow and the rain water does not runoff quickly though the area has proper drainage system.
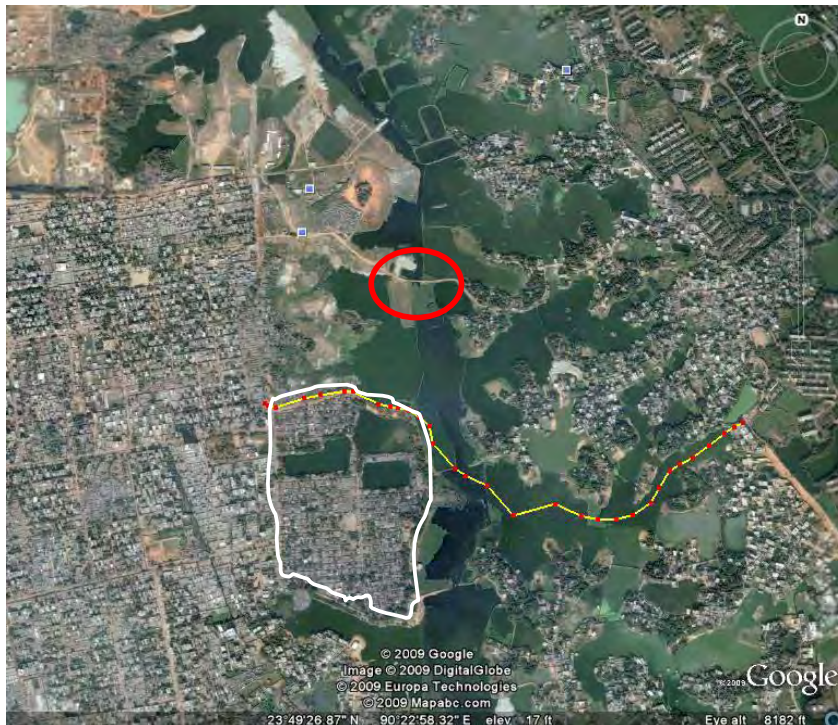
Plate 7.9: The satellite image shows the under construction road (yellow line). A bridge at the down stream of Bauniabandh (Red circle), Bauniabandh in white boundary

The combined disruption from the community dwellers of Bauniabandh, landowners of the wetland/ lowland, the residents on the other side of the water body (canal), the road construction authority and negligence of DCC to collect the garbage from Bauniabandh dumping site will create adverse affect, as the water body will become narrower or may filled up in near future. The outlets of drain of the total area Bauniabandh, Mirpur-11, Rupnagar R/A (extension), Bhashantek, Mirpur 13, 14, Manikdee, Shahidbag, Jalladkhana, Lalmati, will not be active as present. The surface water will not be runoff as a result the water logging or urban flooding will be a common scenario in the adjacent area of the Bauniabandh canal / low land.

Plate 7.10: Garbage deposited at the entrance of Pipe culvert in the under construction road

Plate 7.11: Under construction road on the western side of Bauniabandh

Plate 7.12: Under construction road on the north western side of Bauniabandh

Plate 7.13: Developers are ready to destroy the wetland on the northern side of Bauniabandh.

Plate 7.14: Garbage carried by drain deposited at entrance gate of sluice gate

Plate 7.15: Garbage carried by drain deposited at exit gate of sluice gate

7.4 Risk of interruption in planned development

The study area is a well planned residential area for the low income group with supply of all basic urban services such as planned road, drain, open space, play ground, community center, etc. Now Bauniabandh is well connected to Mirpur-11, Pallobi by wide road. If the under construction road is completed, the area will be connected to Dhaka cantonment, Shahidbag, Manikdi etc, adjacent area. The area will be connected to the airport road easily. The easy communication facility will affect the present residential status of Bauniabandh.

7.4.1 Risk of land speculation

The easy communication facilities to the important area of the city will enhance the outsider (such as developers, real estate firms, private house owner,) to get the planned land of Bauniabandh with urban service facility. At present, the 450sq.ft plot of Bauniabandh sales at 500,000 to 600,000 taka. If the area is connected with the airport road and then uttara, Gulshan, Banani Mohakhali, the price of land will increase tremendously. During the survey it is found that among the present landowners 38.83%

have purchased the land from the rehabilitee (61.17%) of the Bhashantek rehabilitation project. There is high risk of land speculation at Bauniabandh as well as the adjacent to the study area.

7.4.2 Risk of shelter loss

The real estate development at Bhashantek has rehabilitated the dwellers of that area at Bauniabandh 20 years ago. With the assistance of development partners, NGOs & government Bauniabandh has now achieved a comparatively quality lifestyle at least the landowners. In the last 20 years many households have sold their land and settled somewhere else or become shelter less again. It is very tough for the low income group to avoid the option to have a lot of money beyond capacity for the land that is provided by the government. If a developer/ land businessman offer double or triple than many of the landowners will sale their land. As the poor people mostly do not have the capacity to run a business, they spend the compensation money and become penny and shelter less.

Plate 7.16: Wetlands being plotted by fencing as demarcated ownership

Plate 7.17: Many multi-storied building replacing the poor in Bauniabandh

7.5 Conclusion

The existing garbage management practice in Bauniabandh is polluting the local environment as well as the DCC does not collect garbage from the local dumping site. It is found that 7.22 tons of household waste is generated per day in Bauniabandh. Most of the components of household waste are organic matter and this organic matter creates offensive odor during decomposing. It pollutes air, surface & ground water, soil etc and spreads diseases to the community through air, water, human, cattle, pet, etc. the ultimate result is short or long term sickness. The sickness affect the income of the poor people as most of them are depends on daily earnings. Another type of effect of present garbage management is environmental risk such as water logging in the community due to spill over of drain, blockages at sluice gate. In large scale the cumulative effect of poor garbage management can be urban flooding in the adjacent area of Bauniabandh canal.

The Bauniabandh slum has all basic urban services and easy communication facility to other part of the city that has increased the land value of the area. The increased demand for urban land may interrupt the planned development. The poor household of the Bauniabandh may loss their shelter due to land speculation.

Chapter Eight :Recommendation and Conclusion

8.1 Introduction

There are many Ready Made Garments (RMG) industries within walking distance from the Bauniabandh. It is found that the wage of the RMG industries is very low, so there is pressure of housing low-income people in the study area and its adjacent area. As the study area is a planned neighborhood and at present the area has all basic urban services like access road, electricity, gas connection, piped water supply, etc. Also it has the socio-economic infrastructure like school, mosque, madrasha, kitchen market, play ground, healthcare facilities, etc. The area has easy communication with major parts of the city. The under construction road on the north-eastern side of the study area will ease the communication with major business and commercial area and also connect the nearby international airport. The area has most of the urban service except garbage management. The local community has initiated the community based garbage management (collection and dumping) system with the assistance of NGOs in Bauniabandh. But this system is not linked with the DCC's solid waste management system, so it may not sustain in the long run. The existing garbage management system is polluting the water and air quality of the community and also enhancing illegal occupancy of water bodies or lowland. The present practice has prolonged negative impact on the locality and also the adjacent part of the city.

8. 2 Summary of findings

In Bauniabandh most of the basic urban services are present. Among the households 51.5% are landowners, the rest are tenant. Low family space is common in every households both landowners and tenants. About 54% of the households live in 101-150 sqft family space. Average monthly income of household is Taka 4666.67. NGOs are operating primary schools for children and healthcare facilities for dwellers of Bauniabandh. Piped water supply and gas connection has reached in the area due to continuous support of NGOs. At the early stage of this settlement, government has provided access road and drain to every plot.

It has been seen that the present garbage management situation of Bauniabandh is better than many other low income settlement of the city. In Bauniabandh NGO assisted garbage

management system is under operation for collection, transport and disposal. In the study area 7.22 tons of household garbage are generated everyday. Garbage collection vans usually collect garbage from 8.00 am to 1.00 pm but 50.5% of households do not agree with the present timing. About 26% households preferred a time between 3.00-4.00 pm for garbage collection. About 39.5% of households pay taka 15 per month for garbage management service. 58% households expressed that the present charge for garbage management is sufficient with respect to the service delivered. About 17% of households do not pay any charges. For better service about 22.5% of households said the charge could be increased by 10-15taka. About 80% of households support the existing garbage management initiative in Bauniabandh.

The existing garbage management practice of Bauniabandh is an isolated effort without linkage with the city's garbage management system. The primary waste collection (house to house collection) is working well but the secondary waste collection (collection and transport by DCC) is absent. So the system has become isolated from the mainstream garbage management of the city. The primary waste collection is successful but not sustainable. The system has to be linked with DCC's waste collection system like other part of the city where the DCC collects garbage from local disposing site/ container/ dustbin, etc.

The garbage management service was started for better to improve the environment in Bauniabandh. Due to lack of consciousness some households are not interested for availing the service. To encourage the people the management committee was formed consisting of the community leaders and the common people. Any interested people can participate in garbage management committee as executive committee member and also as meeting participant. To motivate the people, different motivational activities, such as group formation, training, rally, environment cleaning activities, day observance, etc. took place in Bauniabandh with the assistance of NGO & CDF.

It is described that about 60% of households more or less participate in the present garbage management system. It was found that people with average income and primary education have better participation in community development activities. Landowners have strong influence in decision making as they are permanent resident of the area.

The existing garbage management practice in Bauniabandh is polluting the local environment. Most of the components of household waste are organic matter and this organic matter creates offensive odor during decomposition and spreads diseases in the community through air, water, human, cattle, pets, etc. The ultimate result is short or long term sickness. Other effects of poor garbage management are environmental risk, such as, water logging in the community due to spill over of drain and blockages at sluice gate.

The Bauniabandh slum has all basic urban services and easy and better communication facility to other parts of the city, and this has increased the land value of the area. The increased demand for urban land may interrupt the planned development. The poor household of the Bauniabandh may lose their shelter due to land speculation.

8. 3 Recommendation

- Due to legal complexity of landownership, the dwellers of Bauniabandh can not deposit the holding tax including road, street light and conservancy tax to DCC as a result DCC does not provide conservancy, road maintenance and street light service to Bauniabandh. This complexity should be resolved and up to then DCC should provide the conservancy service through alternate way, like collaboration with the CBOs/ CDF of Bauniabandh.

- The primary waste collection is run by the CBO but the Dhaka City Corporation (DCC) does not provide the secondary waste collection service to the community as a result the long term deposition of waste creating serious pollution. So DCC should collect the garbage from the local dumping site and dispose it to DCC dumping site.

- In the Bauniabandh wide road is exist on the western and northern side where the 5ton container can be provided. Two 5ton containers can support the Bauniabandh area as 7.22tons garbage is generated in the area each day. DCC should provide two garbage collection containers, one at the lalmati (near to Block-A) and other at the end of C-Block.

- The NGOs should enhance the health & hygiene education and also ensure the households level practice.

- The community of Bauniabandh suffering from multi-dimensional pollution. The poor management of drainage system increasing the risk of water logging. To

ensure the livable environment the DCC can clean drains regularly by nominal service charge yearly from the plot owner.

- DCC should maintain the roads of the area regularly.

- Presently the low land of Bauniabandh canal supporting a large area as retention pond. After completion of road construction, it will enhance the landowners of adjacent low land to fill up the low land to a developed land. If the retention pond is disappeared a large area will suffer from urban flooding. So DOE, RAJUK & DCC should jointly take step to protect the low land.

- The Detail Area Plan of Dhaka Metropolitan Development Plan (DMDP) has marked the adjacent area of Bauniabandh as non-urbanized area and Proposed that the retention ponds of this area should be preserved. For this purpose a green belt aiming recreational area cum Eco-park is to be developed. Wet lands play an important role as a reservoir of rain and floodwater.

- The drainage runoff of the surrounding area and poor garbage management of Bauniabandh has indirectly enhanced the pollution of Bauniabandh wetland. The pollution has enhanced the conversion of the wetland to highland. Due to scarcity and high price of developed highland, private real estate developer enlarge their hands to the low cost wetlands. To protect the wetland, land expropriation and land banking schemes, may be adopted for Manikdi, Balurghat, BaigerTek, Baunia, Kalshi, Chak-Digun, Tafila, Uludha, Bhajaldi, Alokdi, etc. Government can buy large tracts of land at market prices in these areas including the two urban periphery to ensure drainage facilities eco-park development, green belt open space as well as to distribute land to the poor or plan any development maintaining DAP of DMDP.

- The under construction road over the wetland should incorporate a bridge for maintaining the flow/ passing wastewater. As the earlier constructed road at the (about) 500m down stream has a bridge.

- The wetland should be protected to ensure environmental consistency.

- RAJUK, DCC, Ministry of Land should demarcate the area of the canal/ low land to protect it from land encroachment.

- Government can acquire the land for land banking and planned development by protecting the wetland.

8.4 Conclusion

8.4.1 Vulnerable living environment

Multi-dimension of pollution has made vulnerable the life, livelihood and living environment of the dwellers of Bauniabandh. The poor garbage management has affected the community directly as it increases the diseases and long term sickness. Sicknesses lead the low income and consequently affected irregular job, low or no saving. Low capital leads them in vicious circle of micro-credit. Many allotted landowners have sold the plot to others.

8.4.2 Vulnerable shelter

The Bauniabandh has all basic urban services such as road, drain, water supply, biogas plant connected sanitation, electricity, gas connection etc. After 20 years of establishment the area can fulfill the basic needs for standard living but the low income of the community people is a great barrier for this. The rehabilitee got the plot for Taka 7500/- per plot, now the locational suitability with smooth road connection with other parts of the city has increased the value of land. Presently the value of a plot is sold Taka 6.00-7.00 lakh. If the under construction road on the northern side of Bauniabandh completed the value of land will increase beyond assume. The road will make the communication easier with Dhaka Cantonment, Banani, Mohakhali, Gulshan and Uttara. There will be a great pressure from the developer and other affordable persons to sell the land of Bauniabandh or adjacent to the area. There is a great chance to loss the shelter of major portion of households of Bauniabandh. As most of the dwellers have a very low level of education so they might not invest in a productive purpose after selling the land.

8.4.3 Vulnerable environment

Multi-dimensional pollution has contaminated the air, surface water, soil and also the ground water of the study area. There is a high risk of land filling and loss of the low land that serving as retention pond. The poor garbage management has polluted the low land and the pollution enhanced the community to fill up the low land. Loss of low land will lead for urban flooding that could be a long term water logging. So, multi-sectoral administrative and community initiative can save the living environment.

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Bangladesh University of Engineering and Technology, Dhaka
Department of Urban and Regional Planning
Questionnaire for
"GARBAGE **MANAGEMENT** SYSTEM IN LOW INCOME SETTLEMENTS - A CASE STUDY OF BAUNIABANDH SETTLEMENT IN MIRPUR, DHAKA"
(Questionnaire for Household survey)

(For Research Purpose only)   Date of interview:

PART A

1. HOUSEHOLD INFORMATION

1.1 Name of the Block:

1.2 Address

1.3 Name of the Household head:

1.4 Number of Family member:

1.5 Duration of living in this slum: Years……….

1.6 Resident status:…i) Own house ii) Tenant iii) Freehold iv) Leasehold v) No Response

1.7 What is the size of room (s)………………

1.8 If owned, what is the Size & cost of house?

   A. What is the size of the house/plot? …………….sft/ Katha

   B. Resettlement cost (Tk.)……………..…. ii) Purchased (Tk.)……………….

1.9 Occupation: **1.** Day laborer, **2.** Rickshaw / Van puller **3.** Push cart puller **4.** Garment worker **5.** Bus / Truck Driver **6.** Transport worker **7**. Industrial worker **8.** Small Business **9**.Mason **10.**Vendor **11.**Tailor **12.** Mechanics **13.** Beggar **14.** Government service **15.** Private Service 16**.** Housewife **17.** Student 18**.** Tempo / Taxi driver **19.** Handicraft **20.** Unemployed **21.** Others (Specify) **22.**Oversis Employee **23.** CNG driver **24**. Salvage business **25.** Grocery

1.10   Education level: 1. Illiterate 2. Primary   3. High School (class VI- X) 4. S.S.C 5. H.S.C 6. Graduate & above 7. Vocational training

1.11   Family Income (per month) : TK. …………………………

1.12   Household Expenditure:

Sl.	Purposes	Monthly	Yearly
1	House rent *(if Tenant)*		
2	Food (Cereal etc)		
3	Medical		
4	Education		
5	Clothing		
6	Electricity Bill		
7	Gas / Fuel/wood		
8	Water rate		
9	House Repair & maintenance		
10	Waste disposal		
11	Others		
	Total		

PART B : (Basic Urban Services/ Garbage generation)

2.1 What are the basic services available in the study area? [Put (√)Tick]

i) Electricity	YES	NO
ii) Water supply	YES	NO
ii) Sewerage / Sanitation	YES	NO
iv) Energy/ Gas connection	YES	NO
v) Healthcare	YES	NO
vi) Garbage management	YES	NO
vi) Road	YES	NO
viii) Education	YES	NO

2.2 What are the sources / providers (facilitator) of services? [Put (√)Tick]

Services	Provider				
	Government/ DCC	Private	NGO	CBO	Others
i) Electricity					
ii) Water supply					
iii)Sewerage / Sanitation					
iv) Energy/ Gas connection					
v) Health care					
vi)Garbage management					
vi) Drainage					
vii) Road					
viii) Education					

2.3 What is the source of your water?

       i) Community Tube well   ii) Piped water supply   iii) Roadside water point

2.4 In case of water supply, do you have different water source for different purposes?

Purpose	Source				
	Own house piped Connection	Collect from House owner / neighbors	Road side water point	Community Tube well	Others (Pond/ Canal etc)
Drinking & Cooking					
Washing, Bathing, Cleaning					
All					

2.5 Who take cares the water supply?

       i) House owner ii) WASA, iii) CBO with assistance of NGO iv) Dwellers/ User

2.6 In case of maintenance, who repair the water point if necessary?

       i) House owner ii) WASA, iii) CBO with assistance of NGO iv) Dwellers/ User

2.7 In case of sanitation, what shorts of sanitation facilities are available?

       i) Pit latrine with bio-gas line connection, ii) Sewerage line iii) Community Pit Latrine
      iv) Open latrine

2.8 Does NGO support for sanitation service?
          i) Yes ii) No iii) No response

2.9 If yes, what types of?
      i) Construction of community Pit latrine,
      ii) Sanitation materials Ring & Slab
      iii) Supports for Biogas line connection
      iv) Provide healthcare education and awareness
      v) Others

2.10   What sorts of charge they take?
           i) 200 Taka
           ii) 250 Taka
           iii) 300 Taka
           iv) No Charge

2.11   What sorts of Garbage generated from you / your household? (Multiple choice)

      i)   Household & Kitchen waste

      ii)   Papers waste

      iii)   Plastic materials (bottle/ bag)

      iv)   Waste Cloths

      v)   Dead bodies of pet/ birds

      vi)   Straw

      vii)   Waste of fruits (Coconut, Pineapple, plum, Sugarcane, etc)

      viii)   Waste from Slaughter house/ Meat shop

      ix)   Waste from cottage industries

x)   Waste from road sweeping

xi)   Waste from drain

xii)   Construction waste/ Rubbish

2.12   What is the average amount of garbage generated per household per everyday?

i) Up to 0.5.Kg ii) 0.5-1 kg iii)1-2 kg iv) above 2 kg

2.13   What do you use for storage the garbage?
   i.   Pot
   ii. Basket,
   iii. Poly bag,
   iv. Do not store/ Directly thrown
   v.   Others

2.14   Where do you dispose the waste?
   i.   On street,
   ii. Dustbin,
   iii. Drain,
   iv. Open space,
   v.   in front of house
   vi. CBO Container Van

2.15   Who dispose the waste?
   i.   Family member
   ii. Maid,
   iii. CBO Collector Collect from house
   iv. DCC sweepers collect waste

2.16   When your household garbage is usually generated?

i)……………hour(s)

2.17   When the CBO garbage collection van collects garbage from your house?

i)   8.00- 9.00 am   iii) 10.00- 11.00 am   v) 12.00- 1.00pm
ii) 9.00- 10.00 am   iv) 11.00 am–12.00pm   vi) 1.00- 2.00 pm

2.18   Do you think collection time is proper with regards to garbage generated at your house?

i) Yes ii) No iii) no response

2.19   If No, What could be the proper time?

i)   8.00- 9.00 am   v) 12.00- 1.00pm   ix) 4.00- 5.00 pm
ii) 9.00- 10.00 am   vi) 1.00- 2.00 pm   x) 5.00- 6.00 pm
iii) 10.00- 11.00 am   vii) 2.00- 3.00 pm
iv) 11.00 am–12.00pm   viii) 3.00- 4.00 pm

2.20   How long you store the garbage after generate before dispose?
i)……………hour(s)

2.21   What is the frequency of collection in week?

i) Daily ii) Alternate day iii) 3 times in a week iv) Once in a week v) Do not take the service

2.22   What frequency **do you prefer** to collect waste from your home?

i) Daily   ii) After two days interval   iii) Twice in a week iv) No response

2.23   Do you pay charge for garbage management?

i) Yes   ii) No   iii) no response

2.24   Do you think the charge you are paying for garbage collection & disposal is enough?

Level	Remarks
Sufficient	
Moderate	
Low	
Very low	
Do not pay regularly	

2.25   What could be the accurate charge for better management of the existing system? Specify

i) 1-5 taka   ii) 5-10 taka   iii) 10 – 15 taka   iv) 15 – 20 taka

2.26   How the charge is fixed for garbage collection/ management?

i) General meeting of CDF

ii) Meeting of CDF & NGO

iii) General meeting with community people

iv) Service providing agency itself

v) Others

2.27   Do you or your family member ever participate in a meeting regarding environment or garbage management issue?

i) Yes   ii) No   iii) no response

2.28   If yes, what is the number of meeting you have participate

i) ……………

2.29   What is your participation in the meeting?

i) Present as audience

ii) Presence as observer

iii) Raise issue regarding need/ demand

iv) Participate in decision making

v) No Remark/ Not Available (N.A)

2.30   How do you become aware regarding the need of a better garbage management?

i) Motivation by NGO (FGD/ School etc)

ii) Personal feeling

iii) Through Media (TV/ Newspaper/ Radio etc.)

iv) Through Community awareness activities of NGO / CBO

v) Realizing the risk of Garbage

vi) No Remark/ Not Available (N.A)

2.31   Who have motivated you to pay charge for garbage collection & disposal?

i) Motivated by NGOs

ii) Motivated by CDF

iii) Motivated by Community Environment Committee

iv) Self Realization

v) Do not pay charges

2.32   Do you support the existing garbage management system in your community?

i) Yes ii) No iii) no response

2.33   Do you think the existing garbage management system is proper for your community (how do you evaluate the existing garbage management in your community?)

Level	Remarks
Good	
Moderate	
Low	
No response/ Comments	

2.34   Does the existing garbage management system creating pollution to your environment?

i) Yes   ii) No   iii) No response/ Comments

2.35   If yes, what are the major reasons?
i)   Collected waste is disposed in low land
ii)   DCC dose not collect from the Disposed site of CBO
iii)   Waste is scattered in road
iv)   Block the drain
v)   Waste is not disposed in the secondary bin or container of DCC
vi)   Waste is not removed suitably in time
vii)   Offensive odor

2.36   Do you have any suggestion regarding garbage management system in the community?

i)

Bangladesh University of Engineering and Technology, Dhaka
Department of Urban and Regional Planning

Questionnaire for
"GARBAGE **MANAGEMENT** SYSTEM IN LOW INCOME SETTLEMENTS -
A CASE STUDY OF BAUNIABANDH SETTLEMENT IN MIRPUR, DHAKA"

(Questionnaire for CBO of the study area)

(For Research Purpose only)   Date of interview:

1. Why do you feel to organize a CBO for garbage management committee?

    i) Feeling the problem of previous garbage management   ii) Urges by the people of the community iii) For Better environment   iv) Inspired by the local govt. (Ward commission)

2. Who have motivated you?

    i) Self motivation   ii) Feeling urges   iii) NGO   iv) services provider   v) Motivated by similar actions in other community vi) others

3. What was the number of the initial committee?

    i)

4. What is the number of member of the existing management committee?

    i)

5. How the members are selected?
    i) Self motivated persons ii) Selection by the CDF iii) Technical persons

    (Teachers/ religious leader/ NGO representative working in Environment issue)

    iv) CDF leaders v) Local govt. vi) Social worker

6. What is the frequency the meeting take place?

    i) Once in a month ii) once in two month iii) Twice in Year iv) Once in a year

7. Do you issue notice / remainder before meeting?

    i) Yes   ii) No

8. If yes, what is the process?

      i) Notice Book with notice

      ii) Written notice at the CBO Office

      ii) Notice to each member

      iii) Oral notice

9. How long before the meeting?

    i) One or Two day ii) a Week   ii) two week   iii) One month

10. Does Non-Executive Committee member / General people can participate in the meeting?

    i) Yes   ii) No

11. If yes, how do they know the date?

      i) Oral notice

      ii) From the committee member

12. In the meeting the laborer engaged in the in garbage collection participate?

    i) Yes   ii) No

13. If No, Do you feel it is necessary?

    i) Yes   ii) No

14. How do you fix the charge?

    i) In General meeting with community people ii) EC can take the decision iii)

    Meeting with EC, Technical persons, CDF, NGO and local govt (ward commission)

15. Are the dwellers bound to pay the charge?

    i) Yes   ii) No

16. If no, is there any provision in the area to dispose the garbage?

    i) Yes   ii) No

17. What are the major task regarding garbage management of the EC committee?

      i) Collection of charges

ii) Repair and maintenance of Collection Van

iii) Supervised the activity of van puller

iv) Evaluate the dwellers expectation

18. What is the frequency of repair the van?

i) Once in a month, ii) Once in two month iii) As required

19. Do you provide training for the laborer?

i) Yes　　　　ii) No

20. How do you supervise the collection activity?

i) Random   ii) Once in a week iii) Once in two week   iv) Monthly

21. Do you know how much garbage is generated by **per household per day** in your area?

i) …………….Kg

22. Do you know how much **garbage is produced in your area**?

i)………………….Van

23. Do you know how much garbage is collected by your CBO of the area?
i) 20-40 %
ii) 40-60%
iii) 60-70%
iv) 70-80%
v) above 80%

24. If you are not able to collect total amount of the garbage in your area, what are the reasons behind of that?
i) Shortage of enough manpower
ii) Shortage of enough equipment
iii) Low accessibility
iv) Lack of cooperation of households

25. What are the steps followed to collect and dispose garbage?
Step i)
Step ii)
Step iii)
Step iv)

26. What kinds of equipments do you use to collect garbage and dispose it?
    i) Container VAN
    ii) Small push cart
    iii) Spade
    iv) Scraper
    v) Basket

27. How many vehicles/ Carrier are using for garbage collection?
    i) ………….

28. What is the capacity of each vehicles/ Carrier (in cft/ kg/ton)?
    i) …………. cft/ kg/ton

29. How many vehicles are out of order?
    i) ………….

30. How many hours/ shifts garbage are collected by laborer?
    i) ………….

31. How many trips are made by the vehicles per day?
    i) …………. trips

32. How many workers are employed for garbage collection and disposal?
    i) ………….

33. What is the distance of nearest DCC garbage container/ dustbin?
    i) …………. km

34. Do you know how many dustbins or containers are provided by DCC in your area?
    i) …………. Km

35. What do you think the number of dustbins or containers is enough in your area?

              i) Yes   ii) No

36. Please briefly explain the problems of your CBO for relating to garbage management?

     i) Households are not cooperative

    ii) Shortage of employee and vehicles

    iii) Charge collected are not enough

    iv) Lack of cooperation from DCC

    v) Others

37. What are the measures to overcome these problems?

i) Community awareness activities regarding garbage / environment management

ii) Motivational activities through children at school

ii) Meeting with community people

iv) Meeting with NGOs for support

38. In what purpose (garbage related) and frequency you communicate with DCC/ Ward commission?

39. Any suggestion to improve garbage management in your area?

40. Any suggestion to improve garbage management in DCC?

Annexure-III : List of NGOs working at Bauniabandh slum

List of NGOs and their field of intervention

Sl.	NGO	Working area
1.	ARBAN*	Education Health, Vocational Training, Job placement, Community awareness, Garbage management & Micro-credit
2.	DSK	Health, Water supply, Sanitation, & Micro-credit
3.	RADDA*	Mother & Child health
4.	GSS*	Education
5.	CATALYST	Education
6.	Breaking the Silence	Child sexual abuse
7.	Karmajibi Nari	Women empowerment
8.	ICDDR,B	Health service
9.	CIPRB*	Injure Prevention program
10.	UCEP*	Integrated Vocational
11.	Surjer Hasi *	Health education and Awareness
12.	ADD*	Disability
13.	ECHO mother and Child care centre	Healthcare service
14.	FIVDB*	Education
15.	BRAC*	Education
16.	ARH*	Reproductive health and lifestyle
17.	Fulkee*	Daycare centre
18.	ASK	Legal Aid
19.	BNWLA	Legal Aid
20.	BLAST	Legal Aid
21.	Shakti	Micro-credit
22.	ASA	Micro-credit
23.	PROSHIKA	Micro-credit
24.	Save Save	Micro-credit
25.	Surovi*	Education & Micro-credit

* NGOs have permanent physical infrastructure at Bauniabandh

Source: Survey on Health, Sanitation, Education and Rights by ARBAN, March-2009

Annexure-IV : Monthly charge collection book & ticket

পরিষ্কার পরিচ্ছন্ন কার্ড

স্থাপিত ২০০৩ইং
পরিচ্ছন্ন বাউনিয়া বাঁধ, ব্লক-সি

কোড নং-
ব্লক-সি, লাইন- বাসা-

বিঃ দ্রঃ প্রতিমাসে পাঁচ তারিখের মধ্যে মাসিক টাকা পরিশোধ করবেন।

* পরিষ্কার পরিচ্ছন্ন তাই ঈমানের অঙ্গ
* ধৈর্যশীল কে আল্লাহ পছন্দ করেন
* নির্দিষ্ট সময়ে ময়লার গাড়িতে ময়লা ফেলুন
* ঘরের আশ পাশ পরিষ্কার রাখুন
* ড্রেনে ময়লা ফেলবেন না।
* পরিচ্ছন্ন কর্মীকে কাজে সহায়তা করুন
* আপনার কোন অভিযোগ থাকলে কর্তৃপক্ষের সাথে যোগাযোগ করুন।

আপনার এলাকা পরিষ্কার রাখুন
সুস্থ থাকুন।

কার্ড হারিয়ে গেলে বা নষ্ট হয়ে গেলে ২০ টাকা দিয়ে পুনরায় কার্ড সংগ্রহ করতে হবে। তাই কার্ড সংরক্ষন করুন।

মাসিক টাকার হিসাব ২০০৮				
মাসের নাম	টাকার পরিমান	তারিখ	স্বাক্ষর	মন্তব্য
জানুয়ারী				
ফেব্রুয়ারী				
মার্চ				
এপ্রিল				
মে				
জুন				
জুলাই				
আগষ্ট				
সেপ্টেম্বর				
অক্টোবর				
নভেম্বর				
ডিসেম্বর				

মাসিক টাকার হিসাব ২০০৯				
মাসের নাম	টাকার পরিমান	তারিখ	স্বাক্ষর	মন্তব্য
জানুয়ারী				
ফেব্রুয়ারী				
মার্চ				
এপ্রিল				
মে				
জুন				
জুলাই				
আগষ্ট				
সেপ্টেম্বর				
অক্টোবর				
নভেম্বর				
ডিসেম্বর				

নং ৪৯০১ মাস--------
ঘরের কোনে ময়লা ধরি পরিচ্ছন্ন পরিবেশ নিশ্চিত করি
পরিচ্ছন্ন বাউনিয়া বাঁধ সি, ব্লক
৫.০০ (পাঁচ) টাকা
যেখানে সেখানে ড্রেনে ময়লা ফেলিবেন না।
পরিচালনায়-বাউনিয়া বাঁধ সি, ব্লক উন্নয়ন কমিটি।

নং ৪৯০১ মাস--------
ঘরের কোনে ময়লা ধরি পরিচ্ছন্ন পরিবেশ নিশ্চিত করি
পরিচ্ছন্ন বাউনিয়া বাঁধ সি, ব্লক
১৫ টাকা মাত্র
যেখানে সেখানে ড্রেনে ময়লা ফেলিবেন না।
পরিচালনায়-বাউনিয়া বাঁধ সি, ব্লক উন্নয়ন কমিটি।

Annexure-V: List of participants of training on water supply & sanitation arranged by ARBAN

অদ্য এপ্রিল ১৩, ২০০৭ রোজ রবিবার আরবান পরিচালিত পিএটিএসসি প্রশিক্ষণ কক্ষে পানি ও পয়ঃনিস্কাশন বিষয়ক বাউনিয়া বাঁধ "সি" ব্লক এলাকার পরিবেশ বিষয়ক ওয়ার্কিং গ্রুপ এর দিনব্যাপী প্রশিক্ষণ কর্মশালার আয়োজন করা হয়েছে। উক্ত প্রশিক্ষন কর্মশালায় নিম্নোক্ত ব্যাক্তিবর্গ উপস্থিত ছিলেন –

ক্রমিক নং	অংশগ্রহনকারীদের নাম	ঠিকানা		
		লেন	বাসা	ব্লক
১	কাজী আবুল কালাম আজাদ	প্রশিক্ষক	প্রদীপন	
২	সুমিত রঞ্জন মল্লিক	আরবান		
৩	রুমা আক্তার	আরবান		
৪	শামীমা হক	আরবান		
৫	হাসিনা	৫	১৫	সি
৬	ফৌজিয়া	৬	১২	সি
৭	মনোয়ারা	৬	১১	সি
৮	ফাতেমা	৫	৫	সি
৯	মাকসুদা	১৪	১৯	সি
১০	সাহিদা	৮	২১	সি
১১	মিনু	১৫	৬	সি
১২	হাজেরা	১৪	২	সি
১৩	নাজমা	১৩	২৪	সি
১৪	মাহফুজা	১২	২০	সি
১৫	আলমগির	১২	১৬	সি
১৬	সেলিম	৭	১৩	সি
১৭	সালেহা	১৭	১৮	সি
১৮	নাদিম	১৯	৫	সি

আলোচ্যসূচী

পানি ও পয়ঃনিস্কাশন বিষয়ক প্রশিক্ষণ

সময়কাল: ১ দিন

সময়	বিষয়	সহায়ক
09.00-10.00	রেজিস্ট্রেশন শুভেচ্ছা বক্তব্য পরিচিতি ও প্রত্যাশা গ্রহণ	প্রকল্প সমন্বয়কারী, আরবান ও আজাদ-প্রদীপন
	প্রশিক্ষণের উদ্দেশ্য ব্যাখ্যা প্রশিক্ষণ নীতিমালা প্রণয়ন	আজাদ-প্রদীপন
10.00-11.00	জল-মল বাহিত রোগ সমূহ কি কি, রোগের কারন, অর্থনৈতিক ক্ষতি ও উত্তরণের উপায়	আজাদ-প্রদীপন
11.00-11.15	চা বিরতি	-
11.15-12.00	স্যানিটেশন কি। জাতীয় ও স্থানীয় পর্যায় স্যানিটেশনের অবস্থা	আজাদ-প্রদীপন
12.00-1.00	নিরাপদ পানি নিরাপদ পানির উৎস ও ব্যবহার আর্সেনিক	আজাদ-প্রদীপন
1.00-2.00	দুপুরের খাবার ও নামাজের বিরতি	--
2.00-2.45	নিরাপদ পানি কিভাবে অনিরাপদ হতে পারে (পানির উৎস, পানি সংগ্রহ, পরিবহন, সংরক্ষণ ও বিতরণ)	আজাদ-প্রদীপন
2.45-3.15	পানি ও স্যানিটেশন ব্যবস্থাপনার জন্য এনজিও, সিটি করপোরেশন ও কমিটির দায়িত্ব ও কর্তব্য	আজাদ-প্রদীপন
3.15-4.30	পরিকল্পনা কি ও বাস্তবায়ন পর্যায় পরিকল্পনা	
4.30-4.45	চা বিরতি	-
4.45-5.00	কোর্স মূল্যায়ন ও সমাপনী	প্রকল্প সমন্বয়কারী, আরবান ও আজাদ-প্রদীপন

Annexure-VI: Proposed Land use for DPZ-12

Proposed Landuse of DPZ -12: Mirpur-East

Source: Rajdhani Unnayan Katripakkha, (2008)